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# Layered Learning, Eustress, and Support: Impact of a Pre-Service-Learning Training on Students' Self-Efficacy in Teaching in the Community

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*Abstract: Service-learning programs provide students with opportunities to gain discipline-specific skills, while providing community organizations with a steady pool of volunteers. However, because students may lack the skills needed to effectively serve the community, skills-based training may need to be incorporated into service-learning courses. Students in a community nutrition service-learning course engaged in 7 weeks of training before teaching a 6-week-long nutrition education course to community members. The training included three layers of activities: (1) basic activities, which introduced the students to material necessary to build skills for their service-learning experience; (2) directed activities, which allowed them to refine a targeted skillset; (3) and collective activities, which allowed for the application of multiple skills. Through qualitative interviews with 12 of the 19 students who had been enrolled in the course, we determined the impact of a pre-service-learning training program on the development of the skills necessary to successfully teach a nutrition education course. Thematic analysis of the data revealed two major themes: (1) "layered learning" activities facilitate skill building and (2) a stressful, yet supportive, environment facilitates growth. Together, these aspects of course design allow students to develop skills and their self-efficacy in those skills. Therefore, instructors who plan to incorporate service-learning into their nutrition courses may benefit from designing a pre-service-learning training to improve student learning outcomes.*

*Keywords: service-learning, self-efficacy, educational theory*

## Introduction

Many community-based organizations and nonprofits rely on volunteers to expand their educational reach, and often universities are looking for ways to connect their students with meaningful experience in the community. One way to meet both goals is to develop service-learning programs. Service-learning is both a type of experiential education and pedagogy that combines academic content, relevant service in the community, and critical reflection of the learning experience (Eyler & Giles, 1999). Service-learning partnerships should be mutually beneficial for students and community members and include clear expectations for student involvement (Bringle & Hatcher, 1995). Through the combination of academic learning, relevant

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service, and critical reflection, students can grow in their understanding and application of knowledge in the community, their own personal characteristics, and their ability to interact with and understand how community partnerships function (Ash, Clayton, & Moses, 2008). In addition to providing students with an opportunity for personal, academic, and civic growth, service-learning programs benefit instructors, community organizations, and participants in the community programs. Instructors are able to provide students with an opportunity to significantly improve their abilities without sacrificing additional classroom time (Tucker & McCarthy, 2001), while community organizations are able to increase their capacity to serve clients while also identifying potential future employees (Driscoll, Holland, Gelmon, & Kerrigan, 1996).

However, because undergraduate students are not professionals in their fields, they may need additional training before they begin their service-learning experience, especially when the service is related to teaching discipline-specific information in a community-based setting. Many small- to medium-sized community-based organizations lack the staff and time to train students (Tryon et al., 2008), so university instructors should design skills-based training to accompany the service-learning experience. Guides for creating service-learning programs reference the need to orient students to the service-learning experience through training (Bringle & Hatcher, 1995; Yoder, 2006), but parameters about the length or extent of this orientation are not documented. These training programs could be used to not only introduce students to the service-learning experience but also to increase their self-efficacy, or confidence in their ability to perform skills (Bandura, 1977), related to the service-learning experience before the experience begins. According to Bandura, the four sources of self-efficacy are: vicarious learning (seeing someone else perform a similar task), mastery (the process by which one practices and masters a skill), verbal persuasion (receiving feedback about performance), and physiological/emotional arousal (the current state of the body and mind while mastering the skills). Self-efficacy can play a crucial role in a successful, mutually beneficial service-learning experience. When a student's self-efficacy is high, he or she will put in more effort, persist longer in the face of obstacles (Bandura, 1977), and perform better (Bruning, Schraw, & Norby, 2010), all of which benefit the community partner and community participants. It has been established that service-learning programs increase students' self-efficacy in teaching (Bernadowski, Perry, & Del Greco, 2013; Cooke et al., 2015), and field experiences play an essential role in developing pre-service teachers' teaching skills (Ben-Peretz, 1995; Bernadowski et al., 2013). Then, to what extent would a pre-service-learning training program prepare students for teaching in the community? Specifically, what is the impact on their teaching self-efficacy?

Through an iterative process of development, implementation, and revision, the first and fourth authors developed a pre-service-learning training program to guide upper-level undergraduate students in learning and practicing skills necessary to be successful during the service-learning experience. Students enrolled in a community nutrition service-learning course engaged in a pre-service-learning training program before implementing a pre-packaged educational curriculum in the community. The pre-service-learning training was designed to improve self-efficacy by targeting Bandura's four sources of self-efficacy: vicarious experience (modeling), verbal persuasion (feedback), mastery (successfully building the skill), and physiological and emotional state (supportive or stressful) (Bandura, 1977). After the pre-service-learning training, students served as volunteer instructors for the A PACKed Kitchen service-learning program, locally administering the Cooking Matters cooking and nutrition education

curriculum on behalf of the Inter-Faith Food Shuttle, a local food rescue organization. Cooking Matters is a nationally recognized, six-week curriculum that was developed by Share Our Strength, a national organization dedicated to ending child hunger, to teach community members how to make healthier choices and affordable meals. The Inter-Faith Food Shuttle is North Carolina's state partner for Cooking Matters, and A PACKed Kitchen is a satellite of the Inter-Faith Food Shuttle. Participants in Cooking Matters classes come from limited resource backgrounds, and the Cooking Matters classes teach them to make the most of their food dollars. Participants range in age from elementary school to senior adults, and nationally, roughly half of the participants take part in at least one form of federal food assistance (Cooking Matters, 2013). Over 7 years, more than 120 upper-level undergraduate students have been a part of A PACKed Kitchen's programming, reaching over 300 limited-resource community participants through Cooking Matters classes and helping to expand the programming of the Inter-Faith Food Shuttle and Share Our Strength.

Having both qualitatively (Goodell, Cooke, & Ash, 2016) and quantitatively (Cooke et al., 2015) determined that students' self-efficacy increases as the result of the service-learning experience as a whole, we wanted to qualitatively explore the impact of just the pre-service-learning training program on the development of students' skills and self-efficacy. This paper will report those findings and provide details about the course as an example of a training program model that higher education institutions can use to prepare undergraduates to teach a pre-packaged educational curriculum in a community-based setting.

## Methods

### *Course Design*

The community nutrition service-learning course was an upper-level nutrition course at North Carolina State University that served as an elective for students majoring or minoring in nutrition. Students typically elected to take the course during their junior or senior year, but the only pre-requisite was an introductory nutrition course. The service-learning course consisted of a traditional three day a week, one-hour lecture and a one day a week, four-hour lab/field experience. In the lecture, students learned about planning, implementing, and evaluating nutrition education programs, including the importance of catering to cultural differences in nutrition education. The lab was split into two parts: the pre-service-learning training and the service-learning experience. The first half of the semester consisted of a 7-week-long pre-service-learning training where students participated in activities to build their skills as nutrition educators. We categorize these activities into three "layers": (1) basic, (2) directed, and (3) collective (Table 1). The categories describe what students gained from engaging in the activities. Basic learning activities allowed the students to gain an understanding of fundamental principles they would be asked to apply during the service-learning experience. For example, the Gold Standards video and discussion allowed students to observe and critique discipline-specific teaching techniques. Directed learning activities enabled students to develop one targeted skillset and then practice that specific skillset. For example, in the grocery store budgeting activity, students were tasked with going to the grocery store to develop a budget based on the prices of foods they intended to use during the service-learning experience, which served as not only a lesson planning activity, but also an opportunity

to better understand the budgetary constraints of community participants. Collective learning activities required students to apply many skills at one time. For example, during the mock lessons, students were charged with implementing a lesson plan they developed earlier in the semester while simultaneously practicing flexibility, public speaking, and time management. The course

**Table 1. Pre-service-learning-training activity descriptions, organized by week**

| Week | Description |
|---|---|
| Week 1 | Iron Chef Challenge: Students worked in teams to modify a recipe to make it healthier and include a secret ingredient, while only using cooking supplies provided to them (e.g. electric burners and skillets). After presenting their ideas to the teaching team, students then had the remainder of the hour to make the recipe.[a]<br>Introduction to the Service-Learning Experience: Students learned about community partner agencies through in-person and video presentations.[a]<br>Cooking Matters-At-A-Glance Lesson Planning: This first lesson planning assignment introduced students to the pre-packed curriculum by having them complete a one-page diagram of their 6-week teaching plan.[b] |
| Week 2 | Gold Standards Video and Discussion: Students watched video clips of previous students teaching in the community. As a group, students discussed the effectiveness of teaching techniques to gain an understanding of nutrition education standards.[a]<br>Lesson Plan Outlines: Using instructor feedback on students' at-a-glance lesson plans, student teams created more detailed lesson plans for each of the six lessons.[b] |
| Week 3 | Conflict Management: Each student received a unique conflict scenario on a piece of paper and then collaborated with peers to determine solutions. Afterwards, we reviewed all scenarios in a large-group discussion.[a]<br>Facilitated Dialogue: Students practiced using open-ended questions with a partner, competing to be the pair who could keep a dialogue consisting of only open-ended questions going the longest.[a]<br>Grocery Store Budgeting: Students went to a grocery store to prepare a budget spreadsheet for their six-weeks lessons, staying under a certain dollar amount.[b] |
| Week 4 | Knife Skills Evaluation: After watching a series of knife skills videos and practicing, students were evaluated on their knife safety technique and explanation [c] |
| Week 5 | Mini Mock Lesson: Using parts of a lesson plan prepared during Week 2, students taught a 10-minute lesson while peers acted the age of the participants that student would be teaching in the community, purposefully creating challenges.[c] |
| Week 6 | Shopping Matters: As a class, the students set up the classroom like a grocery store, using food labels and empty food packages. The students then led a mock grocery store tour for the instructors and community liaisons.[c]<br>Supplies Inventory: Students received bins with teaching aids and cooking equipment, so they could take inventory and understand what supplies they had available for their mock lesson and Shopping Matters class.[a] |

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|---|---|
| Week 7 | Mock Lesson: Students taught an hour-long modified lesson as a group, while peers and a guest actors pretended to be participants. Again, the participants created challenges for the teaching team and to build their teamwork skills.[c] |

[a] *Basic Learning Activity* [b] *Directed Learning Activity* [c] *Collective Learning Activity*

was purposefully designed to be rigorous and demanding to prepare students for the flexibility needed to work in a community-based setting.

During the second half of the semester, students taught the 6-week-long pre-packaged Cooking Matters nutrition education and cooking curriculum in the community. Students were assigned to teams of five for the semester, and while students each had their own unique part of the lesson, they were expected to team-teach the entire lesson. Each team was supported by a community liaison (teaching assistant) who served as both a connection to the community partner and a peer performance evaluator. The 7-week pre-service-learning training program design was the result of the iterative process of course evaluation and revision and now includes all four of Bandura's sources of self-efficacy (Cooke et al., 2015).

*Participants & Recruitment*

To determine the effectiveness of the pre-service-learning training, we interviewed students who had been most recently enrolled in the service-learning course at North Carolina State University. We chose to interview only students from one semester because previous semesters did not include the Iron Chef Challenge, an activity that we believed was key to team building. After submitting final grades, we recruited eligible students via e-mail, providing an incentive of a $10 gift card for participation. The Institutional Review Board at North Carolina State University approved this research.

*Data Collection*

Before conducting interviews, we developed a standardized interview guide using a list of the activities and assignments from each week of the pre-service-learning training lab (Table 2). The third author, a community liaison who had assisted with implementing the pre-service-learning training and evaluating students during the service-learning experience, was the sole interviewer. Before conducting interviews, the interviewer engaged in a rigorous, standardized multi-pass interview training, which included how to conduct an interview while remaining unbiased and nonjudgmental, how to use reflexivity to review major discussion points with the participant, and a series of mock interviews to hone interviewing skills (Goodell, Stage, & Cooke, 2016).

Before beginning each phone interview, the interviewer reviewed the consent form with each participant, and the participant gave verbal consent to participate in the interview. The interviewer followed the standardized interview guide, starting with an icebreaker and then asking about each week's major activities. Finally, the interviewer asked how the overall lab experience helped to prepare the student for their teaching experience. Each phone interview lasted between 30 and 60 minutes, was recorded on an audio recorder, followed the same questioning sequence, and included member checking at the end of each interview (Goulding, 1999).

*Data Analysis*

After each interview, the third author conducted initial analysis and determined preliminary dominant themes. Once the interviews were completed, the second author transcribed them verbatim. Next, the authors developed a coding manual with 26 codes, 13 skills-based codes and 13 activity-specific codes. The skill-based codes consisted of the skills students reported

**Table 2. Major interview questions and probes from interview guide**

| No. | Question or Probe |
|---|---|
| 1 | What was the funniest thing that happened during the NTR 420 lab? |
| 2a. | In Week 1 of the Community Nutrition lab, you completed the Iron Chef Challenge and got an introduction to A PACKed Kitchen and Cooking Matters. You also watched the community partner videos made by the community liaisons and completed the Cooking Matters-at-a-Glance assignment, determining the basic activities and recipes for all 6 weeks. First, let's talk about the Iron Chef Challenge. |
| 2b. | Now let's talk about the introductions to A PACKed Kitchen and Cooking Matters as well as the community partner videos.* |
| 2c. | Now, let's talk about the Cooking Matters-at-a-Glance assignment.* |
| 3a. | In Week 2, you did an activity with the Cooking Matters Gold Standards by watching different videos from previous classes and then worked on your lesson plan. First, let's talk about the Cooking Matters Gold Standards activity.* |
| 3b. | Now let's talk about the lesson plan you created with your group.* |
| 4a. | In Week 3, you did a conflict management activity where you each got a slip of paper with a conflict scenario from a previous class. Also, you did a facilitated dialogue activity where you got in pairs and had to ask only open questions for five minutes. Finally, you got into groups and worked on your Cooking Matters budget. First, let's talk about the conflict management activity.* |
| 4b. | Now let's talk about the facilitated dialogue activity.* |
| 4c. | Finally, let's talk about the budget you created with your group.* |
| 5. | In Week 4, you had knife skills evaluations.* |
| 6. | In Week 5, you had mini mock lessons. This is where you taught a 10-minute lesson to the class, by yourself.* |
| 7a. | In Week 6, you gave a Shopping Matters tour with your classmates to the TAs and course instructor, and then you needed to give your supplies checklist for your Mock Lesson to the TA or your community liaison. First, let's talk about the Shopping Matters.* |
| 7b. | Now let's discuss the supplies checklist [where you went through the supplies box] for the Mock Lesson.* |
| 8. | Week 7 was the last week before you went out into the community. You taught your mock lesson as a group to your classmates and guests. Let's talk about the mock lesson.* |

| | |
|---|---|
| 9a. | So, I'd like to recap and give you a chance to comment on the whole training experience in lab. When looking back at the whole lab experience in general, what do you think you gained?* |
| 9b. | Looking back, what would you change about lab? |

*Probe used after every major interview question: *Thinking about skills gained, working with teammates and with the community, how did this benefit you when teaching in the community, if at all?*

developing during the pre-service-learning training program. The activity-specific codes were associated with the different activities in the training program. The authors included specific definitions in the coding manual to standardize the coding process and prevent discrepancies in coding. The second and third authors coded the transcripts independently and then reviewed the coded transcripts with the first author. The three authors met weekly to discuss coding discrepancies and came to consensus on a final set of coded transcripts. Reviewing the coded quotes with three researchers ensured consistency in the analysis of the transcripts, reducing coder drift (Bartholomew, Henderson, & Marcia, 2000). NVivo 9 Qualitative Analysis software was used to organize student quotes falling under each coding category. After reviewing the codes and associated quotes, three of the authors prepared a report of the major findings from the analysis and then discussed the findings. The first author reviewed all three reports, creating the explanatory model from the composite of the three reports, confirming structure through a discussion with the fourth author. Ultimately, two dominant themes emerged from the data, which are depicted in the explanatory model.

## Results

Of the 19 students enrolled in the course, 12 completed interviews. Thematic analysis of the interviews revealed two major themes: (1) "layered learning" activities facilitate skill building and (2) a stressful, yet supportive, environment facilitates growth. Students engaged in "layered learning" that incrementally prepared them for the service-learning experience through basic, directed, and collective activities. The rigor of this training program introduced the students to stressors. However, the supportive environment of the course helped students manage these challenges and ultimately prepared them for the service-learning experience. Figure 1 depicts an explanatory model depicting the factors related to skill building during the pre-service-learning experience.

### *Theme 1: Layered learning activities facilitate skill building*

Students stated that the layered approach to skill building during the pre-service-learning training program allowed them to build three categories of skills: (1) teaching, (2) discipline-specific, and (3) interpersonal relationship skills. The teaching-specific skills students gained were lesson

planning, time management, communication, and flexibility. Discipline-specific skills included budgeting, knife skills, presenting nutrition content at a basic level, and answering common nutrition-related questions. The interpersonal relationship skills that students gained were teamwork and community awareness.

*Teaching skills*. Students gained teaching skills from all three types of activities – basic, directed, and collective. All students said that during the training program they developed lesson planning skills and an understanding of the importance of planning. Students believed that preparing in-depth lesson plans during the Lesson Plan Outlines, a directed learning activity, was most beneficial for developing lesson planning skills. Students talked about how doing in depth planning before they began their service-learning experience allowed them to be highly prepared for the experience. One student said: "[Having lesson plans prepared in advance] really benefited us, … instead of focusing on … what we are going to teach [that] week, we were able to just glance at [the lesson plan] and fine tune the details … but we had the core there already, which allowed us to be more prepared." Even though students appreciated the lesson plans during the service-

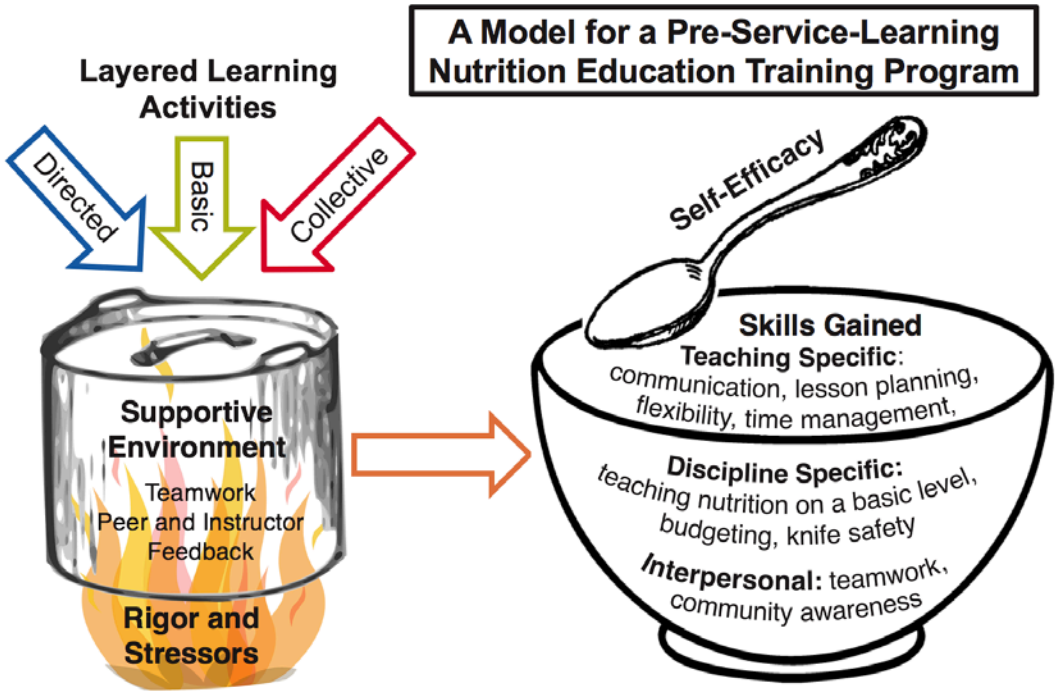


**Figure 1. Model for Pre-Service-Learning Training Inputs and Outputs**[4]

learning experience, many were initially frustrated at the scope of the assignment, feeling ill-prepared to complete it. Some students found it frustrating that they had to complete all their lesson plans during the first two weeks of the pre-service-learning training, but once they started the service-learning experience, they said they were glad to have lesson plans mostly finalized. Even

[4] Images from https://openclipart.org (cooking pot by "tom" and fire by "glitch"), www.clipartpanda.com (spoon), and www.imagui.com (bowl)

though lesson planning had the potential to be time-intensive and stressful, having lesson plans drafted by the second week of the training program allowed students to adjust and refine their plans throughout the next five weeks. The collective learning activities, such as the mock lessons, provided students with the opportunity to practice teaching nutrition and allow them to discover what teaching and planning techniques would and would not work for them. By having lesson plans completed before these collective learning activities, students could adjust the plans as they learned more about effective teaching techniques.

Like lesson planning, the collective learning activities helped students gain time management skills because they participated in activities that mimicked their service-learning experience. One student said that the time constraints of the mock lessons were helpful because: "It really allowed me to … consider the most important aspects of my lesson." The collective learning activities provided students with experiences that allowed them to reflect on their lesson plans and think about how they would spend their time during their future lessons.

Students also reported building communication skills during the pre-service-learning training program. Students said the facilitated dialogue activity, a basic learning activity, was most helpful. They said that this activity allowed them to develop their communication skills by learning how to ask open-ended questions and practicing doing so. One student said they discovered "how important asking open ended questions was, because it showed … how much the kids were actually learning." Students were then able to refine their communication skills by applying what they learned about open-ended questions and the principles of public speaking during the collective learning activities. One student said that the knife skills evaluation was also helpful in building communication skills: "[It was] the first time that we were demonstrating and speaking in front of a group, so it helped with our public speaking, our teaching skills and our knife skills all at once, and it kind of got the nerves out of the way." The basic learning activities gave students a general understanding of communication concepts so they could effectively apply those concepts during the collective activities and ultimately during their service-learning experience.

Students also learned to be more flexible from the collective learning activities. These activities presented students with opportunities to problem solve and juggle many aspects of teaching at once. Students said that by facing unexpected challenges during mock teaching, such as disobedient mock lesson participants, they could learn how to handle these situations and prepare for similar ones in the future. One student said, "I remember being really frustrated [when classmates pretending to be kids were acting up during the Mock Lesson], because I was like, why couldn't they give us a little bit of slack? But when we went out into the community, we actually had a really rambunctious group of kids, so it was good to … have already practiced that and … see how to handle that as a team." A student reflected that these types of activities helped build a realization that "nothing is ever going to go perfectly, and it's important to adapt and make changes so that the participants can learn as much as possible in order to gain from the experience." Through these collective activities, students reported gaining the ability to "think on their feet," learn to remain composed and not panic when difficulties arose, and understand how to answer questions when they were unsure of the answer.

*Discipline-specific skills.* In addition to the teaching skills, students also gained discipline-specific skills that they could combine with their teaching skills to have a successful service-learning experience. Students reported that the budgeting activity, a directed learning activity, taught them about eating healthy on a budget. For example, ingredients in a recipe could be

swapped with less expensive options while still maintaining the healthfulness of the dish. One student reflected, "The recipe called for, I think, almonds. And so almonds were very expensive, so we substituted sunflower seeds instead because they were a cheaper option." Most of the students said that they benefitted from the directed learning budgeting activity because it allowed them to experience the budgeting process and therefore be better equipped to teach budgeting to others. One student said, "If you're going to teach people budget techniques, you're going to have to go through it yourself so you're not just talking about it."

The students also reported gaining discipline-specific skills of healthy and safe cooking. Many students thought they learned the most about food safety from the collective learning activity where they had to demonstrate knife skills and communication skills simultaneously. One student said, "You wanted to make sure you [demonstrated using a knife] the best way possible. … Since we were working with kids, knife safety was so important to be able to teach them, and so holding the knife right was kind of ingrained in our brain by that week." Another student said, "The knife skills [evaluation] really helped me, because it forced me to say [the process of chopping a food] out loud. I think that it kind of gave us an idea, of what it was going to be like it whenever we were telling the kids how to use a knife." This is an example of how the teaching-specific and discipline-specific skill building came together through a collective activity.

Some students also discussed how the training program prepared them to teach nutrition concepts on an elementary level, especially during the mock grocery store tour when they were asked a series of tough questions related to nutrients in foods. As a collective activity, the grocery tour pushed the students to utilize prior nutrition and communication knowledge to develop clear and concise answers to student questions on the spot.

*Interpersonal Relationship Skills.* Students reported gaining community awareness and the ability to work with a team because of the pre-service-learning training program, both skills that had the potential to impact interpersonal relationships with their teams or with their future community participants.

While students had an opportunity to build community awareness throughout the entire course, when discussing the pre-service-learning training, students mainly described the impact of the directed learning activities on developing an understanding of and empathy for community members. Students commented that they could gain a better understanding of their community participants' budgets from the budgeting activity, since they were expected to stay within a tight budget. One student said, "[It] allowed us to … think of where that specific population would shop … and it … had us think more, budget-wise, making sure things were affordable for people, and easily accessible for that group of people." This directed learning activity also allowed students to realize "that not everybody is going to be [from the same] socioeconomic [background]" and that it was important for students to "communicate that you can eat healthy on a lower budget, … that it's not an unrealistic feat."

Most of the activities were team-based; therefore, the layered approach to instruction allowed students to build skills in teamwork gradually throughout the pre-service-learning experience. One student said that the first team activity, the Iron Chef Challenge, was beneficial: "Just to be thrown into it like that, with no preparation, trying to make the best dish, was challenging but kind of, I guess helpful for later on. … We knew that we were able to work as a team after this first week of lab." One student reported that the collective activities helped them identify problems in their group and allowed them to fix the problems before they taught in the

community. That student said, "[One] group member we saw was talking a lot [during the mock lesson], and didn't really give [another teammate] a chance to talk. We saw that we needed to find a way to deal with that in the classroom later on. I guess it just gave us a preview of what was going to happen in the next few weeks." Another student thought that the collective learning activities helped their teams work together and prepare to teach in the community because "it also allowed [them] to see how [their] teammates interacted under pressure and stress." Due to the scope of the interview questions, we did not ask the students how these interpersonal relationship skills might have impacted their experience in the community.

*Theme 2: A stressful yet supportive environment facilitates growth*

While students were able to build many skills through the pre-service-learning training, the rigor of the program left many students feeling stressed and under pressure to perform well. Some students thought that there were an overwhelming number of time-consuming assignments during the pre-service-learning training. However, students reported that they could endure the stress due to support from their teammates and teachers. By the end of the experience, students reflected that the stressful aspects of the program were key to the development of their skills and fully preparing them for the service-learning experience.

*Stressors provide pressure for growth.* The activities that the students found to be most stressful during the training program also happened to be the most beneficial in terms of refining skill development and preparing them for work in the community. The activities that students said were most stressful were the two lesson planning activities and the collective learning activities. When students reflected on the training program after the service-learning experience, they recognized that although these activities were rigorous, they were key to preparing them for a successful service-learning experience.

Students found the two directed activities related to lesson planning to be highly stressful. Some students said the activities made them feel like they were thrown into the class. Even though students were given the pre-packaged curriculum as a guide, one of the students described the process of deciding what to include from the curriculum as: "[being given] a blank piece of paper and [told to] jot down what you're going to be teaching in the next six weeks." However, it was necessary that students be briefly overwhelmed by the scope of this activity so that they would put sufficient time and effort into their lesson plan. A well thought out lesson plan is key to a successful service-learning experience. It is used and edited throughout the training program so students can rely on it during their service-learning experience. After the semester was over, students reported that they found making lesson plans in advance very useful for when they began the service-learning experience. One student said, "Everything we did was, worth it and at the time it could be stressful, but I think it was important to [plan during lab so that when] teaching out in the community we could focus more on the participants and not stress about our lessons. So I think I gained a lot from the lab experience." Even though students claimed to be stressed by this activity, all the teams eventually developed detailed lesson plans that they relied on during the service-learning experience.

The students also participated in collective activities where they taught practice lessons in front of their peers. Students reported being nervous when practicing in front of peers, but they realized it helped build teaching and communication skills. One student reported that these

activities helped them be "comfortable in front of a crowd and able to – demonstrate how to [use a knife properly]." One student also reported that since she was nervous about the first collective activity, the knife skills evaluation, she spent a lot of time preparing for it. The stress of this activity encouraged her to devote more time to her preparation, so that she was confident in her knife skills by the time of the evaluation. Another student recognized that the extra stress that came with this graded assignment motivated them to master their knife skills before they entered the community and were expected to teach kids how to properly use knives. Even though students found the pre-service-learning training to be stressful, they reported that it helped prepare them for the service-learning experience.

*Supportive environment helps relieve the negative effects of stress.* Students reported being able to endure the rigor of the training program because of their teammates, feedback from others, critical reflection, and the course design. The pressure of the course requirements presented opportunities for students to build teamwork. One student discussed working on the lesson plans as a team: "I think it helped our team dynamic. For us to bond, work together and learn how to do that and it also just helped us throughout the whole semester, being able to look back on it as a reference and it really kind of got us thinking about what to teach to the kids." Even though the activity was described as stressful by many of the students, after the training program they recognized that it was a beneficial experience that improved their team dynamic.

Some students also reported that their service-learning teams were different from groups in other classes because they learned they could actually rely on their teammates. One student stated, "I've worked in teams before, but it was the kind of thing where the one person does everything and everyone just kind of slacks off. … [In this situation], we all had learn to do our part and to pull our weight." One student even reflected that the collective learning activities allowed the student to see that "the most beneficial aspect was learning how to support other teammates in terms of their part of the lesson." Teams served as a source of support, so when the students felt stressed, they could rely on their teammates to help them prepare for training activities and eventually the service-learning experience.

Students also found critical reflection to be supportive during skill building because they received feedback from instructors and peers during the collective learning activities that helped them reflect on their successes and shortcomings. One student said, "we kind of learned from our mistakes when we were teaching in the mock lesson and so we were able to change it and do it more efficiently when we were teaching in the community." Another student said, "having [my peers] give me feedback on … what to change and what to keep was really, really helpful." In addition to benefitting from peer feedback, students also found it useful to watch their peers because they could compare their own performance with that of other students and learn from the performance of others. Reflection during the pre-service-learning training program allowed students to hone their skills before teaching in the community and cope with the stress of new teaching experiences.

While the course design was rigorous and challenging, it also served as a source of support during skill building. One student said, "We were taught pretty much everything that we needed to know to prepare us to teach the children. At first it was kind of overwhelming, because we didn't know what we were, kind of, getting into, but they taught us the proper knife skills. They taught us about planning. They taught us about important things to think about when teaching in front of the class and classroom management. They went through the manual that the kids were going to

have, and we practiced cooking every week as a team, and team work and team building." Ultimately, the pre-service-learning training program design allowed students to work in teams to build nutrition education skills and their confidence in those skills, preparing them for the service-learning experience.

## Discussion

The pre-service-learning training program was designed to improve students' skills and confidence in those skills. The service-learning experience had already been shown to improve student self-efficacy in teaching nutrition education (Cooke et al., 2015; Goodell, Cooke, & Ash, 2016), but we found that additional experience and training through the pre-service-learning training program also contributed to an increase in students' self-efficacy. The layered learning approach gave students the opportunity to build skills incrementally before the service-learning experience began. While students reported feeling stressed by the rigor of the program, their teams and the regular critical reflection helped mitigate that stress. Ultimately, students reported that the pre-service-learning training program prepared them for teaching in the community. We believe students' learning can be attributed to the design of the pre-service-learning training program, specifically, the incremental skill building through layered learning activities and incorporation of Bandura's four sources of self-efficacy: vicarious experience, verbal persuasion, mastery, and physiological/ emotional state (Bandura, 1977).

Instructors at higher education institutions can create similar programs with discipline-specific goals to fit their students' needs and the class' learning objectives. Because it takes individuals time to process and respond to feedback (Bandura, 1977), the layered learning structure this training program allowed for students to build skills gradually over the course of the training period, rather than when they teach their first lesson in the community. This layered learning course design differs from Nunley's Layered Curriculum in which students choose from a pool of activities of varying complexity and are graded based on the number and complexity of the activities completed, allowing them to tailor their own learning (Nunley, 2003). Rather, in the pre-service-learning training layered learning design, all the activities were required to fully train students for the service-learning experience, though they did have different grade weights based on the complexity of the task. Still, the principle is the same: when you present students with layers of activities that build upon each other, you give students the opportunity to accomplish each learning goal, even when teaching students of varying prerequisite knowledge (Nunley, 2003). It is important for students to attribute their successes to skills, rather than chance, and for opportunities to build self-efficacy to be varied in nature (Bandura, 1977). Likewise, these layered learning activities provided students with incremental and varied realistic circumstances that serve as opportunities to succeed, therefore increasing self-efficacy in the skills associated with those successes.

The basic activities taught students key concepts related to the service-learning course objectives, such as what to expect in the service-learning experience. In this training program, we provided this basic knowledge of the service-learning experience through vicarious experiences, allowing students to view and discuss videos clips of former students with similar background experience, teaching the same curriculum in a community setting. Using former students as models is most effective in building self-efficacy because students can relate to individuals like themselves

(Tschannen-Moran & Hoy, 2007). Verbal group reflection paired with these examples allowed students to critique previous students' performance, suggesting what they thought was effective and what they would do differently in the same situation. Not only did these basic activities serve as an introduction to the course, but students also began to build self-efficacy through these vicarious experiences by seeing peers succeeding, showing students they, too, were capable of successfully completing the service-learning experience (Wood & Bandura, 1989).

The directed activities provided students with opportunities to develop and apply their knowledge and skills, while beginning to gain mastery of these skills. During these directed activities, students worked with their teammates to build key skills related to their service-learning project, such as how to purchase ingredients for healthy meals on a small budget and how to prepare engaging, organized lesson plans. As novices, students take longer to complete tasks and are more prone to errors (Ackerman, 2007), so these lower-stakes directed activities play an important role in skill building. These activities fit into the middle of the three-stage Model of Domain Learning, between acclimation and proficiency, allowing students, through practice, to become competent in these directed skills (Alexander, 2003). It is therefore important to recognize that while students might be proficient in their discipline-specific knowledge, they might be just becoming competent in these new skills related to the service-learning experience.

Finally, collective activities allowed students to use, improve, and combine their skills to effectively teach nutrition to community members. This is where students demonstrated their mastery, which is the most influential source of self-efficacy (Tschannen-Moran & Hoy, 2007). Since students' self-efficacy increases when they succeed (Bruning et al., 2010), the pre-service-learning training program purposefully included multiple opportunities for students to succeed, in the form of mock teaching experiences. To improve skill and self-efficacy, students experienced verbal persuasion in the form of positive and constructive feedback from instructors and peers after each collective activity. Even if students did not succeed at first, they had several opportunities to do so before they began their service-learning experience. Similarly, many teachers claim to learn the most about classroom and behavior management during in-class mock experiences, followed by actual fieldwork (Stough, 2015). Likewise, the students interviewed in this study claimed that these collective activities were most beneficial at preparing them for the service-learning experience. There was still some mastery during the directed and collective activities, but the overall purpose of these collective activities was to allow for development and practice of skills to prepare for the service-learning experience, and more globally, for future careers in nutrition education. This follows the trend that as teachers become more skilled and build self-efficacy through mastery experiences, the other three sources of self-efficacy have less of an impact on their self-efficacy (Tschannen-Moran & Hoy, 2007).

