Engineering Instructor Experience During Emergency Remote Teaching & Beyond: A Case Study

Dorian Bobbett

Dorian Bobbett (she/her) is a 4th-year undergraduate chemical engineering student at the University of Nebraska-Lincoln. She is currently working on a project with Dr. Grace Panther and Dr. Heidi Diefes-Dux focused on faculty adaptability when teaching in a crisis. She plans on pursuing a Ph.D. in engineering education beginning in the Fall 2023 semester. Some of her research interests include P-12 engineering education, DEI, and qualitative research methods.

Grace Panther (Assistant Professor)

Grace Panther is an Assistant Professor at the University of Nebraska Lincoln. She has experience conducting workshops at engineering education conferences and has been a guest editor for a special issue of European Journal of Engineering Education on inclusive learning environments. Her research areas include spatial visualization, material development, faculty discourses on gender, and defining knowledge domains of students and practicing engineers.

Heidi A. Diefes-dux (Professor)

Heidi A. Diefes-Dux is a Professor in Biological Systems Engineering at the University of Nebraska - Lincoln (UNL). She received her B.S. and M.S. in Food Science from Cornell University and her Ph.D. in Food Process Engineering from the Department of Agricultural and Biological Engineering at Purdue University. She was an inaugural faculty member of the School of Engineering Education at Purdue University and now leads the Discipline-Based Education Research Initiative in the College of Engineering at UNL. Her research focuses on the development, implementation, and assessment of modeling and design activities with authentic engineering contexts. She also focuses on the implementation of learning objective-based grading and reflection.

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Abstract

This research paper addresses the adaptations that instructors at colleges and universities around the world made following the abrupt March 2020 transition from in-person teaching to remote teaching. An in-depth understanding about how teaching instructors chose to adapt their courses when under duress to do so provides insight into how to support future change efforts. The purpose of this case study is to examine how one engineering faculty member responded to the change in teaching format through a lens of adaptability.

Data was collected from engineering instructors at an R1 institution via online surveys and interviews across the Spring 2020, Fall 2020, and Spring 2021 semesters. The interview data was coded deductively for behavioral, cognitive, and emotional adaptability to experiences, as per Martin's et al. [1] adaptability theory.

Behavioral adaptability was displayed via narrative maps for interpretative purposes. Narrative maps were built to display the challenges, behaviors, and successes that one engineering faculty faced while teaching during the pandemic. Tables with descriptive quotes from the interview data are used to elaborate on what is depicted in the maps. It was found that when the faculty member tried to adapt a behavior to better address a challenge, they frequently found success.

Understanding the ways instructors adapted their courses during the pandemic can provide insight into how changes are best implemented. This case study helps to lay the groundwork for understanding the future of engineering education in periods of new, changing, or uncertain circumstances. This research is best suited for presentation in a traditional lecture.

Keywords: COVID-19, emergency remote teaching, engineering, adaptability, instructors, qualitative, case study

Introduction

Globally, education at all levels was disrupted by the COVID-19 pandemic. In Spring of 2020, many schools closed their doors and quickly shifted to emergency remote teaching. Emergency remote teaching (ERT) is defined as "a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances" [2]. An important aspect to note is how ERT differs from traditional remote learning. Courses offered as "online" or "remote instruction" are typically designed over a period of several months by a knowledgeable instructional group so that the class best fits into that format [3]. These courses are frequently developed through a phased approach with heavy investments from institutions and instructors to effectively build the class [4]. This process takes a significantly longer time frame than was given to instructors to transition to ERT, which is a key difference between ERT and online instruction. The investments from institutions and instructors also vary between the two formats, as many of the classes conducted during ERT were done without access to the typical social, instructional, or financial resources afforded to online instruction [2]. One of the most vital differences between

the two teaching formats is simply the desire to deliver online courses. Out of more than 3,500 faculty at 4-year institutions that participated in a national survey, less than half (43%) indicated that they had ever taught online courses before ERT [3]. Instructors that teach online courses typically have an interest in conducting the course in that manner, whereas during ERT, instructors were forced into this position with little to no experience and minimal desire to conduct their course remotely [5]. This forced change to the ERT format offers a unique opportunity to examine instructor teaching experience through a lens of adaptability.

