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WIP: Faculty Adoption of Active Learning in Online Environments: An Application of the Concerns-Based Adoption Model

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Work in Progress: Faculty Adoption of Active Learning in Online Environments: An Application of the Concerns-Based Adoption Model

Abstract

In the last two years, faculty who used active learning faced many challenges in adopting their preferred techniques and materials to the online context with very limited preparation. This study explores instructor experiences and strategies to implement active learning in their online classes by applying the Concerns-Based Adoption Model (CBAM) which has helped researchers understand and monitor developmental processes for individual instructors adopting changes in educational institutions. Thirty-two STEM instructors participated in eight focus-group interviews about barriers to their implementation of active learning in an online context. Through a two-cycle coding analysis based on “Levels of Use”, a diagnostic dimension of the CBAM framework, we demonstrate that most of the instructors were struggling with the initial steps of logistical implementation and acquisition of new skills. We further determined three types of logistic issues: 1) having issues beyond instructors’ control in online environments, 2) struggling with classroom management and organization, and 3) lacking necessary technical skills. In addition, we identified instructors’ advanced skills related to implementing active learning in online classes. This research provides a deeper understanding of STEM instructors’ experiences with respect to adopting active learning in online environments. Our results imply that STEM instructors should be flexible and creative, meanwhile, institutions need to provide on-demand support that is tailored to the Level of Use instructors have mastered when it comes to pedagogical knowledge of online delivery.

Introduction

The transition of courses to online environments in higher education institutions has dramatically accelerated since 2020, and recent studies have evidenced challenges during the process of the change [1], [2]. Faculty in science, technology, engineering, and math (STEM) face issues such as little preparation related to online pedagogy and technology, lack of knowledge about how to effectively deliver online course content, the inability to conduct laboratory courses online, fear of student disengagement, and difficulties in adopting active learning techniques to the online context [2] - [4]. Here, active learning refers to individual or group activities designed to engage students in their learning during class (e.g., answering questions and group discussions) [5]; and it has been shown that, when it is implemented effectively in online settings, active learning can increase student engagement, improve learning outcomes, and create more inclusive online learning experiences, e.g. [6], [7]. Although research on the transition toward online classes has been ubiquitous, a few of published studies have applied theoretical frameworks of educational change to systematically investigate STEM instructors’ implementation of active learning online.

As a proven theoretical model for educational change, the Concerns-Based Adoption Model (CBAM) created by Hall and Hord has helped researchers understand and monitor the developmental process for individuals adopting changes in educational institutions [8]. Hall and Hord describe implementation as a process with a set of developmental and identifiable stages and levels. CBAM has three diagnostic dimensions: 1) Innovation Configuration Maps, 2) Stages of Concern, and 3) Levels of Use (LoU) [8] - [10]. CBAM has been widely applied in the field of education across different educational levels and disciplines, e.g. [11] - [13], and here we apply the framework to understand the transition to online active learning.

In this study, we applied LoU to explore STEM instructors' reactions to adopting active learning in online courses. LoU refers to an individual's behavior when they prepare to use, begin to use, and obtain new skills and experiences [10]. It has eight levels: 0_Nonuse, 1_Orientation, 2_Preparation, 3_Mechanical Use, 4a_Routine Use, 4b_Refinement, 5_Integration, and 6_Renewal (Appendix Table 1) [10]. For users having about one year experience in practicing the change, studies suggest that an individual's behaviors are mainly located at 3_Mechnical Use [9], [10]. At this level, instructors begin to change and are struggling with the initial steps related to logistical implementation and skill acquisition [10]. This work-in-progress paper aims to answer the research question: What behaviors and experiences do instructors report in the unprecedented transition that pertain to early implementations of online active learning issues and solutions?

Methods

Participants

This study is part of a research project on the intervention in instructors' adoption of active learning, and the larger project recruited instructors who taught first- or second-year STEM courses at 56 institutions in the US [14]. In the summer of 2020, we invited forty STEM instructors from ten randomly selected institutions across 4 categories (community colleges, bachelor-, master-, and doctoral-granting institutions). Thirty-two instructors agreed to participate in our study: 83% had more than 3 years of experience using active learning, and 66% had less than 1 year of experience using online instruction. We conducted 8 focus group interviews (two for each of the four school categories) about barriers instructors faced while implementing active learning in online education (Appendix Table 2). All interviews were transcribed verbatim and anonymized.

Data analysis

We coded the transcripts through two coding cycles: 1) labeling codes and refining the codebook, and 2) categorizing codes and identifying themes [15]. In the first cycle, XL and MvdB independently coded four transcripts by using the initial codebook of LoU (Appendix Table 1) via MAXQDA 2020 [16]. Then we worked together to refine the codebook and check the intercoder agreement. Altogether, we coded 196 LoU segments, and from there we found that most (N=164) were coded as level 3_Mechanical Use. To better distribute the codes and more effectively illustrate instructors' logistical implementation and skills acquisition of active learning in online settings, we divided the level into two sublevels: 3a_Mechanical Logistical Issues (N=81) and 3b_ Mechanical New Skills (N=83). With making these changes to the codebook, XL updated code choices in the first four transcripts and coded the remaining four transcripts. In the second coding cycle, XL categorized coded data and determined patterns for segments of each code. MvdB reviewed the coding to validate the identified patterns.

