

INSTRUCTIONAL DESIGN AND ASSESSMENT

Peer-Led Team Learning in an Online Course on Controversial Medication Issues and the US Healthcare System

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Objective. To implement peer-led team learning in an online course on controversial issues surrounding medications and the US healthcare system.

Design. The course was delivered completely online using a learning management system. Students participated in weekly small-group discussions in online forums, completed 3 reflective writing assignments, and collaborated on a peer-reviewed grant proposal project.

Assessment. In a post-course survey, students reported that the course was challenging but meaningful. Final projects and peer-reviewed assignments demonstrated that primary learning goals for the course were achieved and students were empowered to engage in the healthcare debate.

Conclusions. A peer-led team-learning is an effective strategy for an online course offered to a wide variety of student learners. By shifting some of the learning and grading responsibility to students, the instructor workload for the course was rendered more manageable.

Keywords: peer-led team learning, online learning, interprofessional education, healthcare system

INTRODUCTION

Peer-led team learning is an established instructional model that has its origins in science education and is built on the constructivist theoretical frameworks of cooperative and collaborative learning.¹ This educational approach is an example of active learning, which defines meaningful learning as student engagement with complex, authentic problems, as well as social interaction with peers and others. Within education, leveraging complex, real-world learning activities and assessments with instructor workload poses a real challenge to instructional design. While students undoubtedly benefit from active-learning opportunities, these kinds of experiences require individualized and timely feedback, as well as ongoing practice, which can be a challenge for even the most experienced instructor. Instructors can mitigate their workload by using other learners as part of the educational design. In addition to managing the workload of a course, peers are also a potential source of educational scaffolding. Educational scaffolding is the support required for students to engage in authentic, complex tasks through demonstration, feedback, and other necessary resources to allow for successful completion.²⁻⁴

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The use of expert peer-facilitated learning is not new, especially in health professional education.⁵ Residents have commonly played a role in teaching students on clinical practice experiences or leading small-group discussions in a classroom setting. Peer-to-peer teaching is also not new, especially the use of discussion as a specific peer-to-peer active-learning strategy.⁶ Ideally, with peer-to-peer teaching, peers learn from their experiences while simultaneously contributing to the learning of others.⁷ This means that the entire instructional team is prepared to play the role of leader and teacher in an environment where there are multiple opportunities to use this strategy throughout the course. Those educational researchers and theorists who are proponents of peer-to-peer teaching, emphasize the importance of having a good strategy design to achieve the desired learning outcomes.^{8,9}

This manuscript describes how peer-led team learning and learning technologies were used in an online course to achieve complex learning goals among a diverse group of student learners, while maintaining a manageable instructor workload. The learning objectives of this course were for students to combine and apply course content knowledge with evidence-based persuasive argumentation skills through completion of a capstone grant proposal project, critically assess the evidence-based argumentations skills of others through peer review of classmates' grant proposal projects, and to actively reflect

on attitudes regarding their personal rights and responsibilities to be engaged in healthcare debates.

DESIGN

Students studied controversial issues surrounding medications and the US healthcare system and then developed written statements to communicate ideas, persuade others, and defend their viewpoints related to the content. These activities were accomplished through 3 primary assessments: weekly small-group discussions in online forums, 3 reflective assignments, and a final capstone grant proposal project requiring critical reviews of peers' projects as a factor in their own final project grades. Students examined the critical role of medications and the structure that shapes and influences medication use and regulation in the US healthcare system. Students also drew comparisons between medication-use systems around the world and considered other controversies related to access to and choice and quality of health care. Through readings and assessments, students explored not only the impact that human choices, ethics, and behaviors have on the societal decisions surrounding the availability of medications in the United States, but also their rights and responsibilities to be a part of national and worldwide healthcare and medication debates.

The course was discussion-based, completely online, delivered in a learning management system (Moodle, Moodle Pty Ltd, Perth, Australia), and offered to upper-class undergraduate and graduate students at the University of Minnesota College of Pharmacy. There was an average enrollment of 50 students in each of the 2 course offerings.

At the start of the semester, students were assigned to small groups of 5 to 7 students who participated in online discussions and debates on a weekly basis within their small groups for the duration of the semester. Use of a course wiki allowed students to collaboratively write summaries of their respective groups' discussions each week and share these summaries with the entire class, providing students access to overviews of other groups' discussions and arguments.

