Applying Research on Reducing Student Resistance to Active Learning Through Faculty Development: Project Update

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Abstract

This paper provides an update on our research study about active learning in higher education science, technology, engineering, and mathematics (STEM) classrooms. We designed an instructional development workshop to motivate STEM instructors to use active learning and to adopt evidence-based strategies to reduce student resistance to active learning. Our study is a randomized control trial (RCT) to investigate the impact of this workshop intervention on STEM instructors' attitudes and behavior. To measure this, we plan to survey both instructors and their students, before and after the workshop. To prepare for our RCT, we developed survey instruments, assessed pilot offerings of our workshop, and investigated student resistance to active learning in classes of workshop participants.

As a result of the COVID-19 pandemic, we delayed our RCT study and temporarily shifted our research to encompass active learning in online STEM classes. Our interim investigations begin to fill a research gap related to active learning in online classes. They comprise three research foci: (1) student resistance to online active learning, (2) barriers instructors experience in implementing online active learning, and (3) strategies instructors use to promote student engagement during online active learning. Here, we summarize our research progress, describe our ongoing research, and share our next steps.

Introduction

Active learning occurs when students are actively engaged in the learning process; students learn in a manner other than listening to a lecture and taking notes [1]. Active learning benefits student learning and retention (e.g., [2], [3]). Yet, instructors have been slow to adopt active learning in science, technology, engineering, and mathematics (STEM) classrooms [4], [5]; identifying multiple *barriers* to its use (e.g., [6], [7]). These barriers include student resistance to active learning [7].

To reduce student resistance in in-person classes, instructors can use *strategies*, which are broadly categorized as *planning*, *explanation*, and *facilitation* strategies [8]-[10]. *Planning strategies* are those that an instructor completes when preparing or assessing an activity, such as using student feedback while developing an activity. Instructors use *explanation strategies* to share the activity's goals, purpose, and direction with students. *Facilitation strategies* help keep students engaged and the activity progressing smoothly, such as walking around the classroom to answer students' questions [8]-[10].

As part of an ongoing National Science Foundation research project, we intend to conduct a randomized control trial (RCT) studying the impact of a workshop intervention on instructors' use of active learning and adoption of strategies to reduce student resistance in in-person STEM classes [11]. Originally scheduled to begin in the spring of 2020, we postponed our RCT due to the COVID-19 pandemic. It is now scheduled to begin in the fall of 2021.

In March of 2020, higher education instructors rapidly transitioned courses from in-person to online instruction, due to the COVID-19 pandemic. Many instructors taught online courses for the first time [12]. In the semesters following this transition, classes have primarily remained online. Shifting from in-person to online instruction requires instructors and students to learn to navigate the online environment [12], [13]. Because active learning engages students in the learning process (independent of the course modality), it may play a critical role in online courses [13] - [15]. Fortunately, many methods of active learning or *active student engagement* may be adapted to online instruction [14, p. 4]. For example, think-pair-share and small group problem solving actively engage students in learning and may be used in online classes [14].

In light of the rapid transition to online instruction, we temporarily shifted our research to engage with the change in course modality brought about by the pandemic. In the interim, we are exploring instructors' use of active learning and student resistance to active learning *in online classes*. The barriers instructors experience in using active learning in online courses and the strategies they use to reduce student resistance (or increase engagement) may differ from in-person instruction. Therefore, our research shift aims to examine instructors' approaches to reducing student resistance and promoting engagement during active learning in online classes.

In this paper, we provide an update on our ongoing National Science Foundation research project. We include three sections. The first is our research progress prior to the onset of the COVID-19 pandemic, before delaying our RCT. Secondly, we describe the three foci comprising our research shift to active learning in STEM online instruction: (1) student resistance to online active learning, (2) barriers instructors experience in implementing online active learning, and (3) strategies instructors use to promote student engagement during online active learning. Third, we describe the next steps of our project, the delayed RCT. Figure 1 provides a timeline of our research study.