Institutions of higher education were drastically impacted by this change to ERT as students and instructors who lived and worked on college campuses were forced to return home. Many returned home to more difficulties than they faced on campus, such as unreliable internet, the need to provide for families, and lack of motivation to participate in the remote experience [3]. Much of the research done so far on ERT has focused on the student experience with remote instruction rather than that of educators. Researching the instructor experience would provide unique insights into how and why choices were made that impacted education. The purpose of this case study was to examine how engineering instructors at an R1 university responded to the shift to ERT in Spring of 2020, and how they continued to adapt throughout the following semesters. Conducting this research through a lens of adaptability is vital for building and providing systems of support for instructors to use presently and in the future with any type of change in teaching practices even beyond ERT circumstances.

Background

Pre-COVID State of Engineering Teaching and Learning

The hands-on nature of engineering courses frequently makes them difficult to deliver online. The accreditation requirement for these types of courses is more difficult to meet when not offering in-person lab experiences [6]. However, in years leading up to the onset of the COVID-19 pandemic, large strides had been made in the direction of online engineering education. There are a few programs that have found ways to offer fully remote degrees within engineering disciplines such as computer and electrical engineering [4]. The undergraduate electrical engineering program at the University of Wisconsin-Platteville (UW-Platt) is an example of one of these successes that began in 2008 [7]. This program utilizes both synchronous and asynchronous video recordings of lectures delivered to students attending in person, and a combination of labs conducted by travelling lab managers and via web conferencing platforms [7]. Students have been able to complete their degrees remotely by pursuing an associate's degree at a college local to them, in conjunction with completing additional engineering coursework through the UW-Platt distance program [7]. The desire to move towards offering alternative pathways to degree completion stems largely from the desire for flexibility in learning for students [8].

Though the development of these online programs saw some success pre-pandemic, many people still shy away from online education when it comes to engineering fields. Some of the factors that can be attributed to this are course quality and breadth [9]. Online courses are often stereotyped as being of a lower quality than in person courses, whether it be in content, delivery, or interpersonal interactions with students and instructors [2]. When it comes to laboratory style

courses for engineers, these online courses are especially difficult given the desire for hands-on use of tools and instruments [9]. For fields like computer and software engineering, these tools are easily accessed over the internet, making online instruction a more viable option for these programs over the past decade [10]. However, for fields like chemical engineering, the necessary resources to successfully adapt to remote instruction labs are still being developed and tested [11]. Koretsky [12] has been working on developing interactive virtual laboratories and has had some success with early implementation. Technological advances like VR/AR would offer students methods of still receiving a "hands-on" laboratory experience, delivered remotely. Despite these successes, difficulties have been experienced with student expectations of the remote labs, as well as how features are understood and utilized by students. Until the quality of an online engineering class can be proven to be equal to or better than an in-person alternative, there will be difficulty in transitioning all programs to be fully online.

The other issue with remote education for engineering courses is the spectrum of topics that courses cover. Full engineering degrees require courses in theory, application, professional skills, and additional extracurricular courses. To receive a fully remote degree in an engineering field, a student would have to successfully complete all of these courses. This means that the degree awarding department would have to make all these courses available to all students remotely, or outsource classes to other programs, colleges, or universities. Implementing a new style of education for the necessary range of topics to complete an engineering degree can take a significant amount of time and money to fully implement [4]. The Accreditation Board for Engineering and Technology (ABET) accreditation process for engineering programs requires seven student outcomes, including the ability to work on teams, to communicate to a broad audience, and to apply engineering design to a wide variety of topics [6]. These outcomes are difficult to achieve in lab courses when working in a virtual setting, which can discourage institutions, instructors, and students from investing in the learning environment [9]. For example, being able to demonstrate effective teamwork when working remotely is hard to quantify, and difficult to apply to a wide variety of topics. During the time leading up to Spring 2020, many engineering programs across the country operated in-person due to these difficulties, leaving many unprepared to move exclusively to a remote teaching format.

Emergency Remote Teaching

The pandemic caused many universities to shut down campuses with little warning and move to emergency remote teaching [13]. Within the United States, this shift frequently aligned with mid-semester breaks that universities had scheduled. Many of these institutions chose to extend spring break to allow time for instructors to transition their classes to a remote format and for students to return to their permanent addresses [13]. Due to the emergency nature of this transition, the time given to instructors to prepare was minimal, and with the eventual shutdowns of many campuses, instructors found themselves without access to offices, instructional tools, and many other resources. This introduced a new level of stress wherein instructors were not only faced with an unprecedented task but were also left without access to many of the resources to which they had grown accustomed [2].