Using skills developed through these discussions, students completed their final capstone assessment: a mock grant proposal. Students were provided assignment instructions, a template for proposal projects, and sample grant proposal projects. Instructions were available online (<https://sites.google.com/site/4200template/home>). Students' final projects were graded by panels of 3 or more of their peers, and then their scores were averaged to determine the student's final score. To prepare for critical peer review, students were provided fictional examples of project reviews created by the instructional team to

illustrate acceptable and unacceptable peer review submissions. To guide their scoring and to outline the specific elements expected of reviewers for critical feedback, students were also given detailed instructions and a rubric based on standard formatting requirements and expectations of grant proposals (<https://netfiles.umn.edu/users/alimmer/EvaluationForm.pdf>)

Each week, students discussed and debated a medication controversy topic. Students were provided with background information concerning the week's topic in the form of brief online lectures and selected readings. They were prompted with a discussion topic related to the learning materials. Three times each week, students were required to post a minimum of 100 words that contributed something new to the discussion. These posts were to be made no later than midnight on Monday, Wednesday, and Friday. Students were also required to cite at least 1 non-assigned source to support their stance on the issues discussed. At the beginning of the semester, students were required to review an online lecture on how to critically evaluate sources, as well as handouts on the best practices of group facilitator training to aid them in leading weekly discussions. The handouts guided students regarding ways to facilitate an engaging and civil discussion and methods to prompt group members to support claims, expand on a position, or respond to another group member's opposing view. While the instructor was present in the discussions every week throughout the semester, the student who was assigned to act as the designated discussion leader within each group each week was charged with the responsibility of managing the discussion. All group members were responsible for collaboratively writing their group's summary discussion, but at the end of each week, the student leader was also responsible for finalizing the group's weekly summary and reporting group members' participation for the week (ie, satisfied posting and citation guidelines). As a reward for their facilitation efforts, group leaders were not required to find an outside source for the week and were given an extra credit point.

Although students were provided with instructions on facilitator training and evaluating the quality of literature, the role of facilitator was a new experience for many students. To address the potential for the overwhelming nature of this experience for some students (especially undergraduate class members), the instructor played the role of discussion leader in all small groups for the first 2 weeks of the course, modeling the role each student would play as leader at least once that semester. The instructor demonstrated which cited sources required further justification, provided examples of how to prompt and/or challenge group members in a respectful way, and also how to lead the creation of a group summary. The

instructor's initial role as the discussion leader of each group also helped set the tone for collegial debate among students regarding topics that had the potential to be contentious.

Each week's discussion topics were built upon the previous weeks' topics, progressively growing in complexity and challenging students to consider how the decisions they made regarding the topics discussed would impact them, their families and communities, their state and country, and the world. As the semester continued, students further developed skills in evidence-based arguments, while also gaining additional knowledge concerning the role of medications within the US healthcare system by participating in 2 different role-play discussions.¹⁰ For the role play, students were assigned a "side" of a controversial discussion topic for the week. They were charged with convincing their group's leader to vote in favor of their position on a fictionalized piece of legislation related to the week's topic. As a result, students were challenged to explore and articulate arguments in favor of a side they may not have otherwise chosen and reflect on their own decision-making process and the ramifications of legislation impacting the discussion topics.

Students were also required to complete 3 reflection papers throughout the semester. Along with the personal learning benefit that reflection exercises can have, the intention of this educational strategy specific to this course was to provide an opportunity for each student to examine the issues they felt most strongly about and begin identifying issues for further exploration within the final grant proposal project. Prompts for the reflection paper are presented in Table 1. Moodle was used for small-group discussions and to provide students with background information (ie, online lectures and selected readings) for each week's topic. Students were permitted to see and interact within only their assigned small group. The course team posted a new discussion forum each week with a question posed to guide discussion. Within the discussion space, students were required to provide either direct links to online resources or to attach PDF

versions of the sources used to support claims made within the discussion space.

At the conclusion of each week's discussion, each group was required to collectively create a summary, led and finalized by the week's discussion leader, in a wiki site (PB Works, San Mateo, CA). The course team created a folder for each group that included a page for each week's topic, and within each page, an outline of the expectations for the structure of the summary (ie, statement of the issue, position(s), actions proposed, concluding statements, and resources cited during the discussion), as well as the length expectations for the summary (400-600 words), to ensure a reasonably detailed summary rather than a list of bullet-point phrases or a copy of all posts. The course instructor read and graded the summaries each week, awarding points on an all-or-nothing basis. Groups whose submissions were deemed insufficient were required to rewrite the summaries. Although all members of each group received the same summary score, individual members of a group who were judged to be inadequately prepared for the week's discussion were assigned penalties. The group's leader was responsible for itemizing individual posts for quantity, timeliness, and quality (ie, an appropriate number of words and at least 1 reputable outside source cited to support the arguments being made).