In addition to layered learning activities, we found that a balance between stress and support is necessary for student growth and skill development, which relates to the physiological and emotional sources of self-efficacy. Stress is unavoidable when students are introduced to new situations, such as student teaching (Murray-Harvey et al., 2000). It typically has a negative connotation and is most often associated with the destructive response it can generate, but stress can also generate a productive, positive response or "eustress" (Gibbons, 2012; Hargrove, Becker, & Hargrove, 2015; Lazarus & Folkman, 1984), serving as a motivator for performing at an optimum level (Gibbons, Dempster, & Moutray, 2008). The degree to which individuals view stress as positive (eustress) varies within individuals (Lazarus & Folkman, 1984), and their ability

to cope with stress, whether negative (distress) or positive (eustress), is determined by the personality; self-efficacy; and perceived control, support, and coping style (Gibbons, 2012). While there is no magic formula for the appropriate amount of eustress, a supportive course design and learning environment can help mitigate this process.

Students reported that they were stressed by many of the training program activities due to the newness of the activities, compared to traditional class activities, and the scope of the material. While students often seek out peers as a response to course stress (Gibbons, 2012), faculty can provide a supportive peer framework within service-learning courses in order to minimize students' stress levels. In the pre-service-learning training program and the service-learning experience, students' teaching teams could provide this support. Specifically, students stated that their teammates helped them build skills in preparation for both the collective activities and the service-learning experience.

Critical reflection and feedback, both sources of verbal persuasion, were also influential in creating a supportive environment and limiting stress. Teammates provided constructive criticism after most of the collective learning activities, allowing students to learn from a peer who was going through the same experience, not just from their instructors. Building a learning environment that both encourages and requires self-reflection and peer feedback allows students to develop a supportive relationship with peers and instructors. This type of relationship has been shown to have a positive impact on academic performance (Murray-Harvey et al., 2000). While initially students might struggle with receiving constructive criticism, most of the time they are able to respond to feedback positively to improve their performance (Goodell, Cooke, & Ash, 2016). Therefore, constructive criticism and supportive teams should be included in a pre-service-learning training program to help develop a positive psychological state in the students, which is key for an increase in student self-efficacy.

Students claimed that they were stressed during the pre-service-learning training program; however, when they reflected on the effectiveness of the training program after the service-learning experience was completed, they recognized that the rigor of the program was necessary to fuel skill building. Therefore, the incremental, layered approach to learning, and the supportive environment to minimize stress had an impact on student's self-efficacy development, confirming what we saw quantitatively through previous research (Cooke et al., 2015). University instructors can use a similar format to provide students with experiential learning before the service-learning experience, ultimately leading to better-equipped students, and better outcomes for community participants and partners.

*Limitations*

While we employed a rigorous qualitative research design, our study was a volunteer sample. Because the sample was a volunteer sample, not all the students in that semester completed interviews. Therefore, there might be something different about the students who chose to participate in the interviews. To encourage participation in interviews, we provided an incentive for participation. Two years ago, we created the Iron Chef Challenge activity, which we believe was necessary for developing trust in teammates. Therefore, we opted to include only students who participated in the Iron Chef Challenge because others might have had a different experience

with their teammates. While we did not interview students in subsequent semesters, we have confirmed these findings through informal end-of-semester focus groups.

*Implications*

In light of this knowledge, instructors who desire to incorporate service-learning into a course may want to consider creating a pre-service-learning training component, especially if relatively untrained students are going to be educating in the community. This training should be organized with layered learning activities to gradually prepare their students for work with the community paired with a healthy level of stress and support to fuel skill building. Better-prepared students may lead to more effective service-learning experiences for all parties involved, potentially resulting in higher self-efficacy and skills for students, better relationships with community partners, and more beneficial outcomes for community members.

Weekly reflection discussions are also an important aspect of the supportive environment of the service-learning class, involving teammates, professors and community liaisons, in critical discussion of weekly successes and shortcomings while teaching lessons. While this study did not explore the impact of the reflection sessions, future work could determine what role the reflection sessions played in developing self-efficacy during the service-learning experience. As similar pre-service-learning trainings are developed, future studies could determine the similarities and differences in training programs across disciplines.

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# Does Team Formation Impact Student Performance, Effort and Attitudes in a College Course Employing Collaborative Learning?

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*Abstract: The literature on team-based learning emphasizes the importance of team composition and team design, and it is recommended that instructors organize teams to ensure diversity of team members and optimal team performance. But does the method of team formation actually impact student performance? The goal of the present study was to examine whether different team formation methods would affect individual and team performance outcomes and student attitudes in an undergraduate general education course. Across three different sections of the same course, teams were either designed by the instructor, by the students, or randomly by a computer program. We found that teams designed by the course instructor were more diverse, but that students in these teams performed no better than their peers in self-selected or randomly assigned teams. Because student performance was similar regardless of team formation method, these findings suggest that student formed teams can be a reasonable option for instructors to consider when planning a team-based course.*

*Key Words: collaboration, higher education, team formation, flipped classroom*

## Introduction

### Collaborative Learning

Collaborative learning is a form of active learning that encourages student-student interaction in the learning environment (Prince, 2004). Broadly defined, collaborative learning is a method of learning that involves sharing knowledge, experiences, and authority, in which students teach and learn from each other and develop a positive interdependence (Panitz, 1999). Structuring the learning environment in this way helps students appreciate multiple perspectives, provides students with opportunities to learn team work skills, and encourages individual students to make personal contributions to their academic experience (Barkley, Cross, & Major, 2005).

The benefits associated with the implementation of collaborative learning activities have been extensively documented (for reviews see, Haidet, Kubitz, & McCormack, 2014; Johnson & Johnson, 2009; Laal, Naseri, Laal, & Khattami-Kermanshahi, 2013; Springer, Stanne, & Donovan, 1999). Highlighting some of these key benefits, studies have found improvements in critical thinking skills (Gokhale, 1995; Sanchez, Rivas, & Moral, 2015), improved test scores (Crouch & Mazur, 2001; Hake, 1998), and improved retention of course material (Ruhl, Hughes, & Schloss 1987). Even beyond improved test scores, Carmichael (2009) also noted that collaborative activities energized students and increased student engagement with the material and with each other. Similarly, after having students work in small groups to think about and try to solve real-world issues, Chace (2014) found that this type of activity helped foster deeper learning and

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engagement with course material, and gave students the unique opportunity to work together with peers to use scientific evidence to make real policy changes at their college. Other positive effects of collaboration include increased enjoyment of the material, higher student self-esteem, and improved attitudes towards diversity (Johnson & Johnson, 1986).

When considering the impact of collaborative learning activities, it is important to take into account how group learning has been designed and implemented in the course. For example, a group activity can be short term (e.g., organized around specific assignments for a single class or limited number of class periods); or more long term, over the course of an entire semester or year, contributing to the formation of small "learning communities" within the class (Barkley et al., 2005). Using the latter approach is believed to generate greater student learning effectiveness, and is considered a "transformative use of group" (Michaelsen, Knight, & Fink, 2004). Moreover, when groups are used in a transformative way, students not only learn the content and how to use it, but they also learn about themselves, how to interact with others on major tasks, and how to keep on learning after the course is over (Fink, 2004).

## Approaches for Team Formation

Many researchers have suggested that different knowledge, skills, and abilities of team members are important for optimal team compositions. Mixing together students with diverse knowledge, skill sets, and abilities has been thought to allow a team's members to bring their unique skills to the team to provide the team with a broadest skill set (Oakley, Felder, Brent, & Elhajj, 2004; Muchinsky & Monahan, 1987). Belbin (1993) suggested that if the team effectiveness is a function of a set of interdependent roles, the high levels of complementary fit would result in higher levels of performance. Similarly, Michaelsen et al. (2004) suggested that for teams to function effectively they should be as diverse as possible so that the students' assets and liabilities are evenly distributed among different teams. Instructors are encouraged to consider attributes such as student work experience, courses previously taken, demographic representation, and attitude toward group work, among others. These authors suggested that most students do not intuitively have enough information or the inclination to wisely form groups; so the task must always be the responsibility for the instructor (Michaelsen et al., 2004). However, such instructor-based team formation requires knowledge of individual student qualities such as group work style, background knowledge of the field, academic strength, language skills, and the like, and often these data are unavailable or difficult to obtain, particularly as students change into and out of classes early in the academic term (Gillies & Boyle, 2010).

Instructor-designed teams are advocated for by many experts, but there are additional methods available to form effective student teams for instructors in courses employing student teams. For example, Shen et al. (2007) have listed various examples of team formation methods, which can roughly be grouped into three categories: a) the students choose their own teams; b) the instructor forms the teams based on certain pre-determined criteria, e.g., class order, personality type, learning styles, majors, gender, nationality; and c) a random team member selection process is employed. Of these three types of team formation approaches, which type of grouping yields the best student performance and most positive student attitudes in a team-based class? This question has been frequently debated within the literature with little consensus, as there is evidence to justify and support the use of all three of these strategies (e.g. Bacon, Steward, & Anderson, 2001; Bacon, Stewart, & Silver, 1999; Chapman, Meuter, Toy, & Wright, 2006). The goal of the

present study was to examine how different team formation strategies affect student course performance outcomes and student attitudes in a team-based, undergraduate general education course.

## Methods

### Participants

A total of 185 undergraduate students from three separate sections of a general education college science course participated in this study. Using composite SAT scores (i.e. total combined score on the math, verbal, and writing sub-sections) as a proxy for academic achievement readiness, there were no differences between the three sections. Likewise, the average grade point average (GPA) of students in each section was computed at the conclusion of the semester in which the course was taken, and average student performance among sections was similar. There was, however, variation across the three sections with respect to the gender and ethnicity distributions, as well as the number of students enrolled. Details of the enrollment numbers, course design, and student demographics can be found in Table 1.

Table 1

*A Summary of Course Enrollment, Course Design, and Student Demographics*

| Team formation method | No. of teams | TAs | No. of students (F, So, J, Sr) | % female | % under-represented minority | Avg. GPA | Avg. composite SAT score |
|---|---|---|---|---|---|---|---|
| Designed | 11 | A, B | 87 (20, 27, 17, 22) | 31% | 24% | 3.23 | 1765 |
| Self | 11 | A, C | 71 (24, 29, 11, 7) | 55% | 38% | 3.27 | 1767 |
| Random | 5 | B, C | 27 (7, 13, 2, 5) | 33% | 48% | 3.21 | 1800 |

## Procedure

### Course description

The course was offered at a large public university in the Northeast United States. The course content focused on human molecular genetics with contemporary examples from the popular media. Students taking the course earned general education credit in the area of biological sciences, one of the four areas required of all undergraduates at the institution. Three separate sections of the course were taught by the same instructor, and three teaching assistants (TAs) denoted A, B and C were present with the primary instructor for each class meeting, and were assigned in different combinations among sections, see Table 1.

The course was structured as both a flipped course and as a team-based course. The flipped content included prerecorded online lectures, online homework, and reduced in-class lecture time.

The team-based content included team projects, readiness assessments, peer review, and in-class team work. All sections had these course elements in common.

All sections met one time per week for a 75-minute face-to-face session, which was half the usual class time dedicated to similar courses. Online homework and five to seven prerecorded lectures were assigned to be completed prior to class. The prerecorded lectures were designed to cover specific individual topics, and recordings ranged from 5 to 15 minutes in length. These recordings were tightly tied to each week's class content as well as to online homework delivered through the OWL (Online Web Learning) homework system (Hart, Woolf, Day, Botch, & Vining, 1999). The online homework assignments were available for the week prior to an upcoming class. All homework questions provided specific feedback about correct and incorrect answers. Students earned credit for homework depending on accuracy, but these assignments could be repeated as often as desired, thus allowing persistent students who did not understand the concepts upon first homework attempt to obtain full credit. In addition to the OWL homework, students also completed online quizzes (individual readiness assessments, iRAs) prior to class throughout the semester to gauge individual mastery of the course material.

An early class period included a segment in which each team determined three to five important characteristics of a good team member. After teams reported their lists, the whole class came to a consensus list. These four or five characteristics, which were slightly different between sections, were used as the basis of subsequent peer reviews in which team members rated their team members, including themselves, on each of the characteristics. All of these reviews had the common characteristics of communication, attendance and preparation, participation and accountability. Three such reviews were completed during the semester. The last two of the three counted toward the course final grade.

Class sessions typically started with a 20 minute team readiness assessment (tRA) of pre-class material content. The remainder of the class included about 30% instructor lecturing, with the rest of class time focused primarily on team practice with course concepts and material beyond that offered online. Team work in class was facilitated by the instructor and two teaching assistants who roamed the classroom to respond to team questions as needed. Exceptions to this pattern were for the first class session, which introduced the course structure, and two in-class exam sessions.

## Team formation

Each section used a different method to form the teams that then worked together throughout the semester. The instructor-designed teams (Designed) were formed by placing students into teams based on their responses to a personality survey, their year in college, gender, and their major. When forming Designed teams, the instructor's goal was to maximize team member diversity. Student-formed teams (Self) were allowed to assemble in class as the students preferred. Random team formation was accomplished by the use of group-forming software in the course learning management system, Moodle. The two larger sections had more teams to keep the average number of team members per team approximately equal. Each section was informed of the method of team formation to be used in the section prior to the formation of teams, and students were given the opportunity to change sections prior to team formation if they preferred a different team style or a different meeting day. Two students moved from the Designed teams section to the Random teams section.

## Measures

### Student performance measures

Student performance in the course was evaluated at multiple levels—individual performance, team performance, and effort—corresponding the different elements of the course design, as outlined above. The sections that follow provide detailed descriptions of the way in which these measures were calculated for the purpose of this study. A summary of these measures can be found in Table 2.

Table 2

*Summary of Key Study Variables*

| Measure | Components of the Measure |
|---|---|
| Individual performance | Exam and iRA averages |
| Team performance | tRA, project and peer review averages |
| Effort | OWL homework and bonus averages |
| Diversity | Personality traits, class year, and male/female team composition |

*Individual performance.* The individual performance score includes measures that reflect the outcomes for assessments completed by students working alone. This measure was calculated by computing the average of exam and iRA scores for each student. Prior to computing the individual performance average, the exam and iRA scores were both re-scaled such that the maximum score of each assessment was 100.

*Team Performance.* The team performance score includes measures that reflect the outcomes for assessments completed through collaborative work among team members. This measure was calculated by computing the average of tRA scores, project grades, and peer review averages for a team. Prior to computing the team performance average, the tRA scores, project grades, and peer review averages were all re-scaled such that the maximum score of each assessment was 100.

*Effort.* The effort score includes two measures that reflect student persistence in the course, with greater effort represented by higher scores. These two measures were the OWL homework score and the bonus score. As previously described, the OWL homework was designed such that repetition of the exercises would result in full credit. This is a measure of persistence because students received feedback on the homework exercises once submitted and students could repeat them as often as they wished (prior to the assignment due date). The bonus score measured student persistence in that students had the option to complete several surveys, and completion of each survey generated a small amount of bonus credit (0.5% of the total course score).

### Team diversity

The diversity score reflects the combination of three separate measures of diversity: student personality, class year, and gender. Each measure included in the diversity measure had a maximum of 1, thus when combined, the maximum possible diversity score was 3, with higher

scores indicating greater team diversity. The calculation of the separate components of the diversity measure are described below.

*Student personality diversity score.* Personality was assessed with a self-report survey (designed specifically for this course) which provided twelve separate personality types for student selection. These twelve types fell into four broad personality trait categories: leadership, creativity, practicality, and diplomacy. Each of the four categories contained three of the personality types. The degree of diversity based on personality traits was computed as the number of different personality traits on the team divided by the total number of student responses from the team.

*Class year diversity score.* The degree of diversity based on student class years was computed as the number of different class years found on a team divided by 4. For example, a team that had at least one freshman, sophomore, junior, and senior would have a class year diversity score of 1, while a team consisting of only freshman would have a class year diversity score of 0.25.

*Gender diversity score.* The degree of diversity based on the distribution of males and females on a team was computed as:

$$Gender\ diversity = 1 - \frac{|\ Number\ of\ males - number\ of\ females\ |}{Total\ number\ of\ team\ members}$$

**Student attitudes and preferences**

Several end-of-semester survey questions were designed to assess how students felt about the team-based aspects of the course. Students were asked how satisfied they were with the way in which teams were formed, whether they would have preferred teams to be formed in an alternative way, how successfully their team worked together, whether they worked with other students to complete non-team course assignments, and whether they felt connected to other students in the course. These questions were included as part of a voluntary course questionnaire.

## Results

The goal of this study was to examine how different team formation strategies affect student course performance outcomes and student attitudes in a team-based course. Within the educational literature there is considerable emphasis on ideal team characteristics and team formation strategies, and it is often recommended that instructors organize the teams to maximize diversity of team members with the goal to improve team performance. In this study, we compared three different approaches to forming teams within a team-based learning course in order to determine whether these different team formation strategies affect student and team outcomes.

**Student Performance**

We examined student performance in the course in terms of individual performance, team performance, and effort. Individual performance and effort reflect the outcomes on assessments completed by students working alone, whereas team performance reflects the outcomes of assessments completed collaboratively. As such, analyses for individual performance and effort consist of 185 observations (one data point per student), while the analyses for team performance

consist of 27 observations (one data point per team). We used the Kruskal-Wallis test to examine whether there were statistical differences in the student performance measures depending on the three different team formation strategies used in each section.

Supporting the idea that the way teams are formed affects team diversity, we found that the distributions of diversity scores differed depending on the manner in which groups were created, $H(2)$ 14.87, $p$ = .001. We used Mann-Whitney tests with a Bonferroni correction applied for multiple comparisons ($\alpha$ = .0167) to determine which sections differed from one another. Designed teams were more diverse than Self teams ($U$ = 20, $z$ = -2.67, $p$ = .007) and Random teams ($U$ = 1, $z$ = -3.01, $p$ = .001). Additionally, Self teams were more diverse than Random teams ($U$ = 4, $z$ = -2.66, $p$ = .005). See Figure 1 for a graphical representation of these results.

But does team formation strategy, and consequently, the increase in team diversity, affect student performance in the course? First, focusing on individual performance, we did not find evidence that the different team formation methods within each of the three sections affected coursework that students completed on their own, $H(2)$ = 2.20, $p$ = .33. That is to say, we did not find an advantage for any particular team formation method; numerically, students across all sections performed quite similarly on the individual aspects of the course. Likewise, we did not find evidence that team formation method affected effort, $H(2)$ = 2.39, $p$ = .30. Finally, looking at team performance—where arguably the impact of the different team formation methods would be at its strongest—we again found no statistically significant differences in performance across the three sections, $H(2)$ = 3.90, $p$ = .14. A summary of these results can be found in Figure 2.

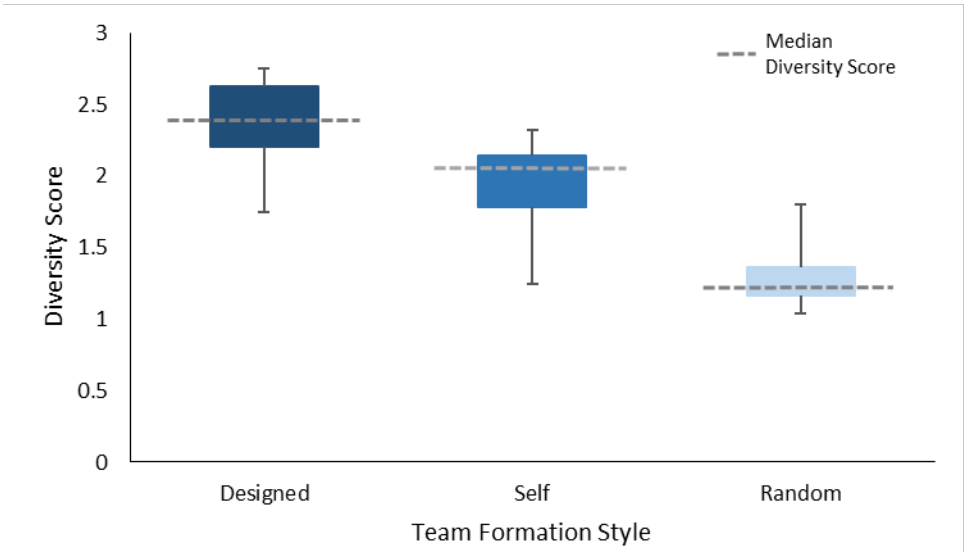


*Figure 1*. Team diversity as a function of team formation method. This graph depicts the diversity score distributions for each of the three course sections. The median diversity score is marked with a dashed horizontal line, the box represents the 25th and 75th percentiles, and the bars indicate the minimum and maximum values. Larger scores indicate greater diversity.

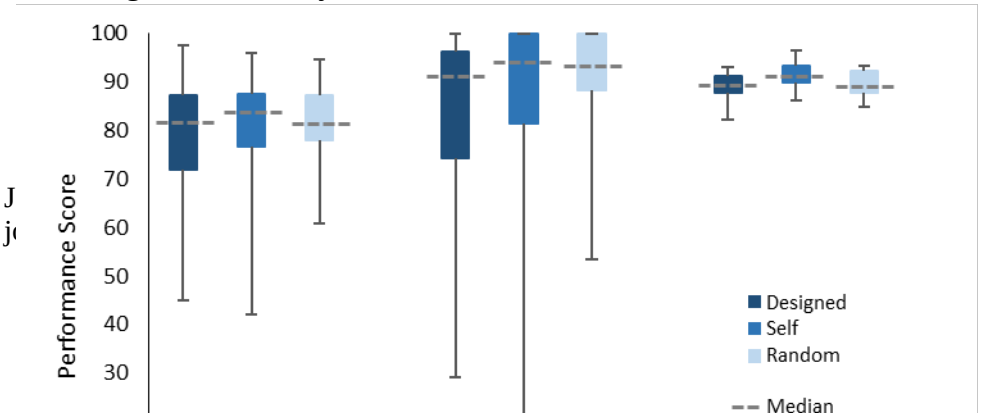

*Figure 2*. Course performance as a function of team formation method. This graph depicts the distributions of individual performance, effort, and team performance scores for each of the three course sections. The median score is marked with a dashed horizontal line, the box represents the 25th and 75th percentiles, and the bars indicate the minimum and maximum values.

**Student Attitudes and Preferences**

In addition to course performance outcomes, we were also interested in student attitudes and preferences regarding the team-based aspects of the course, and whether there were any differences in these attitudes and preferences depending on the different ways that teams were formed in the three course sections. It is important to note that because survey completion was voluntary, we do not have responses from all students in each section of the course. Nonetheless, here we present the findings from the sample of students who responded to the survey (51% of Designed, 57% of Self, and 41% of Random). Because responses to these questions were categorical and the sample size was relatively small, these data were analyzed using Fisher's exact tests. Key findings are discussed below, and for a complete summary of student responses to these questions see Table 3.

Most students (85% of all respondents) were satisfied with the way in which teams were formed within each section, and there were no statistical differences in the satisfaction rates among the three sections ($p$ = .78). However, there was variation in student preferences for how teams should be created ($p$ = .001). A plurality of respondents from Designed teams (48%) responded that teams should be selected randomly, while most respondents from Self teams (66%) felt that teams should be chosen by students. Respondents from Random teams were fairly evenly split in their opinions, with a slight preference for random selection (6 students, or 55% of respondents) over student-chosen teams (4 students, or 36% of respondents).

When asked about teams' abilities to work together—overall, and then specifically on the tRAs and team projects—responses there were no statistically significant differences across the three sections for each of these questions (all $p$ values > .18). Collapsing across the different sections, with respect to opinions on overall team performance, most students (52%) reported that "it was good most of the time." For the tRAs, most students (61%) indicated that teams worked together very well and everyone contributed while the remaining students (39%) felt that team performance was okay, but not everyone contributed. Opinions for team work on the projects were also divided between these two options, as just over half (51%) felt that their teams performed

"very well, and everyone contributes" on projects and just under half felt (48%) felt that their team performance on projects was "okay, but not everyone contributes."

The ways in which students reported interacting with each other in the course outside of the required team-based activities varied depending on the course section ($p = .001$). Most students from Designed teams (39%) did not interact with each other to complete coursework (e.g. homework or exam study) outside the required team-based activities. However, most respondents from Self teams (51%) reported that they worked with some of their team members on coursework, and respondents from Random teams were split between no interaction with peers (4 students, or 36% of respondents) and interaction with some teammates (5 students, or 45% of respondents). Feelings of connectedness with other students in the course also differed depending on the course section ($p < .001$). Respondents from Self teams and Random teams reported that they felt connected with their team members (80% and 64%, respectively). About a third of students from Designed teams also reported feeling connected to their teammates (34%), but their connections also seemed to extend beyond their teams, as respondents from Designed teams most frequently reported that they felt connected with their team and others (43%).

Table 3

*Student Attitudes and Preferences Regarding the Team-based Aspects of the Course*

| Question and Answer Options | Designed (N = 44) | Self (N = 41) | Random (N = 11) |
|---|---|---|---|
| *Were you satisfied with the way that teams were formed?* | | | |
| *No* | 16% | 12% | 18% |
| *Yes* | 84% | 88% | 82% |
| *Given the choice, how would you prefer to form teams?* | | | |
| *Chosen by students* | 23% | 66% | 36% |
| *Designed by the instructor* | 30% | 10% | 9% |
| *Randomly chosen* | 48% | 24% | 55% |
| *What is your opinion on the success of your team's ability to work together?* | | | |
| *It is excellent* | 30% | 39% | 18% |
| *It is good most of the time* | 55% | 49% | 55% |
| *It is good some of the time, but there have been problems* | 14% | 12% | 18% |
| *Most of the time it is not good at all* | 2% | 0% | 9% |
| *How has your team worked together on the tRAs?* | | | |
| *Very well, everyone contributes* | 66% | 63% | 36% |
| *Okay, but not everyone contributes* | 34% | 37% | 64% |
| *How has your team worked together on the team projects?* | | | |
| *Very well, everyone contributes* | 48% | 59% | 36% |
| *Okay, but not everyone contributes* | 50% | 41% | 64% |

| | | | |
|---|---|---|---|
| *Not well, we don't all work together* | 2% | 0% | 0% |
| *Have you worked on other course content (e.g. homework or exam study) with other students in the course?* | | | |
| *No* | 39% | 29% | 36% |
| *Yes, with all of my team members* | 7% | 17% | 9% |
| *Yes, with others in the course not on my team* | 27% | 0% | 9% |
| *Yes, with some of my team members* | 18% | 51% | 45% |
| *Yes, with some of my team and others in the course* | 9% | 2% | 0% |
| *Do you feel connected with other students in the course?* | | | |
| *No* | 20% | 15% | 9% |
| *Yes, to my team and others* | 43% | 5% | 9% |
| *Yes, to my team* | 34% | 80% | 64% |
| *Yes, to non-team members* | 2% | 0% | 18% |

## Discussion

With this study, our goal was to examine the impact of different team formation strategies on student course performance outcomes and student attitudes in a team-based course. The broader thesis of this work is the idea that students can be successful in team-based courses even when the instructor does not design the teams—which is an idea that runs counter to some leading perspectives in the current literature on this topic. Comparing across three different sections of the same course, we did not find statistically significant differences in individual performance, effort, or team performance depending on whether teams were formed by the instructor, by students, or randomly by the learning management system. Also, while there does not seem to be student consensus for one particular team formation method across the three sections, it is worth noting that when asked what method they would prefer given the choice, none of the three course sections chose instructor-designed as the leading method. Data from this course suggest that the instructor-designed method of team formation, which is also more complicated for the instructor to implement, is not favored by students nor does it confer a measurable advantage.

Given that the literature on team formation strategies suggests that diversity plays a key role in the success of a team, we examined the level of diversity on the teams formed with the three different styles. As expected, teams designed by the instructor to be diverse were in fact more diverse than teams formed by students and teams formed randomly by a computer. Surprisingly, student-formed teams were more diverse than teams formed randomly. One must bear in mind that our criteria for quantifying diversity on the teams was based on a specific set of three characteristics: team member personality differences that related to team activities (leadership, creativity, practicality, and diplomacy), years in college, and student gender. We acknowledge that there are many ways to define and measure diversity within student teams, and other measures of diversity may have returned different comparisons of relative diversity between the teams created in these three course sections. Furthermore, we also acknowledge that the operationalization of diversity is critically important for understanding the impact of team composition on student performance, and consequently, for making recommendations for team design. Systematic

comparisons of different ways of conceptualizing diversity are needed, and we hope that this study, and others in the future, will contribute to a more specific and perhaps more nuanced understanding of how to form teams in the classroom.

Prior to discussing the attitude data, we again want to point out that this survey was optional for students, and as a result, only about half responded. Although incomplete, we still feel it is important to summarize and share the opinions of the students who did respond, and we emphasize that these views may not be representative of those who chose not to complete the survey. Overall, students who responded to the survey were satisfied with the way teams were formed, and comparing across sections, satisfaction levels were similar. Since each of the sections used a different method of team formation, this result suggests that students are comfortable with any of the three styles of team formation, perhaps because they have little experience with team formation in a course setting. Importantly, student attitudes toward the collaborative work done by teams are likely to play a major role in team success, and when comparing across sections, we find that students from teams using instructor design, student formation, or random selection all have similar and rather positive opinions about the ability of the team to work together on a variety of team-focused tasks such as collaborative quizzes and team projects.

It was particularly encouraging to find that the vast majority of students across all three methods of team formation reported some degree of connection to their peers in the course. This is promising, as it shows that all three team formation methods can foster feelings of connectedness among students. It is also noteworthy that students in designed teams reported connections beyond their team. This finding highlights a potential benefit of instructor-designed teams, in that students may be encouraged to form a wider range of connections with peers in their courses. At the same time, students in self-formed teams seem to capitalize on their team relationships and take advantage of team member support outside of class to a greater extent than their peers in instructor-designed teams. The increased extent of out-of-class interactions for student-formed teams appears not to play a strong role in overall team success relative to other types of teams, but it does suggest that team formation style may impact student interaction patterns beyond what happens in team activities in class. This would be an interesting empirical question to be investigated with future work in this domain.

Given that instructors in team-based courses find design of teams burdensome and somewhat time consuming during the early sessions of a course, our findings that student-designed teams performed similarly to instructor-designed teams on three separate measures of student performance suggest that a simple and easy to implement strategy for team formation is to allow students to make up their own teams. This method of team arrangement was much easier for the instructor to implement, and was met with no resistance from students, unlike the two other methods of team formation for which a small number of students asked to be assigned to particular teams with each other and expressed disappointment when denied this opportunity.

In summary, our comparison of three team formation methods within three sections of the same team-based course did not provide evidence to support the claim that students in more diverse, instructor designed teams outperform their peers or experience higher levels of achievement in the course. That being said, it is also important to note that we do not contend that instructor-designed teams are not beneficial or that forming teams in this way is not worthwhile, as these claims go beyond the scope of this paper. Rather, we find it encouraging that regardless of how teams were formed in this course, students seemed to achieve similar performance outcomes. Moreover, having students form their own teams reduces resistance to team formation, is easy for the

instructor to accomplish, and it consumes almost no class time. Therefore, based on these findings and observations, we argue that student formation of teams is a viable option for instructors to consider, and more research on the necessity of instructor-designed teams is warranted.

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# Learning to Learn: Lessons from a Collaboration

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*Abstract: E-learning has become one of the primary ways to deliver education around the globe. Research is keeping pace with the use of various techno-aids as educators evaluate how to effectively use these aids in an ever-changing e-classroom. Adding to this body of work, and in assessing the effectiveness of techno-tools, this study evaluates meaningful and deliberative exchanges of online discussions towards building an inclusive online classroom. Unknown to each participant were the gender, race, ethnicity, religious beliefs, course level, and mode of instruction of the other students in the study. These unknowns are important in determining how civically engaged participants are in their discussions with each other. Are they creating dialogue and being reflective irrespective of differing instruction types or levels? A secondary focus of this study, is to provide suggestions in constructing purposefully created online e-learning communities. This project's outcomes have important implications in the ever-demanding need to design effective online communities.*

*Keywords: Online learning, Online Teaching, Instruction Types and Levels*

Online teaching and learning technologies are becoming mainstream as universities and educators reach out to students across domestic and international boundaries. Much of the previous work in this area has centered on hybrid[2] and face-to-face classes (Roscoe 2012) and online discussions complementing in-class usage (Pollock, Hamann, & Wilson 2005, Clawson 2013,). While past research points to growing evidence that online discussions are highly effective means of engagement in political science courses (Hamann, Pollock, Wilson, 2009; Clawson, Deen, & Oxley 2002), we know very little about how students perform in online collaborative projects across levels of courses and instruction type online. Comparisons such as these are important concerns as institutions grow and face challenges to develop and technologically innovate their course offerings. This significance is greatest for educators who want to cultivate and promote reflective student interactions globally across any course level or mode of instruction in comparable fields.

Having been involved in eight semesters of these specifically created online collaborations, I examine one such semester of student participation that used asynchronous discussion forums involving students in three universities across three states and time zones. The levels of the courses and the type of instruction differed across the collaboration. Two of the courses were 3000-level courses. The type of instruction in one class was by online delivery, and the other was a face-to-face course. The third course was a 2000-level, or lower-division, course with face-to-face instruction.

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[2] A hybrid class is where students meet in a face-to-face class for one session and the other session is held online in an asynchronous format.

The purpose of the study was to determine if students are reflective participants despite the differences in instructional type and course level, and if that participation is consistently reflective over the entire term. Reflectivity of student responses to instructor questions were analyzed, not based on their frequency of posts, but for their thoughtful and deliberative comments. Given the ever-demanding need to offer online courses, a secondary purpose is to offer suggestions for creating robust academic collaborations. These are increasingly important as more instructors and universities offer online courses, and these collaborative academic experiences can be shared across comparable disciplines.

*Benefits of Online Discussions*

Offering structured online discussions provides a number of pedagogical benefits. First, online discussions provide for greater diversity than face-to-face classes (Van Vechten et al. 2013). The nature of online discussions allows the flexibility of connecting students across diverse demographic and cultural environments. Unknown to the student was the gender, race, ethnicity, religion, course level or modes of instruction of the others in the study, yet membership in these highly diverse groups greatly challenges viewpoints and develops an awareness of alternative perspectives which can lead to developing a more reflective understanding of collective problems, a deeper appreciation of minority rights, and greater empathy for others (Guttman 2000). Exposure to and experience with diversity can help students develop skills to handle and resolve disagreements arising from conflicting points of view (Zuniga, Vasques-Scalera, Sevig & Nagda 1997; Gurin, Nagda & Lopez 2004). Second, online discussions continue providing educational opportunities for students while travelling or military deployment, thus reducing interruptions of educational experiences. Third, online discussions encourage critical reflection and dialogue concerning current and theoretical issues in a space and time that is comfortable and familiar to the student.

