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Work in Progress: Barriers Instructors Encounter when Using Active Learning in an Online Classroom Setting

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Introduction

This work-in-progress paper seeks to identify the barriers instructors face when using active learning in first- and second-year STEM courses in online-settings at post-secondary institutions. Here, we focus on fully online courses, taught in both asynchronous and synchronous settings, that have no in-person component. For our purposes, we define active learning broadly, as any time the instructor goes beyond simply lecturing with the students taking notes. Active learning leads to improved student learning, more engaged students, and increased interest in STEM (e.g., [1]-[5]). Additionally, active learning increases the quality, number, and diversity of STEM graduates [5]. Despite these positive findings, adoption of active learning in classrooms has been slow [4], and researchers have sought to understand what stands in the way of STEM instructors adopting active learning in their classrooms.

Researchers have identified many barriers to instructors' implementation of active learning in face-to-face settings, such as concerns about: 1) the efficacy of active learning; 2) the amount of time to prepare and implement active learning activities; 3) the amount of class time activities take, and their ability to cover the course syllabus; and 4) student resistance [6]-[8].

Previous work from Finelli explored factors and barriers influencing instructors' decision to implement active learning into their classrooms [6] and identified seven themes: infrastructure/culture, knowledge and skills in effective teaching practices, student experience, time, classroom/curriculum, instructor's disposition, and networking/community. Infrastructure and culture refer to what is emphasized by an instructor's institution, including evaluations, research emphasis, and institution policies. Knowledge of effective teaching practices speaks to the instructor's access to material about effective teaching practices or support offered in order to use these best practices. Student experience can refer to how students react to active learning, how responsive or attentive the students are, or the rapport built between the instructors and students. Time denotes the amount of time it would take an instructor to learn about best practices as well as the amount of time required to restructure and plan for a course. Classroom and curriculum refer to the physical classroom layout as well as how big the class is or how much control an instructor has over controlling the course content. Instructor's disposition refers to how interested in and how confident and comfortable they are in teaching through active learning. Finally, the networking and community category includes whether or not an instructor is able to collaborate with or observe their colleagues regarding teaching practices.

The barriers instructors face in implementing active learning in online STEM classrooms has received little attention and it is unclear whether similar barriers exist to in-person instruction. Active learning in an online setting is also broadly defined with, again with a focus on instructors going beyond simply lecturing to their students. Some possible examples of online active learning include: 1) sending students to breakout rooms where students have one (or more) problems to work through, 2) using a shared document where students work together to fill it in, and 3) an in-class poll [9]. With the COVID-19 pandemic driving many classrooms online format, we have been given an opportunity to study barriers instructors face in implement active learning in online classes.

Research Questions

This research study seeks to answer the following questions:

1. What are the barriers STEM instructors face when adopting active learning in online instruction?
2. How do the barriers differ from those for adopting active learning in in-person instruction?
3. How substantial is student resistance to active learning as a barrier to adopting active learning in online instruction?

Participants

We identified participants from an existing pool of participants for a larger project focused on how an instructional development workshop impacts instructors' adoption of active learning in face-to-face instruction [10]. The pool of participants included instructors teaching a first- or second-year STEM course with an active learning component teaching at schools in relatively close proximity to the University of Michigan. Participants represented 56 different institutions, which we categorized by type (i.e., doctoral granting, masters granting, bachelors granting, and associates granting colleges). We chose this categorization to allow us to illuminate different barriers across institution type once a thorough analysis is complete. For the four institution types, we randomly invited one instructor from each of ten randomly selected institutions to participate in an online focus group. Thirty-two of the 40 invited participants participated. Table 1 lists the number of instructors in each institutional category.

Institution Category	Number of Participants
Associates	7
Bachelor's Granting	8
Master's Granting	7
Doctoral Granting	10

Table 1: Number of recruited participants for the four categories of institution type

Some participants had extensive online teaching experience while others had recently started using online instruction because of the COVID-19 pandemic. For some instructors active learning was an everyday component of their courses, others had included active learning less frequently. Activities ranged from lasting one to two minutes, such as when an instructor initiated a student pol, most of a class period, such as in solving problems in groups. Given the vast differences between courses, we did not focus on defining active learning used in the classrooms, but instead focused on the barriers instructors faced in implementing this active learning.

Focus Group Design

To better understand the barriers instructors' face when adopting active learning in online instruction, we conducted two focus groups each for the four institutional categories, for a total of eight 1-hour focus groups. We used a semi-structured protocol during each focus group to ensure consistency across all sessions. The script consisted of the following sections: informed consent for participation and recording, focus group guidelines, introductions, and prompts related to our research questions.

During the introductions, we provided participants with our definition of active learning and then we asked how long they had using active learning in their in-person teaching, as well as how long they had taught using online instruction. Then, we shared examples of some common barriers (i.e., the physical classroom layout, an instructor's lack of self-confidence in using active learning, and fear of student resistance) to using active learning in face-to-face settings and asked about barriers instructors expected to encounter when deciding to use active learning in online instruction. We chose to define what barriers might look like in face-to-face to ensure instructors would know what we meant by barriers.