Students were required to create their final mock grant proposals using the Web site-building tool Google Sites (Google, Inc, Mountain View, CA). This tool allowed for anonymous exchange for peer-review, enabled instructors to use site histories to monitor progress, and allowed reviewers to confirm that project deadlines had been met. Because Google Sites is cloud-based, a URL for each site facilitated distribution and access to projects. As an adjunct to the user-friendly nature of Google Sites and the standard tutorials, a tutorial was created specifically for students in this course. Unlike a grant proposal typically created in a word-processing document, this online project allowed students to hyperlink their resources for immediate verification and scrutiny by the reviewer and

Table 1. Instructor Prompts for the Reflection Paper

Paper	Prompts
1	We have completed the first section of this course. Think about the topics we have discussed and the information that we have shared with each other. Examine your personal reactions regarding this journey so far. What has surprised you? How have your ideas been challenged or reaffirmed?
2	We have completed the second section of the course and are heading into the last section and your grant proposal finalization. Examine your reactions to discussing these topics with learners within different programs and levels of academic experience. How will this experience influence your grant proposal development?
3	As you reflect back on this journey, how have you or haven't you been changed? How will you use this experience in your future as a student and member of society?

also enabled the integration of rich, multimedia components, such as videos, images, or widgets to enhance the persuasiveness of their proposals. While not a formal part of this project, using these strategies within Google Sites was an opportunity for students to improve their digital writing skills. The evaluation of this strategy for developing competency in digital writing was evaluated in a previous publication.¹¹

The ultimate function of the Google Site document was to allow for anonymous peer-review. Review panels with a minimum of 3 reviewers per project were created, and students were provided with 3 live links to projects for review. All projects were assigned a project number and were deidentified for student confidentiality. Each student completed the peer-review rubric and provided specific comments to justify the score given to each of the sections in the proposal. The final project score was an average of all reviewers' scores. Students dissatisfied with their project scores were permitted to resubmit their projects to the instructor for regrading, provided they included an explanation of how they addressed reviewers' feedback.

EVALUATION AND ASSESSMENT

To address the workload question, the instructor noted time spent on grading and overall workload burden and compared that to course enrollment. Grade distributions were used as an objective indicator of whether learning objectives were met. Open-ended survey questions were used to determine student perceptions of peer-led team learning and the success, effectiveness, and feasibility of using learning technologies.

A survey instrument was developed using previously described guidelines.^{12,13} Following the initial survey development, a healthcare professional student took the survey using the think aloud approach, wherein an investigator sat with a student as she completed the survey, simultaneously describing what she thought the survey instrument was asking her, what she was thinking as she responded, and any difficulties she was having completing the survey. Based on these comments, the survey instrument was revised. The survey instrument was then pilot tested with 5 students not involved in the study, resulting in minor modifications of the survey instrument. The survey instrument contained 7 ranked questions and 6 open-ended questions. At the end of the semester, the consent form and survey instrument were delivered by means of an e-mail invitation with a live link to the survey instrument (SurveyMonkey, Palo Alto, CA). Students were assured that responses were anonymous. One reminder notification to complete the survey instrument was sent 1 week following the original invitation.

Content analysis of the open-ended survey responses used the Classic Analysis Strategy, a constant comparison-like approach to reveal what participants said within their groups.^{14,15} Within themes, student comments were independently reviewed by the 2 investigators, using the Classic Analysis Strategy and compared for internal consistency.

The instructor logged grading and other work time associated with developing and delivering the course. These data were compared with student enrollment data as well as grading workload prior to the implementation of the peer-led team learning strategy.

This study was deemed exempt from review by the university's institutional review board on December 10, 2008. In the combined 2 offerings evaluated (spring 2010 and fall 2010), 101 students participated in the course. Enrolled students were primarily science majors (approximately 50%) and a little less than half were seniors. These offerings also had a small percentage of graduate students (7%) and health professional students (11%, including pharmacy and nursing students). Most students stated in their entrance survey that they did not feel confident about the content area and were motivated to learn more, as they recognized its relevance to their careers and life.