Because universities and instructors seek to offer online courses that are academically challenging, I focused on whether the reflectiveness of students' posts vary due to the differences in type of instruction, level of course, and over course length. Researching the variability in these differences is crucial. Comparing students' learning through online discussions across course levels and modes of instruction for an entire semester offers a longitudinal view of online discussions and not necessarily as an addition to a course. Given that the demographic characteristics of students in online classes are not readily known, they are more likely to be concerned with the quality of the discussion posts and responses.

Hypotheses: In terms of the *level of course, H1:* I hypothesized that student reflectiveness in online discussion forums that were a part *of* the upper-level face-to-face course would be on par with those in lower- division face-to-face courses over the length of the semester. Second, in terms of the *instruction of course, H2*: I hypothesized, similarly, that student reflectiveness in online discussion forums that were a part of the upper-division online course would be on par with a comparable upper-division face-to-face course over the length of the semester. Instruction level or type of course should not vary in reflectivity as online discussions do offer robust means of learning without regard to either. Third, *over the length of the term, H3:* I hypothesized that greater student reflectiveness occurs in posts to the professor and response to their peers earlier in the semester, versus semester-end as students leave projects and papers in their classes typically until they are due. Thus, I would expect a slight drop in reflectivity of posts and responses by semester-

end. Towards this secondary research focus, I examine variations in student reflectivity in their posts and responses.

In addition to measuring student reflectiveness to questions asked by the instructors, I analyzed whether the type of question allowed for variability in the students' responses. Two types of questions were asked: one question focused on current events and one focused on theoretical issues. Fourth in terms of *Question* Type, H4: I hypothesized that students would perform with reflectivity across any type of question the instructor asked**,** and more so to current events questions than to theoretical questions. This is likely because students are more attuned to issues of the day and are more comfortable discussing these via other social media**,** as opposed to the theoretical questions.

Deliberating, pondering, reflecting on ideas and viewpoints, and engaging in discussions with others are important foci in discussion forums as they link learning, developing a sense of efficacy, and civic engagement. When students seek new information, explain or justify their positions, and hold others accountable for their own views, they engage in an active learning process (Bloom 1956; Bender 2003, Van Vechten et al, 2013). Discussions with their instructor or with their peers in the classroom or out in the hallway, further the knowledge students amass and increases their level of engagement as is evident in their participating in discussions beyond the class requirements online. Discussions in online forums may perform similar duties as face-to-face discussions (Hall 1993). These forums are known to aid in higher-order reasoning where peers engage each other in discussions of ideas and positions whether they are online or in classrooms.

As online learning "matures" and educators and universities push for greater online presence, my secondary focus is to provide recommendations, based on length of experience with this collaboration and statistically significant findings, on how to build reflective online communities applicable to online, face-to-face, or upper- or lower- division courses across time zones domestically and globally. The type or level of course would not undermine thoughtful student discussions and interactions with one another when they critically challenged and tested their own and each other's ideas, extended and revisited discussions, understood diverse perspectives, held each other accountable for their views, and for refining their positions.

*Comparability across Courses*

Before the start of the semester, three instructors who had prior experiences with these collaborations, agreed to collaborate on an invitation-only web-project in courses based on similarities in the university-required course objectives that would engage students in discussions about American politics. The students who participated in the program were enrolled in these American Politics courses "virtually" linked by a collaborative project across three different states and time zones.[3]

[3] Initiated in 2008, the American Politics Project represents a collective pedagogical effort to provide an online complement to traditional political science classes: a virtual meeting space for undergraduates enrolled in Introduction to American Politics and American Government courses on different campuses.[3] Each following semesters, a new website was created for each set of participating classes. For instance. In fall 2010, more than 330 students and their professors participated in the project.[3] Instructors followed IRB rules on each campus. Students were give**n** details about the collaboration and asked to sign consent forms to participate. If a student chose not to be a part of the collaboration, an alternative exercise was assigned to them; parental consent was required if a student was under eighteen years of age. After confirmation of consent form, students would be given access via an invitation to join this closed academic site. Only then they could participate in the discussions.

Instructors agreed to distribute common standardized instructions as well as assign a course grade as part of their syllabus requirements.[4] Students were required to post responses to the same number of instructor question and respond to the same number of students' posts in order to build continuous dialogue, further discussions, and maintain a discussion- oriented online community. Professors monitored online student conversations for signs that students were abiding by general rules of respect and civility, but refrained from actually participating or extending the discussion of the forums, reminding students of these ground rules when necessary. Each class was a university requirement at a liberal arts institution. Students were enrolled in the same class type, an American Politics course, at each of the three campuses, a descriptive summary of comparisons are provided in table 1.[5]

As Table 1 shows, all three courses were undergraduate courses, two of the courses classified as 3000-level or upper-division courses; one offered fully online and the other as face-to-face instruction. The third course was classified as a 2000-level or lower division face-to-face course. The instructors had agreed to the same common course objectives and goals for the courses themselves, each centered on lectures in classes with a similar video-taped lecture for the online class, lending similarities across levels of classes. All of the professors refrained from discussing the instructor questions in class. Instructor assigned course grades ranged from 10-15%. Females outnumbered males on the site, at 68% female to 32% male. The group was racially and ethnically diverse as well, with whites comprising 25% of students, African Americans at 44%, Latino Americans at 21%, and 10% indicated, "other" as their category. Data across gender, race, and other characteristics showed no significant difference in participation across their posts and responses.

**Table 1: Summary of Campus Participants**

| Campus | A | B | C |
|---|---|---|---|
| Location | Urban | Suburban | Urban |
| Type | 4-Yr Public Univ. | 4-Yr Public Univ. | 4-Yr. Public Univ. |
| Course Name | American Politics | American Politics | American Politics |
| Course Level | 3000 Level/Upper | 3000 Level/Upper | 2000 Level/Lower |
| Type of Instruction | Online | Face-to-Face | Face-to-Face |
| % Course Grade | 15% | 14% | 10% |
| # Students in Course | 23 | 15 | 49 |
| Gender : Female/Male | 52/48 | 55/45 | 42/58 |

Instructors rotated responsibility for posing questions weekly across a variety of contemporary and enduring issues in American Politics. The total number of required posts and responses was exactly the same for each instructor as noted in table 1. The array of in-class activities

[4] [4] Instructors agreed that all students would be required to post and respond to the same minimum number of questions that would be a minimum of 8 posts and 8 responses. And with a minimum word requirement, that of 75 words for posts and responses. As students had to respond to a minimum of 8 posts and responses in a typical 14 week term, they could miss or continue their postings. Posting by students indicate that despite break schedules students continued posting and responding. FERPA issues were met and are further addressed in the conclusions section.

[5] The common collaboration agreement is in appendix 1.

was the same for all participating classes, further maintaining the similarities across the collaboration. Learning goals were outlined in respective syllabi, and included developing a better understanding of other points of view, deepening (students') sense of identity as members of a political community, improving their communication, research, analytical, and critical thinking skills through short writing assignments, including those online (Van Vechten et al, 2013).

While not a course requirement, several students initiated their own questions, furthering a sense of community. Student questions did not duplicate the instructor questions, students initiated seventy-nine different questions. Students responded to and revisited ninety percent of them throughout the semester.

## Methods

To measure the four hypotheses, a mixed methods approach was used. Content analysis of online discussions that were a part of the students' course requirements was first conducted. Next, a repeated measures anova to test for statistical significance of scores over the length of the term was used. The professors administered an anonymous, online survey during the first week of class with a follow-up survey at the end of the semester.

*The Dependent variable: The Reflectivity Index.*

To measure reflectivity of posts and responses, the total number of postings per student (example: student X posted six times a day, five days in a row) as a measure toward increased learning was not used but rather a measurement of thoughtful understanding and contribution to a post or response. The dependent variable was the reflectiveness index coined and used in the published work of Van Vechten et. al, 2013, a composite measure that measures critical reflectiveness and deliberation that takes place in online interactive discussions. It measures how reflective and/or deliberate the students were; whether they were thoughtful in their posts and responses; whether they tied in a classroom text or idea, or referenced or cited an external web link or book; whether they asked a question that required further discussion; and whether the lengths of their posts or responses indicated a thoughtful, deliberative discussion. In total, ten instructor- initiated-discussion questions were coded[6] and analyzed, yielding a total of over 500 posts and responses. Each post and response was coded across six variables comprising this index:
***Reflectivity Index*** = reflective/deliberative + civic roles + referred to class or text + provided media link + posed an honest question + length of post (+1 for short which met the required minimum of 75 words, +2 for medium, +3 for long).

## Findings

Content analysis on postings to measure reflectivity scores was performed across all three courses. Instructor questions were either theoretical in nature or were centered on current events. When using an anova with repeated measures with a greenhouse-geisser correction, the mean scores across modes of instruction, level of course, and length of term were statistically significantly different ($p$ = 0.001) as noted in table 2 and proving hypothesis 1 and 2. A one-way between-groups analysis of variance was conducted to explore the impact of level of course and mode of

[6] For consistency, one instructor coded all the posts and responses

instruction on the reflectiveness score. Anova results comparing mean scores on the peer evaluations according to level of course and mode of instruction are shown in Table 2 below. There was a statistically significant difference in scores based on level of course, ($p < .001$), as well as mode of instruction, ($p < .001$).

**Table 2: One-way ANOVA results (*F* ratio and eta$^2$ statistic) for reflectiveness across level of course and mode of instruction.**

| Source | Wilks' Lambda | *F* | *P* | *Partial Eta Squared* |
|---|---|---|---|---|
| Level of Course | 293 | .14.486[b] | .000 | .088 |
| Mode of Instruction | .570 | 4.534[b] | .000 | .053 |

*Note. Analysis was performed with the significance level of alpha = .05
b. R Squared = .255 (Adjusted R Squared = .233)
Dependent variable = reflectiveness index

Mean and standard deviation (SD) scores of reflectiveness by each type of course are listed in table 3. Descriptive statistics showed that over the entire semester and across the three classes, students in upper-level face-to-face course had higher means than the upper-level online class; and students in the upper-level online class had higher means that the lower-level face-to-face class. However the one way anova results confirm statistical significance for level of reflectivity across all these classes.

**Table 3: Mean and Standard Deviation (SD) scores of reflectiveness by Upper-Level online, Upper-Level Face-to-Face, and Lower-Level Face-to-Face course**

| Class Type | Upper-Level Online | | Upper-Level Face-to-Face | | Lower- Level Face-to-Face | | Total | |
|---|---|---|---|---|---|---|---|---|
| N | N = 21 | | N= 14 | | N = 37 | | N = 72 | |
| | Mean | SD | Mean | SD | Mean | SD | Mean | SD |
| Q2 | 1.4643 | 2.04066 | 4.4286 | 1.70809 | .6486 | 1.73551 | 1.6215 | 2.29972 |
| Q3 | 2.500 | 2.4950 | 4.500 | 1.5191 | 1.068 | 2.3926 | 2.153 | 2.6104 |
| Q4 | 2.9681 | 2.12424 | 4.1193 | 1.42099 | 2.4730 | 2.4150 | 2.9375 | 2.23300 |
| Q5 | 3.262 | 2.2171 | 3.143 | 2.2738 | 1.595 | 2.0373 | 2.382 | 2.2588 |
| Q6 | 3.333 | 2.4100 | 3.143 | 2.0058 | 2.324 | 2.3429 | 2.910 | 2.3562 |
| Q7 | 3.357 | 2.8816 | 4.036 | 2.4216 | 2.000 | 2.3805 | 2.792 | 2.6481 |
| Q8 | 3.119 | 2.3712 | 4.607 | 1.7451 | .54 | 1.4643 | 2.083 | 2.4581 |
| Q9 | 4.071 | 1.9124 | 4.393 | 1.4568 | 1.216 | 1.9739 | 2.667 | 2.3795 |
| Q10 | 2.286 | 2.1364 | 2.250 | 2.4318 | .405 | 1.4036 | 1.31 | 2.0614 |
| Q11 | 2.452 | 2.2853 | 2.714 | 2.1636 | .459 | 1.3662 | 1.479 | 2.0970 |

To appreciate reflectivity over the course of the semester, I created five time-periods by averaging the first two question reflectivity scores into "timeperiod1" and so on for a total of five time periods. The first and last two weeks of class responses were not used, since two of the three universities started classes the same day, the third institution started and ended a week later. As students had to respond to a minimum of 8 posts and responses over the term, they could miss a posting or continue their postings. Despite break schedules, indications are that students continued posting and responding. Table 4 displays the mean and standard deviation (SD) scores of reflectiveness using a repeated measures anova with a Greenhouse-geisser correction testing for significance of the content analysis of reflectivity scores over the course of the created time periods during the semester. They were statistically significantly different ($p$ = 0.001) for all three courses across the five time periods.

Since the anovas have an overall significant difference in means, I examined the pairwise comparisons using the Bonferroni post hocs. The Bonferroni post hoc tests showed that reflectivity scores increased consistently through every time period 1-5 across all classes, modes of delivery, and levels of courses ($p < .000$). Although the means scores in time periods 4 and 5 are lower than 2 and 3 as noted in table 3, the evidence supports hypothesis 1 that end of semester pressures would produce a drop in the mean scores, as other course level expectations reach their conclusions.

**Table 4: Mean and Standard Deviation scores of reflectiveness Across all classes and five time periods**

| | Mean | Standard Deviation | N |
|---|---|---|---|
| Timeperiod1* | 2.6979 | 3.10041 | 72 |
| Timeperiod2* | 4.1285 | 2.64945 | 72 |
| Timeperiod3* | 4.3056 | 3.02461 | 72 |
| Timeperiod4* | 3.4167 | 3.30706 | 72 |
| Timeperiod5* | 2.0521 | 2.69844 | 72 |

*p<.001

**Table 5 : Turkeys' post-hoc significance of test differences in mean scores for Mode of Instruction and Level of Course**

| Question (Q)# and Type | Mode of Instruction (M) | | Level of Course (L) | | Significance |
|---|---|---|---|---|---|
| | ULOnline | ULF2F | ULF2F | LLF2F | |
| Current event Q2 | -2.9643* | 3.7799* | 3.7799* | | .000*** |
| Current event Q3 | -2.000* | 3.432* | 3.432* | | .000*** |
| Current event Q4 | -1.1512 | 1.6463* | 1.6463* | | .048*** |
| Current event Q5 | 0.119 | 1.548 | 1.548 | -1.667* | .015*** |
| Current event Q6 | -0.488 | 1.497 | 1.497 | | .000*** |

| | | | | | |
|---|---|---|---|---|---|
| Current event Q7 | -0.679 | 2.036* | 2.036* | | .034*** |
| Current event Q8 | -1.488 | 4.067* | 4.067* | -2.579* | .000*** |
| Current event Q9 | -0.321 | 3.177* | 3.177* | | .000*** |
| Current event Q10 | 0.036 | 1.845* | 1.845* | -1.880* | .001** |
| Current event Q11 | -0.262 | 2.255* | 2.255* | 1.993* | .000** |

ULonline = Upper-Level Online course; ULF2F = Upper-Level Face-to-face course
LLF2F = Lower-Level Face-to-face course.
Based on observed means.
The error term is Mean Square (Error) = 3.370.
*. The mean difference is significant at the .05 level.
a. R Squared = .388 (Adjusted R Squared = .371)
b. R Squared = .255 (Adjusted R Squared = .233)
c. R Squared = .078 (Adjusted R Squared = .051)
d. R Squared = .131 (Adjusted R Squared = .105)
e. R Squared = .071 (Adjusted R Squared = .044)
f. R Squared = .104 (Adjusted R Squared = .078)
g. R Squared = .466 (Adjusted R Squared = .450)
h. R Squared = .400 (Adjusted R Squared = .383)

In addition to the student posts and responses in the collaborations, a review of the questions asked by the instructor towards student responses is examined next. I had hypothesized H4, that across theoretical versus current event questions[7] students would perform with similar reflectivity across question type and especially those that were current event questions. Evaluation of reflectivity scores using tukeys' post-hoc significance of test differences in mean scores shown in table 5 support my final hypothesis**.** Current event questions were significant at the .001 level and theoretical question responses significant at the .05 level. This is a crucial finding**,** as universities and educators are concerned with creating a thoughtful and deliberative academic web space.

**Lessons from the collaboration: Building a reflective, deliberative classroom**

Secondary to these findings I provide suggestions based on my length of experience[8] with these collaborations and these significant findings for building reflective academic communities, ones that can be achieved cross country and globally.

[7] Sample instructor-initiated theoretical and current event questions and student-initiated questions are the appendix 3 and 4.

[8] This collaboration was initiated by one professor who recruited interested faculty from the APSA Political Science Education listserv, and the initial three professors developed online activities and the site during fall 2008, recreating the site every following semester to date, with changes in institutions participating. Over the next several years, more professors joined the project after hearing about it at the annual APSA Teaching and Learning conferences. FERPA guidelines were followed at each campus and each participating faculty member filed human subject consent forms on their own campuses as well. Students were told about the collaborations and its implications for research. The students had to sign a consent form for the collaboration knowing its implications for research. If they chose not to, an alternative

Foremost, follow human subjects/IRB rules at each participating campus. Often times this is a length process and one undertaken several months prior to semester start. In all these collaborations, students were told about the collaboration several times, and then asked to sign consent forms or if they chose not to participate, an alternative project was provided. Parental consent may be needed if the student is under eighteen years of age.

Consider using both synchronous and asynchronous approaches. For synchronist, consider scheduling online town hall meetings on various topics. Having visual confirmation of like-minded students discussing and deliberating across states and zones makes these questions identifiable and personal. Also consider asynchronous approaches having students interview one another on the issues and then write papers on the interview. Involving the student on the site by asking them to create their own questions for their peers. With personal involvement, students visit and revisit questions furthering discussion as they develop personal stakes in the question they pose. The use of synchronous and asynchronous approaches build a sense of community.

Consider asking current event questions as students have ready access to information and are attuned to social media sounding out differences in opinion among friends before posting. Discussing the general topic prior to asking the questions would develop more reflective peer-interaction online.

The time and investment in building a challenging academic online site does result in committed and engaged students. An important reminder to note is that none of the students in any of the classes knew that their counterparts were in different class types or levels than they were. This study provides statistically significant support that a purposefully created robust academic web space can provide engaged and reflective citizenry across any mode of instruction or level of course. Each student was responding to others based on the quality of posts irrespective of who had posted them, although some had greater knowledge or skills and provided more thoughtful and deliberative posts.

Post-semester student evaluations of the site were additionally supportive of online collaborations. Table 6 compares students' use of website features across a spectrum of choices, whether the questions initiated by the instructor, questions initiated by the student themselves or the articles and links posed on the site were useful. In every instance, online students found these to be more helpful.

**Table 6: How would you rate the use of the following technology (website features) in your American Politics class?* By Level of Course and Mode of Instruction.**

| Answer Option with agreement for "most helpful" | Upper-Level Course | Lower-Level Course | Online Course |
|---|---|---|---|
| Instructors' Discussion Questions of the Week | | | |
| Mostly unhelpful for my understanding of American Politics. | 83 | 71 | 86 |
| | | | |
| Student-Generated Discussion Questions | | | |
| Mostly unhelpful for my understanding of American Politics. | 61 | 64 | 66 |
| | | | |

project was assigned to them. Students then had to ask permission to join the site, and after the instructor verified their signed consent, they were allowed to join the site. Any student 18yrs or under, had to have parental consent in order to join.

| | | | |
|---|---|---|---|
| Articles or Links posted to the site (Current event Questions) | | | |
| Mostly unhelpful for my understanding of American Politics. *Calculated as a percentage. | 89 | 53 | 90 |

It is noteworthy that the student-generated questions were as useful to both online- and face-to-face students. When students are involved or have a personal investment in the site they do revisit and learn from the site. Interestingly, questions that incorporated articles or links which were current event questions were most helpful and statistical significance in post-hoc reflectivity scores were achieved for the same ($p < .01$) as well as for the theoretical questions at $p < .05$. In current event questions, I find that student posts and responses referred to classroom ideas, class texts, or discussed civic roles versus questions that were theoretical or speculative. Online and upper-division face-to-face students reported that they found the articles and/or links posted with the questions to be useful 89% of the time versus the 53% of self-reports by lower-division students.

Responses about their experience with the site suggest that both online and face-to-face students felt that their experiences on the collaborative site were highly positive, and learning occurred in this collaboration. The students' perspective is key in understanding the learning that occurs in interactions with the instructor as well as with their peers as highlighted in their own words having to do with their interactions with others, and learning from each other and developing informed perspectives.[9] These are important findings, ones that focus on pedagogical benefits of designing a robust academic online community.

This study confirms that e-learning in combination with collaborations enhance the students' educational experience and facilitate communication with other instructors and students and with the global community. Moving from classroom learning to e-learning can effectively succeed when universities provide technical support to instructors and students.

This study is an important step towards better understanding the experiences of e-learners. Future research would benefit from a study to see how widely the e-learning experiences found in this study can be applied across other comparable courses and student populations globally. Other studies can compare courses taught with a similar e-learning collaboration with one taught face-to-face or in a hybrid format without the intervention of the online collaboration. The continued research of peer-student interactions can also add to the knowledge of building mindful e-learning communities. Findings in this study are of greater importance as more universities consider offering online courses but are unsure of the academic effectiveness of discussion forums, or how to design quality e-learning activities in an online class in comparison to a face-to-face course or an upper or lower-division courses. What is clear is that online spaces have great potential to encourage critical thinking and interactions among students.

Appendix 1. **NING Guidelines for Use and Instruction (Sample Instructions given to all students)**

In an attempt to broaden our discussion of American politics, you are required to join the American Politics website. The site's networking platform will allow you to dialogue with other college students who are also tracking American political developments through their classes. Our activities and discussions will encompass a wide range of topics, including the current

[9] Appendix 2 expresses comments from students in their own words about their experiences.

administration, current events and issues, and the political process. You will bring a lot to the table. Make it yours by contributing often!

The website's success **depends on your ongoing participation**. You must:

1. **Join** americanpolitics.ning.com. You will be sent an email invitation to join the site. Follow the steps in the email to join. You are expected to become a member of the site immediately. If you experience any problems, please email me right away!
2. Once you have joined the site, **Complete the beginning-of-the-semester survey.** Another will be given at the end of the semester. Your participation is critical.
3. Every week a question will be posted. You are required to participate in the online dialogue (a minimum of 8 posts and 8 responses throughout the semester) by posting 2 kinds of **entries** (minimum of 75 words each entry)**: (a)** an **original response to a Question of the Week** (a minimum of 8 posts throughout the semester), AND: **(b)** at least **one response to another student's post** (a minimum of 8 responses throughout the semester). Posts should be made before Sunday at midnight.

**You need to consider the following when exchanging posts for this project:**

• **DO NOT** write posts using IM or text messaging language! Yr entries shldnt look like this. Be substantive. Use formal English.

• Each original weekly post/response must contain a **minimum of 75 words**, or about four full lines on a regular webpage. Responses must be understandable. Avoid abstract descriptions like "awesome" and so forth; support your statements with reasoning. One-sentence postings are insufficient (remember, 75 words minimum).

• Politics often engenders passionate beliefs and opinions; all posts must use language that is **respectful of all points of view**, even those with which you may not agree. **No personal attacks or foul or obscene language**. All posted images must also comply with standard university guidelines for decency. We are debating ideas within a larger academic setting, and you need to be mindful of that in all your uses of the site. Violators will be banned from the site and will lose points for ungraded activities. That said, please make the most of this opportunity to collaborate in this cross-country experiment! Learn a lot from each other, and have fun with it.

Appendix 2. Student comments about their experience on the collaborative site

In their own words: Online/Face-to-Face and Upper/Lower-Level Classes

| **Considering other views/Interaction with others--to an issue and thoroughly thinking it through by Upper-Level Courses.** |
|---|
| I learned a lot; I became aware of different people's way of thinking on certain issues and why they think the way they do. I believe that having the chance to take a course like this makes me want to encourage and do more for civic engagement as early as possible in a person's life because that will lead to us being more aware of the issues a minority of the people in the US are aware of. |
| It made me look more closely into the election and other topics in political science |
| It was good to see the different opinions of the students on the variety of topics discussed. It gave me a different overall perspective of the issues that are prominent in society today. |
| It challenged the way you think by the various opinions that went into every post. |
| I was able to understand a broad perspective of views that would not have been presented in a limited class room setting. |

| |
|---|
| This course exposed many topics that are involved in the political process. I also learnt effective ways to participate in the political process. I also learnt about the effect of negative campaign and the causes of polarization in the American politics. I also learnt about the major and minor political parties and where the American politics is leaning in the next fifty years. |
| **Considering other views/Interaction with others--to an issue and thoroughly thinking it through by Lower-Level and Face-to-face Course Comments** |
| i have learn how to interact with person who view things different way than i do, and sometime it does make sense |
| I learned important political issues about the country I live in. |
| I saw different topics differently because of everyone's different perspectives. |
| There is a lot to learn about politics. |
| Some of us shared the samw views |
| more about politics and how interesting it is |
| How to share political insight with people at other institutions. |
| I learned that many young people do voice their opinion on political topics and want to participate in making a difference. |
| I learned how to interact with Colleagues and express my opinion. I learned about others suggestions especially from other students like me, how they are engaging themselves on American Politics. It was really impressive, and very helpful to share political ideas with others. |

| |
|---|
| **Civic Interaction--Participating actively in public life across Online/Face-to-Face and Upper/Lower-Level Classes** |
| I learned about others suggestions especially from other students like me, how they are engaging themselves on American Politics. It was really impressive, and very helpful to share political ideas with others. |
| I was kept abreast of current news going on in politics. This was beneficial to me since I don't really watch the news. |
| I learned more about politics, and how interesting it is. |

Appendix 3. Sample Instructor (DQ) and asked on the collaborative site
Current DQ: Protest Politics: The United States was born from a revolution and many historical changes were instituted through protest politics (e.g., women's suffrage and civil rights). Yet, the large majority of Americans disapprove of political protests and demonstrations as a form of participation. Why do you think this is the case? What do you think about protests and why? Are the implications of this attitude for fringe groups in the political system? The sites below offer opinions from current protests: The Wall Street Occupy protests and the ongoing Chicago Teachers Strike. After reading them ask yourself who you agree with and why? What do protests accomplish? Which other protests seemed to work in our history and what did they ultimately accomplish?

Current DQ: Recently, the news reported that Mitt Romney, Republican candidate for President of the United States, was secretly taped saying that those who do not earn enough to pay federal income tax were unlikely to vote for him and so were not the object of his campaign. He further described those people as dependent on the government. As I thought about this, I

wondered about the 24th Amendment which was ratified in 1964 and removed legal income barriers to voting. How should we understand the national discussions about the 99%, the 1%, the 47%, etc? Should income and income dependency play any role in the election? I am not asking about how people should vote. I am asking whether government's relationship between voters with money and voters without money should be different.

Theoretical DQ: Over the course of this election cycle, we have heard much about social security and Medicare. One of the fundamental questions that is not directly asked is: what exactly is government's responsibility? What is the community's responsibility? What happens if someone can't meet his or her own personal responsibilities, should government, the community, somebody step in? What do you think? What **evidence** can you find to support your opinion? A good argument is bolstered by evidence. Make a case and challenge each other!

Theoretical DQ: Why does the fiscal cliff matter and why is it so important? Share with us two ways the 'fiscal cliff' impacts your everyday life? How and why do you think that divided government (the Democratic-controlled Senate and Republican-controlled House and/or the President and Congress) impact 'solutions' towards this fiscal cliff?

Appendix 4. Sample Student Questions (DSQ)[10] asked on the collaborative site

DSQ: Should American have its first Constitutional Convention?

DSQ: Should the Mosque be built near Ground Zero?

DSQ: Are full body scanners too invasive or a necessary security device?

DSQ: How do young people vote? For years, I've been pondering WHY people DON'T vote and realized that the real question I should be asking is WHY people vote.

DSQ: With access to gas being low all over the country, its affecting a lot of people and hindering them from getting back to business. Whether that affects them when they vote or not, that is the question?

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# Aligning Best Practices to Develop Targeted Critical Thinking Skills and Habits

**Ilea E. Heft[1] and Lauren F. V. Scharff[2]**

*Abstract: This project evaluated the effectiveness of a course design within an upper-level biology course that incorporated what prior scholarship of teaching and learning (SoTL) research has suggested to be best practices for developing critical thinking skills while also managing the grading load on the instructor. These efforts centered on the development of a clearly articulated subset of skills identified by the Critical Thinking Assessment Test (CAT) and also incorporated learning experiences designed to instill what we refer to as a "habit of critical investigation." In this study, we tested the hypothesis that a single semester of an aligned course utilizing active learning and multiple opportunities for practice and feedback would: (a) increase the extent to which students agreed with the importance of questioning the credibility of claims across the semester, (b) increase the frequency at which students reported personally questioning the credibility of claims across the semester, (c) increase the number of students reporting investigation techniques consistent with critical investigation across the semester and (d) result in significantly greater student performance on the CAT questions that assessed the sub-skills practiced in the course when compared to the performance of a representative group of senior students at our institution. We observed substantial and statistically significant gains in both the frequency at which students reported questioning claims and the degree to which their reported investigative actions were consistent with critical investigation. Furthermore, on the critical thinking sub-skills most aligned with what was practiced in the course, the experimental group significantly outperformed the comparison group.*

*Keywords: active learning, alignment, critical thinking dispositions, critical investigation, critical thinking assessment test*

Improving students' critical thinking skills is widely referenced as *the most important* outcome of education (Bok, 2006). Equally important to skill development is student attainment of the inclination and sensitivities that support the application of critical thinking skills in day-to-day life (often termed critical thinking dispositions)(Perkins & Ritchhart, 2004). However, multiple studies have concluded that higher education at large has not been very effective in developing students' critical thinking skills (e.g. Arum & Roksa, 2011). We suspect that current general shortcomings in critical thinking development are not due to lack of motivation or caring on the part of most faculty. Rather, we posit that misconceptions and lack of awareness regarding effective techniques for developing critical thinking skills and dispositions lead to courses that are not well aligned for

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such development.

For example, prior to this research effort, the lead author assigned a major research essay with the proud belief that it would develop students' critical thinking skills. Then, through her experience grading the Critical Thinking Assessment (CAT) at her institution and follow-on discussions with faculty development staff, she had the career-changing realization that a single, summative assignment did not do much to support the development of her students' critical thinking skills despite the fact it took a substantial amount of time for students to write and the author to grade. In response to this realization, we sought to incorporate within an upper-level biology course what prior scholarship of teaching and learning (SoTL) research has suggested to be best practices for developing critical thinking skills while also managing the grading load on the instructor. Importantly, these efforts centered on the development of a clearly articulated subset of skills identified by the CAT and incorporated learning experiences designed to instill what we refer to as a "habit of critical investigation." This article summarizes our explicit example of how best practices can be effectively implemented to achieve substantial and significant gains in critical thinking skills and dispositions. It also shares the lessons learned and recommendations derived from our observations and results.

## Best practices for student learning and development

What do we know about best practices for student learning and development that apply to learning goals in general? We know that alignment between all elements of a course is *essential* to achieving desired outcomes. The effectiveness of any pedagogical technique designed to promote student learning will be limited if the course is not aligned. The concept of alignment has been referred to as constructive alignment (Biggs, 1996), backwards course design (Wiggins & McTighe, 2005), and learning-focused course design (Fink, 2003; Jones, Noyd, & Sagendorf, 2014) and has been shown to greatly improve the achievement of desired outcomes (Cohen, 1987). Elements of a course are aligned when the learning experiences involve the student performing the desired skill, and the assessment explicitly assesses that skill. For example, if a goal is for students to be able to provide alternative explanations for observations, then learning experiences should involve the students practicing this skill, and the assessment should ask the student to provide alternative explanations for observations. This degree of alignment is sometimes negatively interpreted as "teaching to the test." However, "teaching to the test" can in fact be a positive characteristic. If the test assesses your desired skills, your goal should be to develop those skills.

In addition to alignment between course elements, there is substantial evidence that active learning is more effective than lecture in promoting development of both critical thinking skills (Tayyeb, 2013; Yuan, Williams, & Fan, 2008) and content understanding (Freeman et al., 2014) across a range of disciplines. For optimal development, the practice that occurs during active learning should be incorporated into *multiple* cycles of practice and feedback ("*performance-feedback-revision-new performance"*) that focus student learning on the desired skills (Bok, 2006; Fink, 2003; Wiggins, 1998). The type of feedback provided to students during these cycles is also important. Sadler (1989) stated that for improvement to occur the learner must "possess a concept of the standard/goal being aimed for, compare the actual level of performance with the standard, and engage in appropriate action which leads to some closure of the gap" (p. 121). The feedback that is provided must be sufficiently detailed and clearly understood by the student to support each of these steps that lead to development. Additional characteristics of effective feedback noted in the literature are that it is frequent, immediate, delivered supportively (Fink, 2003), and task-

focused (e.g. comments rather than grades; Butler, 1988).

What do we know about best practices for developing the inclination to think critically outside of the classroom? The body of evidence is less robust, however, studies suggest that activities consistent with a culture of thinking (e.g. challenging students to ask questions, seek justification, and probe assumptions) are more effective than traditional "teaching by transmission" activities (e.g. lecture). Multiple studies have reported that students randomly assigned to a course section employing problem-based learning significantly outperformed students assigned to a content-equivalent, lecture-based course on the California Critical Thinking Disposition Inventory (CCTDI) (e.g. Ozturk, Muslu, & Dicle, 2008; Yu, Zhang, Xu, Wu, & Wang, 2013). Additionally, students in an online course in which dispositions were fostered by highlighting exemplars, praising students when they demonstrated critical thinking dispositions, and requiring students to describe examples of critical thinking dispositions in action were reported to outperform, on the CCTDI, other students who had been in an equivalent course without these features (Yang & Chou, 2008). Overall, such practices support the development of a culture of thinking, which in turn provides motivation for challenging mental work such as critical thinking (Ritchhart, 2015).

## Challenges to implementing best practices

As indicated in our above review, prior research has identified best practices for student learning and development; however, they are often not implemented for several reasons. Some reasons include lack of knowledge of best practices by individual faculty, the time and effort required to change a course and to provide multiple iterations of feedback, and the (cognitively painful) realization that one's current course may not be not in line with best practices. Furthermore, pressure (perceived or real) to "cover" a certain quantity of content material within a semester may be a barrier to providing time and opportunities for effective skill development. This content-coverage-versus-skill-development challenge may be exacerbated by the assumption that students already have the desired skills and habits or that development of those skills and habits are the responsibility of a different course.

