Creating Dynamic Learning Communities in Synchronous Online Courses: One Approach From the Center for the Integration of Research, Teaching and Learning (CIRTL)

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Abstract

The ability to convert face-to-face curricula into rigorous and equally rich online experiences is a topic of much investigation. In this paper, we report on the conversion of a face-to-face research mentor training curriculum into a synchronous, online course. Graduate students and postdoc participants from the Center for the Integration of Research, Teaching and Learning (CIRTL) reported high satisfaction with the online training and increased confidence in their mentoring. Both quantitative and qualitative data indicate that the synchronous environment was successful in creating a strong sense of community among the participants. Specific pedagogical approaches for cultivating learning communities online as well as implications for scaling up such efforts are discussed.

Introduction

An increasing number of stakeholders from colleges and universities, government agencies, for-profit corporations, and nongovernmental organizations are concerned about the quality of postsecondary science, technology, engineering, and mathematics (STEM) teaching and learning in the United States. The Center for the Integration of Research, Teaching and Learning (CIRTL) is a multi-institutional

network of research institutions committed to improving the quality of teaching in postsecondary education (www.cirtl.net). This network is funded by the National Science Foundation (NSF) and specifically supports the professional development of graduate students and postdoctoral fellows across the country. The professional development opportunities made available to network participants include campus-based workshops, network-wide in-person conferences, on-campus teaching fellowships, and a series of online professional development discussions, webinars, and courses on research mentoring, course design, teaching in a diverse classroom, and other topics of great interest to CIRTL members.

In this paper, we chose to focus our research questions on the learning and professional development outcomes for several classes of students who took one of the network's synchronous online professional development courses (on the topic of *research mentoring*). In the paragraphs that follow, we explore answers to the following question: Can we convert a successful face-to-face professional development curriculum into a rigorous and equally rich online experience for graduate students and postdocs in such a way that maintains participant satisfaction, confidence, learning, and a sense of belonging to a learning community?

We start by grounding this question in the literature of online learning in general and synchronous online learning specifically. We then describe the course and the network that served as the context for our inquiry. This description will include an overview of the CIRTL Network's conceptual foundation, goals, and activities; the history of the Research Mentor Training (RMT) curriculum; and the process that was undertaken to translate the RMT curriculum from a face-to-face to an online context. Next, we provide an overview of the method we utilized in this investigation and an overview of the findings, ultimately answering our research question (articulated above). The paper ends with implications for instruction and for further research.

Literature Review

Both the design of and research about this course took into account research about the efficacy of online learning in postsecondary higher education, as well as research about the characteristics of good teaching in face-to-face settings (which are applicable to an online context). As is detailed in the Method section of this paper, the course at the focus of this inquiry began as a very successful face-to-face training program. Prior to being offered online, over 650 people attended 8–10 hours of RMT at both the University of Wisconsin–Madison and at other institutions across the country. In order to feel comfortable with developing a version of the RMT curriculum for an online audience, the instructors/course developers needed to be committed to debunking some of the myths about online education. Critics of the quality of online educational experiences often say online learning is impersonal, not rigorous, marked by learning distractions, not able to support group work, void of affective communication, and vulnerable to the health of the technologies needed to house such courses (DeMaria & Bongiovanni, 2010).

In designing the online version of the course, the faculty members took into consideration what researchers found to be important factors that influence the success of online learning experiences. Researchers found that three key factors contribute to high-quality online learning environments (Swan et al., 2000). First, the quality of the instructional interface must be *transparent* and of *high quality*. As with in-person classes, students must feel comfortable with and know how to locate necessary learning tools in the online interface. Second, any online course needs to have an *interactive, high-quality instructor*. In this case, the faculty knew that their approach to teaching online needed to make students feel connected to them and each other. Students needed to feel welcomed, encouraged, and guided, just as they would in a face-to-face class. The faculty also knew that they must be prepared to model the communication strategies they wanted their students to utilize with their peers. Third, the faculty knew that the instruction

had to be dynamic, and discussions among students and faculty needed to be both authentic and valuable. The importance of these factors in building community is highlighted by Swan et al. (2000):

> It is our belief that this combination of factors is not an accident, but rather that they jointly support the growth of…. "knowledge building communities." We agree with many in the online education field that the development of such communities is critical to the success of online courses. (p. 379)

The faculty members then needed to decide whether the online version of this course would be offered in a synchronous, asynchronous, or hybrid format. Synchronous learning involves students and faculty members interacting with each other in real time, just as they would in a face-to-face course. Asynchronous learning, on the other hand, occurs even when participants and instructors are not online at the same time. Of course, decisions about which of these models to use should depend upon the desired learning outcomes for a particular course. After Hrastinski (2008) performed an analysis of the communication threads of a course he was teaching, he found that content-focused language was most often found in asynchronous courses. He found that rhetoric focusing on task planning and/or social support appeared more often in synchronous classrooms. This course was composed primarily of synchronous online learning because of the complexity of the issues being discussed, the important role that community building played in the desired outcomes and processes in the course, the reliance on high student motivation for course success, and the level of demands we put on the students to work together on tasks (e.g., case studies). Each of these factors was identified by Hrastinski (2008) as being particularly amenable to synchronous online learning environments.

In a pilot study of synchronous learning with nursing students, Little, Passmore, and Schullo (2006) noted the importance of starting with a clear but flexible lesson plan and supporting interaction among students during synchronous sessions, including making use of the hand-raising tool and interspersing activities throughout the synchronous session. Students in the nursing course noted that the synchronous tools "helped bring group cohesion to the class" (p. 322). The authors noted that oft-used face-to-face activities could be adapted to the online format, including active and cooperative learning activities.