Fifty students responded to the course evaluation for the combined course offerings evaluated, for an overall response rate of 51%. Grade distributions for the 2 semesters evaluated for this project provided an objective measure of student learning and achievement of expected knowledge and skills (Table 2). Based on grade distributions, most students completed this course successfully, with the majority earning an A. In the capstone experience, students practiced applying both the course content knowledge, evidence-based argumentation, and critical review skills each week, and were able to extend those skills to the grant-proposal assignment. In the reflection assignments, students also experienced a shift in their sense of personal responsibility to engage in these topics, which was another important learning objective of this course. Most students stated in their first reflection that healthcare issues impact everyone but that they felt under-equipped to personally engage in a discussion of these issues and believed they should defer to elected officials to grapple with the problems. By the third reflection, most students felt, to their own surprise, that they had an obligation to be involved in these debates and felt capable of doing so.

Based on student open-ended comments provided in the course evaluation, assuming the role of discussion leader was a positive experience, as was the weekly exposure to peers' ideas. For both the spring and fall 2010 offerings, 100% of students said they would recommend

Table 2. Grade Distributions for Spring and Fall 2010 Offerings of the Peer-Led Team-Learning Course

Grade	Spring 2010	Fall 2010
A	43	44
B	2	6
C	2	2
D	0	0
F	0	1
I	0	1

the course to others. This is the same result as for the course evaluations from the spring and fall 2009 offerings. Of the students responding to the question regarding how assuming the role of group leader and preparing the weekly summary influenced their learning, an overwhelming 96% indicated that being a peer leader was a valuable aspect of their learning experience, with many specifically mentioning how it challenged them to engage with the content more extensively and actively. The 2 students who did not respond positively indicated that being a peer leader had no impact on their actions that week or their learning.

Comparing instructor workload estimates of offerings prior to the implementation of the peer-led team-learning strategy, average time facilitating weekly discussions decreased, but not markedly. The most significant change in instructor workload was in grading the mock grant proposals. Using a peer-review process allowed for a realistic-application capstone event. Prior to the student grading strategy, a course with an enrollment of this size required an unsustainable amount of instructor time (Table 3).

The use of a student peer-review process required a significant investment in upfront development. Creating the peer-review rubric was time-consuming, but subsequent offerings have required only minor revisions. The most significant time commitment was in the creation of the peer-review groups. In this course, a course coordinator, who grouped students into semi-cohesive peer-review teams and collated completed review forms was part of the instructional team. The coordinator also monitored the peer-review forms for completeness and thoroughness, forwarding problematic submissions (eg, those that

included inappropriate comments or tone or were incomplete or too brief) to the instructor and, once reviewed by the instructional team, electronically returned peer-review feedback to students. Although time-consuming, a noninstructor can successfully complete the assessment steps involved in the final project. The instructor also graded resubmitted projects; however, despite students being given the option to revise and resubmit grant proposals with their 1 page response to reviewers' comments, only 2 students from the combined course offerings resubmitted for grading by the instructor, resulting in minimal investment of time and effort by the instructor for grading final proposals. Grade distributions for semesters prior to implementing the peer-review strategy and those of the capstone project were similar when an average of 3 peers reviewers' scores was used as the project score.

DISCUSSION

The potential benefits of peer-to-peer teaching are documented in the educational literature as active-learning approaches. Educational researchers and theorists who are proponents of peer-to-peer teaching, emphasize the importance of good design of the strategy to achieve the desired learning outcomes.^{8,9}

Many educational models use a collaborative approach to teaching; peer-led team learning is just 1 example. All of the models that are based on a similar framework, however, emphasize important principles: students must actively participate in the group setting, prepare for that interaction by completing preliminary work, and be held accountable individually.¹ In classroom settings, students may be required to complete a quiz to demonstrate their readiness to engage in the learning session. In this example, individual students were held accountable for their group participation by several aspects of the project: transparency of student posts within a discussion board, detailed criteria outlining expectations, a minimum of 3 posts spread across the week, a linked source, and meaningful contributions to discussion, all of which were reported by the group leader in a public wiki document. This strategy involved a projected public assessment of individuals' performance in group discussions in addition to assessment by the instructor. Students quickly realized that being unprepared for discussions was obvious not only to the instructor but, because the wiki was public, to an audience of peers as well. Because individual accountability is essential for successful group work, there were also grade consequences for students who were not prepared for the week's discussion.^{1,11}

The complexity of the learning context—medication use in the US healthcare system—and the diversity of learners in the course, required multiple sources of

Table 3. Instructor Workload Distribution by Semester

Instructor Responsibility	Spring 2009	Fall 2009	Spring 2010	Fall 2010
Weekly discussions (hrs/wk)	16.5	15	11.5	10
Grant proposals (hrs/semester)	40	40	5	7.5

educational scaffolding. In this example, scaffolding was made available in many forms, in recognition of the many types of educational support and the likelihood that diverse learners would require different kinds and levels of support.¹⁶ Educational scaffolding included online lectures, readings, and videos, as well as course tutorials and modeling by the instructor and peers. In subsequent offerings, actual examples of peer reviews and final projects from prior students (with explicit approval of those students) have been posted on the course site, expanding the use of student work as a source of scaffolding.