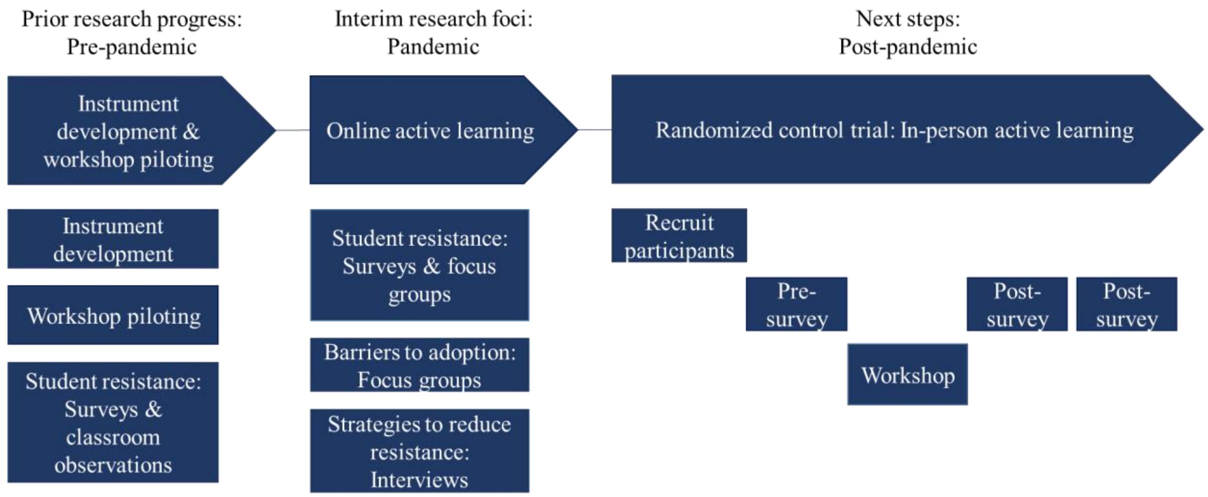

Figure 1. Research study timeline.

Prior Research Progress

We designed an RCT to investigate the impact of an instructional development workshop on instructors' adoption of active learning in first- and second-year STEM courses. The workshop is designed to promote active learning and strategies to reduce student resistance to active learning [16].

We developed student and instructor surveys to assess the workshops' impact. The student survey focuses on instructors' use of active learning, instructors' use of the associated strategies to reduce student resistance, and students' responses to active learning [17]. The instructor survey measures instructors' intentions and motivation (value and self-efficacy) for using active learning as well as strategies to reduce student resistance to active learning [18].

We assessed three pilot offerings of the workshop by measuring instructors' attitudes toward active learning before and after attending the workshop [16]. We found instructors' intentions and motivation to use active learning and the strategies to reduce student resistance to active learning increased after attending the workshop. Furthermore, participants valued aspects of the workshop design aligned with a theoretically-based instructional development framework [20] on which the workshop was built [16].

Additionally, we studied student resistance to active learning in first- and second-year STEM classes of instructors who attended one of the pilot offerings of the workshop [17]. In a single class period, we surveyed the instructor and their students. The instructor survey (in part) asked about instructor's perceptions of their students' responses to active learning, while the student survey asked students about their responses to active learning in that same class period. To provide triangulated data, we conducted a classroom observation during the same session. Students reported participating in the activities as well as valuing and enjoying them. We found instructors' perceived greater student resistance to active learning than observed during classroom observations or from students' self-reports [17].

Interim Research Foci

Interim Research Focus 1: Student Resistance to Active Learning in Online Classes

Research studies on student resistance to active learning have primarily focused on in-person classes ([e.g., 21]). For example, DeMonbrun and coauthors [21] developed the Student Response to Instructional Practice (StRIP) instrument for measuring student responses to active learning. The StRIP framework relates instructional type (interactive, constructive, active, passive [22]), instructor strategies (explanation, facilitation), and student resistance (value, positivity, participation, distraction, and evaluation) [21]. The StRIP framework has not yet been investigated in online classes.

Our first interim research focus involves developing a better understanding of instructors' conceptions of active learning and student resistance to active learning in synchronous and asynchronous online classes. We aim to investigate how students' responses to active learning in online classes relate to the StRIP framework [21]. Specifically, we ask three research questions:

RQ1. When instructors brainstorm potential negative student responses to synchronous and asynchronous online activities, what is the distribution of those activities according to the StRIP framework categories?
RQ2. Are there forms of negative student responses that are not currently captured by the StRIP framework unique to online classes (synchronous and asynchronous)?
RQ3. Is the distribution of negative student responses (according to the StRIP framework) different for synchronous and asynchronous online classrooms?

To address these questions, we recruited participants who intended to use active learning in teaching a first- or second-year STEM course. We collected data using a mixed-method sequential research design using the nominal group technique [22]. Participants (*n* = 25) completed an initial asynchronous brainstorm survey where they generated potential examples of student resistance in both synchronous and asynchronous online classrooms. We then invited participants to a virtual focus group to clarify the examples and generate new ones. Finally, we sent participants a follow-up survey after the focus groups on which they indicated the extent to which they believed each example behavior represented student resistance to active learning.