McBrien, Jones, and Cheng (2009) found that, despite some technical difficulties, students in three graduate and three undergraduate courses reported a positive experience taking a synchronous course. However, some students were overwhelmed by the multiple simultaneous forms of interaction. These authors reminded faculty to remain vigilant and proactive in managing interaction during the real-time sessions. Students in the McBrien et al. study also expressed a need for a clear and consistent structure in the virtual setting. LeBlanc and Lindgren (2013) noted the importance of building community within online language courses. The use of webcams allowed their students to see nonverbal cues, and faculty at their institution made sure that students introduced themselves at the start of the course and had the opportunity to provide timely feedback on the structure of the course during the semester.

The knowledge generated from this previous work formed the conceptual foundation for our approach to translating the research mentoring curriculum for the online context.

Method

Course Context and Structure

CIRTL Network. The RMT course is offered through CIRTL Network. The CIRTL Network is collaboration among 22 public and private research universities from across the United States. Each

member institution is committed to improving the education of undergraduate students studying STEM by better preparing future STEM faculty to teach. Together, the 22 universities that make up the CIRTL Network graduate over 20% of the individuals who earn STEM doctorates in the United States each year. Many of these individuals go on to become faculty members teaching undergraduate students at community colleges, liberal arts colleges, and comprehensive universities as well as research universities. CIRTL works to improve the teaching skills of future faculty so that they are better prepared to help their students learn.

CIRTL Core Ideas. The overarching goal of CIRTL is to increase the quality of STEM learning of all undergraduate students, thereby contributing to increasing the number and diversity of those individuals working in STEM fields. Three core ideas infuse CIRTL programs:

- Teaching-as-Research (TAR) is the deliberate, systematic, and reflective use of research methods by STEM instructors to develop and implement teaching practices that advance the learning experiences and outcomes of all students.
- Learning communities (LC) bring together groups of people for shared learning, discovery, and generation of knowledge. To achieve common learning goals, a learning community nurtures functional relationships among its members.
- Learning-through-Diversity (LtD) capitalizes on the rich array of experiences, backgrounds, and skills among STEM undergraduates and graduates through faculty to enhance the learning of all. It recognizes that excellence and diversity are necessarily intertwined.

CIRTL goal and approach. The goal of CIRTL is to prepare STEM graduate students and postdocs to become faculty who use and improve best practices in STEM teaching and learning with attention to diverse student audiences. CIRTL works to achieve this goal by (1) establishing interdisciplinary learning communities across and within a network of universities, each founded on the CIRTL Core Ideas, and (2) establishing a scalable cross-network learning community such that future faculty are better prepared for successful teaching careers as a consequence of the network's diversity, and such that institutional members benefit from the shared expertise in future faculty development across the CIRTL Network.

CIRTL Network activities. During the 2013–14 academic year, CIRTL member institutions collectively offered over 100 local teaching and learning professional development programs. These programs included courses, workshop series, cohort-based seminar series, and opportunities for graduate students and postdoctoral fellows to participate in TAR experiences. Opportunities ranged from single events to series with over a dozen meetings throughout the academic year. Together, attendance at these events exceeded 4,000. While some individual programs are located within a particular department or discipline, the vast majority of CIRTL programs are interdisciplinary, involving students and faculty from several STEM and social and behavioral sciences (SBE) departments. All of CIRTL's cross-network online programs are interdisciplinary and interinstitutional. Graduate students and postdocs from member institutions who are in a STEM, SBE, or a STEM-education field may participate in CIRTL courses. This interinstitutional format allows participants to benefit from the diversity and collective experiences of classmates at different universities. Participants in CIRTL courses bring a wide range of experiences, backgrounds, and perspectives, including experiences unique to their graduate program and institution. The course that is the subject of the inquiry in this paper (Research Mentor Training) was first offered online to CIRTL students in the fall of 2010, as one of two online CIRTL courses offered that semester. Since that time, CIRTL's cross-network learning community and the number of online course offerings have grown considerably. In 2014, the online curriculum included 16 full and short courses, including a massive open online course (MOOC) in STEM college teaching (https://www.coursera.org/course/stemteaching).

Face-to-Face Research Mentor Training course. The central question we pose in this paper is this: How can a successful face-to-face professional development curriculum be converted into a rigorous and equally rich online experience for graduate students and postdocs in such a way that maintains participant satisfaction, confidence, learning, and a sense of belonging to a learning community?

Research Mentor Training curriculum history. RMT offered through the CIRTL Network is based upon the Entering Mentoring (EM) curriculum (Handelsman, Pfund, Miller, & Pribbenow, 2005) and was designed to improve the effectiveness of mentors working with undergraduates. Published evaluation of EM indicates that mentors who participate in training are more likely to consider issues of diversity, discuss expectations with their mentees, and to seek the advice of their peers. EM (www.researchmentortraining.org) has since been adapted and enhanced for use across STEM fields as well as within medicine and public health, for mentors and mentees at various career stages (Pfund et al., 2006; Pfund et al., 2013; Sorkness et al., 2013; https://mentoringresources.ictr.wisc.edu). Results from a recent randomized, controlled trial using an EM-based curriculum at 16 sites indicate the effectiveness of the approach for both mentors and their mentees (Pfund et al., 2013; Pfund et al., 2014).

The EM curriculum uses a process-based approach to introduce core mentoring competencies, experiment with various mentoring strategies, and provide a forum to solve mentoring dilemmas with small peer groups. Training sessions are typically offered as a series of interactive one-hour sessions facilitated by one or two faculty, staff, or postdocs. The six competencies from the EM-based curricula are (1) maintaining effective communication, (2) establishing and aligning expectations, (3) assessing mentees' understanding of scientific research, (4) addressing diversity within mentor–mentee relationships, (5) fostering mentees' independence, and (6) promoting mentees' professional career development.