The use of learning technologies enabled this strategy to be implemented in a manageable way. Asynchronous student discussions in Moodle throughout each week provided both the necessary learner flexibility and a peer-led team-learning opportunity. Because students were required to provide direct links to online resources or attach PDF versions of the sources used to support claims made within the discussion space, group members were able to immediately verify evidence used, resulting in better-reasoned discussions. Students were not able to make sweeping claims without providing credible evidence, as hyperlinking provided group members with the opportunity to not only be critical reviewers of the arguments being made but also of the evidence being used to support those arguments. Students were similarly asked to use this critical eye while identifying resources and developing their own arguments for their grant proposal projects and while reviewing their peers' projects.

The use of a wiki for weekly discussions added another layer of peer-lead team learning while also exposing learners to the thoughts and ideas of other groups. Aspects of this peer assessment are transparent, with detailed criteria, and a rotating position. Each student served in the group leader role at some point during the course. Because individual accountability is an essential component of cooperative educational approaches; issues of power and control within the learning group were addressed as thoroughly as possible to avoid unsatisfactory outcome. The purpose of the weekly summary was to frame the discussion by requiring students to revisit the entire exchange and organize it, mapping out the primary arguments that arose and evolved throughout the week. Although groups were not required to come to a consensus, most did, and leaders were encouraged to help their respective groups explore areas of agreement and build on compromised solutions. This activity was designed to prepare students to think through options for the grant proposal. In addition to being held accountable for the arguments they made, students were required to cite an additional source for each topic, resulting in an expanded list of resources that could be reviewed and used by students in their final

projects. While students could see only their personal small-group discussion in the Moodle course site, they were able to review each other's summaries in the wiki, which expanded student exposure to other group dynamics and positions and additional literature sources.

The major learning technology component, however, was the use of Google Sites. The use of this Web-based collaborative tool allowed for ongoing monitoring of student progress with the project, as well as a mechanism for timely peer-review. Without this strategy, student projects would have needed to be exchanged in person or through some other electronic mechanism (eg, e-mail, Dropbox), which would have posed logistical and timeline challenges and may have compromised student anonymity. Instead, student confidentiality was maintained by assigning a project number and allowing for immediate exchange of proposals through URLs.

Each week, students were asked to debate difficult topics and collectively explore potential solutions. The concept of constructive controversy was used within the peer-led team learning design. According to previous research, "being confronted with an opposing point of view promotes uncertainty about the correctness of one's views, an active search for more information, a reconceptualization of one's knowledge and conclusions, and, consequently, greater mastery and retention of the material being studied and a more reasoned judgment on the issue being considered."¹⁷ The purpose of this strategy was to place students in the role of the engaged citizen and to require them to acknowledge that there may be good arguments for opposing viewpoints. It was not considered sufficient to simply understand the issue and concede that some improvement was needed. Students were asked to be a part of the potential solution by considering, proposing, and debating options to best address the issues discussed. As highlighted in the prompts for the reflection paper, students were challenged to consider themselves a part of the solution rather than a complacent observer and to purposefully reflect on the influence of their peers on their personal progression through the course. The reflections created a framework for students, wherein they came to understand that with increased understanding of the healthcare system and new skills of evidence-based argumentation, they have a responsibility to be a part of the wider societal debate and that it is important to look beyond a familiar cohort for ideas and input. Four conditions for transformation have been previously proposed: the presence of the "other," reflective discourse, a mentoring community, and opportunities for committed action.¹⁷ In this course, exposure to different student perspectives and life experiences, guided reflections, ongoing individual feedback by the instructor, and weekly and final

project requirements to design solutions achieved a transformative learning experience for most students. Students stated in their final reflection papers that they had changed as a result of the course and could no longer hear news reports or talk with family and friends about these issues in the same way as they had previously. The use of peer-led team learning and learning technologies allowed for the creation of a learning environment with these components while maintaining a manageable instructor workload.

SUMMARY

Implementing peer-led team learning is an effective strategy for an all-online course on the US healthcare system offered to a wide variety of student learners. The course achieved its educational goals to empower learners (health professional students, graduate students, and upper-division undergraduate students) to engage in the health-care debate.

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