Our preliminary insights suggest that instructors focus on constructive and interactive types of learning activities [23] when identifying active learning in both synchronous and asynchronous online classrooms. We also find that instructors perceive student resistance to active learning similar to that identified in previous research (e.g., [24]), but they express concerns unique to the online classroom environment. For instance, participants identified concerns about students feeling uncomfortable communicating through video or audio, perceiving a lack of community in asynchronous activities, and experiencing screen fatigue.

Interim Research Focus 2: Instructor Barriers to Adopting Active Learning in Online Classes

Instructors experience barriers in adopting active learning for in-person instruction (e.g., [6], [7]). These barriers have been succinctly summarized as *student resistance*, *low levels of instructor disposition*, *lack of time to restructure courses*, *expectation of syllabus coverage*, *large class size/room inadequate*, *teaching-centered tradition, and a lack of incentives/rewards* [25, p. 970]. A corresponding summary has yet to be established for online instruction.

Therefore, we explore the following research questions:
RQ1: What barriers do instructors expect to experience when adopting active learning in online instruction?
RQ2: How do the barriers instructors expect to experience when adopting active learning in online instruction differ from those for in-person instruction?

We recruited instructors who used or planned to use active learning in teaching a STEM course for first- and/or second-year students [26]. We conducted eight one-hour focus groups with them. Each focus group had three to seven instructors teaching at similar types of institutions, categorized by the highest level of degree granted (Associates, Bachelors, Master’s, and Doctoral). Focus groups took place during the summer of 2020, following the March transition to online instruction [26].

In the focus groups, we asked instructors to share barriers they expected to experience in a future semester when they would be using active learning in their online classes [26], recognizing that the barriers may differ from those they experienced when they unexpectedly transitioned mid-semester to online instruction. We also asked instructors about the types of student resistance to active learning in online classes they expected to see in a future semester. We concluded each focus group session by reviewing all of the barriers shared by participants and asking each participant which barrier they thought was most significant [26].

We are in the process of transcribing and coding the focus group data, and we plan to integrate an inductive and deductive approach [27] in our analysis of the focus group transcripts [26]. Our preliminary insights suggest that, though an overlap in barriers between in-person and online courses (e.g., insufficient preparation and class time) may exist, some barriers are unique to the online modality. For instance, instructors shared concerns about a lack of verbal and non-verbal student feedback [26].

Interim Research Focus 3: Instructors' Strategies for Promoting Student Engagement

Instructors may find it is more difficult to promote student engagement during active learning in online classes than in in-person classes [28]. For this research focus, we investigate strategies instructors may use to promote student engagement during active learning in online classes and explore the way these strategies may align with strategies to reduce student resistance to active learning in in-person instruction.

We ask three research questions:

RQ1: What kind of general strategies and specific behaviors do instructors use to promote student engagement and reduce student resistance during online, synchronous active learning?

- RQ1a: How do those strategies align with the planning, explanation and facilitation framework?
- RQ1b: What student behaviors do instructors hope to promote/reduce by employing these strategies?

To address these questions, we conducted interviews with 20 instructors teaching a STEM course. Instructors taught at a range of institution types (Associates, Bachelors, Master's, and Doctoral), and the interviews lasted approximately one hour or less. During the interview, we asked participating instructors to share examples of active learning in their online classes and then to share strategies they employed to promote student engagement for each example. We concluded by asking them if they knew of other strategies, although maybe they had not used them, to promote student engagement in active learning in online classes.

We are in the process of transcribing and coding interview data. Similar to the focus groups, we will use both an inductive and deductive analysis approach. Our preliminary insights suggest that some strategies to reduce student resistance apply in both in-person and online instruction (e.g., joining student groups to answer student questions and breaking problems down into multiple steps).

Next Steps

We are continuing to analyze qualitative data from our interim research foci. We expect that our findings about student resistance to online active learning, barriers instructors experience in using online active learning, and strategies instructors use to promote student engagement in online active learning will contribute to future instructional development workshops on active learning in online classes.

Further, we are prepared to begin our RCT. In the summer of 2021, we will start recruiting STEM instructors who plan on using active learning in teaching first- and/or second-year courses. They will complete our instructor survey about their attitudes toward active learning and their classroom experiences using active learning in the early fall of 2021, before attending the instructional development workshop. We plan to survey students in their classes at the same time. Our instructional development workshop on active learning is scheduled to take place online in October or November of 2021. Instructors and students will complete another survey, after instructors attend the workshop, and instructors will again complete a follow-up survey in the spring of 2022.

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