The implementation of best practices in support of critical thinking development is further hindered by expansive definitions of critical thinking. For example, the website for the *Foundation for Critical Thinking* (2015) defines critical thinking as:

> that mode of thinking — about any subject, content, or problem — in which the thinker improves the quality of his or her thinking by skillfully analyzing, assessing, and reconstructing it. Critical thinking is self-directed, self-disciplined, self-monitored, and self-corrective thinking. It presupposes assent to rigorous standards of excellence and mindful command of their use. It entails effective communication and problem-solving abilities, as well as a commitment to overcome our native egocentrism and sociocentrism.

Similarly broad definitions exist for critical thinking dispositions (Facione, 1990). While a large set of discrete skills and dispositions can be considered to constitute critical thinking, broad definitions can be an impediment to the implementation of best practices because they are often overwhelming, do not paint a clear picture of what the student should be able to do, and mask the fact that individual sub-skills must be individually developed and assessed. In order to design an aligned course focused on critical thinking skills and to provide the targeted practice and feedback

that develops them, we must clearly define the specific skills we want to develop and the criteria for their assessment. We must also make these skills and criteria visible and explicit to students (Heijltjes, Van Gog, & Paas, 2014; Marin & Halpern, 2011).

Pedagogical misconceptions also hinder student development of skills. Two misconceptions we often encounter related to critical thinking development are the belief that a single summative assessment or stand-alone assignment (often an essay) develops critical thinking skills, and the assumption that students' skills will develop implicitly by completing assignments in the course that do not explicitly focus and provide feedback on the desired skills. A single summative assessment or stand-alone assessment is unlikely to be effective in developing students' skills because there is no requirement for students to use feedback on these assignments to improve their skills and try again. Rather than promoting development, a single assignment asks students only to demonstrate their skills at a particular point in time. Furthermore, even multiple cycles of practice and feedback will be of limited effectiveness unless the desired skills are made clear (Heijltjes et al., 2014; Marin & Halpern, 2011) and are made the primary focus of the assessment, e.g. they have a meaningful number of grade points dedicated to them. If the desired skills are not the primary focus of the assessment, it becomes possible for students to receive a high grade without demonstrating mastery of the desired skill (Wiggins, 1998) by demonstrating, for example, strong writing skills or content knowledge. The authors acknowledge that crafting and implementing multiple iterations of essay assignments that meet the above criteria can be a Herculean task that becomes difficult to implement due to the time required for students to write the essays and for the instructors to provide quality feedback. As a solution, below we describe an approach for developing and assessing critical thinking skills that incorporates best practices for skill development, is rigorous, and is manageable to implement.

## Our approach for developing critical thinking skills and dispositions

As mentioned above, broad definitions of critical thinking make it challenging to design effective, aligned learning experiences. Further, there is a lack of guidance regarding how to assess these skills in a manner that is both rigorous and manageable. These challenges can be overcome by converting broad definitions into a set of discrete but rigorous skills with clearly defined assessment criteria. The Critical Thinking Assessment Test (CAT) (Center for Assessment and Improvement of Learning, 2016) provides an example for doing this. The CAT is a standardized critical thinking assessment created by researchers at the Tennessee Technological University through the support of a National Science Foundation grant.

One of the hallmarks of the CAT is that it is graded by faculty onsite at each institution, with very specific rubric instructions and guidance provided by trained facilitators. Institutional grading is submitted to the CAT organization, where a scoring check is performed. Data collected across several hundred institutions allow normative interpretations. While participating in one of our institution's CAT grading sessions, the lead author realized that the discrete skills assessed by the CAT could serve as a framework upon which to build targeted learning experiences and assessments that were manageable to implement and to assess. While the individual CAT sub-skills are concrete and explicit, they are not trivial or easy. When polled, most faculty agree that the questions on the CAT are valid measures of critical thinking (Stein, Haynes, & Redding, 2006). Additionally, the design of the CAT questions and scoring rubric model a way for these challenging skills to be probed and scored with relative ease, thus enabling implementation of multiple cycles of practice and feedback.

Seeing this approach, the lead author was inspired to design her Human Nutrition course to focus on the development of a subset of critical thinking skills from the CAT that naturally aligned with the goals she had for her students. Beyond these skills, the lead author also wanted her students to develop a complimentary set of critical thinking dispositions that we refer to as a "habit of critical investigation". Our "habit of critical investigation" is conceptually similar to Perkin's (1993) disposition "to seek and evaluate reasons" and includes: valuing the importance of questioning health/nutrition claims, frequently questioning health/nutrition claims, and when evaluating claims, taking actions that are most likely to result in a sound conclusion.

Thus, the key components of our approach were: (1) targeting discrete skills and habits associated with critical thinking, (2) aligning all elements of the course with development of those skills, (3) explicitly communicating intent and activity alignment with students, (4) giving students multiple opportunities throughout the semester to practice, receive prompt feedback, and be formally assessed on those skills, using examples that are highly relevant to them, (5) establishing clear scoring criteria so that the assessments could be easily and reliably evaluated. Through the use of multiple, salient activities and assessments, we hoped to create a classroom culture that clearly supported the value and development of critical thinking and the habit of critical investigation.

The purpose of our research was to investigate the effectiveness of this approach at developing the desired habits, attitudes, and skills. Specifically, we hypothesized that a single semester of this type of course would: (a) increase the extent to which students agreed with the importance of questioning the credibility of claims across the semester, (b) increase the frequency at which students reported personally questioning the credibility of claims across the semester, (c) increase the number of students reporting investigation techniques consistent with critical investigation across the semester and (d) result in significantly greater student performance on the CAT questions that assessed the sub-skills practiced in the course when compared to the performance of a representative group of senior students at our institution.

## Methods

### Participants

Three sections of the Fall 2013 Human Nutrition course, an upper-level course taught by the Biology Department, were used to evaluate the effectiveness of the learning experiences (n=72; 78% seniors; 22% juniors). This course was open to students from all majors who had completed the introductory Biology course. The sections for this study included large proportions of biology, management and civil engineering students. At the end of the semester, the CAT performance of the Human Nutrition (HN) cohort was compared to the CAT performance of a representative group of seniors who took the CAT in May of 2014, referred to as the senior (S) cohort (n=96; a representative sample of approximately 1000 students in the entire senior class). For all measures of student academic aptitude analyzed, independent sample *t*-tests revealed that the mean values for the Human Nutrition cohort were significantly lower ($p<.001$) than the senior cohort. These included Composite SAT (HN = 1247; S = 1338), Major's GPA (HN = 2.79; S = 3.14), Cumulative GPA (HN = 2.8; S = 3.05), and an institution-designed Academic Composite score (HN = 3141; S = 3358) reflecting pre-college academic achievement.

### Materials

Our assessment utilized two instruments, the CAT and an instructor-generated questionnaire created to assess students' habit of critical investigation. The CAT contains 15 multi-part questions (mostly open-ended) that assess different critical thinking skills. The CAT creators have grouped these 15 specific sub-skills into four categories: Evaluating Information, Creative Thinking, Learning and Problem Solving, and Communication. Examples of individual skills include "evaluate how strongly correlational-type data supports a hypothesis" and "provide alternative explanations for observations"; for the full list of sub-skills see Table 1.

Table 1

*CAT Sub-skills, How They Aligned with the Course, and Student Performance for the Human Nutrition (HN) and Senior (S) Cohorts*

| Sub-skill | Skill Assessed | Alignment with HN | Max Possible Score | HN Cohort Mean | S Cohort Mean | ANCOVA F & p values* |
|---|---|---|---|---|---|---|
| 1 | Summarize the pattern of results in a graph without making inappropriate inferences. | High | 1 | 0.94 | 0.75 | F = 6.73 p=0.01 |
| 2 | Evaluate how strongly correlational-type data supports a hypothesis. | High | 3 | 2.1 | 1.83 | F = 4.08 p=0.05 |
| 3 | Provide alternative explanations for observations. | High/Partial | 3 | 1.69 | 1.74 | F = 0.03 p=0.86 |
| 4 | Identify additional information needed to evaluate a hypothesis or particular explanation of an observation | High/Partial | 4 | 1.15 | 1.58 | F = 2.16 p=0.14 |
| 5 | Evaluate whether spurious relationships strongly support a claim | Partial | 1 | 0.94 | 0.92 | F = 0.90 p=0.34 |
| 6 | Provide alternative explanations for spurious relationships | High/Partial | 3 | 1.85 | 2.15 | F = 3.10 p=0.08 |
| 7 | Identify additional information needed to evaluate a hypothesis/interpretation | Partial | 2 | 0.41 | 0.58 | F = 1.02 p=0.31 |
| 8 | Determine whether an invited inference in an advertisement is supported by information | Partial | 1 | 0.81 | 0.78 | F=0.97 p=0.33 |
| 9 | Provide relevant alternative interpretations of information. | High | 2 | 1.26 | 1.08 | F = 4.39 p=0.04 |
| 10 | Separate relevant from irrelevant information when solving a real-world problem. | None | 4 | 3.09 | 3.46 | F = 6.77 p=0.01 |
| 11 | Analyze and integrate information from separate sources to solve a real-world problem | None | 2 | 0.87 | 1.03 | F = 1.32 p=0.25 |
| 12 | Use basic mathematical skills to help solve a real-world problem. | None | 1 | 0.89 | 0.91 | F = 0.03 p=0.87 |
| 13 | Identify suitable solutions for a real-world problem using relevant information. | None | 3 | 1.11 | 1.37 | F = 0.16 p=0.69 |
| 14 | Identify and explain the best solution for a real-world problem using relevant information | None | 5 | 1.72 | 2.54 | F = 5.16 p=0.03 |
| 15 | Explain how changes in a real-world problem situation might affect the solution | None | 3 | 0.94 | 0.98 | F = 0.25 p=0.62 |
| Total Score | -- | -- | 38 | 19.79 | 21.69 | F = 1.39 p=0.24 |

*df = 2 for all ANCOVA tests

Our Habit of Critical Investigation Questionnaire contained 5 items that asked for self-report responses on a combination of Likert-style and open-ended questions regarding specific behaviors associated with critical investigation. Importantly, one of the open-ended questions asked students to describe the behaviors they were likely to take when they questioned the credibility of a claim. The responses to this question provided a more direct assessment of students' behaviors than could be obtained from the Likert-style questions.

Responses to two questions indicated that they were not consistently interpreted across students, resulting in unusable data. The three remaining questions and their intent are described in Box 1.

**Box 1. Questions utilized from the Habit of Critical Investigation Questionnaire**

Question 1 (Assess frequency of questioning the credibility of information):
*Question:* "How frequently do you question the credibility of nutrition/health related claims that you hear/read?"
*Response options*: never, rarely, sometimes, most of the time, always.

Question 2 (Assess consistency of response with good critical investigation):
*Question:* Students were asked to provide a written response to the question "When you question the credibility of a nutrition related claim, what are you most likely to do?"

Question 3 (Assess agreement with the importance of questioning the credibility of information):
*Question:* Select the extent to which you agree or disagree with the following statement: "I think it is important to question the credibility of nutrition/health related information that I hear and read."
*Response options*: Strongly Agree, Agree, Disagree, and Strongly Disagree

## Course Design and Lesson Procedures

*Incorporation of best practices.* For the development of both the skills of critical thinking and the habit of critical investigation, the instructor explicitly shared the activity and lesson goals with students, and explicitly reinforced connections between the practice and assessment of those skills and habits throughout the semester. The course goals, learning experiences and assessments were all aligned with the development of critical thinking habits and skills (Box 2). The desired skills were explicitly communicated and substantial class time was devoted to their development: 2.5 lessons (out of 40) were entirely devoted to the development of critical thinking skills, plus small portions of at least 5 additional lessons included explicit reminders and/or activities. Multiple cycles of practice (active learning) and feedback occurred within the 2.5 devoted lessons as students worked through multiple problems in groups and as a class. Working through problems in class allowed students to receive frequent and immediate feedback. Application of the desired critical thinking skills was reinforced throughout the semester by beginning several lessons with a nutrition claim relevant to the day's lesson and having students evaluate it as a class. The assessment of critical thinking skills on two formative, low-threat quizzes provided an additional means for each student to receive individual feedback. Students were allowed to retake these quizzes to improve their score, thus incentivizing the use of feedback for improvement. Critical

**Box 2. Alignment between all course elements (Explicitly communicated with students)**

Course Goals:

- Be able to determine the extent to which a nutrition related claim is supported by facts & data
- Be able to provide accurate dietary recommendations tailored to individuals and their goals
- Have an attitude of skepticism and a habit of critical investigation

Lesson Objectives (Lessons 4 & 5; additional half lesson of practice on Lesson 11)

- State the reasons that anecdotal evidence does not constitute strong support for a claim
- Identify if a study was observational or intervention and describe the limitations and benefits of each type of study
- Summarize the pattern of results, in a graph or in written form, without making inappropriate inferences.
- Evaluate how strongly a given claim is supported by the data provided
- Provide alternative explanations for a pattern of results that has many possible causes.
- Identify additional information needed to evaluate a claim.

Quizzes and Exams

- Formative, low-threat learning quizzes on Lessons 6 & 12
- Higher stakes exams on Lessons 14 & 28

Example practice/assessment question set for a nutrition claim related to Attention-Deficit/Hyperactivity Disorder (ADHD):

1. A researcher has noticed that more children seem to be diagnosed with ADHD and is wondering if it might have something to do with changes in the food supply. *Summarize the results of the graph below.*
2. *How strongly do the results support the claim* that a change in the food supply is causing increased rates of ADHD?
3. *Provide an alternative explanation for the results in the graph.*
4. *What additional information would you need to evaluate the claim* that a change in the food supply is causing increased cases of ADHD?

thinking skills were also evaluated on two higher stakes exams. The evaluation of critical thinking skills on these high stakes assessments reinforced the primacy of these skills to the course goals. The feedback provided on both high and low-stakes exams was delivered through detailed grading rubrics designed to help the student understand exactly where they needed to improve. Additionally, all instruction and practice of the critical thinking skills was done actively, with students applying critical thinking skills to evaluate authentic and relevant nutrition claims.

*Developing Critical Thinking Skills***.** The critical thinking skills that we focused on in the course came from the CAT and included: summarize the pattern of results in a graph without making inappropriate inferences (Sub-skill 1), evaluate how strongly correlational-type data supports a hypothesis (Sub-skill 2), provide alternative explanations/interpretations (Sub-skill 3,

Sub-skill 6, Sub-skill 9), and identify additional information needed to evaluate a hypothesis or particular explanation of an observation (Sub-skill 4). Note however that in Table 1 we identify Sub-skill 3, Sub-skill 4, and Sub-skill 6 as having "high/partial" rather than "high" alignment. This reflects our post-hoc assessment of what actually occurred in the course. While we intended for each of these Sub-skills to be highly aligned, we later realized that key components were not well aligned or not sufficiently practiced. Specifically, Sub-skill 3 of the CAT included a particular component (articulation of change over time) that was only practiced one time in the course. For Sub-skill 4, correct answers were accepted during the course that focused on a description of sound experimental design rather than a clear articulation of information required to evaluate a hypothesis. Lastly, Sub-skill 6 required students to clearly articulate their responses at a level beyond what was focused on in the course. In Table 1 we also identify four sub-skills as having partial alignment because they were lightly utilized and closely related to the primary skills, but not explicitly discussed, practiced or given feedback for improvement.

Those sub-skills with high alignment had lessons 4 and 5 at the beginning of the course dedicated to their instruction, practice, and feedback. Students spent the majority of time during these lessons engaged in active learning of the concepts. For example, students were given a worksheet containing popular claims and worked individually and in groups to develop alternative explanations. The instructor (first author of this paper) then led the class through a discussion of possible alternative explanations with students providing the answers. The desired skills were practiced and assessed with questions similar in style to those on the CAT, which provided strong and clear alignment between what was practiced and what was assessed. In addition to these two lessons, these skills were integrated into multiple lessons and assessments throughout the semester. When the first formative assessment quiz revealed that many students still struggled with the skills, an additional half lesson was devoted to additional practice on these skills. As mentioned above, the integration of these skills into lessons throughout the semester reinforced the development of these skills as well as the habit of critical investigation.

*Developing the Habit of Critical Investigation***.** In order to develop a habit of critical investigation, learning experiences were designed with the intent that, through the repeated application of critical thinking skills and critical investigation to relevant claims, students would realize that personal experience, anecdotes, and unsupported claims that had previously guided their decision-making were not valid. We posited that through these experiences, students would come to see critical investigation as personally valuable to them, useful for realistically achieving their health and/or performance goals, and for avoiding scams. The hope was that if students viewed critical investigation as personally valuable to them, that they would adopt such behaviors in their own life outside of the classroom. Specifically, lessons four and five of the course included explicit instruction on the limitations of anecdotal evidence, personal experience, and observational studies and how to identify flaws in experimental design that affect the reliability of a conclusion. Students were also taught a specific method for critically investigating claims, were provided with specific credible websites that they could use to verify claims, and were given time to practice using these websites in class to research claims in which they were interested.

## Assessment Procedure

Prior to data collection, the researchers received ethics approval for the study from the Institutional Review Board. The Critical Thinking Assessment Test (CAT) was administered on the second-to-last lesson of the semester, and students were given the full period to complete it. The majority of

students finished within 45 minutes, while a few finished sooner than that and a few used the full class period.

The Habit of Critical Investigation Questionnaire was administered on lessons 1, 20, and 38 (of 40 total lessons), and took approximately 10 minutes for the students to complete. To remove any perception on the students' part that their answers on the questionnaires could affect their grade, a person not affiliated with the course collected the forms and assigned a random number to each set of questionnaires. This individual separated the students' names from the questionnaires so that the responses could be reviewed and general trends discussed during class.

## Results and Discussion

### Critical Thinking Skill Development

In order to determine if the systematic implementation of critical thinking development practices led to a significant improvement in critical thinking as measured by the CAT, we compared end-of-semester results from the Human Nutrition (HN) cohort and the senior (S) cohort. Specifically, we used two-group comparisons to examine total CAT scores as well as each sub-score. Of particular interest was whether or not those sub-skills that were targeted in the HN course showed greater group differences than those sub-skills that were not targeted. Following the guidelines and rubric provided by the CAT creators, student performance was first scored by a group of our faculty. Scores were then verified by the CAT office.

Academic Composite was used as a covariate because pre-analyses indicated that the two groups were initially different on this measure and for both groups combined it significantly correlated with overall CAT scores $r(145) = 0.34$, $p<.05$. Therefore, CAT tests for which the Academic Composite score of the test taker could not be identified (by linking student number on the CAT test to an academic database) were omitted (9 HN CAT scores and 3 S CAT scores) leaving 54 HN CAT scores and 93 S CAT scores.

The right three columns of Table 1 show mean scores for the HN and S cohorts and the F and p values, respectively. For the HN cohort, the average total score, low and high scores were 19.79, 11, and 30, respectively, and for the S cohort they were 21.69, 12, and 31, respectively. On three of the sub-skills of critical thinking most aligned with the skills practiced in Human Nutrition (Sub-skills 1: summarize graph, 2: correlational data, and 9: alternative interpretations), students who took the Human Nutrition course significantly outperformed the representative sample of seniors. Specifically, the HN cohort outperformed the senior cohort by 19% on Sub-skill 1 and by 9% on both Sub-skills 2 and 9. However, the HN students did not perform better than the senior cohort on those Sub-skills with high/partial alignment (Sub-skills 3, 4, 6) or any of those with only partial or no alignment.

Overall these group comparison results have some implications regarding the development of critical thinking. First, despite the limitation that the CAT was given only at the end of the semester (and not pre-post) for the HN cohort, we believe the HN cohort achieved meaningful development in the critical thinking sub-skills that were well targeted by the course activities. Because the HN cohort was composed of 22% juniors and performed worse (in two cases significantly so) than the S cohort on most CAT items not practiced in class, it seems reasonable to conclude that they were not any better than the S cohort on Sub-skills 1, 2, and 9 prior to taking the class. It can therefore be cautiously concluded that the level of development that occurred on those targeted items over the semester is at least as great as the final difference in performance between the HN cohort and the S cohort, and that the development was due to the targeted practice

throughout the semester.

A second conclusion is that, even in a class with an overt focus on critical thinking, students develop little in the areas for which they do not receive multiple cycles of aligned practice and feedback. On those sub-skills of critical thinking for which the activities in class were less well-aligned with what was assessed on the CAT, HN student performance was not significantly different from the S cohort. Not surprisingly, for the sub-skills not at all practiced in the class, student performance either was not significantly different across the two cohorts, or the senior cohort performed significantly better. A pattern of significant improvement on only a few sub-skills is consistent with previous studies that used the CAT to assess critical thinking skills (e.g. Frisch, Jackson, & Murray, 2013; Gasper & Gardner, 2013). These findings reinforce the idea that critical thinking is made up of a large set of diverse skills and that multiple rounds of explicit practice and feedback is required with each individual skill.

**Habit of Critical Investigation**

In order to examine the development of habits of critical investigation, responses from the pre, mid, and end-of-semester questionnaire were scored and analyzed as follows. The data from all three Human Nutrition sections were treated as a single group. If data from all three time-points was not available for a participant on a particular question then all responses from that participant, for that question, were dropped. Responses to each question were scored as described in Box 3.

**Box 3. Analysis methods for Habit of Critical Investigation questions**

Question 1 (Assess frequency of questioning the credibility of information):
*Analysis Method:* Responses were given a score of 1-5 with "1" representing an answer of "never" and 5 representing an answer of "always."

Question 2 (Assess consistency of response with critical investigation):
*Analysis Method:* As detailed below, student responses were categorized as being: consistent with critical investigation, unclear with respect to being consistent with critical investigation, or inconsistent with critical investigation. The types of responses in each category are shown below.

Consistent with Critical Investigation
Consult a credible source
Evaluate the credibility of the source
Evaluate the study design
Evaluate it using biological knowledge
Evaluate the nutrition facts label

Consistency with Critical Investigation Unclear

Consult another source (credibility not mentioned)
Consult a teacher/professional/nurse/M.D.
Consult a Coach/Trainer

Inconsistent with Critical Investigation
Try it for myself
Consult someone who has tried it
Do not use the product/Do No Research
Consult a biased/non-credible source
Ask a friend or family member (rationale not stated)
Don't worry about/"Eat it anyways"
Gut Instinct/Guess
Consult someone who is "very health-conscious"
Consult the most convenient source (e.g. internet)

Responses in which all statements were consistent with critical investigation were awarded a value of "2". If the consistency of the response with critical investigation was unclear and did not include any inconsistent statements, the response was awarded a value of "1." If the response included a combination of "consistent" and "unclear" statements, the response was also awarded a value of "1". Any response that included statements not consistent with critical investigation was awarded a value of "0."

Question 3 (Assess level of agreement with the importance of questioning the credibility of claims):
*Analysis Method:* Responses were awarded a score of 1-4 with "1" representing an answer of "Strongly Disagree" and 4 representing an answer of "Strongly Agree."

The frequency with which respondents stated they "questioned the credibility of claims" increased steadily over the course with the percentage of respondents selecting "Always" increasing from 9% to 25% by the middle of the course and to 41% by the end of the course. See Figure 1 for a summary of all responses for the three time periods. Mean scores with a score of 5 being the highest possible were 3.64 (pre), 3.98 (mid), and 4.33 (post). A single-factor (time) within-subjects ANOVA suggests that the shifts in the student responses were highly reliable; $F(2,126) = 27.86$ ($p<0.001$). Post-hoc Tukey's tests revealed that all paired differences (pre-post; pre-mid; mid-end) were significant ($p<.01$).

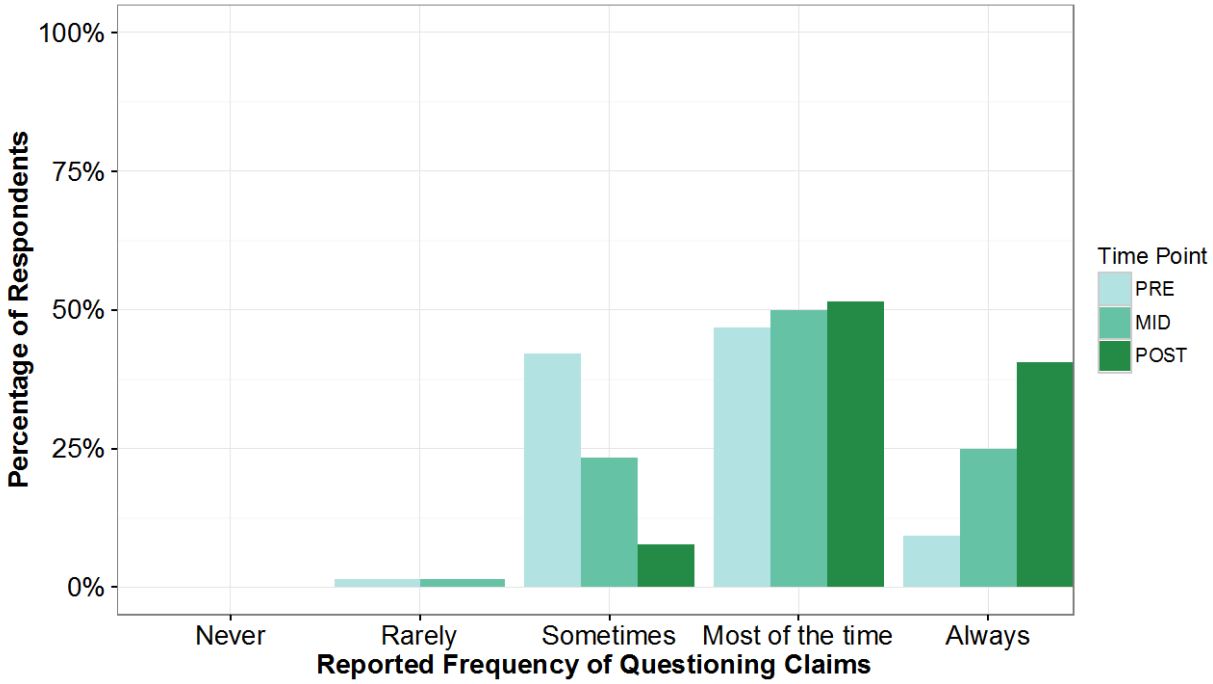


*Figure 1.* At pre, mid, and post semester, the percentage of respondents (N = 64) reporting each level of frequency in response to the question "How frequently do you question the credibility of nutrition/health related claims that you hear/read?"

When asked to "describe the actions they would take when investigating a nutrition related claim," the percentage of respondents providing responses consistent with critical investigation increased from 20% to 44% by the middle of the semester and to 77% by the end of the semester. Further, by the end of the semester, the percentage of respondents whose actions were clearly inconsistent with critical investigation had dropped from 52% to 16.39% (Figure 2). Mean scores, with a score of 2 being the highest possible (answers consistent with critical investigation), were 0.67 (pre), 1.16 (mid), and 1.61 (post). A single-factor (time) within-subjects ANOVA suggests that the shifts in the student responses were highly reliable; $F(2,120) = 21.23$ ($p<0.001$). Post-hoc Tukey's tests revealed that all paired differences (pre-post; pre-mid; mid-end) were significant ($p<.01$).

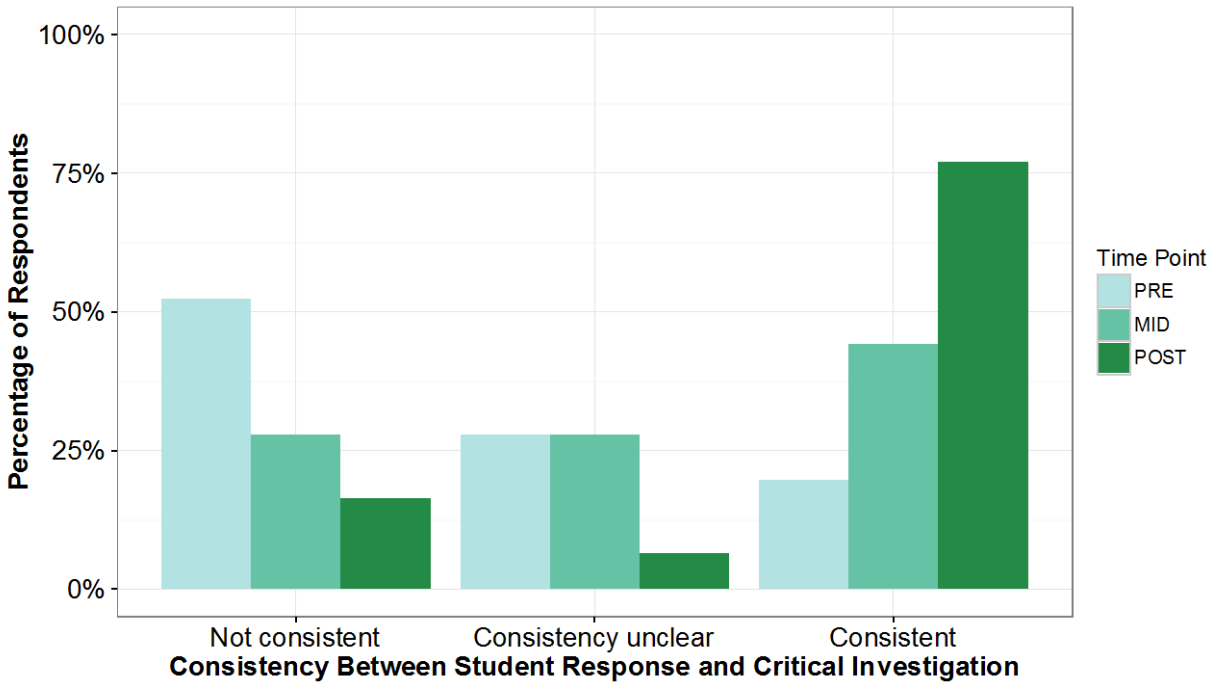


*Figure 2.* At pre, mid, and post semester, the percentage of respondents (N = 61) reporting habits consistent with critical investigation, habits for which the consistency with critical investigation is unclear, and habits which are clearly not consistent with critical investigation.

When asked to indicate their level of agreement with the statement "I think it is important to question the credibility of nutrition/health related information that I hear and read," the majority of participants at all time periods indicated strong agreement. Mean scores, with a score of 4 being the highest possible (strongly agree), were 3.67 (pre), 3.67 (mid), and 3.63 (post). A single-factor (time) within-subjects ANOVA indicated no reliable changes in perceived value across the semester (Figure 3).

Taken together, these results have several implications regarding the development and assessment of habits of critical investigation. One of the more striking findings was the disconnect between students' reported agreement with the importance of questioning claims, their self-reports of actually practicing it, and their self-reported actions when investigating a claim. Even at the beginning of the semester the vast majority of students reported strongly agreeing with the importance of questioning claims, but only 10% reported engaging in such practice all of the time and 47% most of the time. Further, when their actual self-reported actions were evaluated for consistency with good critical investigation, only 20% at the beginning of the semester described actions that were completely consistent with critical investigation. This pattern indicates that reports of agreement with the importance of an action are not reliable indicators of behaviors, and even more crucial, self-reports of behavioral frequencies are not necessarily a reliable indicator of whether their actions would be consistent with critical investigation. Therefore, if you want to assess the effectiveness of a course in developing students' habits of critical investigation, it is

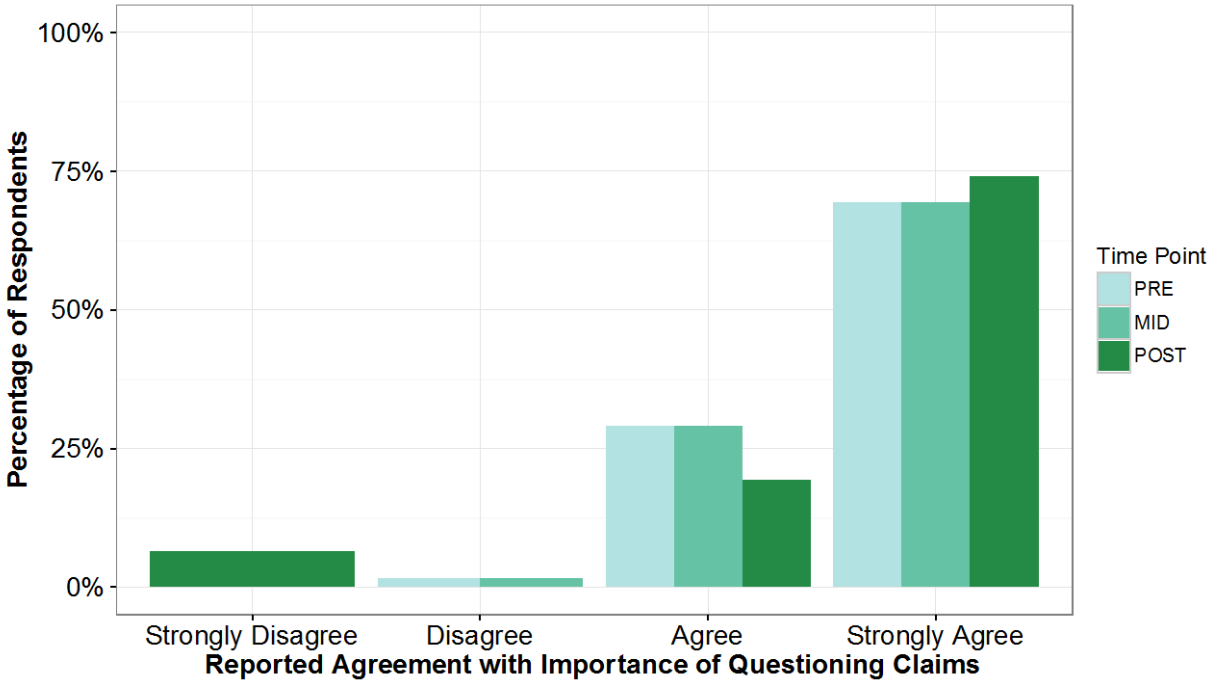


*Figure 3.* At pre, mid, and post semester, the percentage of respondents (N = 62) reporting each level of agreement with the statement "I think it is important to question the credibility of nutrition/health related information that I hear and read."

important to examine students' actions rather than just their intent. This can be facilitated by the use of open-ended rather than Likert-style questions.

A second implication of our results is that when provided with intentional focus on the value of critical investigation and opportunities to practice with feedback, students report significant changes in the frequency with which they engage in critical investigation and show significant increases in self-reported actions that are consistent with good critical investigation.

A third implication of our results is that the gain in self-reported frequency of actions and the number of students reporting actions consistent with a habit of critical investigation doesn't happen in just a few weeks. Our students showed significant gains both from pre- to mid-semester and from mid-semester to the end of the semester. Thus, if you desire to develop this habit in your students, continue to focus on developing it throughout the entire semester (or until an assessment shows you that your students have fully achieved your desired outcome).