Results

We identified three themes for 3a_ Mechanical Logistical Issues and two themes for 3b_ Mechanical New Skills (Table 1). Next, we elaborate on the results in detail, providing quotes directly from transcripts.

Table 1. Themes Identified at CBAM Levels 3a and 3b

Level	Themes	Subthemes

3a_ Mechanical Logistical Issues	Having issues beyond instructors' control in online environments	a) Limited real-time feedback b) Difficulty in delivering laboratory and hands on content c) Low attendance due to time zones, jobs, home environments, and technology
	Struggling with classroom management and organization	a) Student engagement in live classes b) Student motivation to participate in activities c) Time required to prepare online education and execute online activities d) Time required to provide feedback on student homework submission
	Lacking necessary technical skills	a) Limited technical skills in applying digital tools for synchronous course b) Unfamiliar with software for asynchronous course
3b_ Mechanical New Skills	Practicing advanced skills related to implementing active learning in online classes	a) Flexibility and creativity in trying new strategies of online active learning b) Incentives to increase student motivation c) Gaining student "trust" and "rapport"
	Facing issues caused by adopting active learning strategies	No subthemes in this case

3a_Mechanical Logistical Issues

Segments labelled as Mechanical Logistical Issues are about implementing active learning online. In segments at this level, instructors identified various issues they struggled with, but they did not mention any strategies to overcome them.

Having issues beyond instructors' control in online environments

One challenge instructors shared was not seeing students' reactions and thus receiving "real-time feedback" to sense "the emotional tone of the classroom" as they could do in an in-person class. Instructors attributed this challenge in part to many students lacking a webcam or having a slow internet connection. Other students turned off their cameras because they were shy or felt "uncomfortable showing their personal space". Class size also contributed. For instance, in a small class (e.g., 20 students) instructors could technically see all of the students via the gallery view, yet this was not possible in larger classes (e.g., 70 students). In asynchronous classes, the time delay did not allow instructors to have immediate feedback to track student learning progress.

Participants who were teaching laboratory-based science courses and courses with hands-on activities stated that they struggled to deliver content. In some cases, students did not have access to learning sources and equipment to improve lab techniques and practical skills. In others, the students did not have access to the advanced technology software that their instructors had/used. For example, students could not enter their campus learning areas to practice using a pipette.

Another mechanical logistical issue involved low attendance rates. Students had difficulty attending synchronous classes if they were in a different time zone or if they had to take jobs that prevented them from attending class. Instructors also attributed low attendance to some students' having limited learning environments at home (e.g., younger siblings nearby, or a single family-owned computer). Finally, students unable to connect to stable, high-speed internet were "kicked out" of the virtual classroom and often had to attend classes via cell phones.

Struggling with classroom management and organization issues

Instructors struggled with engaging students in synchronous online classes. Instructors shared that some students felt "very anxious" when first exposed to online settings, some did nothing other than show up, and some considered the contents unimportant when they took "non-major classes."

Instructors also had trouble motivating students to participate in activities (e.g., solving problems or group discussion). The instructors stated this happened partly because students were disconnected from instructors and peers and did not experience instructor or peer pressure as they did in face-to-face classes. Some instructors received student complaints about "time-wasting" activities.

The time commitment required by the instructors for online active learning was another issue. Instructors reported it was time-consuming to design and search for effective learning activities and materials to engage online students. Meanwhile, they shared that estimating the amount of time required for online activities was harder than in-person.

Checking student homework submissions and providing feedback consumed instructors' energy and time. During online teaching, an instructor had to check submissions in the Learning Management System, follow up with students who did not submit, and write individual feedback to all students. In addition, it was challenging to verify the authenticity of student assignments. For instance, mathematics instructors mentioned that students could "get any answer just by googling it."

Lacking necessary technical skills

Some instructors were teaching online for the first time. They were first-time users of the online-teaching software for synchronous classes (for which they had not received training) and as such, had limited applicable skills. For example, several instructors were unfamiliar with the functions of online meeting software and had difficulties in using it for group activities.

Instructors who mainly taught asynchronously struggled with recording and editing videos. They had to immediately apply related digital tools without enough time to learn or fully understanding of how to use them. They felt overwhelmed when trying to select suitable software from many options, and often did not have the necessary hardware.

3b_ Mechanical New Skills

At 3b level, instructors have already introduced some active learning to their online classes yet are experiencing issues they are trying to overcome. Segments that contributed to 3b pertain to instructors attempting to acquire new teaching skills and implementing strategies.