As instructors transitioned to ERT, they faced a number of difficulties. Rodriguez-Mejia et al. [14] found in one study that the majority of instructors surveyed reported a significant increase in

workload with the shift to ERT. Workload increases were due to student concerns, a general increase in meetings, and finding new, effective course delivery methods. Another study by Vijaylakshmi et al. [15] categorized faculty challenges with ERT into four distinct areas: technical challenges, pedagogical challenges, multiple demanding roles, and the nature of courses. All of the challenges mentioned are unique to ERT and the drastic shift that universities experienced during the Spring of 2020.

Despite these difficulties, a study conducted by the Engineering Education Transformations Institute [16] found that the faculty experience with the move to ERT was positive. They collected "stories" from students and faculty within the university's college of engineering and categorized them on a scale from extremely negative to extremely positive. Consistently, student stories were classified as negative and faculty stories were classified as positive. A national survey of higher education faculty and found similar results [3]. Faculty frequently had better perceptions of remote learning than before the move to ERT. Authors [17] also conducted a study that found instructor emotions across the last seven weeks of the Spring 2020 semester tended to be more positive than negative. However, these studies only gathered stories and data from early in the pandemic, leaving a gap in the understanding of how instructor experience may have changed as ERT progressed into pandemic-impacted teaching. Longitudinal studies of the impact of pandemic-impacted teaching are only beginning to emerge. There is a need to look at the instructor experience over the course of ERT and beyond to best understand how instructors continually adapted to this change in instruction.

Theoretical Framework: Adaptability

Adaptability is defined as an "individual's capacity to constructively regulate psycho-behavioral functions in response to new, changing, and/or uncertain circumstances, conditions and situations" [1]. This theory encompasses an individual's cognitive, behavioral, and emotional regulation when faced with novel, uncertain, or changing situations [1]. Cognitive regulation is an individual's ability to change how they think in order to manage a situation [1]. Behavior regulation is an individual's ability to change how they behave in order to manage a situation [1]. Affective regulation is an individual's ability to change how they moderate their emotions in a situation [1]. Adaptability differs from resilience and coping, as it requires regulation of the three domains rather than simply "staying afloat" [18]. This difference is especially important when looking at education in the face of the COVID-19 pandemic. When faced with a crisis, distinguishing between actively managing and passively surviving stressors is necessary to develop better supports for instructors who are dealing with the unprecedented situation. Identifying challenges that instructors faced, the ways in which they adapted to them, and the success of their adaptations allowed for a story to be told about the importance of adaptability when faced with a crisis.

Adaptability has been used as a framework for research in K-12 education, and less frequently in higher education. Collie and Martin [19] discuss the importance of adaptability for K-12 teachers, as the classroom is an ever-changing place. Adjusting to the needs of students, colleagues, and unplanned events is all a big part of education [19]. The onset of the COVID-19 pandemic in Spring of 2020 is one example of a situation where educators had to quickly adapt to a novel situation. Using adaptability as a framework in this study is useful to understand and

describe the changes that instructors experienced over the course of pandemic-impacted teaching and how insights from those experiences can best be used to support instructor change in the future.

Research Questions

The purpose of this study was to examine how engineering instructors adapted to pandemic-impacted teaching over the course of three semesters. This case study was a part of a larger research project looking at several engineering instructors' experiences while teaching during the pandemic, including their use of resources, interpersonal interactions, and emotions. Specifically, this case study focused on the behavioral adaptability of an individual instructor in the context of the challenges they faced while teaching and the subsequent successes due to their actions. The research questions that guide this study are:

1. How did the challenges that one instructor faced during pandemic-impacted teaching impact their behaviors?
2. What are the outcomes of an instructor's behavioral adaptability during pandemic-impacted teaching?

Methods

Setting and Participants

The setting for this study was an R1 university located in the Midwest United States. As part of the larger study, all instructors in the university's College of Engineering that were teaching undergraduate courses in Spring 2020, Fall 2020, and Spring 2021 were invited to participate. Instructors were initially chosen to participate in interviews based on their position, department, and number of years teaching to maximize the perspectives represented. Interview participants from Spring 2020 were invited to continue with interviews in Fall 2020 and Spring 2021. This process resulted in a total of five participants with interview and survey data for all three semesters. Participant Alex (pseudonym) was chosen for this case study. Alex was chosen for this case study because their experience teaching across the pandemic appeared representative of the experience that many instructors had. Alex is a tenured faculty member in the college of engineering. They participated in a total of 9 interviews and 23 surveys over the course of three semesters.