The lack of any significant increase in the reported agreement with the importance of questioning the credibility of information is potentially due to a ceiling effect for the majority of the respondents (68% of respondents selected the highest possible response on the pre-class questionnaire and 98% selected one of the top two responses). Surprisingly, 4 individuals selected the lowest possible response on the post-course questionnaire. However, these same students reported high frequencies of questioning claims and actions consistent with critical investigation. Thus, we believe they might have misread the response options and thought they were indicating strong agreement rather than strong disagreement. It seems unlikely that someone who "Strongly Disagrees" with the statement that it is important to question the credibility of claims they encounter would report that they "Always" question the credibility of claims. In the future, we

recommend including an open-ended question that asks students to describe the degree to which their attitude has changed and how.

## General Conclusions

Based on the above findings, we conclude that an aligned course utilizing active learning and multiple opportunities for practice and feedback is an effective means of developing students' targeted critical thinking skills as well as their habit of critical investigation. Specifically, for the targeted sub-skills of the CAT that had high alignment, the HN cohort significantly outperformed the senior-level control group that had not received the targeted practice and feedback. Further, the percentage of students who reported taking actions consistent with critical investigation when they question a claim increased from 20% to 77% over the course of the semester.

Our results reinforce the need to break expansive definitions into discrete sub-skills and provide opportunities for explicit practice and feedback with each individual sub-skill. Because of the large number of sub-skills within the expansive definitions, it would be extremely difficult to effectively target them all within a single semester course. We believe instructors should choose the specific components that best fit their course goals. If such targeted efforts were combined with other courses targeting other components, then across a curriculum, a student should develop broader critical thinking skills and habits.

We also believe that the targeting of discrete sub-skills through the cycles of activities, discussion, and feedback led to a more manageable load for the instructor and the students when compared to previous semesters when the lead author assigned a long research paper that was intended to require critical thinking. The total effort put into critical thinking development across the semester of this study was at least as great as the writing and grading of the longer essay papers in previous semesters, however, because it was distributed over time and occurred in smaller chunks, it was more manageable for both the instructor and the students and followed best practices for skill development. Further, the targeted nature of the skill development made the learning goals clearer, which led to clearer evaluation of performance and allowed feedback to be more focused and rigorous. An approach consisting of small, manageable chunks is also more likely to be adopted by other instructors than one which involves a large overwhelming assignment. One additional benefit of our approach was that students did not display the negative responses often associated with major papers, but rather, they were engaged and seemed to enjoy the critical thinking activities and assignments.

Despite these encouraging results, we must also acknowledge some limitations of our study. First, our measures of the habit of critical investigation are self-reports, which means some caution is warranted when making claims about those results due to possible demand characteristics. However, we derive some comfort from the fact that fewer of our participants reported engaging in critical investigation than the number who reported that it was important to do so, i.e. they didn't chose to max out their responses on both questions in order to portray themselves in the most positive light. Further, our open-ended question required students to describe how they would approach a claim requiring critical investigation, thus minimizing their ability to inaccurately claim proficiency.

Second, we also acknowledge that we did not have pre-class measures of CAT performance for the Human Nutrition Cohort. Therefore, the exact level of development that occurred over the course of the semester cannot be quantified. However, given that the Human Nutrition Cohort had lower initial measures of academic ability than the Senior Cohort, it is reasonable to conclude that

their initial CAT sub-skill scores would not have been significantly higher than the Senior Cohort at the beginning of the course, and that they may have been lower. Given this logic, we are comfortable concluding that the difference in performance between the two groups indicates the minimum level of development in the HN cohort that occurred over the semester.

As we encourage others to implement similar approaches in their courses and curriculum we have several recommendations. In addition to incorporating multiple cycles of well-aligned practice and feedback focused on well-defined sub-skills and creating a culture of thinking, we recommend that instructors do the following. They should focus on developing the desired skills and dispositions throughout the entire semester, or until an assessment confirms the desired level of mastery has been attained. This recommendation is supported by our results showing that, over the second half of the semester, students made substantial and significant improvement in the habit of critical investigation above and beyond the gains made in the first half of the semester. Furthermore, some students may not achieve proficiency by the end of the semester (e.g. 17% of respondents at the end of the course still reported taking actions inconsistent with critical investigation). Thus, faculty, program directors, and general curriculum designers should ensure that multiple courses target desired skills, both to reinforce skills for those students who have achieved competency and to provide additional opportunities for development for those students who do not achieve competency after a single course.

Based on our findings and on the literature, we plan to modify our pedagogy and incorporate additional best practices. In an effort to promote deeper thinking (De L'Etoile, 2008) and minimize the likelihood that students memorize a formulaic type of answer, which appears to have occurred on Sub-skill 4, we plan to add open-ended justification components to skills assessment questions. We also plan to incorporate activities designed to increase students' sensitivity to opportunities for critical thinking (Halpern, 1998), as low sensitivity has been reported to be a large contributor to low performance on measures of ability (Perkins, Tishman, Ritchhart, Donis, & Andrade, 2000).

The scope of our intervention may seem daunting, but the evidence suggests that there is broad need for such efforts. Even at our highly selective institution, roughly half of our upper-level students described taking actions clearly inconsistent with critical investigation at the beginning of the semester, and national data (e.g. Arum & Roksa, 2011) suggests this is not isolated to our institution. We believe that the critical thinking skills and approach outlined here are applicable across the disciplines and levels of expertise. The media provides a continuous stream of claims to which critical thinking should be applied, and even among experts in a field there is often disagreement on the proper interpretation of data. The current climate of information overload and readily available claims in the media underscore the need to implement best practices for developing critical thinking skills and creating a culture of thinking. We hope that instructors in all disciplines are inspired by the clarity and viability of this approach to incorporate these practices within their own classrooms.

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# Grand Rounds: A Method for Improving Student Learning and Client Care Continuity in a Student-Run Physical Therapy Pro Bono Clinic

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## Abstract

***Background and Purpose.*** *Grand Rounds is a teaching methodology that has existed in various forms in medical education for centuries. When a student-run pro bono clinic identified a growing challenge of providing continuity of care for clients and a lack of preparedness in students, they implemented a Grand Rounds model of case presentation within the curriculum. The purpose of this paper is to describe the implementation and assessment of Grand Rounds as it attempts to improve both the continuity of care for the clients and the learning experience for the students involved in a student-run pro bono clinic.*

***Case Description and Evaluation.*** *The Student Board divided the student physical therapists and the clients into three teams. Each team of students would meet every three weeks to discuss the clients on their caseload. More advanced students helped to mentor the more novice students and a faculty member would facilitate the discussions.*

***Outcomes.*** *After eight months of implementation, the Student Board gathered evaluative data from students, supervisors and client. The Widener University Institutional Review Board approved the program evaluation. Analysis of the data collected revealed that the students grew more confident and effective in their ability to implement and advance the physical therapy program.*

***Discussion and Conclusion.*** *The program evaluation confirmed that the implementation of teams and Grand Rounds positively impacted students' confidence and ability to collaboratively treat and advance clients and their physical therapy program in the student-run pro bono clinic. The program evaluation was not effective in thoroughly assessing the impact that the model had on clients and their recovery. Further evaluation should be conducted with client outcomes measures. Recommendations for the modification and improvement of Grand Rounds emerged.*

***Keywords:*** *grand rounds, case presentations, mentorship, student-run pro bono clinic.*

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## Background and Purpose

Grand Rounds is traditionally defined as "rounds involving the formal presentation by an expert of a clinical issue sometimes in the presence of selected patients" (Merriam Webster Dictionary, 2015). Grand Rounds has its roots in medical residency training as an educational method for introducing new material and enhancing clinical reasoning through discussion of authentic client cases (Medicine Net 2015). Historically, Jean Martin Charcot is credited with the initiation of Grand Rounds (Goetz, Bonduell, Gelfand, Charcot, 1995). In the late 1800s, he routinely delivered extensive neurological case presentations to an audience of physicians, students, family members, and other interested members of the public. Typically, his patient was present for the case presentation as a visual aid. The purpose of the case presentation was to share his expertise and to advance the care of the patient (Goetz, Bonduell, Gelfand, Charcot, 1995).

Grand Rounds remained a staple of medical education for years, but concerns for patient dignity and confidentiality led to the practice of conducting Grand Rounds without the patient present (Stanyon & Khan, 2015). In time, the Grand Rounds format shifted away from case based presentations and evolved into an expert lecture with an emphasis on the latest evidence (Hebert & Wright, 2003). This version of Grand Rounds is largely didactic with little opportunity for audience engagement. Hull, Cullen, and Hekelman (1989) researched the implementation of Grand Rounds is the late 1900s. They noted that Grand Rounds provided continuing medical education credit as well as a forum for the socialization of medical students. The medical culture was perpetuated as experienced physicians provided examples of problem-solving techniques, values, application of evidence, and presentation of cases.

A 2001 survey of US hospitals with medical residency programs found that Grand Rounds were offered in 97% of 300 respondent hospitals. The most important objectives of these contemporary Grand Rounds were to educate audience members, showcase faculty role models, and to promote a collegial atmosphere. The formats were largely lecture-based and patients were present less than 3% of the time. Of all of the Grand Rounds, only 10% represented clinical case presentations and overall, opportunities for learner participation or interaction were minimal (Hull, Cullen & Hekelman, 1989).

In 2009, Van Hoof, Monson, Mafdalany, Giannotti & Meehan conducted an in-depth qualitative investigation of Grand Rounds at a particular medical institution. The researchers observed 16 Grand Rounds presentations and conducted interviews and focus groups with key informants from the audience, the presenters, and the planners. Similar to Hebert and Wright's findings (2003), the Grand Rounds lacked active participation or input from the learners. The presentations were didactic and the audience assumed a very passive role.

Distinct from Grand Rounds are the historical practice of “ward rounds” which is the term typically used to describe the activity of a team of physicians, residents, and/or medical students visiting clients in the hospital as a daily routine (Parissopoulos, Timmins & Daly, 2013). Ward rounds focused first on the needs of the client and second on the needs of the student. Recent research around the educational value of ward rounds found that “the main obstacles to effective learning and teaching were lack of time, number of patients, frequent interruptions, lack of interest from seniors, and the relationship between seniors and juniors” (Laskaratos, Wallace, Gkotsi, Burns & Epstein, 2015). Ward rounds returns the focus to case-based learning but this article found that they may not be the optimal venue to meet the educational needs of the student.

The challenge is to find an optimal education method to facilitate student learning while simultaneously enhancing patient care. An article in recent medical education literature describes a monthly Grand Rounds meeting where first through fourth year medical students met to produce

concept maps that linked together curricular content in their medical education across four years. The researchers held focus groups for students from each year to determine their impressions and perceptions of participating in the case conferences. The Grand Rounds was found to increase the interaction of students across classes, encourage students to develop as peer teachers, and strengthen links between pre-clinical and clinical course content. The cases discussed were fictitious and were created only for the learning experience (Richards, Schwartzstein, Irish, Almeida & Roberts, 2013).

Rigby, Schofield, Mann & Bernstead (2012) describe a contemporary Canadian format for Grand Rounds that has returned to the case-based presentation practice by Charcot, but with incorporation of a more active based pedagogy. In this model, a resident presents a case and attendees are encouraged to participate by asking questions, providing feedback, offering suggestions. A staff physician typically serves as moderator, charged with engaging the audience in discussion and providing expert guidance as needed. Rigby, Schofield, Mann & Bernstead (2012) sought to identify elements that contributed to a highly educational Grand Rounds experience and conducted a Delphi study of 32 physician experts involved in these Canadian Grand Rounds. Three rounds of questionnaires were completed and the researchers found strong support for case based rounds, high level of audience interaction, and resident participation in case presentation and analysis. This form of Grand Rounds retains the case-based presentation that serves to enhance client care as well as an active learning pedagogy that facilitates student collaborative learning.

Students of the Widener University Institute for Physical Therapy Education encountered client continuity and case progression challenges that they thought might be remedied by the additions of Grand Rounds as described by Richards, Schwartzstein, Irish, Almeida & Roberts (2013) and Rigby, Schofield, Mann & Bernstead (2012). The students had been treating clients from Chester, PA and surrounding communities in the student-run pro bono physical therapy clinic, the Chester Community Physical Therapy (Clinic) for five years. With 100% student participation from all three classes, as many as 150 students are circulating through the clinic treating a pool of 20-25 clients at any given time. This had led to difficulty with continuity and progression of client programs. Students proposed breaking themselves and their clients into teams and establishing a regular schedule of rotating team Grand Rounds where student team members could discuss client cases on their teams every three weeks. The purpose of this paper is to describe the implementation of teams and Grand Rounds and to assess the effectiveness of the method as it attempts to improve both the continuity of care for the clients and the learning experience for the students.

## Case Description and Evaluation

Students of the Widener University Institute for Physical Therapy Education treat uninsured and underinsured clients from the Chester community and surrounding areas in the student-run pro bono physical therapy Clinic under the supervision of licensed physical therapists. The Clinic's mission statement is:

> "to simultaneously improve healthcare access to physical therapy services by providing pro bono services to the underserved and underinsured population in the surrounding community while educating a new generation of physical therapists in the areas of competency, character, citizenship, and social responsibility." (Chester Community Physical Therapy Clinic, 2016)

The Clinic is run by a Student Board consisting of 12 board positions with representatives from all three classes of students (see Figure 1). While the Student Board oversees the operations of the Clinic, every physical therapist student in the Institute for Physical Therapy Education at Widener University serves at least four nights / semester; therefore, all physical therapist students have an active role treating in client care.

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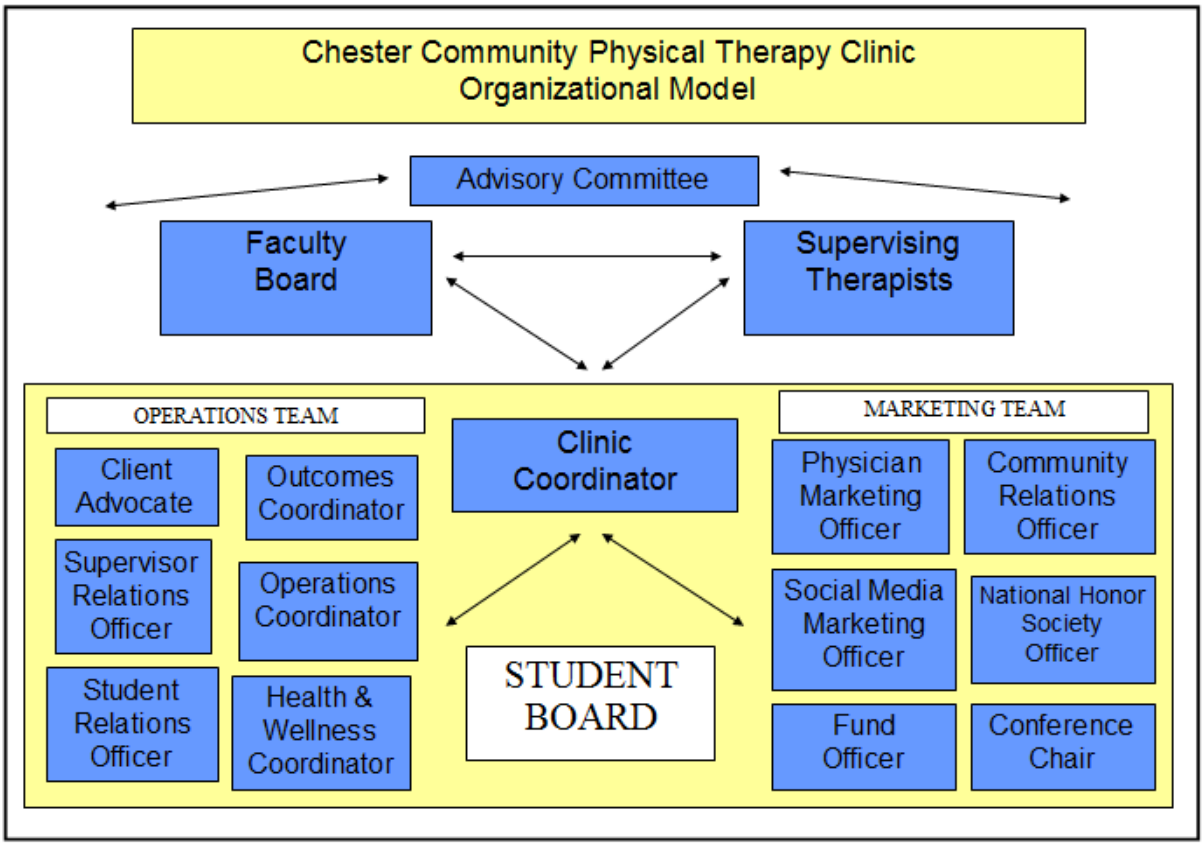


**Figure 1. Organizational Chart of the Chester Community Physical Therapy Clinic and the Student Board**

The Clinic is open four evenings / week throughout the entire year. Students across three years of the Doctor of Physical Therapy (DPT) curriculum take turns serving in the clinic always under the licensed supervision of physical therapists. The licensed supervisors include full-time faculty members, adjunct faculty members, and local physical therapists, many of whom are alumni of the program and served in the Clinic as students previously. The students participate in client care in accordance with their level of education in the curriculum. For example, the students in their first semester learn general principles of client interviews, how to take vital signs, and basic therapeutic exercise and basic transfer and gait training intervention. The first-year students are expected to assist in client care in these areas and do so under the mentorship of second and third-year students and ultimately supervised by the licensed physical therapists onsite. In their second semester, they learn basic tests and measures and begin to contribute to the Clinic with

application of these skills. Second-year students possess the skills to conduct a complete evaluation or re-evaluation but require guidance and mentorship with establishing goals and determining progression. Third-year students bring the higher-level skills of manual techniques and managing complexity. They serve as peer mentors for the first and second-year students. Students throughout all three years of the curriculum participate in documentation. All of this occurs under the direct supervision of the licensed physical therapists and faculty onsite each evening in the clinic.

Throughout the three-year curriculum, the DPT students are sometimes off campus for their full time clinical experiences and are not able to participate in the Clinic in this time. Table 1 depicts the months that each Class of students are on campus and participating in the Clinic.

**Table 1. Rotation of Students Participating in the Clinic throughout the Curriculum**

| | Jun | July | Aug | Sept | Oct | Nov | Dec | Jan | Feb | March | April | May |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1st Year | | | | | | | | | | | | |
| 2nd Year | | | | | | | | | | | | |
| 3rd Year | | | | | | | | | | | | |

**Table Legend**

| | |
|---|---|
| | Students are off campus and not available to participate in the pro bono clinic |
| | Students are on campus and are participating in the pro bono Clinic |

The program begins in June of the first-year with a full-time10-week anatomy course that is off campus. The second-year students have a full-time clinical experience and are off campus April through August. They return to campus for September and October as third-year students before leaving for their two full-time clinical experiences that occur from November through to graduation in May. The students are considered to advance in the program every June.

The Clinic is open for two hours each night and services an average of 6-10 clients / night. Student physical therapists sometimes expressed to Student Board members that they felt unprepared to treat unfamiliar clients at the Clinic. While they had 30 minutes prior to client arrival to conduct a chart review with the assistance of the licensed physical therapists onsite for the evening, they still felt lost and inadequately prepared to understand and confidently advance the client's program. While students were expressing a sense of unpreparedness, clients noted that they rarely saw the same student therapist twice. Clients remarked favorably when there was therapist consistency in their treatments. Additionally, the licensed physical therapy supervisors serving in the Clinic had communicated that students generally struggled with program progression and discharge planning.

In an attempt to provide better continuity of care for the clients as well as a stronger learning experience for the students, the Student Board members of the Clinic suggested the

formation of teams and the implementation of a Grand Rounds-type review of client cases. They approached faculty for help in designing something that would be mutually beneficial to students as well as clients and be mandated within the curriculum. Simultaneously, the faculty were in the midst of curriculum change and had an opportunity for the integration of something new within the curriculum. Together, the Student Board and faculty designed a two-credit course that would be called PT770: Grand Rounds. The objectives are listed in Table 2.

**Table 2. Objectives for PT770: Grand Rounds**

1. Participate in the design and implementation of best clinical practice for pro bono clients
2. Demonstrate professional behavior and effective communication skills within the team setting
3. Provide mentorship to peers in an effective manner
4. Demonstrate improved clinical decision making skills by using clinical judgment and reflection to identify, monitor, and enhance client programs
5. Apply current knowledge and professional judgment while considering the client perspective in client management
6. Identify, respect, and act with consideration for client differences, values, and preferences when designing and advancing programs.

In order to effectively implement Grand Rounds in a manageable fashion, the Student Board created teams of students and clients. They divided the three student classes into three equal groups and assigned them to Team A, Team B, or Team C. Each student team had an equal number of first, second, and third-year students, allowing for mentorship within the teams. The Student Board also assigned the active Clinic clients to Team A, B, or C. A range of 5-8 clients was on a team at any given time during the duration of the trial period. A total of three students per team (one student per class) were scheduled at the Clinic to treat their respective clients each evening. Table 3 shows a fictitious structure of the student and client schedule for a night of Clinic operation in the beginning of the fall semester when all three classes of students are on campus.

**Table 3. Fictitious Sample Schedule**

| | | | |
|---|---|---|---|
| **Pre-PT Receptionist** | Amanda (pre-PT work study student) | | |
| **Student Board Administrators** | Daria (PT3) & Nolan (PT2) | | |
| **Licensed Supervisors** | Wayne (adjunct faculty) and Mark (full-time faculty) | | |
| | TEAM A | TEAM B | TEAM C |
| **Student Teams** | Jess (PT3)<br>Amanda (PT2)<br>Tim (PT1) | Nicole (PT3)<br>Scott (PT2)<br>Brittany (PT1) | Kyle (PT3)<br>Khyati (PT2)<br>Tom (PT1) |
| **4:30** | Team A Client | Team B Client | Team C Client |
| **5:00** | Team A Client | - | Team C Client |
| **5:30** | Team A Client | Team B Client | Team C Client |
| **6:00** | `- | - | - |
| **6:30** | - | - | - |

Note that two licensed physical therapists (in this case one full-time faculty and one adjunct faculty member) provide the supervision. The third-year PT students provide mentorship for the first and second-year students. The team of students determines how they will handle the clients on the schedule and will work together within the skill sets that they have to provide the service. For instance, the first-year students will be expected to greet the clients and take their vital signs. The second and third-year students will be responsible for program progression, higher-level skills and assessments. The first-year students, however, will be alongside the session and will be learning from the second and third-year students throughout. The two faculty members provide the needed supervision and direction. Much like clinical education, the amount of direction and close supervision needed depends on the skill levels of the students at the time. By the time they are third-year students, more distant supervision is acceptable. When the third-year students are off campus and the second-year students are mentoring the first-year students, more direct supervision from the faculty member or licensed physical therapy clinician is needed. The clinic space consists of two wide-open spaces with curtains that can be drawn for privacy as needed. The openness of the space provides for ease of supervision by the faculty and licensed physical therapy supervisors.

The addition of the Grand Rounds course provides an additional forum to prepare students for treating the clients in the Clinic. The faculty designed two-credit course spans five semesters, allowing students to participate across all three years in the curriculum. With the guidance of an adjunct faculty member, each team of students met for one hour every third week to discuss the clients on their team. Students from the second-year class would sign up to give a case presentation for a client whom they had recently evaluated or treated. The second-year student would present his or her case and open up the opportunity for discussion and questions. Case presentations average five minutes / case. Some cases require less time and some more. A template to guide the case presentation helps the student cover key components in an efficient manner and is included in Appendix A. The adjunct faculty member would facilitate the discussion and would encourage

demonstration and instruction of unfamiliar concepts or interventions. The course was designed as a pass / fail course with student attendance and participation required for passing.

We initiated the teams and Grand Rounds course at the start of the summer session in May. This meant that only the second-year students were on campus and were the only class serving in the clinic and participating in Grand Rounds until the start of the fall semester in September. From September onwards, all three classes of students were on campus and participating in both the Clinic and in Grand Rounds. In Grand Rounds, the second-year students continued to take the lead in the case presentations while the third-year students served as mentors, contributing their knowledge from their recent full-time clinical experience. The first-year students attended but were not expected to actively participate. They were told to listen and absorb what they could of the cases presented. We evaluated the effectiveness of the implementation of teams and Grand Rounds after an eight-month time period, May through to December. In this period, each team met for Grand Rounds a total of seven times. A faculty member and six second-year Student Board members analyzed the outcome data which included surveys of first and second-year students, reflections of third-year students, interviews with clinical supervisors, and analysis of client satisfaction surveys. The Widener University Institutional Review Board approved the evaluation plan.

## Outcomes

Participants in the evaluation included 45 first-year students, 42 second-year students, and 43 third-year students. Four clinic supervisors who volunteered at the Clinic both before and after the implementation of Grand Rounds, and 16 client satisfaction surveys, which encompassed clients who had received therapy both before and after the implementation of Grand Rounds, were also part of the evaluation.

### *Retrospective Reflective Paragraphs from Third-Year Students.*

The third-year students participating in Grand Rounds were required to submit a reflection of their experience in Grand Rounds as part of their PT715 Teaching and Learning class. They provided informed consent to use their reflection in the evaluation. The statement to guide the reflection is included in Appendix B. Student reflections were de-identified prior to review. Two of the Student Board members reviewed the reflections and noted recurring themes.

### *Second-year student pre and post surveys*

The second-year students were informally surveyed by two of the Student Board members before and 8 months after the implementation of Grand Rounds. The electronic survey was created by the two Student Board members and students completed the survey anonymously via Survey Monkey. The survey consisted of 5 questions asking the students to rate their confidence on a 5-point Likert scale. A copy of the survey is included in Appendix C. A Wilcoxon Signed Ranks test was used to analyze the data given that it was a non-parametric data set. The significance was rated on a p value of $< 0.05$. See Table 4 for a complete presentation of the statistics for each of the five questions.

**Table 4: Second-year Physical Therapy Student Survey**

| Question Asked | Knowledge of patient's condition | | Amount of prep time | | Understanding of patient progression | | Confident in altering patient's POC | | Confident in treating the patient's pathology | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Pre | Post | Pre | Post | Pre | Post | Pre | Post | Pre | Post |
| **Means** | 3.25 | 4.09 | 3.61 | 4.00 | 2.75 | 3.76 | 2.92 | 3.97 | 3.42 | 4.03 |
| **Standard Deviation (pre-post)** | 0.89 | 0.75 | 0.79 | 0.95 | 0.76 | 0.89 | 1.04 | 0.97 | 0.68 | 0.78 |
| **Wilcoxon Signed Ranks Test Significance** | 0.01 | | 0.03 | | 0.01 | | 0.01 | | 0.03 | |

Likert Scale (5= Strongly agree; 4= Agree; 3= Neither agree or disagree; 2= Disagree; 1= Strongly disagree), n = 42

$p<0.05$ is found to be significant change

*First-Year Student Participation Reflection*

First-year students gave informed consent and completed an anonymous reflection via Survey Monkey regarding their participation in Grand Rounds. The reflection questions were created by two Student Board members and are included in Appendix D. Two Student Board members individually read the responses and then collaborated to discuss recurring themes.

*Interviews of Clinic Supervisors*

Four clinic supervisors gave informed consent and participated in an interview by one of the Student Board members. Interviews were de-identified and transcribed onto a Microsoft Word document. Responses were first read individually by two of the Student Board members to identify recurring themes and then reviewed with all researchers to discuss findings. A copy of the supervisor interview form is included in Appendix E.

*Client Satisfaction Surveys*

The treating physical therapy students routinely administer client satisfaction surveys at the client's initial evaluation, re-evaluation, and discharge visits. The Health and Wellness

Coordinators of the Student Board collect them anonymously. The client satisfaction surveys are separate from, and are in no way linked to, the medical record. With the implementation of Grand Rounds, the client satisfaction survey was altered to include questions designed to obtain client feedback in regards to the initiation of teams and Grand Rounds. Two of the Student Board members reviewed and analyzed the client satisfaction surveys of clients who had been treated in the Clinic pre and post Grand Rounds implementation. The client satisfaction survey is included in Appendix F.

Upon initial review of all of the data by pairs of Student Board members, the evaluating team came together with the faculty member and did a comprehensive review of all of the data, looking for repeated and relevant themes. The five data points were triangulated by the evaluation team to provide an assessment of the effectiveness of Grand Rounds in improving student learning and client case progression and satisfaction. After examination and re-examination, they agreed that the five data points supported three major themes. Those three themes were confidence, teamwork, and continuity.

*Confidence*

Four of the data points strongly supported the theme of confidence. The pre and post surveys administered to the second-year students revealed a statistically significant improvement across all measures with the largest gains noted in the understanding of a client's progression as well as confidence in altering a client's plan of care ($\mu$= 3.76, 3.97). Supervisors corroborated these data in their interviews. Supervisors consistently noticed students feeling more confident in their treatment strategies which led to clients feeling more comfortable with the care that they received, *e.g.* "I think it really carries over to confidence in the clinic, and confidence always translates to better care, when the patient is actually there. I have noticed an overall better continuum of care" (Supervisor #3). Another supervisor noted, "I think they have a lot more confidence coming into the patient treatment session and I do think that they are providing a better service because of it" (Supervisor #1).

Thirty-nine of forty-five first-year students commented on how Grand Rounds was helping to increase their familiarity with clients and their programs. Twelve communicated that they thought they could do more than just sit and listen in Grand Rounds. They expressed a desire to have a more active role. Five of the third-year students made this specific observation as well. They felt that the first-year students would be capable of a stronger participation role in Grand Rounds.

Forty of forty-three third-year students described the addition of Grand Rounds in a very positive manner using phrases like, "excellent idea", "valuable experience", "very effective", and "great addition". They indicated that they felt the addition of Grand Rounds benefitted both the clients and the students. Three students specifically stated that they wished they had had this opportunity starting in their first year of study. They indicated that it would have helped their confidence and skill development.

*Teamwork*

Another pertinent theme noted through data analysis was teamwork and the subsequent mentorship between classes. The third-year students were able to initiate a mentorship role for the second and first-year students.

> I also found it helpful as a teaching, learning and collaborating experience with the PT I and II's because they would discuss certain patients and their specific plan of care and *exercise programs and I think our class as PT III's, having been out on clinic, had really good ideas to bring to the table (Third-year student reflection #18)*

The first-year students also commented on how they were able to contribute right away to treatment of clients and noted ways that the second and third-year students were able to help them learn and work together in figuring out how to most effectively treat the client *e.g.* "I've learned techniques in Grand Rounds from the teachers and older PT students that help me deliver a better session with a patient" (First-year student reflection #14). The supervisors saw evidence of the mentorship among students manifest in the Clinic as well, *e.g.* "The students are serving as mentors to one another in the clinic." (Supervisor #1).

*Continuity*

Improved continuity of client care was addressed repeatedly through all forms of data collected, but was noted especially by third-year students, Clinic supervisors, and clients. Client opinion was captured with the client satisfaction survey. The question "Are you generally seeing the same therapist or group of therapists?" was met with an equal numbers of yes and no responses. When asked if the student therapists knew more about the client's specific case, 8 of 16 answered "yes". One client added, "It's great that they are all working together and knowing all the patients." (Client Satisfaction survey #2).

The supervisors also recognized an improvement in students' understanding of client cases and effectiveness in establishing and working toward client goals. "I have noticed an overall better continuum of care" (Supervisor #3). They noted that student therapists seemed to be more comfortable working with the clients and felt that the discussion of client cases during Grand Rounds led to better consistency with client care, e.g.. "I think Grand Rounds has been an excellent addition to client care continuity especially on the side of the student's experience". (Supervisor #1).

Even first-year students began to connect with the importance of client progression and continuity of care.

> "Grand Rounds has been helpful in staying in touch with the patients I have treated and seeing how they've progressed since the last time I saw them, as well as making sure I understand the plan of care for the patient I will see next time I go". (First-year student reflection #37).

Third-year students noted how the implementation of Grand Rounds has led to increased involvement and discussion as a team on how to properly treat the clients and what ways the plan of care can be optimized. The third-year students pointed out that continued mentoring and interaction between experienced and novice students have led to an environment of information sharing that will benefit the clients' progression.

> "I was happy to see such involved and engaging discussion about some of the patients we are treating in the clinic. The PT2s are doing a good job presenting their patients and

> updating us all on each patient's status and progression, while the PT3s seem to be doing a seamless job in sharing practical experience and suggesting ways in which we can do even better" (Third-year student reflection # 9).

## Discussion and Conclusion

In general, there was positive feedback from all participants in the study. The first-year students appreciated the introduction to therapy terms and treatment progression early in their curriculum, the second-year students felt more comfortable and confident with skills and program progression, and the third-year students were proud to share personal experiences from their clinical experiences to help mentor the younger students and assist with the progression of client programs. The supervising therapists also noted an increase in student confidence. The clients were ambiguous on whether they saw more familiar faces but were affirmative that they felt that the students were knowledgeable.

Recommendations to enhance the method emerged from the data as well. First-year students indicated that they felt they were ready to take a more active role in the Grand Rounds presentation. Third-year students recommended forming smaller case presentation groups within Grand Rounds composed of students across the classes. In these groups, the first-year students could present the basic information about the client, the second-year students present the majority of the case, and the third-year students provide mentorship and guidance to the case discussion. This mirrors the Grand Rounds model described by Rigby, Schofield, Mann and Bernstead (2012). Examples of this peer mentoring have been researched in the relationship between fellows and residents during training and education. Backes, Reber, Trittmann, Huang, Tobmlin, Moorehead, Bauer, Smith and Mahan (2011) found that 87.5% of residents in their study believed fellows to be important in their learning experiences. Another study with medical student participants revealed that peers viewed the senior medical students as "clinical teachers" (Doumouras, Rush, Campbell & Taylor, 2015). This can be translated into the small groups during Grand Rounds by utilizing the third-year students as mentors or clinical teachers. Furthermore, the breakdown into smaller groups would allow for all students to play a more active role in their respective case presentations. This is also consistent with the findings of Rigby, Schofield, Mann and Bernstead's (2012) where both resident participation in analysis of the case study, and high levels of audience interaction, were strongly supported as key features for student learning. In smaller groups, students would be presented with more opportunities for client discussion and collaboration, thus leading to improved learning opportunities. Additionally, the Delphi study identified value in giving leadership responsibilities to the residents. The Student Board could appoint a student to serve as a teaching assistant alongside the Clinic supervisor / adjunct faculty member. This role could provide a leadership opportunity to the student leader as well as increase student participation.