Although this research was conducted in the midst of the COVID-19 pandemic, instructors were asked to focus on barriers to using active learning that would be present in online classes, regardless of the pandemic. We specifically asked about online courses, instructors shared about asynchronous or synchronous online courses.

During the focus groups, participants discussed barriers to active learning and what they felt was the biggest barrier for them to overcome. The first prompt ("What barriers do you think you might encounter ….") took the bulk of the focus group time, and in many instances, participants expanded upon others' comments before sharing a new barrier. Two or three researchers noted each barrier during the focus group as it was shared by an instructor. The facilitator asked follow-up questions and synthesized and restated participants responses.

If unaddressed by this first prompt, we gave instructors a brief description of student resistance ("One of the most common barriers that instructors cite to using active learning in face-to-face teaching is fear of student resistance - not only students being openly confrontational, but also being distracted, disengaged, giving the instructor low end-of-term ratings, or just not participating") and then asked if instructors also thought this was an issue for online learning. After participants had discussed the barriers, we synthesized the full list of barriers they had listed (based on the researcher's notes) and asked each participant to identify, in their opinion, the largest barrier.

Preliminary Results and Analysis

As this is a work-in-progress paper, full analysis of the transcripts is not yet complete. However, we have conducted a frequency analysis on notes we took during the focus groups to identify the extent to which the barriers instructors cited to adopting active learning in online instruction aligned with a framework [6] for barriers instructors identify to adopting active learning in face-to-face instruction.

In our focus groups, instructors most often cited the *amount of time and effort* it took to create online content as the most substantial barrier they faced, especially when participants reflected on creating asynchronous online active learning content. This is similar to what has been found in the literature for barriers found when trying to implement active learning in face-to-face classes, as time and effort to create activities is one of the most commonly cited barriers [e.g., 11, 12, 13, 14].

Face-to-Face Barriers (adapted from [6])	Online Examples
Infrastructure and Culture (policies, evaluations, tenure, etc.)	• Software licensing issues • Certain platforms are required at their institutions (e.g., Canvas, Blackboard)
Knowledge and Skills (access to information, support)	• Little to no training in how to teach online • No support in learning technology
Student Experience (student reactions, rapport, learning outcomes)	• Difficult to build online class rapport (build trust and form relationships) • Students are intimidated by online format and will not unmute or turn on videos • Willingness to participate disappears online
Time (time to learn, time to adapt curriculum)	• Time to learn new technology • Time to create video content or active learning modules
Classroom and Curriculum (class size, curriculum flexibility)	• Facilitating many breakout groups
Personal Disposition (confidence in teaching, passion for teaching)	• Not yet found
Networking and Community (collegial discussions)	• Not yet found

Table 2: Preliminary comparison of barriers to using active learning in face-to-face and online instruction [6]

Instructors cited the difficulty they would experience in *building classroom rapport* or in being able to engage their students in the online course content second-most frequently. Instructors reported that students commonly did not have their videos on, and this resulted in little to no student feedback. This made it difficult for instructors to assess student engagement and to feel connected to their students.

Finally, instructors often cited difficulty navigating the technology required for online teaching. This barrier related to hardware (e.g., students using phones to login to class), software (e.g., licensing), or internet connectivity issues for both instructors and students.

Our preliminary analysis of our research notes suggests that many of the barriers cited in online instruction align with the categories of our Finelli and coauthors' framework [Author], while others have distinct online components. This framework from face-to-face instruction is outlined in Table 2 and examples of barriers to using active learning in online teaching identified in our focus groups. Focus group participants cited barriers for using active learning in online teaching from five of the seven categories (infrastructure and culture, knowledge and skills, student experience, time, and classroom and curriculum) for the framework for face-to-face instruction. No examples of personal disposition or networking and community are evident in our notes, but may emerge in our full analysis.

Furthermore, we identified an additional category of barriers, centered around technology, for online instruction that did not align with a comparable theme in Table 2. Many instructors cited

both software and hardware problems as a barrier to using active learning in their online classes. Additionally, current technologies do not always allow teachers to easily sense or "read the room" to assess whether their students are understanding the learning activities. Instructors described difficulty assessing whether students engaged in the active learning because the technology they used did not track student progress.

Future Work

A more detailed analysis of this data, including full transcription and coding using an inductive and deductive approach [15], is currently underway. In addition to learning more about the barriers in general, we will analyze what, if any, differences exist for instructors from different types of institutions. We also plan to determine how the instructors may experience different barriers based on online teaching experience and experience using active learning. Preliminarily, we noticed a difference between 'experts' and 'novices' in the type of barriers highlighted. This is likely related to the abruptness of the transition to online instruction for many instructors caused, particularly for those with less experienced with online teaching and identified barriers such as learning new technologies to use active learning in their online classes.

Participating instructors also discussed various strategies to overcome these barriers during the focus group setting. Our research team is currently working to also identify these strategies and their effectiveness in overcoming barriers to using active learning in online teaching.

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