Data Collection

Data collection was conducted through surveys and semi-structured interviews throughout three semesters: Spring 2020, Fall 2020, and Spring 2021. This case study utilized interview data collected across all three semesters. Web-conferencing interviews with instructors took place three times a semester. These interviews lasted approximately 30 minutes each. Audio was recorded and transcribed by the web-conferencing platform and then manually revised for accuracy. The interview questions were designed to align with the theoretical framework of adaptability and gave context to the responses instructors had given on their surveys regarding emotions, successes and challenges, and community engagement around teaching. For example,

instructors were asked "Can you describe a time that you have been frustrated/confused/at-a-loss during this transition?" This question allowed instructors to elaborate on the experiences that they had where they struggled with overcoming new challenges, and directly allowed for the researchers to gather data on the specific behaviors that instructors engaged in to adapt to new circumstances. Engineering courses at the university studied in this project are typically not offered online, and a significant number of the instructors in the engineering department did not utilize the university's learning management system prior to the shift to remote instruction in Spring 2020, leading to the conclusion that the initial comfort level of instructors with remote instruction was low.

Data Analysis

Alex's interview data was analyzed qualitatively based on the theoretical framework of adaptability. Data was coded for behavioral adaptability to experiences, as well as successes and challenges Alex faced while teaching. This study focused on building a relationship between the behavioral domain of adaptability and these challenges and successes. Definitions in the code book were established prior to coding, and examples were added to the code book as the data was analyzed. Table 1 includes the codes, their definitions, and contextual examples for each. Coding was an iterative process, consisting of multiple pass throughs of each interview and survey response, updating and refining previously marked themes [20]. The coded data was used to build a case study looking at how challenges during pandemic-impacted teaching led to Alex's adaptability in the behavioral domain, and how these behaviors played a role in Alex's teaching successes in later semesters.

Table 1. Qualitative Themes, Definitions, and Examples.

Theme	Definition	Contextual Examples
Behavioral Regulation	The ability to adjust how one behaves in order to manage a new or uncertain situation.	Changed how papers were graded, implemented a flipped classroom, holds additional office hours
Teaching Success	An action taken by the instructor had a positive outcome in teaching the class while in the new context of pandemic-impacted teaching.	Had students engage in class, good exam scores with the new delivery method, utilized a new resource successfully in class
Teaching Challenge	A difficulty encountered in teaching the class due to the context in which the class is being taught.	Struggled with academic dishonesty, students not participating in class, difficulty with classroom technology

After coding for the above items, results were used to create narrative maps of Alex's story. Narrative mapping uses visuals to present events that happen over time [21]. The left-hand side of Figure 1 illustrates this concept in the context it will be used in this case study. Narrative maps consist of two parallel timelines, one illustrating the experience of the subject, and the other illustrating the adaptations that they made. The bottom timeline of the figure is the experience landscape. This states the actual events, challenges, and successes that Alex experienced throughout the course of pandemic-impacted teaching. The top timeline of the figure is the adaptation landscape. This includes the behavioral adaptations that Alex made to address the experiences they had throughout the course of pandemic impacted teaching. The dashed arrows