While the evaluation showed that students experienced a significant benefit with the addition of teams and Grand Rounds, it was not as conclusive on the benefit to the clients. This could be because clients are still seeing many different student physical therapists and although the students on that team now have a better understanding of that specific client, the number of students that clients might see remains large. Consideration should be given to further narrow the number of potential student physical therapists that the client could see. In addition, client satisfaction surveys may not have adequately captured the client experience. First, only four questions specifically addressed the addition of teams and Grand Rounds; second, only 16 clients

experienced the Clinic prior to the initiation of Grand Rounds as well as during Grand Rounds; and third, the survey did not sufficiently call for clients to respond in depth or elaboration.

As for the positive response that the second-year students demonstrated in the pre and post surveys, it is impossible to distinguish if their improved perceptions of their competence are a result of Grand Rounds or if they are a product of increased knowledge gained from the curriculum. In the 8 months of the Grand Rounds trial, the second-year students were also participating in 8 months of additional curricular coursework. We cannot know for sure that the implementation of teams and Grand Rounds was the cause for the improvements in the pre and post surveys. It is also interesting to note that this study can no longer be exactly replicated in this particular AMA program, as Grand Rounds is now in the curriculum and control groups that have not experienced Grand Rounds no longer exist. The evaluators would be unable to obtain pre-implementation data.

The model of Grand Rounds as described by Rigsby, Schofield, Mann and Bernstead (2012) proved to be an effective way to actively engage physical therapy students of all levels in a collaborative discussion of client cases furthering their confidence and effectiveness in advancing the physical therapy programs of clients in a student-run pro bono clinic. The model encouraged teamwork and collaboration with students mentoring one another within Grand Rounds as well as in the Clinic. In addition, several recommendations emerged from the evaluation to further improve the model. Specifically, Grand Rounds will be revised to give the first-year students specific roles and responsibilities in reporting on basic client case information and small groups will be formed to go over a case. These groups will consist of first, second, and third-year students to allow for greater mentorship.

The findings of this evaluation may be applicable to other physical therapy programs where opportunities for client care within the curriculum exist. The current program evaluation did not effectively measure the client experience or capture client clinical outcomes. The next program evaluation should focus on revision of the client satisfaction survey and institution of standardized client outcome measures to capture the effectiveness of the physical therapy program. The second-year students completed a Likert-scale survey and had less opportunity for open-ended response than the first and third-year students. Future program evaluation should allow the second-year students opportunity to openly reflect on ways that Grand Rounds might be improved as well. Overall, the program evaluation proved very insightful and will lead to positive changes in the method. The institution of teams and Grand Rounds was effective in facilitating student learning and in moving clients toward more continuity in their care.

**Appendix 1. Case Presentation Template**

**Client Grand Rounds Guide**

**Team: ____ Client:_____ Date: _____**

**Student Therapists:_____**

Background
Name, Age, Gender, Diagnosis:

Date of onset, Mechanism of injury, History of symptoms:

Course of treatment prior to pro bono clinic:

Social History: (occupation, support system)

Date of eval, # of visits to date, cancel/no show:

Current Status / Clinical Decision Making
Present interventions:

Current response to interventions:

Clinical Assessment:

Prognosis / Progression / Clinical Decision Making
Progression for the next three weeks:

Anticipated Discharge Week:

Discharge Concerns / Preparation:

Other: Updated script? / Communication?/ Re-eval needed?
Other concerns? / Important things to note?

**Action Steps: What and Who Responsible**

**Appendix 2. Third-Year Student Reflection**

PT715 Teaching and Learning Grand Rounds Reflection.

Attend and participate in the Grand Rounds meetings for you team. Reflect upon the experience. What went well? What went not so well? What is your overall assessment of the Grand Rounds experience? Please include any suggestions for improvement.

**Appendix 3. Second-Year Student Therapist Pre and Post Survey**

Please evaluate the following statements.

**1. I have adequate knowledge of my client's condition / impairment prior to treating them at the clinic.**

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

**2. I have an adequate amount of time to learn all that I need about my client prior to their arrival via chart review and WebPT.**

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

**3. I am knowledgeable of my client's progression in their program plan.**

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

**4. I feel confident in making alterations to my client's plan to improve their plan of care.**

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

**5. I am confident in my ability to treat my client's specific case / pathology.**

Strongly Disagree Disagree Neither Agree nor Disagree Agree Strongly Agree

## Appendix 4. First-Year Student Reflection Questions

Please complete the survey about the Grand Rounds meetings that you attended last semester. Your participation will help us improve the Grand Rounds experience.

**I find Grand Rounds valuable.**

Strongly Agree Agree Neutral Disagree Strongly Disagree

**What did you find valuable about Grand Rounds?**

**Grand Rounds is a waste of my time.**

Strongly Agree Agree Neutral Disagree Strongly Disagree

**How could Grand Rounds be improved in general?**

**What could be done to improve your experience as a first-semester, first-year student in Grand Rounds?**

**Please feel free to give us any additional feedback here.**

Thank you for your participation.

## Appendix 5: List of Supervisor Questions

Since the implementation of student treatment teams and grand rounds meetings:

1. What types of changes, if any, have you observed in the student therapists' knowledge of their patient and case?

2. Have you noticed any change in the student therapists' confidence during treatment? If yes, how so?

3. Have you noticed a change in patients' attitudes during therapy? If yes, how so?

4. What types of changes, if any, have you observed regarding the quality and continuum of patient care?

5. What types of changes, if any, have you observed in the efficiency of patient visits?

6. Is there anything else you would like to comment on?

## Appendix 6: Client Satisfaction Survey

Client Satisfaction Survey

We would like to know how you feel about the services we provide so we can make sure we are meeting your needs. Your responses are directly responsible for improving these services. All responses will be kept confidential and anonymous. Thank you for your time.

**Your Age** : _____ **Your Biological Sex is** : _____

**Your Race/Ethnicity** **(please check all that apply)**
___ Asian ___ Hispanic or Latino (All Races) ___ White (Not Hispanic or Latino)
___ Pacific Islander ___ Black/African American ___ American Indian/Alaska Native
___ Unknown

**Your Gender is** : (ie. Male, female, transgender, etc.)_____

| | 5<br>Great | 4<br>Good | 3<br>Ok | 2<br>Fair | 1<br>Poor |
|---|---|---|---|---|---|
| **Ease of getting care:**<br>Ability to get in to be seen | | | | | |
| Hours Center is open | | | | | |
| Convenience of Center's location | | | | | |
| Prompt return of calls | | | | | |
| **Waiting:**<br>Time in waiting room | | | | | |
| Time in exam room | | | | | |
| **Staff:**<br>Provider (PT/Student PT) Listens to you | | | | | |
| Takes enough time with you | | | | | |
| Explains what you want to know | | | | | |
| Gives you good advice and treatment | | | | | |
| **Receptionists:**<br>Are friendly and helpful to you | | | | | |
| Answer your questions | | | | | |
| **Cost of Services ($5/visit):**<br>What you pay | | | | | |

| | | | | | |
|---|---|---|---|---|---|
| Explanation of charges | | | | | |
| **Facility:** Neat and clean building | | | | | |
| Ease of finding where to go | | | | | |
| Comfort and Safety while waiting | | | | | |
| Privacy | | | | | |
| **Confidentiality:** Keeping my personal information private | | | | | |
| **The likelihood of referring your friends and relatives to us:** | | | | | |

What do you like best about our Clinic?

What do you like least about our Clinic?

What suggestions do you have for improvement?

How comfortable are you with working with a student physical therapist?

Do you feel like you are seeing the same general group of student physical therapists?

Do you feel like the student physical therapist has adequate knowledge of your case?

In regards to the new teams, do you have any general feedback on your experience?

*Thank you for completing our Survey!*

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# Implementing Collaborative Learning across the Engineering Curriculum

**Patricia A.S. Ralston[1], Thomas R. Tretter[2], and Marie Kendall-Brown[3]**

*Abstract: Active and collaborative teaching methods increase student learning, and it is broadly accepted that almost any active or collaborative approach will improve learning outcomes as compared to lecture. Yet, large numbers of faculty have not embraced these methods. Thus, the challenge to encourage evidence-based change in teaching is not only how to educate faculty about collaborative learning techniques, but how to support them as they attempt to implement paradigmatic changes in how they deliver their courses. This paper presents a multiple case study detailing the approach the University of Louisville's J. B. Speed School of Engineering used to encourage faculty in all departments to embrace the use of collaborative learning techniques, and then analyzes the impact of the approach on faculty participants. Support structures to enable faculty to implement collaborative teaching techniques, as well as the benefits participants experienced from pedagogical shifts, are discussed.*

*Keywords: collaborative learning, faculty development, case study, barriers to pedagogical change*

Substantive and widespread research over the past 20 years has shown active and collaborative teaching methods increase student learning, and it is broadly accepted that almost any active or collaborative approach will improve learning outcomes as compared to lecture, the dominant pedagogical approach in Science, Technology, Engineering, and Mathematics (STEM) courses. Yet, large numbers of faculty have not embraced these methods perhaps because of lack of pedagogical support from administrators and colleagues when faculty attempt to implement these teaching techniques. Thus, the challenge to encourage evidence-based change in teaching is not only *how to educate* faculty about collaborative learning techniques, but *how to support* them as they attempt to implement paradigmatic changes in course delivery. This paper presents a multiple case study detailing the approach the University of Louisville's J. B. Speed School of Engineering used to encourage faculty in all departments to embrace the use of collaborative learning techniques, and then analyzes the impact of the approach on faculty participants.

The Speed School of Engineering has a Center for Teaching and Learning Engineering (CTLE) that works in partnership with the university's center for teaching and learning. Through this partnership, which is supported by the dean and the center director, a faculty learning community (FLC) on collaborative teaching was designed to educate one faculty member from each engineering department (a total of six participants) about collaborative teaching techniques and to provide support and guidance during an initial implementation. FLC facilitators collected data throughout the process in order to answer the following research questions:

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1.) How can engineering faculty overcome challenges and barriers to implementing collaborative learning approaches in their teaching?

2.) What benefits do engineering faculty members perceive from the implementation of collaborative learning techniques?

The emergent structure and themes that arose from the analysis will serve to guide others interested in effecting evidence-based change in engineering faculty pedagogical practice.

## Theoretical Framework

### *Collaborative Learning in Engineering*

The benefits of collaborative teaching techniques on student learning have been well documented over the last 20 years (Johnson, Johnson, & Smith, 1998 a, b; Prince, 2004; Springer, Stanne, & Donovan, 1999). Specific benefits include improvements in student achievement, quality of interpersonal interactions, self-esteem, student attitudes, and retention. Collaborative learning falls under an umbrella term that includes or overlaps with many terms associated with active learning in the literature, but in this paper, we use the term as defined in Barkley, Cross, and Major (2005); they describe collaborative learning as any structured form of small group interaction. In addition to content learning and understanding gains, collaborative activities improve students' communication and social skills necessary for the global workplace.

In addition to the challenge by Prince (2004) for engineering faculty to promote collaboration in their classes, the accrediting agency for engineering programs (ABET, 2014) specifically links collaboration to the engineering curriculum via two of the 11 required student outcomes (ABET, 2014). The two outcomes directly related to a student's ability to collaborate are "an ability to function on multidisciplinary teams" and "an ability to communicate effectively." Additionally, employers desire graduates who are able to collaborate on teams, but have reported that students are not well prepared to do so (Jaschik, 2015).

An extensive series of surveys of engineering graduates from a large public university showed that graduates rated teamwork and communication along with data analysis and problem solving as the most important ABET competencies for their professional practice (Passow, 2012), and a recent review of the international literature to identify the skills needed by graduate and future engineers found teamwork and communication skills to be among the five most emphasized skills (Abdulwahed et al., 2013). Despite this body of evidence that should inspire engineering and other STEM faculty to strive to incorporate collaborative activities in their courses, changes in teaching practice have been slow to take place (Borrego & Henderson, 2014; Fairweather, 2010). Fairweather (2010) noted that one reason is that faculty perceive that curricular change will take valuable time away from research activities critical to promotion and tenure. This is not necessarily the case as barriers to change for STEM faculty have been researched and discussed broadly and include situational constraints – most notably fear that time taken would prevent necessary content coverage, student attitudes (including laziness and resistance), lack of ongoing professional development, unsupportive institutional or departmental culture, and personal beliefs and expectations about teaching and learning (Henderson & Dancy, 2007; Michael, 2007; Sunal et al., 2001; Walczyk et al., 2007).

Until recently, efforts to effect change in undergraduate STEM education focused on individual faculty innovators to test, create, and disseminate reform approaches (Kezar et al., 2015). This method of change has been challenged as unsuccessful (Fairweather, 2010; Kezar,

2011). The research results of Kezar and colleagues highlight the need for change agents to develop explicit change theories rather than work from implicit theories that do not engage in an examination and evaluation process. They describe the need to create professional dialogues and supporting networks to implement and spread reform. Borrego and Henderson (2014) identify and categorize eight change strategies supported in STEM literature, one of which is faculty learning communities. We selected the faculty learning community (FLC) approach as the strategy for effecting change.

*Faculty Learning Communities*

An FLC is a group of interdisciplinary faculty members (6-15) engaging in an active, collaborative program of significant duration designed to foster scholarly teaching and enhance student learning (Cox, 2003). FLCs are structured, intensive professional development opportunities designed to provide encouragement, support, reflection, and community building, and participants typically produce deliverables to share their knowledge and accomplishments with the wider university community (Cox, 2004). Research suggests that FLCs increase faculty interest and confidence in teaching; foster growth and innovation in scholarly teaching; encourage active, learner-centered, multidisciplinary approaches to teaching; and lead to increased student learning and retention, and higher rates of tenure. Faculty learning communities have also been demonstrated to generate a knowledge base accessible to the broader university community, thus improving teaching more broadly (Cox, 2001; 2003; 2004).

## Methods

Methodological considerations include research design, participants, intervention support structures, data sources, and analysis. This study employs a cross-case methodology to allow the use of multiple data sources to illuminate converging and diverging patterns across cases. Case studies are suitable for exploratory, descriptive and explanatory research (Yin, 2003), and cross-case methodology has been specifically highlighted as appropriate and rigorous for community and systems change research (Lee & Chavis, 2012), which is consistent with the research goals of this study. Methodological and data source triangulation affords construct validity and reliability which increases confidence in interpretation and facilitates uncovering the story of whether, how, and why change transpired.

*Cross-Case Research Design*

The current study is a multiple replication study of a common pedagogical problem of practice: that of implementing collaborative learning approaches in college-level engineering courses. This research design is appropriate from a systems change research perspective because of the complex and varied contexts in which pedagogical experiences in engineering occur (Lee & Davis, 2012). Understanding system change is often facilitated by cross-case synthesis which can illustrate both common themes and unique experiences (Yin, 2003; 2012). Accordingly, we wanted to study cases that vary on a number of parameters (e.g., disciplinary perspective, course level, level of prior experience with collaborative teaching, tenure status) in order to get a snapshot across the engineering curriculum.

*FLC Participants and Facilitators*

The dean of the Speed School of Engineering charged the CTLE with encouraging faculty to embrace collaborative learning strategies, in large part because the administration had redesigned some classrooms to facilitate collaborative learning, and these new learning spaces were not appropriate for a lecture-only approach. The CTLE director collaborated with the university's teaching and learning center to lay the groundwork and begin preparations for a new topically-based faculty learning community to accomplish this goal. The CTLE director contacted the chairs of each of the school's seven engineering departments to identify faculty participants. This process ensured cross-departmental participation that aligned with department goals and individual faculty work plans. The chairs responded positively by forwarding one or more faculty names. Final selection of participants was made by the CTLE director after conversations with the faculty members. In the end, the FLC proceeded with six participants from six departments who included one junior faculty member near mid-tenure, three faculty members in their tenure year or just tenured, one tenured associate professor, and one tenured full professor. There were five males and one female. Table 1 describes the faculty members' disciplinary affiliation, implementation course and student composition, and type of collaborative technique implemented.

**Table 1. Participants and Context for Implementing Collaborative Learning**

| Faculty and Department | Course and Students | Collaborative Learning Technique(s)[a] |
|---|---|---|
| FM1[b]<br>Civil and Environmental Engineering | CEE graduate course<br>Taught 3 times prior<br>(*n*=9) | Case Study<br>Collaborative Writing |
| FM2<br>Chemical Engineering | CHE senior required course<br>First time with this course<br>(n=36) | Structured Problem Solving<br>Test Taking Teams |
| FM3<br>Mechanical Engineering | ME graduate elective course<br>(*n*=27)<br>Taught course approx. 15 times | Send A Problem<br>Group Investigation<br>Jigsaw |
| FM4<br>Engineering Fundamentals | Introductory Calculus<br>(remedial course)<br>Freshmen (*n*=35) | Think Aloud Problem Solving |
| FM5<br>Electrical Engineering | Sophomore course for most majors<br>(*n*=41)<br>Taught approximately 5 times prior | Jigsaw<br>Team Matrix<br>Structured Problem Solving |
| FM6<br>Computer Engineering and Computer Science | Graduate course in CECS<br>Grad students & Seniors (*n*=29) | Critical Debate |

[a] Adapted from Barkley, E.F., Cross, K.P., & Major, C.G. (2005). *Collaborative learning techniques: A handbook for college faculty.* San Francisco: Jossey-Bass.

[b] FM 1-6 indicates FLC faculty member one through six.

The facilitators for the learning community were paper co-authors Pat, Marie, and Tom. Pat is the director of the CTLE, an experienced engineering educator and department chair, and she actively leads engineering faculty development efforts for the engineering school. Among those efforts, she has been immersed in the literature for course redesign and collaborative learning in engineering. Marie is associate director for teaching, learning, and innovation at the university's teaching center and a faculty development expert at the university. She has initiated and supported numerous faculty learning communities, and one strand of her work has been focused on teaching and retention in STEM. Tom is an experienced science education researcher, including qualitative, quantitative, and mixed research design methodologies. He holds both a bachelor's and master's degree in engineering, contributing to his unique perspective on education initiatives within engineering contexts.

*FLC implementation*

The faculty learning community kick-off took place in January 2014 and four one-hour meetings of the group occurred through spring semester. Participants received a copy of the FLC focus book, *Collaborative Learning Techniques: A Handbook for College Faculty* (Barkley, Major, & Cross, 2005) to create a shared understanding of collaborative learning as a pedagogical technique. Participants implemented some collaborative activities in their spring courses. At the beginning of the summer, a half-day workshop was held to share the research design and implementation plan. The group reconvened for a follow-up half-day workshop at the end of the summer to share their planned redesign and to obtain feedback from the session facilitators and their fellow FLC members. Facilitators designed the FLC so that participants experienced opportunities to:

- Enhance their knowledge of the research base for collaborative learning as a pedagogical approach and its implications for teaching in engineering;
- Identify and explore practical classroom applications for collaborative learning that will maximize the capabilities of the Speed School of Engineering's redesigned collaborative learning spaces;
- Implement a range of collaborative learning techniques and evaluate the effectiveness of these approaches relative to "traditional" teaching methods;
- Receive pedagogical and technological support for integrating digital collaborative techniques into a selected course in a meaningful way;
- Engage with colleagues and share ideas for enhancing student learning;
- Reflect on one's personal philosophy and approach to teaching; and
- Become part of a cohort of the Speed School of Engineering FLC graduates who can provide collegial support and advocacy for collaborative teaching approaches at the school.

In order to successfully complete the learning community, participants were expected to attend FLC meetings and workshops and identify, develop, and assess the implementation of a collaborative activity in a selected course. Participants submitted reflective memos, project proposals, took part in collaborative learning activities themselves, conducted peer classroom observations during the implementation period, and met in the Speed School of Engineering's new collaborative learning space. After all participants completed their implementation, the facilitators and participants organized and led an all-school presentation to engineering faculty in which they each described their FLC collaborative activities and shared their findings and reflections. Upon

completion of the program, participants received a $2000 grant for professional development activities.

*Sources of data*

Consistent with recommendations by Lee and Chavis (2012) for triangulating both methods of data collection as well as data sources, we collected data on each case as outlined in Table 2. Data were collected by facilitators at three points during the semester-long implementation cycle. Among the data collection triangulation approaches, we employed both emic (insider) and etic (outsider) perspectives (Fetterman, 1998).

**Table 2. Sources of Data**

| | Pre-semester | During semester | Post-semester |
|---|---|---|---|
| Emic (insider) perspective | | | |
| | Intent and plan (written summary to articulate outcome goals and implementation plan) | Written reflections and observations (to capture impressions and thoughts in the moment) | |
| | Written course documents (e.g., syllabus, handouts, directions for students) | | Semi-structured post-interview (see Appendix 2) |
| | Semi-structured individual pre-interview (to focus on particulars of upcoming effort) | | |
| Etic (outsider) perspective | | | |
| | FLC Facilitators: Semi-structured pre-interview (see Appendix 1) with interpretation and follow-up questions | FLC Facilitator observation (at least one) | FLC Facilitators: Semi-structured post- interview (see Appendix 2) with interpretation and follow-up questions |
| | FLC Facilitators: Interpretations of course documents and collaboration intent and plan | Peer Faculty observation (at least one) | |

The emic perspective from the faculty teaching the course and implementing the collaborative learning strategies offers strength because this perspective appreciates the rich, detailed context of the work, and brings value to exploring the implementation of collaborative learning techniques from those closest to the work. By contrast, the FLC facilitator team is outside of the classroom teaching-learning experience, and this etic perspective from the FLC facilitator team permits comparisons across the multiple teaching contexts and contributes to generalization of overall conclusions. The etic perspective also complements the embedded insider perspective to mitigate potential blind spots from being too close to the implementation.

*Analytic approach*

The three facilitators collected all data for each case in common online folders accessible to all facilitators plus the faculty implementer. For each case, Pat and Tom read through the corpus of data, in time sequence from pre-semester, during-semester, post-semester in order to capture the time-dependent development of implementation challenges and faculty approaches to ameliorating those challenges as they emerged. Using a grounded theory approach (Corbin & Strauss, 2015), these two facilitators independently, inductively developed themes emergent from the data that were relevant to responding to the research questions targeting challenges and benefits to implementation. Pat and Tom applied the emergent themes to the data iteratively, moving back and forth among the different sources of data within each case, and wrote research memos capturing how the implementation of the particular collaborative learning strategy unfolded. Specific pieces of data were attached to salient elements of the emergent themes in order to document the evidentiary chain. Finally, Pat and Tom triangulated core elements of the emergent themes with multiple sources of evidence (Yin, 2003).

Pat and Tom then shared their emergent themes with each other for each case for critical and reflexive feedback. Evidence taken directly from the raw data was used to confirm or disconfirm any substantial discrepancies between the two facilitators in order to ensure validity and reliability in this analytic approach. Once the individual case reports for each faculty implementer had been developed via this process and consensus was reached, the six cases each became a unit of analysis for the cross-case analysis. Collaboratively identified patterns emerged across cases. In addition to commonalities, unique aspects of cases were identified. These aspects generated interpretations about which features of a given case might be most salient. In this manner, the cross-case analysis was able to identify both commonalities as well as unique aspects across the six faculty implementation cases. After Pat and Tom completed the individual case summaries and cross-case analysis, Marie independently read and offered input into a final draft of each. This independent third perspective was used to strengthen and validate the case development.

**Results – Individual Cases**

Results are presented for each of the six faculty cases. After each individual case summary for the six faculty implementers is presented, the discussion is organized around the research questions and informed by a cross-case synthesis across all six cases. *AUTHORS' NOTE: The masculine pronoun is used throughout the paper to anonymize participants, but one of the faculty members was female.*

*Case of FM1—Civil and Environmental Engineering*

FM1's graduate level course in civil engineering was redesigned to implement collaborative learning activities in and outside of class in order to improve student motivation and learning of course content. FM1 had taught the course three times before with lecture as the primary class activity. However, as a result of the FLC study, FM1 felt teamwork and collaboration could be used to develop students' (independent) thinking ability about real-world issues in course content area as well as to improve their understanding of fundamental course concepts. FM1 decided to assign semester-long group projects that applied course concepts to real world problems.

Implementation required a literature review, intermediate and final writing steps, presentations, and a feedback system that evaluated both the project and the collaboration. FM1 also decided to integrate collaborative activities associated with the group project and group problem solving into regular class meetings.

FM1 stated that the biggest challenge in this re-design was deciding how to condense content to make time for collaborative activities. He ultimately replaced approximately one-fourth of his lectures with collaborative activities. Tegrity videos, PowerPoint presentations, and assigned readings replaced the previous lectures. He also used class time to have students work together on one problem, rather than simply working two or more examples for them. FM1 explicitly communicated to students the value of collaboration via the way he integrated and implemented activities into class (e.g., explicit schedule, rubrics, and evaluation plans for the group project), and his syllabus noted that these activities were worth 35% of the final grade. FM1 used careful pre-planning to design and implement well-structured activities. He noted that making use of a structured format (such as requiring students to use Google Drive and a Blackboard link) forced individual and group accountability and resulted in a portfolio that chronicled the collaboration.

During class observations, several students stated that the structured group project helped them learn the content better as they worked to understand their real-world problem. They also noted that they gained a better understanding of the benefits of collaboration both for individual learning and for tackling a large project. Some students related equations and material from class to various articles they read, linking material to real-world issues (a goal of FM1), and others noted that they were able to transfer and apply the knowledge they gained to another class in civil engineering. One student commented in response to a question after a presentation about the collaborative experience, "I definitely learned more with this group process than I could have learned alone."

FM1's implementation was a major pedagogical change from his previous practice of lecture only. During the semester, as he reflected on his own progress and on feedback from observers, he judiciously made changes by adding more structure to some activities, but wisely waited for the next implementation to make more involved changes. FM1 was comfortable that he had delivered all of the course's primary objectives. He also described his experience this way, "I learned a different way of teaching. At first I viewed traditional and collaborative learning as separate entities, but gradually learned to be comfortable integrating the two." He further noted that he thought students' thinking improved as he was able to interact with them during in-class problem-solving activities.

*Case of FM2—Chemical Engineering*

FM2 taught a new senior-level transport phenomena course in chemical engineering that was added to the curriculum to develop students' appreciation of fundamental phenomena behind chemical engineering processes. FM2 incorporated small group homework sessions into the course to allow students to work through problems by pooling their individual knowledge. Since FM2 was present, he could guide and redirect students' thinking in real-time. Students completed group homework instead of individual homework. FM2 communicated to students the value of the collaborative activities by assigning one-third of the course grade for group homework. Individual accountability for course objectives was maintained through conventional assessments for the other two-thirds of the grade. FM2 had experience with utilizing undergraduate teaching assistants

(UTAs) in another educational research project and thus recognized the value of peer learning. He had tried a few collaborative techniques in previous classes, although non-systematically.

FM2's main goal with collaborative learning techniques was to help students develop careful and critical thinking about fundamental concepts so that they could better understand problems. FM2 wanted them to generate the correct differential or partial differential equation to solve, rather than attempting a solution by simply mimicking an example, which is what FM2 had observed that many students do when faced with transport problems. FM2 had two goals for this approach, one was to give "real-time" feedback that would correct and adjust student thinking as they were challenged with problems, and the second was to empower students to connect with each other as learning sources. He also hoped that the stronger students would emerge as peer mentors for the class in the future. FM2 noted the importance of planning ahead of time with focus on how to rearrange course content. He decided to use PowerPoint presentations and Tegrity videos to "flip some pieces" in order to make time for the in-class group homework activity.

FM2 did not explicitly tell students *how* to be effective collaborators in the group activities, and he noted that some students were not properly prepared for daily activities. This caused time-management issues: some groups finished way ahead of others, some groups were off-task, and others were unsure of what to do. Observers similarly noted that although most students were on task and focused, there were varying degrees of student-student and student-teacher interaction. FLC members suggested that additional structures such as including a "close-the-loop" activity or an individual daily deliverable, coupled with explicit instruction on student roles and responsibilities for group activities, might improve the experience for everyone.

FM2 recognized the need for alterations in his next iteration of the course to better manage time and further structure activities to stimulate deeper thinking which was his overall goal. He found that incorporating collaborative activities didn't take as much time as he originally thought, although doing so was "a different way of teaching." He was pleased that stronger students emerged as peer mentors for their classmates and he valued the ability to give real-time feedback to students to help them shape their thinking dynamically rather than waiting for exam feedback.

*Case of FM3—Mechanical Engineering*

FM3 is a traditional lecturer who had taught a graduate-level course in mechanical engineering 15 times. He re-designed the course to incorporate in-class exercises that focused on a single problem that students worked in randomly selected 3-person teams to solve. FM3 then reviewed the problem and answered questions for the class before he continued with lecture. In other, more-structured activities, different teams applied a particular theory to a problem, then combined their results with other teams to compare theories. FM3's overall goal in implementing collaborative techniques was to give students more opportunities to "think through" concepts with "real-time" teacher input and feedback to improve students' learning.

FM3 initially thought that he would need to free up 4-5 full class sessions in order to incorporate the planned collaborative activities, and he wanted to be intentional about the change both for himself and students. He explicitly communicated the value of collaboration via the integrated activities that changed the class time from purely lecture-driven to some collaboration most days. While preparing for the revision, FM3 noticed that many things he covered were "booky and dry" and topics for which he could find alternate means of delivery, such as Tegrity or PowerPoint presentations. A goal for FM3 was to make his course "more interesting for me as well as for the students" by incorporating structured collaborative activities. Making these changes

opened time for more interaction, both student-student and faculty-student. He also thought class would be more interesting if he answered student questions, rather than just "talked." He shared that he had "never done a wholesale edit" of the course and the "idea of change [in reference to how he taught] was a challenge in and of itself." Prior to implementing the course, FM3 indicated "doing this at all will be an area of growth. I've never done anything like this before" which highlights his initial feelings of "stress and anxiety" as he prepared for this shift. FM3 ultimately discovered he could make the edits necessary to incorporate collaborative learning without sacrificing content.

During class observations, the 25-30 students participated and interacted well with each other and FM3, although observers noted that many students didn't follow instructions of assigning one recorder per group which meant that multiple students were writing at the same time. However, observers and FM3 noted this didn't seem to keep students from interacting with each other. Observers specifically mentioned that the instructor did an outstanding job interacting with students and "closing the loop" at the conclusion of the structured team activity which seemed to bring everyone's understanding to same point. In response to an observer question about the collaborative activities, one student said, "Doing this helps me break things up one step at a time instead of cramming things together like I would do if I just listened to lecture and then did homework by myself."

FM3 is convinced of the value of collaborative activities for students and plans to use them again in his courses. He found that he really "liked being able to direct students' thinking by interacting as they solved a problem, correcting faulty thinking as it arose ('real-time'), rather than correcting a flawed final solution" on a test. He found the "overall stress of change was manageable" and learned that "planning ahead is essential." He also "learned some things related to managing time that should change in the next implementation, but overall, the activities didn't take as much time as originally thought." Having been a traditional lecturer for a long time, FM3 mentioned that "this isn't the thing I would have done [on my own]. This process and experience has been very good."

*Case of FM4—Engineering Fundamentals*

FM4 teaches an introductory engineering calculus class to engineering freshmen majors who are not calculus-ready. The course includes a content delivery component through an online interactive and education system that accompanies the textbook, and a twice weekly face-to-face component, which is where the collaborative learning strategies were implemented. FM4 is deeply interested in exploring pedagogical approaches to best teach his students, and for a number of years prior to this project had been engaged in experimentation with pedagogical approaches including "flipped" teaching where students view recorded lectures prior to class so that class time can be used on problem-solving, question/answer, and otherwise addressing student needs. FM4 approached this collaborative experiment with enthusiasm and some familiarity with relevant literature in engineering education. He decided to restructure the face-to-face component of the course around small-group student collaboration. Every day, his 27 students worked on a series of problems in small groups. They had well-defined roles that had been explicitly taught and modeled by FM4 at the beginning of the course. FM4 also provided handouts and other written guidance on how to effectively collaborate with this small-group activity. Observers noted that while students were collaboratively solving problems, FM4 was actively engaging various students and groups of students throughout the room, primarily asking them to articulate their thinking.

Given FM4's expressed conviction that the entire purpose of the course was to support the development of student thinking about the course's underlying logic, he did not find any conflict with time. He reported that the "last time [I taught this course, it was] was me meeting with students one-on-one to talk about how to think [which] was NOT effective. With this collaboration approach I'm trying this time, students have to share ideas with each other." External observers noted that students seemed to appreciate the central focus on their thinking—rather than their problem-solving skills—as the reason for the course.

FM4 was overall pleased with student cognitive engagement in the course compared to prior years. He was surprised at how well students reflected on their own thinking and potential gaps in understanding, and he was pleased with their willingness to engage in this new learning experience. In particular, he noted that he was able to help students improve their abilities to think about calculus concepts by addressing their explicit, articulated thinking and by giving feedback to them in the moment, rather than at a later time. He learned that for the desired impact to be realized, the collaborative tasks had to be well-structured and well-designed. He noted that preparing for the course required a different instructor skill set as compared to preparation for a typical lecture-based course. He recognized that collaborative learning approaches can be effective ways of teaching, but noted that "reading about it and doing it" are two very different things so he hypothesized that most faculty will need practice and support in order to fully realize the benefits.

*Case of FM5 – Electrical Engineering*

FM5 taught the first sophomore-level electrical circuits and network analysis course. He had been exploring and implementing a variety of pedagogical strategies over the last few years and was genuinely interested in exploring additional pedagogical approaches. He chose to use a structured problem-solving team approach as the core of his collaborative pedagogy, wherein students in class (e.g., quick sample problems, sometimes longer problem sets) and out of class (e.g., homework problem sets) were assigned to groups of approximately four and asked to turn in one solution set for the entire group. His approach to the collaborative pedagogy was thorough and intentional. He generated a number of documents and a scaffolded sequence of mini-tasks in the first weeks to introduce and reinforce for students both how to function as a team as well as why. During the planning and implementation stages, he sought advice and suggestions from the faculty learning community members regularly, in part to anticipate potential issues and design approaches to avoid or minimize them.

In addition to setting learning goals for his students (e.g., increased grades, learning to work successfully in teams), this faculty member also had a clear goal for himself: "I hope to gain experience on effective strategies for forming and managing collaborative teams." Of potential concern were how much additional time and effort this would require on his part for structuring teamwork, but he was able to recapture some time by using the first class session to discuss teamwork instead of routine review of syllabus and class policies. It became clear late in the semester that FM5 was struggling with the scope of implementation and myriad details in an effort to maintain fidelity with the literature on structuring teams, but in his implementation targeting frequent short homework assignments, such extensive structure proved problematic. Additionally, as was the case for other participating faculty, he wanted to "ensure that collaboration activities would not negatively impact content coverage in terms of taking away time from a content focus." He expressed some initial anxiety about intentionally implementing team collaboration strategies,

which he characterized as very different from the abstract, theoretical concept he had previously read about.