Online Research Mentor Training course. In 2010, a multidisciplinary version of the EM curriculum was adapted for use in online courses to mentors across the nation through the CIRTL Network. This course was intended to be primarily synchronous, with a few asynchronous elements. The course was structured to allow students to achieve the goal of leaving the class with a similar set of learning outcomes to students who took the face-to-face course. The developers believed that students' ability to achieve this outcome would depend upon a set of key choices regarding the "space" for the synchronous classes and asynchronous work, as well as explicit pedagogical choices to ensure the development of a rich learning community in an online setting.

Where were the synchronous class sessions held? Regardless of where synchronous learning takes place (face-to-face or online), instructors need to ensure that the *space* where learning will take place has the resources and accessibility needed for high-quality instruction. We utilized Blackboard Collaborate (formerly Elluminate) as our virtual classroom. Because a primary goal was to create a sense of community among the learners, despite the physical distance between participants, several factors were considered when selecting a technology to host the synchronous class sessions. Desirable base functionality for the virtual classroom included cross-platform compatibility and accessibility for users of assistive technology. It was important for students to be able to participate using a variety of operating systems and browsers. However, it was the interactive features of the classroom itself that were of particular interest. Though technology was changing at a rapid pace, virtual classrooms in 2009 and 2010 still had some limitations. For the CIRTL Network courses, several available online-learning features were deemed critical, including support for direct audio and video interactions. Many students connected to class from laboratories or other spaces on campus where there was no access to a landline phone or poor cell phone reception. The virtual classroom needed to facilitate hand raising, support text chat, some form of document or application sharing as well as a polling feature to gather responses from students. Finally, support for virtual breakout rooms with whiteboards was weighted heavily during the process of selecting course tools, as the use of small group discussions is a core pedagogical approach used in RMT.

Students were also asked to create Skype accounts to serve as a backup method of contacting the instructor (should they have trouble connecting to Blackboard Collaborate) as well as for one-to-one interactions with classmates outside of class.

Where did the asynchronous learning take place? We chose the Moodle course management system (CMS) to provide the basic information-sharing functionality used in many courses. We used this CMS system to share the course syllabus, readings, and assignments. We also used the CMS system to support the learning community among participants. Students posted brief biographical sketches and photos during the first week of class. These profiles helped students get to know each other. Throughout the course, Moodle was also the place where students posted interesting articles to share with their peers and instructors. E-mail was of course another asynchronous strategy used to connect the students with the instructors and with each other.

What pedagogical choices were made to maximize student learning? Successful use of any synchronous online learning system requires thoughtful pedagogical choices on the part of the instructors. Our goal was to make technological choices that supported our pedagogical goal of building a sense of community in the online space. These choices included patiently waiting for people to turn on their camera and audio; stressing the importance of using video when speaking; making use of breakout rooms that allowed everyone to use video simultaneously; utilizing whiteboard space to have everyone share ideas and responses to questions; encouraging students to use the emoticon, thumbs-up, and thumbs-down functions to solicit feedback about student understanding; and reminding students to use the chat window to pose questions or add ideas at any time. Table 1 provides a more detailed overview of how approaches used for teaching RMT in a face-to-face context were adapted to work in the synchronous and asynchronous online contexts.

In addition to making pedagogical choices that took advantage of the technology, we made choices that we would make in any face-to-face setting. Most of these choices took advantage of and emphasized the importance of the learning community. Throughout the course, the instructors reiterated that the primary goal of the seminars was to establish a learning community focused on the improvement of mentoring practices. We discussed elements of constructive and destructive group dynamics, how to work well in groups, and the importance of participation and confidentiality. We implemented processes of peer review of mentor–mentee compacts and mentoring philosophies, allowing participants to see examples of these compacts, with the aim of fostering collaboration and cooperative learning. Finally, we set the expectation that those who were absent from class would still send their responses to a case study or provide thoughts on the reading so that the larger group didn't miss out on hearing their ideas.

Table 1

Conversion of Pedagogical Approach From Face-to-Face to Synchronous Online Setting

Approach used in face-to-face classroom	**Approach used in synchronous online classroom**
Introductions around the room	Students take turns turning on their camera and microphone and introducing themselves to the group.
Visual presence in every session	Students take turns turning on their camera and microphone and saying hello each week.

Mini-lecture	PowerPoint slides are shared on the whiteboard, and instructor "lectures" using audio and video.
Brainstorming	Students all write their ideas simultaneously on a shared whiteboard.
Small group discussion and report out	Students work in small groups in separate breakout rooms with audio and video; they record their ideas on the whiteboard in their breakout room, which is then shared with the larger group during a report-out session.
Case studies	A case study is posted on the whiteboard, and students work in small groups in breakout rooms (see above) or in a large group to answer questions about the case. Students can share their ideas using audio and video or using the chat room.
Think-Pair-Share	Students work in pairs in separate breakout rooms with audio and video; they record their ideas on the whiteboard in their breakout room, which is then shared with the larger group during a report-out session.
Large group discussion	Students share their ideas using audio and video with the large group. Students are asked to raise their hand if they wish to share or type their ideas in the chat room window.
Question and answer	Students are encouraged to raise their hand using the hand-raising feature to ask or answer a question. Alternatively they can ask or answer a question in the chat room window.
Clickers	Students are asked to use their keyboard to respond to polling questions (yes/no, multiple-choice). Answers are displayed for all to see.
Peer review	Students can review other students' materials outside class and then meet with them in breakout out rooms to share feedback.
Quick check-ins	Students were asked to use the emoticon to show how they were doing or if they understood the material. These include a smiling face, frowning face, thumbs up, or thumbs down.