in the middle section illustrate the progression between the experience and adaptation landscapes, showing which behaviors Alex engaged in as a direct response to a challenge, and the connection to the resulting successes. In the case that a behavior is continued beyond a success, that is illustrated with the continuation of the dashed arrow. Moving left to right across the diagram illustrates the passing of time. It is important to note that the gaps between behaviors and successes do not necessarily indicate a standard period of time has passed. Due to the nature of the interviews, as well as the nature of higher education, events occurred at different times and were discussed at different intervals over the course of data collection. The interview in which the quote was discussed is listed on the timeline in the format SemesterYear_InterviewNumber. For example, a challenge discussed in the third interview of the Spring 2020 semester would be presented as Sp20_03. An example of a narrative map of someone less willing to adapt when faced with a new challenge is also included. The right-hand side of Figure 1 shows how the challenge is not addressed successfully with a change in behavior but is instead perpetuated by a continuation of a previous behavior.
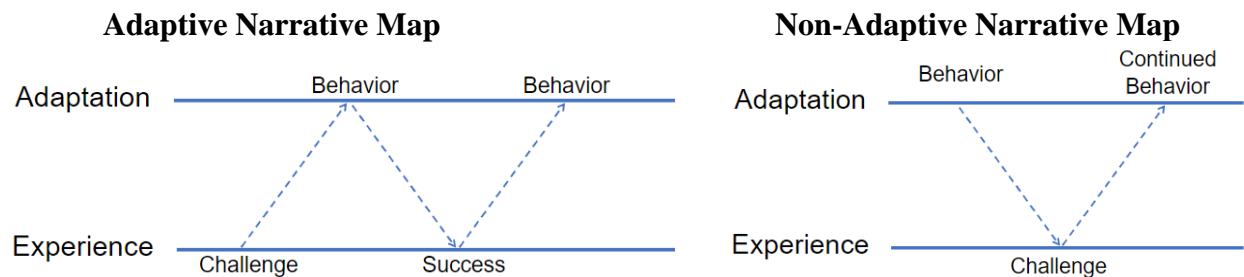
Adaptive Narrative Map   **Non-Adaptive Narrative Map**

Adaptation ———— Behavior ———— Behavior ————   Adaptation ———— Behavior ———— Continued Behavior ————

Experience ———— Challenge ———— Success ————   Experience ———— Challenge ————

Figure 1. Narrative Mapping Framework

Results

Alex frequently discussed challenges in areas related to course delivery and utilizing new methods for remote course instruction. Narrative maps and the corresponding quotes from Alex regarding challenges, behavioral adaptations, and successes are presented in this section.

Alex's course delivery mode changed across the three semesters from 100% remote (Spring 2020) to a synchronous zoom and in person (Fall 2020) and concluded with a similar dual mode setup (Spring 2021). For the Fall 2020 and Spring 2021 semesters, students self-selected into one of three attendance mode groups. They attended in person on either Tuesdays or Thursdays, attending remotely the other day, or attended completely remotely. The change in course delivery modes over the three semesters led to a change in the tools Alex chose to use to teach and how effective Alex considered they were.

One of Alex's initial challenges in Fall of 2020 in delivering instruction in a dual mode pertained to the ability to juggle the in-class students with the online students and giving students on Zoom (online) a similar classroom experience as seen in the Fa20_01 quote in Table 2. One aspect of this challenge was related to Alex using their pre-pandemic teaching method of screen casting from their tablet to deliver lecture content to students in-class which did not occur as seamlessly when teaching in a dual mode. With the additional burden of balancing the technology demands of the dual mode with teaching, Alex unhappily (denoted by the "wah wah wah" phrase used by Alex in the Fa20_02 quote) transitioned to delivering their lecture content via PowerPoint.

Alex indicated that they adopted PowerPoint to give students, regardless of attendance mode, a "fair shake at learning the material." Despite being hesitant about using PowerPoint, ultimately this became a success for Alex as they felt that the students were all given a fair chance to learn by having the same material available to all students regardless of attendance mode (Fa20_03 interview).

Table 2. Fall 2020 PowerPoint Lectures Quotes

Challenge	"I would like to have more interrogatories between me and the students and between the students, and the distance makes it hard to do that. I find that in a lecture I'm splitting my attention. I'm trying to watch the chat and stuff, but the thing that bugs me the most is when I screen share and then I can't see the stuff that I could otherwise have open. So, I guess where I feel like I'm falling short of my goals and my intended strategy is giving the students on Zoom quite as much attention and interaction."	Fa20_01
Behavior	"All my notes and kind of all the lecture delivery to PowerPoint. Wah-wah-wah. It wasn't something I really was enthusiastic about doing, but because I had students who were in person and students who were on Zoom and I was trying to manage questions from both groups, my normal approach would be to write on the surface and just screen cast that to the projector and to the Zoom, but I didn't feel like I could do that as fluidly with managing all the other things going on with synchronous Zoom. And so, for the sake of giving everybody a fair shake at learning the material, I went ahead and, well part of it was just the students were really, really wanting to have notes before the lecture that they could follow along with. And so, to do that I just thought I have to put everything in PowerPoint, which I haven't done in, like, ever. You know, I have a PowerPoint here and there for different topics that are well suited for that, but this was the first time I had pretty much the whole class in PowerPoint."	Fa20_02
Success	"But it worked out, you know, and I think it satisfied what students wanted and made it fair for everybody. That everybody had the same materials up front and that whether they were in the classroom or not, they were going to get the same stuff."	Fa20_03