*Case of FM6—Computer Engineering*

FM6 taught a senior/graduate-level course in computer science and incorporated two new collaborative learning approaches in the course. A motivating factor in his participation in this FLC was his belief that, "if I'm better at teaching, it will have a better outcome for students." However, in the pre-interview he also indicated, "I prefer to work alone" and "I don't want to emphasize teamwork [as part of my teaching activities]." He further articulated this stance by saying, "I definitely will not explicitly teach teams; I don't feel like I should force it on them. They are senior students so I am assuming they will have experience in teams." Therefore, he provided no formal structure for group exercises. The first collaborative activity he suggested using was to have students share lecture notes with each other for the purpose of collaboratively working on select class exercises. For the second collaborative approach, FM6 decided to hold an in-class debate on a related computer science topic near the end of the semester.

A primary concern for FM6—as was an issue for other study participants—was "making time" in the course structure for collaborative activities. He believed that his students were taking the course to benefit from his expertise on the subject, and he was hesitant to release class time to other student-focused activities because it would negatively impact how much content he could deliver. The group exercises replaced his prior approach for individual exercises, resulting in a one-to-one trade-off in terms of time. He was able to make time for the in-class debate by omitting his standard lecture on ethics, and instead shared the slides from that lecture to help students prepare for the debate. FM6 reported that he shared a teamwork paper with his students as an option for them to read, but he did not otherwise explicitly teach or monitor any team skills. He reported being satisfied with the student debate experience, based in large part on his observation of students engaged during the process. While independent observers noted the active attention and involvement of students, they also noted that only some students spoke throughout the debate, perhaps because of the large group sizes (two groups of about 15 students in each group) or because English was not the first language of all students. FM6 did not note any appreciable cognitive benefits for students.

Overall, FM6's implementation of collaborative techniques was minimal and did not represent a significant change in course structure. His domain expertise in the content of the course shaped his decision to retain a lecture format so that his students would be able to take advantage of that expertise. FM6 commented that he was satisfied that these collaborative activities, but the limited and disconnected nature of the implementation likely had little to no impact on student learning. In such cases, it may be preferable to retain a traditional course structure rather than to implement a collaborative activity without appropriate support, conviction, and follow-through.

## Discussion

This discussion section is organized to address the two research questions related to engineering faculty incorporating more student-centered collaborative techniques in their classes: (1) challenges and barriers to overcome, and (2) benefits of this implementation. The discussion draws on the 6 individual case results above and synthesizes across those cases.

*Overcoming Challenges and Barriers*

There were two primary challenges that the faculty identified for implementing student collaborative teaching approaches. The first, and most dominant, was how to create time in the class schedule for student collaboration without sacrificing content coverage. As is true for all engineering courses, the content covered in a course was substantial and completely filled the semester schedule in prior implementation. A second challenge was recognizing the need to plan for this different way of teaching. For some, this included not just time or need to learn new teaching strategies, but also some anxiety about changing a long-standing approach to teaching.

*Time and Content Coverage*. A challenge considered to be a dominant potential barrier for implementing student-centered collaboration was the concern about carving out class time for collaborative activities and the potential for reduced content coverage in the course. This challenge was articulated by all faculty in our study, and was a major topic of feedback and discussion with faculty both during and after teaching their classes. This concern could also be framed from an efficiency perspective, a framework very familiar to an engineering mind, because delivering content via instructor lecture is much more time efficient for content coverage than student collaborative sense-making tasks during class. However, as was noted in the individual cases above, these faculty were interested in exploring collaborative student learning approaches so that they could have stronger, more timely opportunities to uncover student thinking and respond to that thinking in the moment. Essentially, there was a willingness to (potentially) sacrifice some content in exchange for strengthening depth of student learning. Several faculty commented that it was because of the FLC structure that they were willing to experiment with implementing collaborative techniques, and FM3 said that he never would have tried this without the support of the FLC.

Revisiting this theme of the challenge of time and content coverage at the end of the semester, every faculty member confidently expressed that they had found a way to not substantially sacrifice content coverage. Faculty indicated that they were able to modify their pedagogical approaches to still achieve the primary course content objectives while making time for student-centered collaboration during class time. One theme that emerged is that some faculty noted that the collaborative activities did not take as much time as they originally thought, especially when the instructor explicitly taught students the parameters around how to collaborate effectively. Most were able to gain some class time for these collaborative tasks by assigning students independent viewing/reading (Tegrity videos, powerpoint, assigned readings) of material that in the past he would have spent time lecturing in class.

All faculty indicated that they were very satisfied with the content coverage of the revised course, and in many cases, there was either explicit or implicit (via tone of voice or facial expression) surprise exhibited when they noted that content coverage was not negatively impacted. Across the six cases there were varying degrees of modification to existing courses as described in the individual cases, and positive outcomes were achievable across this spectrum. Generally, faculty noted that the changes – especially frontloading reading/powerpoint/videos prior to class – were relatively small, but took some time to plan for and implement.

*Planning.* Faculty consistently emphasized the necessity of planning ahead for implementing collaborative learning techniques. Several participants observed that they needed to prepare differently for this type of teaching because it requires different teaching skills than traditional lecture or problem-solving courses. They also noted a gap between reading about collaborative teaching and actually implementing meaningful activities. Most faculty also

expressed that they approached this experience with clear intentions about seeking change for themselves in terms of how they teach *as well as* change for what students would do to learn in their course. In short, the extent to which each participant engaged with the experience was self-determined, but clearly required some investment of time and energy for planning this new way of teaching.

Because this approach to teaching is innovative for most faculty, participants regularly expressed appreciation for the support provided by faculty learning community. FM3 went so far as to say he never would have tried these collaborative techniques without the support of the FLC, and even with that support he was a bit anxious about changing things in a course he had taught 15 times previously. This was expressed in a positive sense, in that this same faculty member indicated post-semester that he would now teach this course differently in the future—even without the FLC support—since the supportive experience helped him move past his initial nervousness.

### *Benefits of Collaborative Learning Techniques*

In all cases, faculty expressed overall satisfaction with the course enhanced with the student collaborative learning techniques. The faculty reported benefits they noted for the students as well as for themselves, and student comments were consistent with the faculty perspectives on student benefits. Most (FM1, FM2, FM3, FM4) highlighted that their approaches really helped them uncover student thinking in the moment, and gave them opportunities to directly address misconceptions or other confusions before those became deeply entrenched in student thinking. Faculty also highlighted that independent student thinking was a strong element of benefit for the students through these approaches. Student thinking about problem-solving or connecting course content to real-world situations were explicit goals of the courses that faculty and students themselves reported were stronger outcomes as a result of the collaborative techniques.

The ability to interact more directly and frequently with students was another theme that emerged from many of the faculty. Students themselves expressed appreciation for the opportunities to try out their thinking, and get immediate feedback from peers and the faculty, underscoring that the faculty perception of benefits to the students paralleled what students themselves thought. Faculty also indicated that these approaches made teaching the course more interesting to them because they could more regularly hear and interact with students about their questions and thinking process, which was more interesting to explore together rather than the instructor doing all of the talking at the front of the room.

## Conclusions

### *Overcoming Challenges and Barriers*

Two main barriers or challenges that have been documented in the literature concerning pedagogical change in general were also mentioned in one form or another by most participants in this study: i) the concern that collaborative activities would reduce time for content coverage and ii) the fact that faculty need support in course re-design and a community of peers to share concerns and frustrations with as they make course changes. Results showed that these faculty were able to overcome both of these challenges in this study. Most faculty found that by restructuring the course to deliver some content outside of class (e.g., video, assigned readings, posted PowerPoints), they could gain some class time for collaborative activities. They reported strong satisfaction with this

approach for retaining appropriate coverage of content while making class time for student collaborative activities.

This study confirmed the faculty learning community model was a positive vehicle for helping faculty implement collaborative learning techniques for 5 of the 6 participants. One participant (FM6) realized that he was more focused on relating his expertise to students and did not value time students spent together. A faculty member must be authentically committed to trying collaborative techniques to be successful, and should consider his/her stance on the value of student-centered collaboration before deciding to implement collaborative approaches.

The FLC allowed barriers to be overcome by providing the time and structure to introduce collaborative techniques, and to encourage faculty to "make a whole-sale edit" of their course, examining why and how they covered material and how could it be re-designed in ways that would allow time for collaboration without sacrificing needed content. The FLC provided a safe environment of peer scholars and facilitators whose only purpose was to help and encourage the faculty member. FLCs are not evaluative or punitive, but participants are held to providing deliverables. Being able to share successes and challenges in a safe community of faculty is critical to success of such an implementation.

Further, the FLC facilitators and participants engaged in discussions and peer observations that helped participants recognize the need for alignment of collaborative techniques with course activities, the need for well-structured collaborative activities that clearly relate to course objectives, and the need for the faculty member to "close-the-loop" for students after activities – clearly relating it back to course objectives. Participants also learned that it is OK to move slowly, make small changes, evaluate, revise and try again. Participants also recognized that even small changes are very different from traditional lecture methods and preparation is entirely different. The reason the faculty learning community model was successful is it provided a structured environment where faculty recognize these challenges and learn ways to overcome them together.

*Benefits of Collaborative Teaching*

Benefits faculty perceived from the collaborative learning implementation related primarily to students, but also to faculty themselves. The most often mentioned benefit was the opportunity to give "real-time" feedback to correct a student's thinking interactively in class instead of days or weeks later on an exam. Participants noted with satisfaction the demonstrated improvement in their students' thinking and understanding based on conversations they had with students. Some participants noticed an improvement in knowledge transfer from content in one course to another due to the collaborative activities used. Faculty participants were pleased with the largely positive attitudes students had about the activities as many students expressed an increase in understanding because of the real-time feedback. Another benefit was the understanding of collaboration and teamwork and the many ways faculty can support students' acquiring skills in becoming good team members. One faculty participant specifically noted that this FLC experience inspired him to approach his research activities with a different attitude, actively seeking more collaborators to expand his work.

*Summary*

Three elements necessary for success clearly emerged from our study. The first element concerns the faculty member's philosophical position with respect to the value of collaborative learning for

a particular course. The second element concerns aligning appropriate collaborative techniques with course activities. The third element concerns a fully developed pedagogy, i.e. structured follow through and integration within the course.

When a faculty member's philosophical position is centered on the importance of the expertise the faculty member brings, then the faculty member may view students spending time collaborating with each other as a less valuable use of time. FM6 represents this situation in our data set. Authentic commitment by the faculty member is a must for a meaningful collaborative experience for students.

The alignment of collaborative techniques with course activities is critical for success. Drawing from our results from FM5, we see FM5's well-intentioned commitment to student collaboration being implemented sub-optimally. FM5's implementation began with several readings and course discussions about the importance of collaboration and how to be an effective team contributor. However, in this case, trying to force each homework activity to be a team evaluated effort led to student resistance as well as an overwhelming management burden for FM5. Whereas this teamwork accountability approach, including the intentional instruction on how to collaborate, would be very appropriate in larger, longer-term projects, students perceived it as artificial for frequent, relatively short homework assignments.

Well-structured collaborative activities need to include both a clear explanation of process and desired outcome as well as a closure element that integrates the collaborative activity with the course goals. Considering the case of FM2, both facilitators and peer observers noted that not all students were equally engaged in collaboration during the activity. This was likely because FM2 did not explicitly impose structure on the collaboration. A piece of the structure that was missing was explicit teaching or discussion during class about how to be an effective collaborator; note the contrast with FM5. One effective way to emphasize the intended learning outcome of a collaborative task is to bring the class's attention back and make explicit the connection of the activity to the overall course goals.

Our results provide evidence that it is possible for engineering faculty to overcome barriers for implementing student collaborative teaching pedagogies, including widespread concern that these approaches will interfere with course content coverage. However, as noted above, there are several elements to consider in order for implementation to be successful. Of note is the importance faculty expressed for careful planning of these teaching approaches, and of supportive structures such as those offered by a faculty learning community. It is encouraging that these positive shifts in instructional pedagogy toward student-centered collaboration are possible in a wide variety of engineering courses (from freshmen level to graduate level, across many different engineering domains) and by a wide spectrum of faculty. Faculty long-experienced in exploring implementation of collaborative techniques (e.g., FM4) as well as faculty who were interested but who—even with many years of teaching experience—had yet to systematically undertake a shift in instruction (e.g., FM3) were able to meaningfully reconsider and modify their instructional approaches.

**Appendix 1. Pre-Semester Semi-Structured Interview Protocol**

1. How do you anticipate that collaborative teaching will impact your teaching effectiveness?

2. What are your goals for student benefits from your collaboration strategies?

Follow-up: How will you know it when you see it *(e.g. what would be the evidence – student engagement, peer-peer conversation, academic outcomes, classroom dynamics, …*)

3. What components, if any, of your collaborative learning strategies are you most looking forward to/ curious about/ interested in/ have high expectations? Why? (*if all the same without highlighting and particular component, ask what (*s*)he expects will be the most atypical for students*.)

4. What parts of your collaborative strategy effort do you expect will be the most significant growth area for yourself as a faculty?

**Appendix 2. Post-Semester Semi-Structured Interview Protocol**

1. What are your thoughts now about collaborative learning and your ability to implement collaborative learning techniques in your teaching?

2. Has your thinking about collaborative learning changed since the beginning of the semester? If so, how?

3. Did you learn anything from this experience that you hadn't thought you would learn?

4. Would you do anything differently if you were to try this again?

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# The Guilded Classroom: Using Gamification to Engage and Motivate Undergraduates

**Julia Gressick [1] and Joel B. Langston[2]**

***Abstract:*** *There is a breadth of psychological research that points to potential cognitive benefits of game play. Games engage and motivate learners while promoting mastery of skills and content knowledge. Further, thoughtfully applying gaming elements and structures to classroom environments, an approach called gamification, has the potential to optimize learning. This paper discusses theory-driven classroom gamification innovations implemented in an undergraduate educational psychology course and uses a case study approach to understand how these changes impacted students' in-class learning experiences in positive ways. We will discuss specific interventions, students' perceptions of these interventions, instructor reflection of the effects on student learning outcomes, and implications for classroom practice.*

*Keywords: Gamified, motivation, educational psychology, game-based learning, collaboration*

The purpose of this paper is to describe a case of instructional innovation in an undergraduate educational psychology course guided by the principles of gamification, which involves applying game-based elements to non-game environments (Kapp, 2012). We examined the effectiveness of these approaches on student learning and student perceptions of these interventions. The instructional design approach we employed reflects the deep structures of games that motivate individuals and hold potential to promote student engagement and the development of enduring understanding.

In the following sections, we define gamification, review related literature, describe interventions based on the intersection of approach and theory, provide evidence of the effect of these initiatives on students' learning, and offer conclusions. This innovation was guided by the following question: *How does thoughtful gamification influence student perceptions, engagement, and learning outcomes in an undergraduate educational psychology course?*

## From Games to Gamification: The Benefits of Gamification

There is a breadth of research on learning that points to the potential cognitive benefits of game play. Because of their design, games engage learners in a way that motivates and encourages perseverance (Gee, 2003). This is largely because games offload mistakes to the process of play in a way that minimizes personal association with failure and encourages students to strive for

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mastery (Salen & Zimmerman, 2003). Games offer rewards and immediate feedback that leads to a sense of accomplishment for the player (Kapp, 2012). Moreover, gaming often promotes authentic learning and ample problem-solving opportunities (Gee, 2003). When playing games, individuals are likely to become immersed in the experience and, as a result of this engagement, are more likely to remember information and develop enduring understanding of concepts (Gee, 2003). Through engagement, games afford participants agency and have the potential to prepare them for future learning (Bransford & Schwartz, 1999). In addition, a study of the social interactions that occur alongside formal gameplay, in online forums, indicates substantial learning and demonstration of scientific habits of mind (Steinkuehler & Duncan, 2008).

The application of game design principles and elements to non-game contexts, including classroom pedagogy, is broadly defined as *gamification* (Kapp, 2012). When designing classroom experiences that are inspired by games, there is potential for students to be engaged in their learning and persist in problem solving, much as they would during actual game play. Self-monitoring and progress tracking through feedback promote self-regulated learning (Zimmerman, 1990). In recent years, gamification has become a widely-adopted pedagogical approach (e.g. Seaborn & Fels, 2015; Dicheva, Dichev, Agre & Angelova, 2015). Kapp (2012) and Hamari, Koivisto & Sarsa (2014) acknowledge, however, that for gamification to truly impact participant learning in positive ways, the integration of game-inspired elements must go beyond superficial integrations like points or badges to focus on deeper structural considerations of games such as "the story, the challenge, the sense of control, decision making, and a sense of mastery" (Kapp, 2012, p. xviii).

In higher education, gamification interventions have been implemented and investigated in multiple formats. While most gamified courses are offered in online environments, Dicheva et al. (2015) indicate face-to-face and hybrid formats have also been explored. The literature indicates that across formats, computer science and game design courses are the most common domains in which gamification occurs (e.g. Sheldon, 2011; Seaborn & Fels, 2015; Dicheva at al.,, 2015; Barata, Gama, Jorge & Goncalves, 2013; Ibanez, Di-Serio & Delgado-Kloos, 2014; Iosup & Epema, 2014); however, many other domains are also represented.

Gamification efforts have shown positive effects on student engagement, affect, and learning outcomes. For example, Poole, Kemp, Patterson & Williams (2014) consistently found students were more actively involved and that test scores improved with a gameshow-style approach in undergraduate business courses. Similarly, Iosup & Epema (2013) found graduate students in a computer science course were more satisfied, successful, and persisted beyond minimum course requirements as a result of gamified interventions. In 2015, Leaning reported similar favorable findings on the use of leaderboards and other game-like activities in a Media Studies undergraduate course.

*Gamification and Best Practices*

There are many psychological underpinnings that support gamification as a widely-applicable, effective approach to classroom pedagogy. Despite the amount of theoretical support, in a recent review Seaborn and Fels (2015) found that nearly 90% of the empirical studies they reviewed on gamification interventions did not explicitly connect to theoretical foundations, but rather focused on the mechanisms. The benefits of gamification, however, align largely with theories of learning and pedagogical best practices. Because of an emphasis on choices, gamification can promote learner agency (Bandura, 1989), which, in turn, motivates students toward mastery goals (Schunk,

Pintrich, & Meece, 2008). Further, gamification can scaffold students' self-regulation by providing opportunities to self-monitor performance, which establishes clear expectations and promotes learner accountability.

A primary component that makes games engaging is the underlying story. Because storytelling can potentially restructure how individuals chunk information, it has the potential to promote deeper conceptual meaning which, in turn, leads to more enduring understanding. This leads to more efficient processing and, like expertise within a domain, provides individuals with more sophisticated chunks which represent greater mastery of content (Chi, Feltovich, & Glaser, 1981).

Another inherently appealing component of games that is useful for educators is the way that games encourage players to persist when they fail. In traditional learning environments, students often lose motivation. One of the main reasons for this is that they feel inferior to peers whom they perceive to be understanding easily (Gee, 2003). Because fear of failure can inhibit students' classroom performance (Dweck & Leggett, 1988), appropriating approaches from games that promote persistence in problem solving can benefit students' motivation to learn. Game elements like "extra lives", which provide second chances for success, and activities that promote pooling resources are motivating elements that map to classroom learning.

An essential component of a gamified classroom is for students to work collaboratively. In many games, players form guilds (groups of players with similar goals and interests) which encourage collaboration, assistance, and collective intellectual risk-taking. Sheldon (2011) identifies guilds as a cornerstone of gamification. This approach is supported by the theory of small-group cognition, where the small group is considered a unit that accomplishes intellectual outcomes that are a result of social transactions not always possible with individuals (Stahl, 2006). This theory asserts that learners are co-constructing meaning as they work toward the common goal of solving problems in highly integrated ways that move beyond the contribution of any single student. Ideas are more likely to be developed through discourse, leading to more connected, robust understanding of course concepts (Stahl, 2006).

Problem-based learning presents learners with an open-ended, ill-structured, authentic task to complete, which is similar and complementary to problem solving in game play. This approach engages learners with domain knowledge, promotes critical thinking skills (Hmelo & Evensen, 2000) and serves as a meaningful complementary pedagogy to gamification. Research on problem-based learning indicates that, much like game play, it engages learners, offers motivation through choices and collaboration, and leads to an increased, enduring understanding of complex concepts (Albanese & Mitchell, 1993). Through the use of problem-based, actively collaborative approaches, gamification exemplifies and integrates Kuh's (2008) high-impact practices.

## Gamification in General Educational Psychology

Aligned with the theoretical and empirical support for gamification, we focus on applying this instructional design approach to a face-to-face undergraduate educational psychology course through a series of systematic, theory-driven innovations designed to optimize student learning. Next, we provide an overview of the context, details of specific elements of gamification, and the results of this approach, including student perceptions of these interventions.

### *The Context and Problem*

A common goal across foundational undergraduate courses is for students to develop transferrable knowledge of concepts that they will apply in subsequent courses and in their careers. Because there is an implicit expectation that students will recognize and build upon their understanding in the future, it is imperative that the design of foundational courses prepares students for future learning (Bransford & Schwartz, 1999).

The course that is the focus of this case study is an introductory 200-level course, *General Educational Psychology*, offered to undergraduate teacher education students at a public regional state university campus. The data reported below were collected from the Spring 2014 semester. Across two face-to-face courses, 62 students were enrolled and participated in surveys and evaluations.

*General Educational Psychology* is part of a foundational sequence of courses taken by all teacher education candidates, including elementary, secondary, special education, art education, and music education students. The importance of understanding course concepts extends beyond the final exam; additional courses elaborate on the topics and assume that students will be able to transfer their understanding to other courses and field experiences. The topics of the course include developmental, learning, and motivational theories. Considering this, promoting enduring understanding and preparing students for future learning are essential considerations in this course.

Typically, this course enrolls 30 students per section and has historically been taught in a lecture format guided by Woolfolk's *Educational Psychology* textbook (2012). Prior to the innovations discussed in this paper, students completed multiple-choice assessments as the primary composition of their course grade. Faculty members grew concerned, however, that students were memorizing rather than understanding, which impeded students' far transfer to other courses, field experience, and state-required licensure exams. This motivated the exploration of alternative, innovative instructional approaches to improve student learning outcomes, engagement, and motivation.

*Gamification Innovations to Promote Learning and Engagement*

Gamifying *General Educational Psychology* involved a series of discrete changes to the course structure, activities, and syllabus. These theory-driven innovations were guided by the framework described above and detailed here. The primary goal was to design a classroom experience that leveraged the deep structure of games to promote students' engagement and understanding (Kapp, 2012).

*Storytelling: Scaffolding students' conceptual knowledge.* Kapp (2012), Sheldon (2011) and Gee (2003) all acknowledge the story as an essential element of what makes games engaging. When students entered *General Educational Psychology*, course content was chunked into three distinct regions of a virtual world map (Figure 1). Since our course covers a wide range of topics, this element of gamification was applied as a means to scaffold students' initial learning and conceptual organization of a variety of sophisticated psychological concepts. For example, at the beginning of the semester, students are transported via rocket ship to the Growing Plains, a region of the EdPsych world. There, they met theorists and interacted with essential course concepts through immersive and collaborative activities designed to promote engagement and enhance students' understanding.

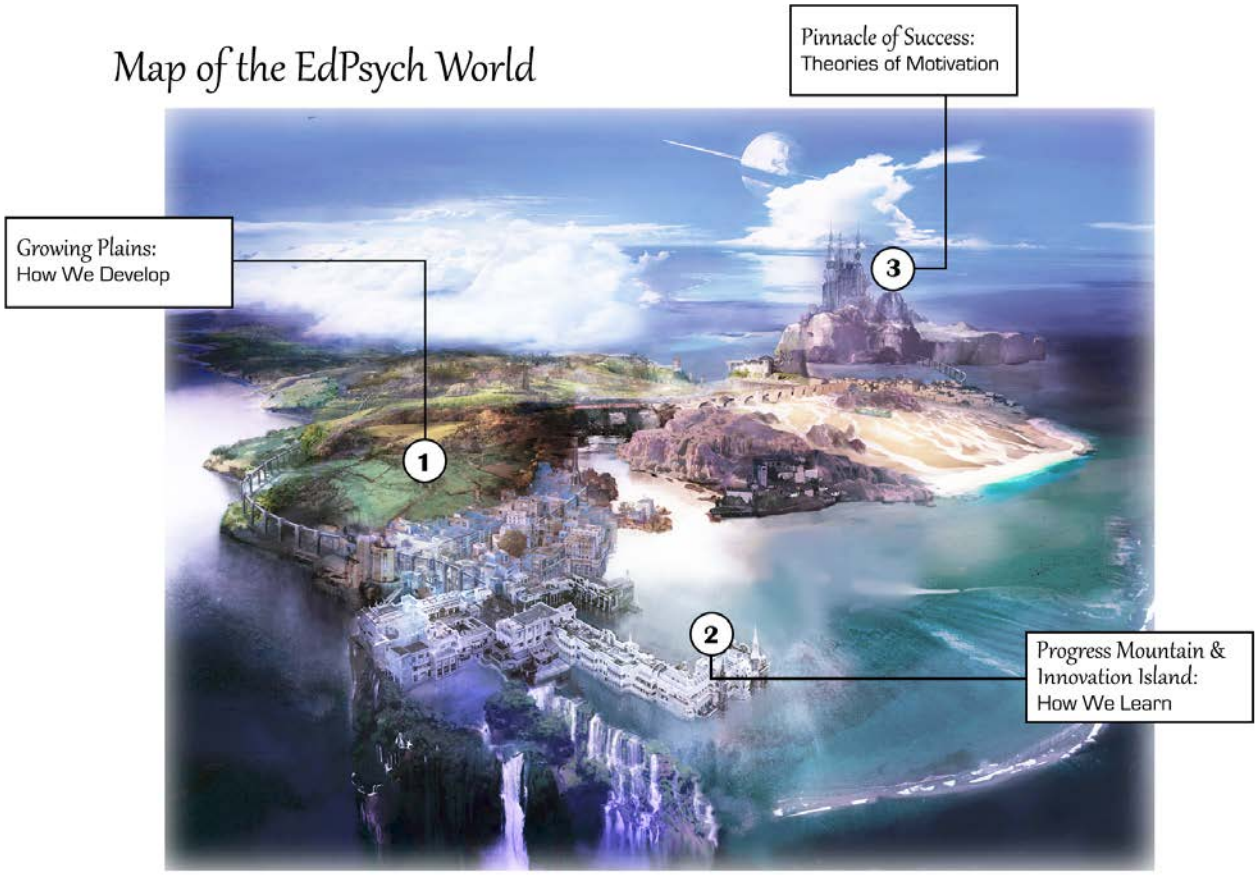


**Figure 1. Virtual world map of General Educational Psychology.**

*Guilds: Strategic grouping to encourage collaboration and community.* Another gamification innovation to *General Educational Psychology* was the introduction of collaborative guilds. We assigned students to guilds of five or six students in which they applied course concepts through problem-based learning (Barrows, 1996; Hmelo-Silver, 2004), analyzing case studies, and playing table top games. Students remained with the same guild all semester, per the recommendation of Sheldon (2011). To assign groups in a way that would encourage discussion, collaboration and intersubjectivity (Nathan, Eilam & Kim 2007), we created a survey using *Google Forms* where students shared information about their teaching interests and career goals. Students completed the survey at the beginning of the semester. From survey data, groups were thoughtfully assigned based on common interests. Students were then inducted into their respective guilds and assigned a course-related theorist as a mascot (e.g. Jean Piaget, Lev Vygotsky). Students were assessed periodically by Guild Reports that provided evidence of productivity across these activities. Further, students conducted peer and self- evaluations of performance as a means of group accountability. This provided valuable feedback for the instructor, in case a group experienced problems with shared leadership or group dynamics (Gressick &Derry, 2010).

In addition to within-guild collaborative activities, students engaged in inter-guild challenges. Since a primary purpose of guilds was to encourage collaboration toward common goals, any competition within class happened between guilds. During these challenges, guilds competed against each other in games and design challenges. For example, students played a traditional *Jeopardy* review game at the end of the semester where competition was between guilds

and augmented by texting-in their responses.

*Scaffolding self-regulated learning with visualizations.* We improved the syllabus for this course following suggestions offered by Sheldon (2011) in his book *The Multiplayer Classroom*. The revised course syllabus included a gamified approach in how evaluation was articulated and displayed for students. A "leveling up" approach was adopted for course points. Further, visual scaffolds for student grade composition were included (see figure 2). As mentioned above, the syllabus was framed using the metaphor of a virtual world to discuss different sections of course content and to help students "navigate" the broad range of topics covered in this introductory course.

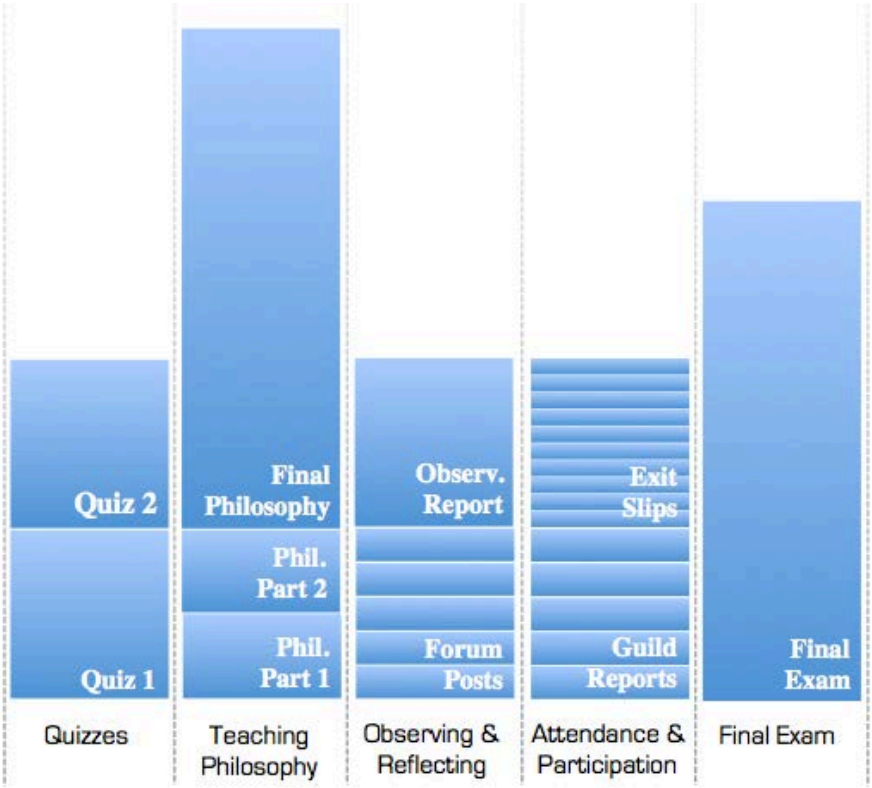


**Figure 2. Visual representation of course grade composition.**

*Discrete Games to Engage Learners.* Throughout the semester, guilds learned through a variety of activities. In addition to collaboratively applying concepts to written case studies and problem-based learning, students participated in discrete games. Two of the games used in the course are highlighted next.

The first game students played was called *Erikson's Psychosocial Development Card Game: An Inter-Guild Challenge.* Students worked with their guilds to understand Erik Erikson's stages of psychosocial development (Erikson, 1963). The objective of the game was for individuals within a group to reach consensus over which stage of Erikson's theory was represented in a scenario and to determine whether a positive or negative resolution had been established. Each guild member received a set of cards printed with Erikson's 8 stages of development and a "+" and "–" card to indicate positive or negative resolution of the crises associated with the stages. Each guild also received a set of "scenario" cards. A player would read the scenario and each guild member would select the stage and resolution card they thought was represented by the scenario.

Guilds then discussed, reached consensus, and recorded their agreed-upon response and justification. The entire class then discussed their responses and scores were kept at the guild level. A secondary goal of this game was to encourage negotiation and collaboration within guilds.

Students also participated in a *QR Code Scavenger Hunt.* In this review game, students worked with their guild to find and answer questions about course concepts. QR codes that linked to the questions were hidden throughout a campus building near classrooms and offices. When students scanned a code, they were linked to questions hosted by *Google Forms*. When guilds submitted a response, they were directed to a new location in the building. If a guild's response was correct, they would find another QR code to scan in the new location. If they were incorrect, they would *not* find a new code and attempt the question again, until they were directed to the location associated with the correct response and a new code. The first guild to finish won the game. Data from students' responses were logged in a spreadsheet. This provided evidence of student performance and revealed concepts that needed further review (Gressick, Spitzer, & Sagarsee, 2014).

*Promoting Perseverance with "Extra lives": Virtual 1Up learning opportunities.* As mentioned above, a motivating element in games is the opportunity for players to experience multiple paths to success. Considering this, we developed activities that allow students to earn additional points toward assignments. The goal of these activities was to promote student meaning-making by encouraging connections to popular culture. For example, one series of activities engaged students in "thinking with" course concepts by applying them to various films. Throughout the semester, students could earn extra lives by engaging in analysis of popular films as a way to make meaning of course concepts. For example, students could analyze the movie *Cast Away* (Zemeckis, 2000) in terms of object affordances, environmental constraints, and creative problem solving. Similarly, students could earn 1Up points by using developmental theories to describe social roles and patterns of behavior in *Mean Girls* (Michaels, 2004). These opportunities afforded students agency to both choose learning opportunities and control the points they earned for the class. Further, this approach was adopted to help promote student success, innovative thinking on assessments, and to ultimately encourage a shift in goal orientation from grade-driven performance to mastery understanding of content knowledge (Schunk, Pintrich, & Meece, 2008).

## Methodology

To understand the impact of the aforementioned innovations on student learning, we leveraged a case study approach, where the effects of theory-driven classroom gamification innovations were observed in the authentic context in which they occurred (Yin, 2009). Adopting this approach and collecting data from multiple resources was motivated by our desire to formulate an in-depth understanding of implementing gamification in the classroom. Further, the interventions are an inherent part of the class structure similar to how underlying structures in games support motivation and engagement. Therefore, to gain organic insights on the effectiveness of this approach, it was essential to study this phenomenon within its authentic context.

### *Data Sources*

Data were collected from two *General Educational Psychology* courses taught in the spring semester of 2014 at a Midwestern regional state university campus. The courses were both taught by the same instructor and were identical in terms of content and delivery. The classes were

approximately the same size and enrolled a total of 62 students. Multiple sources of data, as described below, were collected and synthesized to build understanding of how gamification approaches influenced students' learning experiences.

*Initial Student Survey.* At the beginning of the semester students completed an individual online survey for the instructor. Data were used to thoughtfully group students into collaborative guilds and to establish their baseline understanding and motivation about educational psychology and teaching.

*Mid-semester Guild Progress Evaluations.* As part of guild activity, students completed self and peer evaluations that were guided by participation norms and distributed leadership expectations (Gressick & Derry, 2010). Students responded to the following questions using a 4-point scale, where they rated the following questions as High (4), Mostly (3), Somewhat (2) Low (1), not demonstrated (0):

1. Did this person make sufficient contributions?
2. Did they actively participate in your guild's discussions?
3. Was this person a good group citizen, taking on some leadership? (i.e., helping keep the group on task, helping to problem solve, contributing positive and encouraging words to others)

Students rated their peers anonymously and were encouraged to write comments about the overall guild operation and specific members.