Participants

Demographics. A total of 44 graduate students and postdocs took the course in the fall 2010, fall 2012, and spring 2014 semesters. Of these participants, 39 responded to the surveys (for an overall response rate of 88.6%). These respondents represented 17 different institutions in the CIRTL Network (see Table 2 for a comprehensive list of institutions in the CIRTL Network). Eighteen of the participants were graduate students, 19 were postdocs, and 2 did not identify their training level. Of the survey respondents, 23 identified as female and 16 identified as male. The racial/ethnic makeup of the group was 62% White (24 participants), 5% African American (2), 8% Hispanic/Latino (3), and 18% Asian/Pacific Islander (7), and 8% identified as members of more than one racial/ethnic group (3). The instructors of the RMT course included three individuals from three different CIRTL institutions. All three were white females who held academic staff/instructor positions at their home institutions and were each engaged in teaching,_learning,_and_research_initiatives.

Table 2

CIRTL Network Institutional Participants

Boston University	University of California, San Diego
Cornell University	University of Colorado at Boulder
Howard University	University of Houston
Iowa State University	University of Maryland, College Park
Johns Hopkins University	University of Massachusetts Amherst
Michigan State University	University of Missouri–Columbia
Northwestern University	University of Pittsburgh
Texas A&M University	University of Rochester
University of Georgia	University of Wisconsin–Madison
University of Texas at Arlington	Vanderbilt University
University of Alabama at Birmingham	Washington University in St. Louis

Experience with technology. The majority of our participants had some experience with synchronous learning technologies that served as the foundation for CIRTL online courses such as RMT. Over 75% of the participants had experience engaging others via online chat channels (e.g., AIM, IM), voice over IP services (e.g., Skype), video and audio conferencing, or use of emoticons in online communication. This familiarity is not surprising given the ubiquity of these tools in casual and personal online communication. Participant experiences with online technology in a formal educational setting were much more limited. Only 27% of participants had experience with virtual, synchronous online classrooms (e.g., Blackboard Elluminate); 33% of participants had experience using asynchronous online classrooms; and 24% had experiences using an electronic whiteboard.

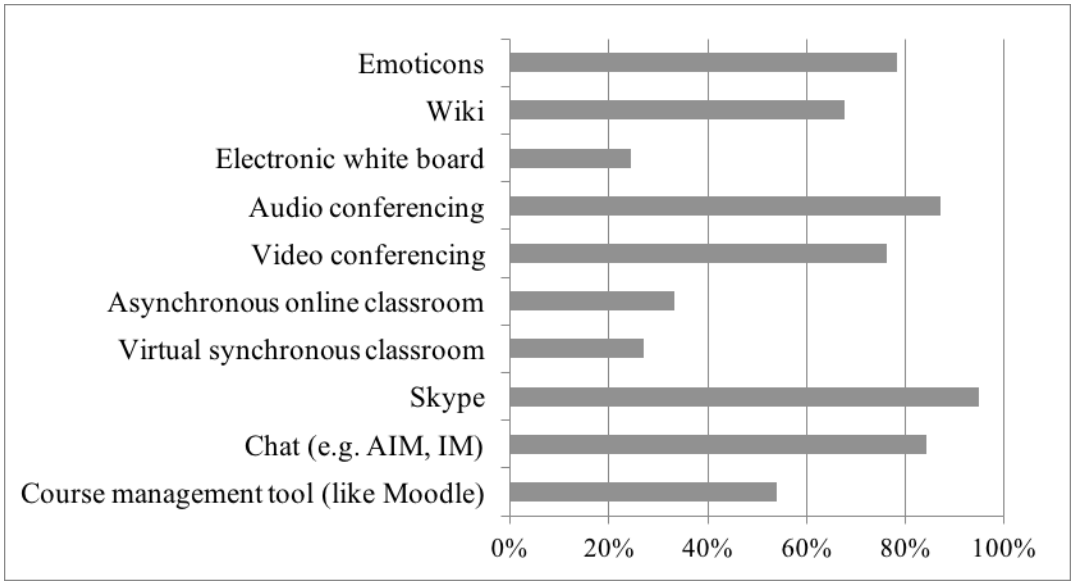

Figure 1. Percentage of participants indicating prior experience with various forms of technology used in the online Research Mentor Training course (n = 37–39).

Background and Preparation of Course Faculty

All of the RMT course instructors were experienced facilitators and were skilled in utilizing active learning strategies with undergraduates, graduate students, postdocs, and/or faculty. One of the instructors (Pfund) is an original developer of *Entering Mentoring*, the face-to-face version of RMT, and was primarily responsible for adapting the course for the synchronous, online version. This instructor had her first experience teaching in a synchronous, online environment in 2009, co-leading a different CIRTL Network course. This instructor was one of the co-instructors in each of the three RMT offerings described in this paper. Both other instructors had some familiarity with the *Entering Mentoring* curriculum and had taught elements of RMT before teaching the online version. One of these instructors had previous experience teaching an asynchronous online course, while the other instructor had no prior experience teaching in an online venue. Prior to teaching the RMT course, detailed facilitator notes were prepared for each session. These notes were based on the facilitator notes previously created and published for *Entering Mentoring* and adapted for the synchronous/asynchronous, online environment. Co-facilitators met for 30–60 minutes prior to each session (1) to review the prior session and discuss needs for improvement, (2) to discuss the facilitator notes and the course material, and (3) to discuss the potential challenges that might arise with the technology. In these meetings, the co-facilitators also decided who would lead each part of the session. Importantly, the person not in charge of leading an activity or discussion was assigned the task of monitoring the chat window, addressing any questions, and navigating any technical issues, if they arose.