Practicing advanced skills related to implementing active learning in online classes

Instructors who transferred in-person learning activities to an online format shared encountering problems, while others shared "flexible" and "creative" solutions for teaching online. Instructors engaged students in live classes by assigning participation credits/points, creating videos with worksheets or quizzes, or utilizing technological tools (e.g., Google Doc and Canvas). Some instructors included "poll questions" in slides, or embedded quizzes within videos asking students to submit pictures of their worksheets on Canvas to receive a grade for each individual task.

Some instructors boosted engagement in group activities by giving students "some accountability factor" such as requiring them to report their responses, arranging them "in their friend group", or developing some collaborative activities to allow student groups to work "at their own pace".

One instructor had students assess one another after they completed an active learning activity, which could also "take some burden off" the instructor of grading.

A few instructors made efforts to build "trust" and "rapport" with students to reduce students' anxiety and encourage student engagement during class. For example, instructors emailed "a funny, very personal" self-introduction video to students, asked students to share similar ones, and set up discussion platforms for students to post questions. In addition, instructors provided "one-to-one" virtual meetings for office hours.

Facing issues caused by adopting active learning strategies

Instructors also shared students resisting participating in more complex activities or "intimidating" active learning online, difficulties in meeting students' needs and achieving learning outcomes, and limited knowledge about how to group and organize students to participate activities (e.g., think-pair-share and partner learning). Meanwhile, instructors reported that considerable time was required to make good quality videos to engage students for asynchronous courses. A few instructors did not know "how to incorporate" laboratory activities in an online environment and hoped advanced technology could help in the future.

Summary

Instructors shared struggling with logistical implementation and acquiring new teaching skills and strategies while teaching using active learning in online settings. Related to logistical implementation, these challenges included issues that were beyond their control (e.g., transitioning laboratory activities online), managing and organizing online classrooms, and lacking necessary technical skills. Instructors also shared acquiring new teaching skills and implementing strategies in adopting active learning in online settings. They creatively introduced strategies to engage students in group activities and to build student trust.

Practical implication and future direction

Our findings are consistent with previous studies, e.g. [1], [2], [3], [17] which highlight challenges that instructors faced while transiting their courses to online environments. Our results provide additional detail, the underlying reasons, and potential strategies that instructors had applied.

There are three main implications. First, STEM instructors should have access to on-demand and tailored support for online delivery and technical skills, applicable to their level of experience. For instance, our STEM instructors shared using real-time feedback to gather information on students' learning progress in in-person classrooms, yet this method was less successful in online environments. Instructors need support in learning how to ensure their students are learning and succeeding in online settings. Second, institutions should provide technical support for both faculty and students. And third, STEM educators and researchers should have access to support to evaluate the effectiveness of potential strategies and help instructors with further issues.

Our study contributes to research on transitioning active learning online and the application of CBAM. We will further apply the Stages of Concerns framework to analyze instructors' feelings and attitudes while implementing online active learning. In doing this, we will explore practical strategies to support instructors through the challenges involved in implementing online active learning.

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Appendix Table 1. The Codebook for Levels of Use.

Level of Use	Category	No. of Segments identified	Description
0_No use	Nonuser	0	Instructor has little knowledge of the change, and no plans for implementation.
1_Orientation	Nonuser	0	Instructor seeks more information but has not made a decision to implement the change.
2_ Preparation	Nonuser	3	Instructor is actively preparing to put the change into practice but has not actually begun to implement it in the classroom.
3a_Mechanical logistical issues*	User	81	It is about the implementation for the initial steps toward active learning online. In segments at this level instructor identifies various issues that he/she struggles with, but he/she does not mention any strategies to tackle these issues.
3b_Mechanical new skills*	User	83	Instructor has already introduced some active learning to online classes, but he/she is still struggling with issues. It also includes instructors acquiring new teaching skills and implementing strategies for active learning in online settings.
4a_Routine	User	27	This level is about settling into patterns. Instructor establishes a pattern of regular use and makes a few changes and adaptations in use of the innovation. Instructor does not focus on learning new skills or strategies. Instead, he/she already sets up specific steps or schedules for learning activities online.
4b_ Refinement	User	0	Instructor may actively assess the impact of the implementation on students and initiate change in innovation.
5_ Integration	User	1	Instructor collaborates with colleagues to make changes in the implementation for the benefit of their students.
6_Renewal	User	1	Instructor senses the need to greatly change the innovation or explore alternative practices.

*****3_Mechanical means that instructor begins the change and is struggling with the initial steps with logistical implementation and acquisition of new skills. It was divided into two sublevels, 3a_Mechanical logistical issues and 3b_Mechanical new skills because it was too crowded with segments to illustrate patterns.
Adapted from [10]

Appendix Table 2. Number of Participants for the Four Categories of Institution Type

Institution Category*	Number of Participants	Number of female participants	Number of male participants
Community Colleges	7	4	3
Bachelor’s Granting	8	6	2
Mater’s Granting	7	7	0
Doctoral Granting	10	6	4
Total	32	23	9

*We organized two focus groups for each institution category.
Adapted from [14]