*Student Reflection Survey.* At the end of the semester, students completed a brief survey that was designed to collect information and gain understanding of students' perceptions of the applied gamification principles in *General Educational Psychology*. Paper surveys were administered to students during the last day the course met. Students were asked to anonymously rate the effectiveness of the syllabus format, working in guilds, and in-class games.

*Course grades.* Grades from the Spring 2014 semester were compared with the Spring 2013 semester course taught by the same instructor. In Spring 2014 *General Educational Psychology* enrolled 57 students. Overall course averages were compared across semesters to assess whether the gamification interventions improved students' academic success. The previous class had been taught using traditional lecture and multiple-choice question assessments.

*Unsolicited student feedback.* Students completed official university-administered evaluations of *General Educational Psychology* at the end of the semester. Along with numerical ratings, students have an opportunity to provide qualitative comments on the course. Relevant comments are discussed in the results section below. Follow-up, unsolicited email correspondence from students about the gamified course are also included in the results section below.

*Instructor observations of student learning.* In addition to collecting data from students, the course instructor kept a detailed reflective journal of her perception of the impact of gamification strategies on student learning. The focus of this journal was on student interaction and engagement during guild activities. We analyzed the journal for themes about the instructor's perceptions of the interventions.

## Results and Discussion

We collected data from a variety of sources to address our general research question centered on the effectiveness of the described gamification innovations on student learning, engagement, and perception of the course. Overall, the results of gamification were positive.

*Mid-semester Guild Progress Evaluations*

We calculated the average for each individual's scores resulting from peer rating and the average across group members for each guild. The results of the mid-semester guild progress evaluations are provided in Table 1. Results indicate a high level of participation across group members and a positive perception of peers within guilds. Most guilds received unanimous high ratings across guild members, which suggests a strong sense of community within the groups. The lowest across-member, within-guild average was in Group H from Class Section 2. On closer analysis of student surveys, the group's average was lower because of a single guild member who was absent and, when present, spent all of their time off task. One student wrote that the member was constantly on their smartphone rather than engaged in guild discourse. Interestingly, this didn't influence other ratings within the guild. The results of these evaluations allowed for an opportunity for the instructor to provide additional support for that group's distribution of leadership and engagement.

**Table 1. Mid-semester guild progress evaluations**

| | Guild Average Ratings | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Class Section 1 | | | | | | Class Section 2 | | | | | |
| | A | B | C | D | E | F | G | H | I | J | K | L |
| Question 1 | 4 | 4 | 4 | 3.8 | 4 | 4 | 4 | 3.5 | 3.8 | 4 | 4 | 4 |
| Question 2 | 4 | 4 | 4 | 3.8 | 4 | 4 | 4 | 3.5 | 3.8 | 4 | 4 | 4 |
| Question 3 | 4 | 4 | 3.8 | 3.8 | 4 | 4 | 4 | 3.5 | 3.8 | 4 | 4 | 4 |

Students were encouraged to write comments along with providing numerical ratings. Of the 62 students who participated, 13 provided written comments along with their numerical ratings. Most of the comments students provided indicated that they enjoyed working with their Guild (e.g. "I felt like we all worked well together").

*Student Reflection Questionnaire*

Overall, students responded positively, both affectively and academically, to the gamification innovations described above. At the end of the semester students completed a brief, anonymous survey about these innovations (see Table 2). Sixty-two students completed the survey. The general prompt students received on the survey was: *This course includes instructional approaches that relate to gaming. Indicate your satisfaction with the following elements of this, relative to how you feel they helped you learn.*

**Table 2. Student reflection questionnaire results**

| | Really Helped (4) | Somewhat Helped (3) | Didn't Impact My Learning (2) | Minimally Helped Me (1) | Not at All (0) |
|---|---|---|---|---|---|
| Syllabus Format | 14 (23%) | 39 (63%) | 7 (11%) | 2 (3%) | -- |
| Working in Guilds | 35 (56%) | 26 (42%) | -- | 1 (~2%) | -- |
| In-class Games | 47 (76%) | 15 (24%) | -- | -- | -- |

n = 62

Survey results indicate that students felt the syllabus format and in-class games helped them learn. 23% of students indicated they found the syllabus format highly helpful and an additional 63% of student indicated the format was somewhat helpful. More than half of the students indicated that working in guilds really helped their learning and 42% indicated this gamification feature as somewhat helpful. In addition, students unanimously indicated that in-class games helped them to learn, with 76% of students indicating this approach as highly helpful. Overall, the survey results indicate that students positively perceived the *General Educational Psychology* gamification interventions. These results are supported by unsolicited qualitative comments reported below.

*Course Grades*

We compared final student course averages from Spring 2014 with a previous, traditionally-taught semester to provide a quantified overview of students' success in gamified *General Educational Psychology*. The average student score in the gamified course sections was 95.16% (SD = 4.15). The average student score in a previous semester was 87.26% (SD = 6.52). Students' averages in the gamified sections of *General Educational Psychology* were significantly higher than the previous lecture sections, $t(117) = 7.95$, $p<.001$. This indicates that the overall gamified approach led to higher summative student achievement.

*Unsolicited student feedback*

In addition to the reflection questionnaire distributed at the end of the semester by the course instructor, students provided unsolicited comments on the University's official course evaluations. Table 3 provides evidence of students' unprompted perceptions of the innovations.

**Table 3. Student comments about gamification interventions on official course evaluations**

| |
|---|
| *By putting everyone into guilds we were forced to get along with the other students but because the learning environment was so positive this was not a problem* |
| *I was unsure as why we were broken down in "guilds" or groups at first. but after our first group assignment I began to like the group time, it made me understand [course] terms better, if I was off track a bit. Even though I did have a quiet group, these group activities were fun.* |

| |
|---|
| *I would have to say placing us in designated groups made class so much more enjoyable, and it forced us to interact with others in the class, and I made some new friends.* |
| *The learning environment was great I liked the guild activities because they helped open up the class and get to know people.* |
| *It was a comfortable environment where we could open up and voice our opinions. I think the guilds also contributed to that because we had our own groups that were always the same so we could really communicate well rather than choosing from the whole class.* |
| *[the professor] eliminates as much stimuli as possible and has us set up in guilds. I must say my guild is the best and [the professor] knew what she was doing when she set us up in guilds because I feel I am walking away with lifelong friends.* |
| *I feel as if the Guild Teams really brought everyone together to learn and create strong social bonds. These teams also broke many of the barriers that impede learning in a lecture-style classroom.* |
| *I love the layout in the syllabus* |
| *There are many places that you can keep track of your grades in this class, it is very helpful* |

The sample student comments supplied in Table 2 suggest that the interventions had a meaningful impact on their learning. These comments echo the perception of the guild structure that students communicated at the mid-semester guild progress evaluations, reported above. The course also received high numerical ratings overall, with an average of 1.12, where 1 = "strongly agree" with desired criteria and 5 = "strongly disagree."

In addition to comments from students supplied on the course evaluations, the instructor received multiple unsolicited follow-up emails from students in semesters after the course ended, indicating the impact the course had on their enduring understanding of concepts and how it prepared them for future learning. Three examples are illustrated in table 4.

**Table 4. Sample emails received from students after the course ended**

| |
|---|
| *… I thought you might like to hear this. I was reading my textbook for [other education class] and ran across several key terms from your class. I know you told us that this would happen and I was expecting it. What surprised me wasn't that they were there, but that I didn't even skip a beat when it came to understanding what it meant!* |
| *And it just hit me all of a sudden that I understood all of it with perfect clarity, and it made me realize I actually learned something from [General Educational Psychology] that stemmed beyond the course. It was an awesome feeling. So just thought I'd drop you an email letting you know (:* |
| *You will not believe this, but I am taking [other education class] and during class he mentioned ALL of the following things, which I remembered from your class and totally understood:*<br><br>*-The ZPD*<br>*-Vygotsky and Piaget*<br>*-Piaget's stages of development (!!!!)*<br>*-Cognitive, moral, and social development*<br>*-Scaffolding*<br>*-Erik Erikson's 8 stages of psychosocial development* |

Unsolicited feedback received both immediately on official university course evaluations after the course ended and through emails from students received months after the course was over indicate that students enjoyed the course, felt engaged in learning, and developed enduring understanding of course concepts.

*Instructor observations of student learning*

Along with soliciting feedback from students on the gamification of *General Educational Psychology*, the course instructor kept a reflective journal throughout the semester on her perception of student learning and engagement. The instructor observed that students were more actively engaged within small group discussions, indicating that the classroom was often filled with talking and laughter. The instructor observed that students enjoyed working with their guilds and this approach promoted a positive, collaborative learning environment. While attendance was not factored into students' course grades, the instructor noted that attendance was consistently high throughout the semester. Another recurring theme was the positive classroom climate where students seemed focused on learning and future growth rather than getting caught up on their mistakes. These observations offer direct support for the students' perception of the interventions.

## Conclusion

As evidenced by the data above, the theory-driven gamification of *General Educational Psychology* was, overall, a successful innovation. Student survey data and comments indicate that, from a student perspective, the innovations to the course were valued and encouraged learning, collaboration, and peer contacts. From an instructor perspective, the gamification elements promoted student learning and enhanced the classroom climate. Unsolicited feedback from students suggests their learning experiences promoted enduring understanding.

Overall, students enjoyed working in guilds. Students were thoughtfully grouped and were supported through clear expectations and opportunities to provide peer feedback on fellow guild members. As indicated in the results section, one group self-reported some challenges. A future consideration will be to develop interventions to help groups self-diagnose and remedy social challenges that may impede group learning (Barron, 2003).

The grades within gamified sections of *General Educational Psychology* were significantly higher than a traditionally-taught section of the class. Similar to the findings of Iosup and Epema (2013), this suggests students were willing to go above and beyond minimal course expectations and that thoughtful gamification interventions potentially promote persistence in learning.

We recognize there are limitations to our study. Having never been taught through gamification practices, we could not rely on our own experiences as students to help inform best practices in this intervention. Instead we relied heavily on those that had gone before. This presents an interesting challenge for many educators who would attempt the use of gamification in their classrooms, as, unlike most pedagogical approaches, instructors have very little to no personal experience off which to model this new process. Since this course enrolled future educators, modeling innovation is important to encourage future teachers to take theoretically-informed instructional risks, which means these students will have had the experience that most gamification innovators lack. The students in the class experienced the vicarious impact of these interventions on their own learning (Bandura, 1989).

Further, as Seaborn and Fels (2015) suggest in their investigation of gamification as a whole, the concepts and practices of gamification are by no means monolithic in nature. Our work adds to the theoretical and empirical body of support for the use of games and gamification in the undergraduate classroom. Because of the general nature of the gamification interventions described in this paper, they could easily be adapted to various contexts, even outside of formal education. Moreover, gamification elements, like guilds, storytelling, and leveling up, can be adopted individually to support specific learning objectives.

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# Thinking as a Student: Stimulating Peer Education with an Undergraduate Teaching Assistant in the Humanities Classroom

**Lara Karpenko[1] and Steven Schauz[2]**

*Abstract: In this article, I argue that peer educational experiences should be incorporated into the undergraduate humanities classroom by providing a case study of a successful Undergraduate Teaching Assistant (UTA) pilot. In keeping with Topping & Ehly's (2001) criteria for successful peer education, I assigned the UTA a significant role in direct instruction. Partly owing to the UTA's active classroom role, the experience enhanced learning for students and helped me create a dynamic, critically-engaged class environment. The experience also provided an opportunity for the UTA to engage in deep learning and develop a professional identity; near the end of this article, the UTA shares his reflection about the experience.*

*Keywords: Peer education; Undergraduate Teaching Assistant; Humanities Education; Case study*

Undergraduate peer instruction has long been regarded as an effective tool for enhancing student engagement and for developing valuable transferable skills (Basinger, Peterson, & Spillman, 1984; Bichy & O'Brien, 2014; Fingerson & Culley, 2001; Gordon & Dempster, 2013; LaPlant, Mason & Singh, 2010; Micari, Streitwieser, & Light, Trimble, Carter, 2005).[3] Writing as early as 1975, Scott McNall deemed peer educators a "hidden resource," as he called on faculty from his field of sociology to leverage undergraduate knowledge to promote deep learning (136). Since that time, McNall's challenge has been met by faculty and staff from beyond the field of sociology in order to invigorate undergraduate educational experiences across a variety of institutional settings and learning contexts.

Peer educators have experienced particularly high degrees of success in Undergraduate Teaching Assistant (UTA) programs (Adler, 1993; Bernstein, 1984; Cook, 2002; Fernald, Chiseri, Lawson, Scroggs & Riddel, 1975; Fremouw, Millard, & Donahoe, 1979; McCormick & Shofner 2010; Mendenhall & Burr, 1983; Murray, 2015; Socha, 1998).[4] As peer educators with significant teaching roles in classroom settings, UTAs can have a wide range of duties depending on programmatic or institutional needs (Socha). For instance, Cook & Bernstein assigned grading duties to UTAs while Adler, McCormick & Shofner, and Streitwieser & Light all emphasized that UTAs can be effective discussion leaders, Mendenhall & Burr and Bichy & O'Brien expected their UTAs to hold office hours and Murray provided UTAs with service learning opportunities. As wide-ranging as the UTAs' duties might be, all the scholarship points to one consistency:

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[3] Please note that this list is far from exhaustive.
[4] This list is also not exhaustive.

incorporating UTAs leads to almost uniformly positive results for UTAs, for faculty mentors, and for all students involved in the process. Despite the high success rate of UTAs and though the scholarship detailing this success is fairly extensive, there has been very little sustained discussion surrounding UTAs in humanities courses. While work by Smith (2008) and McCormick & Shofner (2010) provide valuable exceptions to this tendency, with the exception of the field of Rhetoric and Composition, UTAs remain relatively foreign resources in humanities courses in general or in literature classrooms in particular.

To some extent, the relatively limited discussion surrounding UTAs in humanities courses reflects a larger and troubling trend. Though many, if not most, humanities instructors regularly incorporate informal peer-based pedagogies such as group work, classroom discussion, and student-led presentations into their courses, there is far less evidence to suggest that humanities instructors gravitate towards the more formalized methods of peer instruction that underpin UTA experiences. But by embracing students as partners in our classrooms, we create dynamic spaces that encourage content-level engagement and professional development. Fortunately, as work by Eby & Gilbert (2000), McCormick & Shofner (2010), and Tompkins, Smith, & Eby (1990) all demonstrate, peer education in the humanities is fast becoming the welcome subject of a growing scholarly conversation. Still, when compared to the robust work surrounding UTAs in the sciences and social sciences, it seems clear that that this conversation must be widened.

Desiring to experiment with more formalized methods of peer education and inspired by the robust scholarship detailing the efficacy of UTAs, I recently incorporated a UTA into a semester-long general education course on Postcolonial Literature and Theory (PLT). In this article, I provide a case study of that pilot experience.[5] In designing/assigning the UTAs duties, I was influenced by Topping & Ehly's (2001) criteria for successful peer education—particularly by their suggestions that peer education should be beneficial to all parties, that it involve conscious teaching by the undergraduate, and that it be professionally supervised (2001). Especially inspired by their suggestion that peer educators should be involved in "conscious teaching" and in contrast to many UTA programs, I assigned the UTA, Steven Schauz, a significant role in direct instruction. Altogether, Schauz, a senior English major who had taken the course previously (from a different instructor) and received an "A," was responsible for about 20% of class instruction. Partly owing to Schauz's active classroom role, the UTA experience enhanced learning for students and helped me create a dynamic, critically-engaged classroom environment. The experience also provided an opportunity for Schauz to engage in deep learning and develop a professional identity; near the end of this article, Schauz, now a Masters student in a College Student Personnel program, shares his reflection about the experience. Overall the success of this pilot suggests that Undergraduate Teaching Assistant programs and peer educational experiences more largely can and should be incorporated into the undergraduate humanities classroom.

## The Experience

I teach in the English department at a small comprehensive university and our general education program has a focus on cultural competency. Because of this cultural focus, our department's course on PLT draws a wide cross-section of students. Though PLT can count towards the English major, the prominence of this course in our general education program ensures that English majors represent only a small percentage of the class population in any given semester. During the

[5] Please note that the IRB board at my institution declared that this study was exempt.

semester that I piloted the UTA experience (Fall 2014), out of the 27 students in the course, only one was an English major. None of the students knew that that the course would include a UTA prior to enrollment.

I selected Schauz for this experience because of his academic aptitude, his interest in graduate school, and because, as a Resident Assistant, he also had experience in peer supervisory roles. Further, Schauz and I had worked together the previous summer on an institutionally-funded grant which allowed him the opportunity to read deeply on postcolonial theory; he was thus able to start the semester with fairly extensive content-based knowledge. Schauz was not financially compensated for this experience; however he did receive elective credit which allowed him to fulfill one of the requirements towards his English major. While this course was part of Schauz's regular semester load. I taught the course as an overload and received a small amount of compensation.

As a UTA, Schauz was asked do to the following:

1) Teach a week long unit of the course (4 hours of classroom instruction).
2) Lead study review sessions before the midterm and final exams. (One class session per exam: 4 hours of classroom instruction).
3) Lead one class session on effective strategies for writing the argument-driven research paper (2 hours of classroom instruction).
4) Hold weekly office hours.
5) Attend every class session and keep up with all course readings.
6) Attend weekly meetings with me in order discuss a series of pedagogy-focused readings and discuss lesson plans.

As I mentioned earlier and as the above list suggests, I was influenced by Topping & Ehly as I developed the UTA's role. I also elected to remove Schauz from any duties which involved grading—a departure from many UTA programs. This was partly done in order to preserve the privacy of undergraduates at a very small institution, but more importantly, I made this decision in order to ensure that the UTA's relationship to the students was defined by a mutually-beneficial sense of inquiry instead of results-based assessment. Further, as I detail above, Schauz was responsible for teaching 10 out of the 52 hours the course met in total. Though it was perhaps a bit unconventional to assign almost 20% of the course's total instructional time to an undergraduate, it was possibly the most successful part of the experience: it helped him take ownership over his own leadership role (i.e., it positioned him as a "conscious" educator of his peers), and resulted in deep learning for the UTA and the students (beneficial for all parties.)

In order to help Schauz succeed in his teaching experience, I ensured he received pedagogical training and support (professional supervision). In particular, I instituted the following six procedures/protocols:

1) Strategic syllabus planning
   I planned the syllabus so that Schauz's first teaching experience did not occur until mid-semester: after he had observed me teaching the course for about six weeks, after he and I had discussed the course itself (in terms of the syllabus, goals, theoretical framework), and after he had completed some of the major pedagogical readings.
2) Direct-pedagogical instruction

Schauz came to the UTA experience with a fair amount of content knowledge but comparatively little pedagogical training. In order to provide this training, we, as I suggest above, met weekly in order to discuss significant pedagogical readings (e.g., John Dewy's "The Need for a Philosophy of Education" and Sheridan Blau's *The Literature Workshop*). After we had read and discussed the pedagogical readings, I asked Schauz to submit a teaching philosophy statement in which he articulated how his personal philosophy of education aligned with (or departed from) the goals of the pedagogical theorists we covered.

3) UTA lesson planning and review
   Before each class session that he led, I required that the UTA submit a lesson plan that explained how his plan connected to his own teaching philosophy. We discussed his philosophy statement, his lesson plans, and his pedagogical goals during our weekly meetings.
4) Empowering the UTA
   In order to help students in the course view Schauz as a course leader (even though he was not responsible for any grading), I ensured that he was ultimately responsible for all his pedagogical decisions. For instance, during the content-based unit he taught, Schauz was responsible for selecting all course texts (including the specific editions), writing his lecture and leading all class discussions. For the skills-based courses he led (i.e., midterm/final review and writing workshops), he was responsible for designing all sessions and thinking through the issues of scaffolding and review. In all the sessions he taught I participated only as an active student.
5) Feedback and debriefing
   After each session that he taught, Schauz and I would meet and discuss his lesson: what I observed, what he observed, and the overall strengths and shortcomings of the lesson. During these discussions, we were also guided by his philosophy of education and discussed how the course sessions met (or failed to meet) his pedagogical goals.

As I have articulated, this experience was at once elastic and highly regulated—allowing the UTA a considerable amount of authority within a carefully scaffolded framework. This structure proved successful, suggesting that this experience can and should be replicated in future humanities-based courses.

## Evaluating the Experience

I will discuss the benefits of the UTA experience according to two of the three parties involved in the course: the students and me as the instructor. Schauz will then discuss the benefits and the challenges of the UTA experience from his perspective.[6]

### *Benefits for the Students and Instructor*

As I mentioned earlier, students had enrolled in the course without knowing there would be a UTA. On the first day of class, I explained Schauz's role—emphasizing that he would not be grading but

[6] For those interested in further discussion, Schauz and I spoke about the UTA experience on Scrawl Radio out of De Paul University in Chicago, IL. Please go here to listen to the show.

that he would be teaching certain days of the course and holding office hours. At the end of the semester, in order assess student engagement with the UTA experience, I conducted a survey (19 out of 27 students responded). (Please see appendix for entire survey.) I also took more informal notes and made observations throughout the semester.

During the first half of the semester, when Schauz's role was mostly limited to observation, students did not respond to the UTA much at all and his office hours remained largely unattended. After Schauz taught his first class session (an extensive midterm review), students began to turn to him more; and after he taught his week-long content-based unit and then led a writing workshop, students embraced Schauz's role as a UTA and readily turned to him as a resource. By the end of the semester, his drop-in office hours were extremely busy. Along these lines, nearly 30% of the survey respondents answered that they had met with Schauz at least once during the semester and the vast majority of those students met with him between 2-4 times during the semester. (This was in addition to the required meetings every student had with me.) Further, of the students who answered that they had met with Schauz, 100% indicated that they found their meetings with him to be "extremely helpful" (the other potential categories were "helpful," "neither helpful nor unhelpful," "unhelpful," and "extremely unhelpful"). In other words, the data suggests that students appreciated having an UTA to consult with outside of class. As one student commented "I found [Schauz] to be an invaluable resource. He thought as a student and provided wonderful intellectual insight when I was at a roadblock for my paper." "He was very knowledgeable on the class material" commented another student. "[He] made sure I left with all of my questions answered." (Anonymous, Survey, December 2014).

Student respondents also positively evaluated Schauz's teaching with over 70% describing it as "superb" or 'good." The narrative comments were once again positive and enthusiastic. "It was helpful and reassuring to hear tips from a student, since he can relate to us with the pressure of exams and papers" commented one student; another student suggested that "it was nice to get the information from a student" and another student wrote "Honestly, I could envision him being a professor himself; everything he said clicked with me and I learned a lot from his sessions." Though some students did report mild dissatisfaction (approximately 6% of respondents described Schauz's teaching as "average"), the majority of respondents suggested they were pleased with the UTA's teaching.[7]

Students also responded positively to the general experience of having an UTA. When asked to rate their overall impression of the experience, over 50% of students responded that they "loved having a UTA" while 42% of students responded that they "liked having an undergrad TA" and 5% (i.e., one student) respond that s/he "mildly" disliked having an undergrad TA claiming that "TA's [are] not a selling point for admission." The positive narrative comments however overwhelmed the single negative one. "I think it was good to have him as a resource" one student answered, "sometimes it can be more convenient than having to reach out to a professor." Another student commented that Schauz "was an effective, additional resource and teacher in the class!" Other comments include "I thought that it was good to have another person in the room besides the professor to come to for help. It sometimes is not as intimidating when the TA is an undergrad just like the students;" "I loved being able to go meet with Steven in a casual environment outside of class to ask any questions I may have;" "It was nice having another person to approach with

[7]About 23% of respondents skipped the numerical ranking and only provided narrative comments; however, since the narrative comments were almost uniformly positive here, I surmise that the students were pleased with Schauz's teaching.

questions and the extra office hours were great;" and "I think he contributed to the class with helpful tips and another view of the material. He provided a peer influence that was not intimidating... I liked the fact that he did not do any grading, but rather contributed to our learning that was led by the instructor."

Overall, though the sample size was admittedly somewhat small, the data and the narrative comments reveal that students embraced the prospect of a UTA and saw Schauz as a valuable resource. Further, though grades did not necessarily go up from previous years, I noticed that students seemed more willing to engage with some of the course's more difficult theoretical material as they wrote their papers. For instance, I have taught this course for about ten years and always include Gayatri Spivak's "Can the Subaltern Speak?" on the syllabus. Students understandably find this text very difficult and have generally avoid referring to it as they write their papers. Schauz, however, followed up my initial lecture and discussion of the text by referring to Spivak extensively during the unit he taught. For the first time that I can remember, students extensively and intelligently incorporated Spivak's theories in to their final papers. Though there are of course many reasons that can explain this (personality of the students; stronger lecture/discussion from me, etc.), I attribute the students' sudden comfort with Spivak to the incorporation of a UTA. Seeing an undergraduate speak about and grapple with Spivak's theories was powerful to the students and Schauz was able to encourage students to overcome their trepidation and think about Spivak's theories deeply and meaningfully. This is just one example of course. But overall, the student level of discourse in this course was markedly higher than in previous years and to me, this is inextricably linked with the presence of a UTA in the course. Further, the UTA experience inspired students to learn from one another in a way that struck me as particularly profound. Far from detracting from the goals of the humanities, peer education led to a quintessential humanities-learning experience—one in which students engaged deeply with the source material and grappled with complex problems. As the semester progressed, there were moments in which students almost seemed to forget my presence as they turned to Schauz and to one another as co-educators--inspiring an active classroom environment defined by discussion and exploration.

On a personal level, I found this experience was deeply rewarding. In fact, this experience has indelibly altered how I approach course design. Though I always emphasize active learning strategies as I teach, I now deliberately seek opportunities to weave peer- educational experiences into the organizational fabric of my courses. Though in some ways, this experience admittedly required time and energy, it also—perhaps counterintuitively—energized my teaching. Incorporating a UTA seemed to render my teaching and lectures more relevant to the students and helped general education students embrace the importance of a liberal arts education. Throughout this experience, I seemed to occupy a role that cannot be quite described by either the "sage on the stage" or the "guide on the side" paradigms. I was something of both and of neither—functioning instead as an integral member of this discourse community.

*Benefits for the UTA: a reflection by Steven Schauz*

When I first heard of the opportunity, I was excited by the possibility, especially as I recognized that I would be a bit of a test subject for this model. I was honored to be considered for this role, but I also struggled at first to see how I could fulfill its expectations. But I accepted the offer as my excitement far outweighed my doubts. Sometime after this experience now, I am pursuing graduate studies in a College Student Personnel program, and have finished my first year of a

Master's program. I absolutely believe that my experience as a UTA made me an attractive candidate for admission and helped prepare me for graduate study.

The UTA experience included two major components of study and practice: pedagogical and postcolonial theory. The pedagogical preparation as well as the actual experience of teaching challenged me to think about the ways that I interacted with and continue to interact with students. As a UTA, I had the opportunity to witness several "a-ha" moments for a collection of students, most frequently when they were struggling with some concepts, with incorporating new information that challenged their hegemonic perspective, or with composing a paper. For the students who came to me as a resource, I was often present to guide them through the process. It was as if they were on a journey of learning, but that some obstacle had blocked their path. When they received some of my guidance, it was as if they were able to move past this obstacle, and that is when the lightbulb would ignite. Helping to provide this guidance to students was something that I thoroughly enjoyed, and also has become a very helpful experience as I have continued in my graduate studies and often use similar skills with a new group of students.

Throughout the UTA semester, I made efforts to perceive learning as a partnership: that the instructor can and should learn from their students just as much if not more than their students learn from them. When I entered the UTA experience, I had an understanding that, while my professors had greater degrees of knowledge in a subject, I also had to make meaning for myself. I understood that I should value the teachings of the professor, but I also had to question, explore, and make salient the curriculum on my own. I came into the UTA experience knowing that I would also be learning in the classroom setting that I was now responsible for instructing, as well as from the readings, lesson planning, and discussions with Dr. Karpenko. However, I did not realize just how much I would be learning about my teaching and my ideas from the students. Their ability to ask questions of me (which I was not always prepared for) or create an interpretation of a text (that I had never conceived) challenged me, at times made me a little uncomfortable, but ultimately demanded that I learn, that I go back to the texts to reread, that I look deeper or at different pedagogical perspectives and that I become fluid in my teaching practice.

Further, when I first began reading about educational pedagogy, I was a bit caught up in the lofty premises of the theories. I envisioned these techniques in a very theoretically perfect fashion. Yet, I very quickly learned that the classroom setting is not this perfect system. In fact, it was often radically different. Then the question became: how do I apply the framework of the theory to this particular reality? What will work? What won't? Theory is fascinating and an important tool, but it is an illusion to think a theory will translate seamlessly in-to practice. I quickly learned that theory could not answer all of the anomalies, behaviors, conversations, or questions that arose within a classroom, but rather that it ought to be used to inform and frame my practice. One of the greatest challenges for me was to overcome the assumed rigidity of a given theory and to perceive the fluidity of its perimeters in practice.

The UTA experience also increased my subject-area knowledge of postcolonial theory. I am someone who is fascinated by complex subjects. Perhaps it is because I grew up playing puzzles and brain-teasers as a child, but I still thoroughly enjoyed putting the pieces together. I felt as if I was at a point in my academics where I could help others put these pieces together. But without the UTA experience, I might not have reviewed and sought to understand the components of the theory in quite as much detail. In short, I think that I needed to spend more time with the theories in order to disseminate a sense of understanding to the students I was working with, and that demanded that I construct frameworks about postcolonial theory in my mind in relation to other perspectives. The meanings that I have constructed of postcolonial theory, and of how I

approached my pedagogy on the subject, have persisted in my current studies and professional practice.

In short, the UTA experience provided me an opportunity to explore subjects that interested me, to challenge myself to learn more and to see in more than a singular perspective, and to be critical and intentional in my pedagogy. I continue to consider this one of the most impactful educational experience I had during college. I think it helped me to grow as a person and as a student, and it continues to shape the realities through which I interpret my current studies as well as inform how I interact with students in my professional practice. We talk a lot about preparedness—about how a student feels prepared to graduate from an institution and confident in their ability to use their skills in the real world. For me, this experience brought me to a point of preparedness. I have a feeling that the UTA experience has the potential to have similar effects on others who are able to rise to the challenge and who receive guidance from their mentoring faculty member. Overall, it was an exciting, challenging, and meaningful experience.

## The Future

The benefits of this UTA experience—even on the small scale that I described—were profound; however, because I advocate a program model that removes UTAs from grading responsibilities and instead recommend pedagogical training and supervised instruction, the experience I describe cannot be considered a cost or time savings as promised by Cook (2002). Instead, in keeping with Eby & Gilbert (2000), the experience demanded a considerable amount of my time and because Schauz received credit via an independent study for which I was compensated, the experience also required a small amount of financial support from my institution. In addition, establishing institutional or departmental programing takes time and though my department was impressed by the results of the study and is interested in making the opportunity a part of our regular offerings, we have not yet instituted a formal UTA program.

Despite the potential difficulties of instituting a department- or institution-wide UTA program, many aspects of what I describe above can be easily incorporated in to any humanities course. For instance, student groups can be assigned to teach certain units of a course and to display content knowledge as well as knowledge of pedagogical best practices during their teaching units; students can be assigned roles as content experts and asked to conduct “mini-courses” throughout the semester; students can elect a student leader to oversee aspects of exam review etc. Overall, the low cost/high benefit of the program certainly suggests that UTAs can and should be incorporated into humanities courses.

Perhaps more profoundly, this case study also suggests that humanities courses—even those courses that tackle complex theoretical material—can benefit from peer educational experiences. On that note, I want to close by suggesting that UTA programs and peer educational experiences can help us think through some of the profound challenges that face humanities departments today. While I do not want to paint an overly optimistic picture of what peer educational programs can accomplish, I do want to emphasize that such programs constitute the essence of humanities study. Indeed, I partly write this essay in order to encourage those of us in humanities-based fields to embrace rather than retreat from the rigorous dialogue and the topsy turvy sense of authority that lend vitality to our disciplines. In so doing, we can invigorate our own practice and perhaps even encourage entire campus communities to understand why the humanities remain necessary in our complex and rapidly changing world.

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## Appendix I: Survey for Students regarding the UTA experience

**Please answer the following questions. Your answers will be really helpful as we think about the role of peer education in our department. You can skip any question and still complete the survey. Your answers will be kept anonymous.**

1) How many times did you meet with the undergrad TA outside of class?
    a) More than 5 times
    b) Between 2- 4 times?
    c) 1 time?
    d) 0 times?

2) If your answer to #1 was yes, why did you meet with the undergrad TA? (Check all that apply)
    a) Help with midterm or final exams
    b) Help with final paper
    c) Other reason (Please specify)

3) If you visited the undergrad TA outside of class, please rank how helpful you found the meeting(s) on a scale of 1 to 5. (5 being exceptionally helpful and 1 being not helpful at all.)
    a) 5
    b) 4
    c) 3
    d) 2
    e) 1

4) Please explain why or why you did not find the undergrad TA helpful when you met. If you did **not** meet, please explain why.

5) Altogether the undergrad TA led five days of class (one day of midterm review; two days on the *The Wild Irish Girl*; one day of writing tips and tricks; and one day for the final exam review.) Of these five teaching days, how many did you attend?
    a) 5 days
    b) 4 days
    c) 3 days
    d) 2 days
    e) 1 day

6) If you attended at least 1 day of the undergrad TA's teaching, please explain your reaction to his teaching. Was he effective? Ineffective? If you did not attend any days of his teaching, please say why.

7) If you attended the undergrad TA's two classes on *The Wild Irish Girl*, please rate his teaching on a scale of 1 to 5 (5 being exceptionally taught and 1 being poorly taught.) Please briefly explain your impression.
    a) 5
    b) 4
    c) 3
    d) 2
    e) 1

8) This is the first time that the English department has made use of an undergraduate TA and we would like to know your overall impression of your experience. Please rate your experience according to the following. Please briefly explain your impression.
    a) 5
    I loved having an undergrad TA and would encourage the English department to make use of undergrad TAs in the future.
    b) 4
    I liked having an undergrad TA. Perhaps the English department should make use of undergrad TA's in the future.
    c) 3
    I am neutral on having an undergrad TA. I am unsure/undecided if the English department should make use of undergrad TA's in the future.
    d) 2
    I mildly disliked having an undergrad TA. I think the English department should avoid having undergraduate TAs in the future.
    e) 1
    I completely disliked having an undergrad TA. I think the English department should never do this again.

9) Would you be interested in serving as an undergraduate TA in your major? Why?
    a) Yes
    b) Maybe/Unsure
    c) No

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