Survey

In order to answer our research question, we designed a survey and collected data from online RMT participants—graduate students and postdocs—after the course was completed in fall 2010, fall 2012, and spring 2014. Participants received an e-mail link on the last day of class, inviting them to take an electronic survey. After providing some demographic information, participants were asked questions covering the following categories:

- Prior experience with various technologies
- Prior and current mentoring experiences
- Overall satisfaction with the course
- Usefulness of and interest level in various course topics
- Effectiveness of different technological tools for learning course content
- Experience of the learning community
- Importance of different technological tools to promote community
- Course impact on the student's confidence
- Course impact on the student's interest

These questions used Likert-type scales with values of interest, agreement, usefulness, and effectiveness. As quantitative questions were identical each year, in this paper we report the collapsed data across three offerings (fall 2010, fall 2012, and spring 2014; means within semesters were not statistically different from one another). Participants also had the opportunity to answer open-ended questions on their experience of the learning community in the course and their experience of the course in general.

These questions can be found in Table 3. Participant responses to the open-ended survey questions were analyzed using open and selective coding (Strauss & Corbin, 1990).

Table 3

Open-Ended Questions Contained in Survey of Research Mentor Training Online Participants

Related to participant experiences of a learning community in the course

- Describe in what ways, if any, involvement of students or instructors from other institutions had an impact on your learning.
- What aspects of the course or activity made you feel most a part of the learning community?
- What aspects of the course or activity were barriers to your feeling part of the learning community?

Related to participant experiences and suggestions about the course in general

- What motivated you to attend the online Research Mentoring Training seminar sessions regularly?
- Please discuss the ways in which the technology used in this course has impacted your experience.
- Would you recommend the mentoring seminar to a colleague? Please explain.
- Based on your experience in the Research Mentor Training seminar, what, if anything, will you do differently next time you mentor?
- Please list any comments or suggestions as a way to improve the Research Mentor Training seminar.

Findings

In this section we provide an overview of responses participants provided about their overall satisfaction with the course, the role that other participants and instructors had on their experience of class community, the degree of comfort they had sharing and participating in class, and the positive and negative aspects of different types of synchronous technologies used.

Participants Were Satisfied With the Course and Reported Confidence Gains

Participants were asked to rate their overall satisfaction with the RMT on a scale of 1 to 5, with 1 equal to *extremely dissatisfied* and 5 equal to *extremely satisfied*. The average satisfaction rating was 4.46, ranging from 4.20 to 4.70 across the three offerings. One hundred percent of the participants reported that they would recommend RMT to a colleague. One participant noted, "Most definitely—I have already recommended it to several colleagues!" Similar to the data reported from face-to-face offerings of RMT, participants highly rated all of the topics discussed in the seminar (Pfund et al., 2006; Pfund et al., 2013). For the offerings reported here, participants rated the topics of "Setting goals and establishing

expectations," "Identifying the elements of good mentoring," and "Articulating a mentoring philosophy" as the most useful and interesting (data not shown). The lowest rated topics were "Applying the CIRTL Core Ideas to mentoring" and "Assessing understanding" (data not shown). Upon completion of the course, participants reported confidence gains in their mentoring abilities and intent to change their mentoring behaviors.

Figure 2 shows the impact of the RMT course on participants' confidence in several aspects of mentoring.

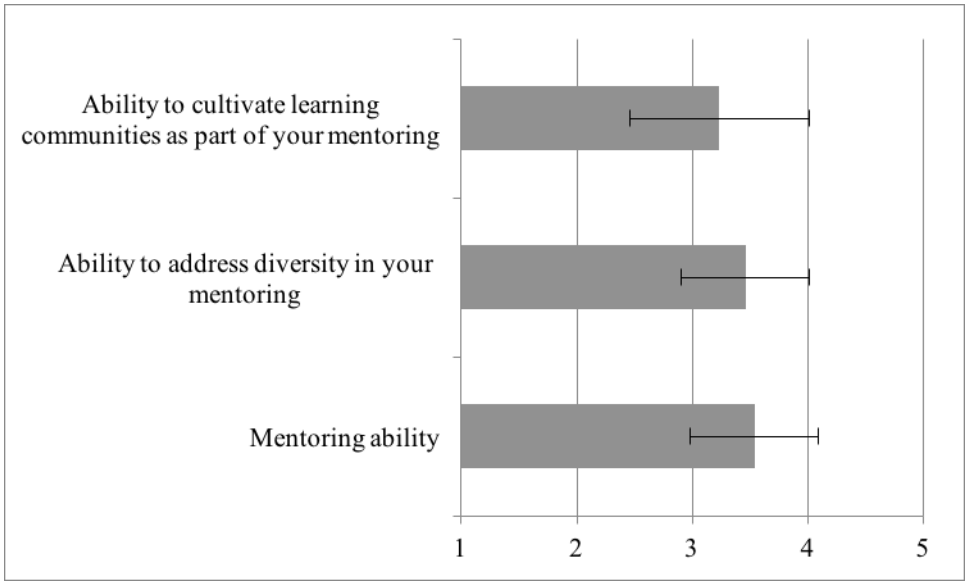

Figure 2. Self-reported impact of the Research Mentor Training course on participants' confidence. Participants were asked to rate the impact of the RMT course on their confidence in each of the indicated areas on a four-point scale from *none* (1) to *a lot* (4). Standard deviation is shown for each mean.

Participants Found Value in the Learning Community

Survey data revealed that our students had positive feelings about the learning environment and the connections they made with the instructors and fellow participants. This outcome challenges the myth that online education is more impersonal than face-to-face instruction.

Participants experienced an inclusive learning environment, and this added value to their experiences in the course. One of the core ideas that CIRTL (2013) advocates is that a successful learning community cultivates an inclusive learning environment: "Learning communities succeed when diverse backgrounds and experiences of learners are welcomed in such a way that they help inform the group's collective learning. Whenever possible, activities should be sought that help participants reach out and connect with others from backgrounds different from their own" (para. 6). Participants were asked to rate their level of agreement (on a scale of 1 to 5, with 1 equal to *strongly agree* and 5 equal to *strongly disagree*) with the following statement: "The course exhibited an inclusive learning environment." Of the 39 survey respondents, 32 responded that they strongly agreed with this statement (average 4.82).

The participants who offered written comments frequently noted the important role their classmates played in helping them learn about *differences* in culture—ideas, disciplines, campuses, labs,

local cultures, and regions of the world. These responses are in alignment with the participants' strong agreement that the course promoted an inclusive learning environment for all and reflects another core CIRTL idea, Learning-through-Diversity, or leveraging the experiences and backgrounds of all for the benefit of all. In some cases, as illustrated in Table 3, students found that these differences freed them up to be more comfortable in the classroom and to expand their network of contacts.

Table 4

Example Qualitative Responses From Participants Noting the Impact of Differences, Across the Indicated Categories, on Their Learning

Category of difference	Sample open-ended responses
Institutions (e.g., labs, universities)	"It was important to understand the research culture in other labs, and to some extent at other institutions. In addition, I think working with students at other institutions made it easier to speak candidly about my own experiences without having to worry about certain campus politics." "Involvement of students and instructors from other institutions gave me a diverse perspective on aspects of mentoring." "Positive connections to researchers in remote location (relative to my location), whose ideas and opinions were educational and valuable to the group"
Disciplines	"Mentoring in my discipline is handled very differently compared to other disciplines, primarily due to the type of research work performed. I also got to learn from people doing things I am not doing at this time."
Regional and international cultures	"It was just another point of view … and I found it to be really cool that we were having a class with students all around the country." "I only knew lab systems in [my country]. I realized how researchers from other countries are well trained to design research projects and mentor." "It is cool to know what modern technology can do by bringing people from different parts of the country together."
Career stage	"I really enjoyed learning from the postdocs in the class."

Participants experienced peers as valuable in learning course content. Learning communities have also been found to contribute to the learning of the course content among participants in the class. Participants were asked to rate their level of agreement (on a scale of 1 to 5, with 1 equal to *strongly agree* and 5 equal to *strongly disagree*) with the following statement: "I experienced functional connections with others in the class." Of the 39 survey respondents, 18 responded that they strongly agreed with this statement, and 16 responded that they agreed with this statement (average 4.36). Two additional survey items asked participants to rate their level of agreement with questions related to the effect of peer interaction on learning course content. The average response to "I felt our discussions promoted learning" was 4.65; the average response to "I developed a deeper understanding of content through large group discussions" was 4.38. One participant noted the following:

> Participating in a live discussion makes me produce better ideas than I would doing a written assignment by myself. The ability to ask questions through chat without breaking an ongoing verbal discussion was also very encouraging.

When asked about the value of discussions on some of the core class topics, 30 of 39 respondents reported the following topics as "useful and interesting": designing mentee research projects, setting goals and expectations, developing good communication strategies, sharing mentoring challenges with each other, designing approaches to address mentoring challenges, addressing issues of diversity, identifying the elements of good mentoring, and articulating a mentoring philosophy.

Participants felt welcomed by peers and instructors and comfortable participating in class. Responses to three survey items demonstrated that participants strongly agreed that they felt welcomed in class and felt their ideas were respected. Participants were asked to rate their level of agreement (on a scale of 1 to 5, with 1 equal to *strongly disagree* and 5 equal to *strongly agree*) with the following statement: "I and my ideas were welcomed and respected by the instructors." They were also asked to use the same scale and respond to this question: "I and my ideas were welcomed and respected by the other students." The average response to each of these two questions was 4.80 and 4.75, respectively. The high level of agreement with these statements was reflected in some of the responses to open-ended questions:

> I think both instructors did a great job of keeping everyone engaged and feeling like valuable contributors to the class. And I felt the fact they participated and shared with the class earned them immediate trust and respect (which may be hard to do, having never met most of the students in person).

In addition to expressing a general feeling of being in a welcoming environment, respondents indicated that they were quite comfortable being active participants in class—through asking questions, sharing ideas, and exposing gaps in knowledge during class. Figure 3 displays the average responses to items covering each of these areas.

These results were reflected in one student's response to one of the open-ended questions:

> When I was a student I was typically quiet and hesitated to speak up in class—I always had some anxiety to share my thoughts or ask questions. In this course I felt much more comfortable asking and answering questions and offering my thoughts. This was likely largely due to the good work of the professors in designing and running the course, but I also attribute some of it to the nature of the virtual classroom. The design allowed for really good use of break out discussion groups and for sidebar discussions using the chat feature.

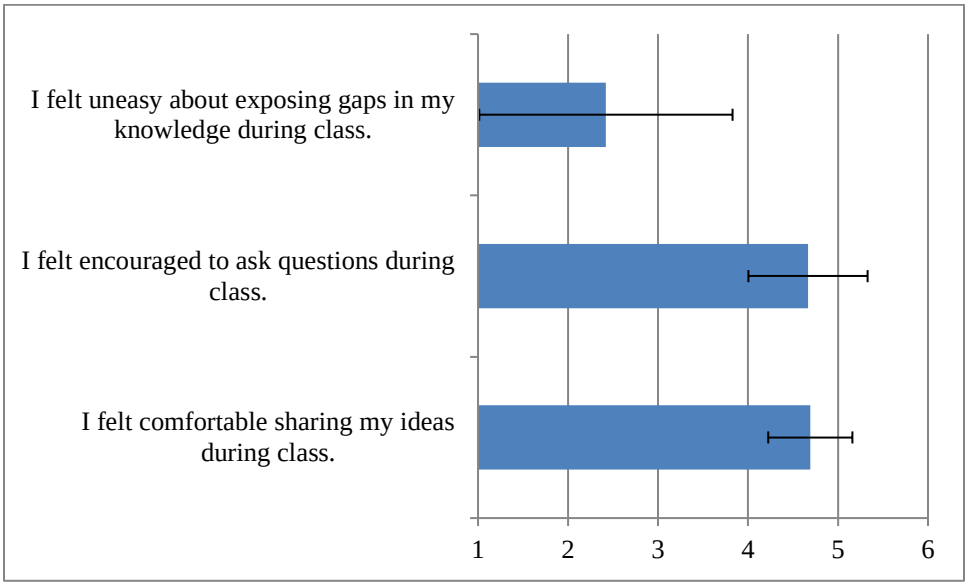

Figure 3. Average rating of agreement with indicated statements regarding the learning environment. Participants were asked to rate their agreement on a scale of 1–5 from *strongly disagree* to *strongly agree* with the indicated statement (n = 39). Standard deviation is shown for each statement.

There were still some barriers to participants feeling part of a learning community. Despite this "good news," we know from the literature that group experiences are not always positive, or at least not for everyone in class. After acknowledging the value of alternative perspectives brought by peers, one respondent shared the following: "They often created distractions that detracted from the experience." The instructors did feel that the course size in 2014 (n = 20) had become too large—this is echoed the sentiments of one participant from spring 2014: "The size of the class, I think it was too large and that affected some of the session discussions." One student mentioned language as a barrier to feeling like part of a learning community, but also acknowledged a dimension of the synchronous system that helped:

> I am not a native English, and it was tough for me to follow conversations between native speakers ... [The] whiteboard and case studies, were helpful to me.

Finally, some respondents were concerned that "the class interaction was dominated by a handful of students," with 10 out of 39 of the participants agreeing or strongly agreeing with this statement.

Participants rated the overall effectiveness of the various technologies in this class quite high, but pointed out drawbacks as well. There were both closed-ended questions and open-ended items that, when examined together, provided us with some feedback on participant perceptions of the effectiveness and usefulness of several Blackboard Collaborate functions in promoting online community: the chat window, whiteboard, video, and audio. Participants also provided general comments about the effectiveness and usefulness of the synchronous and asynchronous technologies in this class.
Table 5 (next page) summarizes these responses.

Table 5

Impact of Technology on Student Experience of the Class

	Agreement with statements about the use of technology to successfully promote an online community of learners in a synchronous classroom. 5-point scale: 1 = *strongly disagree*; 5 = *strongly agree*	Sample responses to open-ended questions (positive)	Sample responses to open-ended questions (negative)
Chat window	"Having a chat window provides me with a way to share my ideas, when I might not otherwise." *Average Rating: 4.44*	"I think a chat window is a great way to make comments and share ideas when someone is talking—this adds to both the depth of the conversation that you don't get in in-person classes and provides another way for people to express themselves." "I liked being able to share ideas through chat and not having to speak all of the time."	"As I said I cannot read and listen at the same time so some times when the conversation come to the chat I felt left out and started to read frantically what the reference was about." "There were a couple of instances where I felt that discussions in the chat window were tangents from the discussion happening in the audio/video area. It was difficult to follow both at the same time."
Whiteboard	"Sharing breakout whiteboards effectively brings our ideas to the larger group." *Average Rating: 4.15*	"The anonymity of the white board was also liberating and I felt less self-conscious about contributing." "I like the use of the whiteboard to express ideas without a name being attached."	"I found it very difficult to write on the white board. This was particularly a problem if I would volunteer to take notes in the small break-out groups…. I really like the concept of using the white board, but I would really like to see the technology improved."
Group discussion: Video	"It is important to see students and instructors when they are speaking." *Average Rating: 3.97*	"It was important that we could see each other when we were speaking, and that the instructors had us each talk at the beginning (and in small breakout groups)."	"Not being able to see everyone's face at the same time."

		"I like the way we had shared video discussions in the class."	
General comments		"I really liked the multiple avenues for discussion—I can raise my hand and commandeer the video/audio (with the help of the moderator), or I can enter a quick comment or link in the chat window without interrupting the conversation. I also like the emoticons, like applause, or thumbs up or thumbs down, which replace the non-verbal communication we would have in a class room (nodding, smiling, etc.)" "I loved how I was able to connect and communicate in various formats."	"It was extremely useful when it worked correctly. The technology was frustrating at times depending on the connection of others in the class/group. It took some getting used to and I had to remind myself that it wasn't meant to be a stand-in for face-to-face interaction. It required more patience than I thought, and sometimes when the connection cut in and out." "There were some students who often had audio problems. It was sometimes difficult to understand them and have a discussion with them. I wonder if it also prevented these students from participating more in the discussions."

Participants indicated they would use what they learned in this class in their day-to-day mentoring practice. Nearly all (35) of the participants responded to the following open-ended question: "Based upon your experience in RMT, what if anything, will you do differently?" Of the 35 respondents, 23 mentioned their intent to use a mentoring compact with their mentee (or some other process to make expectations explicit at the beginning of the relationship). A few respondents mentioned that they hoped to use the technology from this course in their own teaching:

- "I really liked all the technology used in this course. Learned a lot of tools that I can use in the future."
- "I would like to learn more about using sites like Moodle for my own teaching because I think Moodle makes organizing a course easier than without it."

A few other students mentioned the relationships they have gained through participation in the class:

- "I feel like I have people in other places that I can reach out to. Thanks to the LinkedIn group, I already have."

- "It also gave me a great opportunity to network and gain relationships that I can continue to benefit from in terms of mentoring technique."

Discussion

Instructor Reflections

The instructors realized how much work could be accomplished in an online teaching and learning environment. Even when it was clear that many active-learning pedagogies could be adapted to work in a synchronous, online environment, we still doubted that the class could achieve the same sense of community afforded in face-to-face classrooms. One of our primary concerns was about the possible negative impact of the lack of physical presence on students and faculty; we questioned whether or not we would retain the ability to read the body language of our students and adjust what we might say or do in class accordingly. Despite these limitations, the sense of community was strong (as shown by the data reported here). One instructor reported seeing a student at conference many months after the class ended and immediately feeling a sense of familiarity with them, despite never having been physically present in the same room with them before.

One reason for the unexpected feeling of connection may have been the use of the chat room. What was sacrificed in terms of visibility was made up for in the level of informal sharing that occurred via chat room. Many of the ideas that would have been left unsaid in a face-to-face classroom were posted in the chat room, giving new insight into the participants' thoughts and reactions. While this generation of students may be comfortable with the level of interaction they experience online, getting to know students online was a new experience for us as instructors.

Implications for Instruction

After reviewing these findings, we have easily identified some things we learned that we will implement when teaching other synchronous courses through the CIRTL Network. First, the size of the class matters—even though the evaluation data were overwhelmingly positive for spring 2014, the instructors found themselves overwhelmed teaching this specific curriculum (which is very processed based) to 20 students (as opposed to 12 or 15). This burden on instructors poses a challenge for scaling up and suggests that a train-the-trainer model for online instructors of RMT might be useful.

It was clear that not all students had a positive experience, with some students experiencing poor-quality video and audio connections during course sessions, leading to delays in communication and dropped connections. This feedback makes it clear that instructors need to do a better job communicating the technology requirements (on the student's side) that we know lead to a more positive experience with the technology itself.

Although we covered the topic of diversity and difference in the course (and discussed its application to mentoring relationships), there is still more we can do to make the RMT online course a more inclusive one for everyone in the class. Concerns were mentioned about the difficulty of participation for students who speak English as a second language. Also, multiple respondents noted that each class had several individuals who dominated the class discussion. In the future we need to better attend to the different channels of communication (chat, video, and audio) and make sure to monitor and support the contributions of all participants.

Finally, we need to remember that one of the most positive parts of the course experience for participants was the ability to engage in the learning community with colleagues across the country. Because of the importance of a sense of learning community, and because learning communities are

central to the CIRTL project, we need to continuously foreground the importance of multiple levels of student engagement during the course.

Limitations and Implications for Research

The education and social psychology literature is fairly consistent in noting that individuals, particularly novices to a topic or those who are unskilled in an area of study, tend to overestimate their abilities on intellectual tasks (Kruger & Dunning, 1999; Ehrlinger et al., 2008; Falchikov & Boud, 1989; Zell & Krizan, 2014). Often known as the *Dunning–Kruger effect*, people not only tend to overestimate their abilities, but also fail to realize that they are doing so (Kruger & Dunning, 1999). The data in this study was self-reported. We attempted to minimize the Dunning–Kruger effect by asking about participant "confidence-level" or "interest," instead of asking them to evaluate their specific understanding of or skill in different aspects of mentoring. A second limitation of this work is that two of the three authors of this paper were instructors for the course, and therefore our study design and/or interpretation of the data may have been influenced by our subjectivity—our own positive regard for the course we had developed and taught. We believe our survey instrument allowed for plenty of opportunities for respondents to provide any negative feedback about their experience in the course through both Likert-scale items and open-ended question types. Finally, the conclusions we drew from our course data were based upon a relatively small number of respondents. Future work could include additions to the current sample (through surveying students taking RMT in future semesters) and possibly an extended study design that would longitudinally follow RMT participants as they implement (or do not implement) what they learned in the course in their own research sites and laboratories.

Synchronous online learning represents a small fraction of the quickly expanding landscape of online learning. As colleges and universities, government agencies, and for-profit and nonprofit corporations turn to asynchronous online learning, massive open online courses, and web-based tutorials, the study's authors encourage professional development providers to keep synchronous online learning in the mix. Despite the rapid changes in technology and connectivity, synchronous classes require strong, continuous high-speed connections. As ubiquitous as connectivity seems to be across the United States, high-speed Internet connections are not always guaranteed. These will improve over time, but instructors will need to continue to talk to students about the best ways to maximize the benefits and minimize the drawbacks of learning that is so reliant on one technology.

The experiences reported here demonstrate that with careful planning, organization, and thoughtful pedagogy, it is possible to convert a face-to-face learning experience into a rigorous and rich online experience that is rewarding to both students and instructors. The multi-institutional nature of the experience added an important component to the course that would not be feasible to recreate to the same extent in a face-to-face setting, because it allowed students and instructors to learn about the institutional and cultural differences related to undergraduate mentoring across the 17 institutions represented in the class. We found this network to be such a powerful benefit of our course that we in turn suggest that faculty teaching face-to-face classes consider instructional strategies (and available technologies) to connect students to a broader network of colleagues and scholars in their field.

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