The narrative map (Figure 2) further emphasizes the interaction between Alex's experiences teaching in the classroom and their behavioral adaptations. Alex's experience of teaching in a dual mode resulted in difficulties that led them to adapt the course by moving the course content to PowerPoint slides. This behavioral adaptation resulted in a positive teaching experience for Alex where students were able to engage and were all treated fairly. This positive experience re-enforced Alex's behavioral adaptation from earlier and they chose to continue to use PowerPoint to deliver course content in a dual mode.
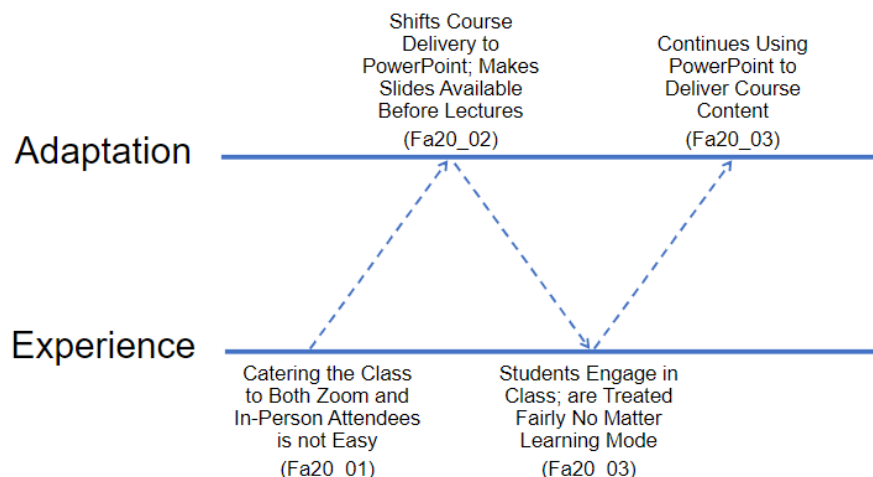
Figure 2. Fall 2020 PowerPoint Lectures Narrative Map

Another challenge that Alex faced during the initial shift to fully remote teaching in Spring of 2020 came from the inability to utilize physical learning objects in the classroom, as indicated in the Sp20_03 quote in Table 3. This was a challenge for Alex, as they had previously used these items to engage their class in discussion, as well as offer them hands-on experience working with the devices they will frequently encounter in their professional careers. Without the opportunity to pass these objects around a classroom space, Alex determined that building an annotated photo-deck would be the best way to give students an equal opportunity to engage with these devices, as mentioned in the Sp21_01 Behavior quote in Table 3.

This challenge persisted across all three semesters of data collection, and Alex indicated that their solution was not ideal (marked by the Sp20_03 quote "...there were things that were left out of my class..."), but they were able to begin to make significant progress towards their goal of creating a pandemic-safe alternative to what they had traditionally used in the classroom. Denoted by the Sp21_01 Behavior quote, Alex had to "have some way to show them what's going on," which they did successfully by building the compendium of photos and comments as a supplemental learning tool.

Table 3. Spring 2020 to Spring 2021 Physical Learning Objects Quotes

Challenge	"Certainly, there were things that were left out of my class because there's some handling of physical objects that we can't do, the more interactive discussions that were just left out of the last few weeks of class. Things that we had handled and passed around and talked about before, but not in the same context of the new topics that we were covering. I kind of use these artifacts as ways to jumpstart different types of discussions, even though we're talking about the same objects that we look at throughout the semester."	Sp20_03, Sp21_01
	"I have this bag of goodies that I would always bring to class. And it's like all these different medical devices. And I use them as examples for lots of different things over and over throughout the semester. This is probably the thing that bugs me the most, is not being able to give students a chance to handle these things and touch and feel and see oh,	

	this is heavy, this is soft and squishy, this is, you know, and relate the form to the function in terms of the device design and the intended use."	
Behavior	"I'm going to have to take a bunch of photos and I don't know what else, that's coming up soon. It's just a lot of the students aren't going to be in the classroom at all, so I have to have some way to show them what's going on."	Sp21_01
Success	"I have a few photos, but I need to take a bunch more photos and kind of put together a good slide deck and some comments and things."	Sp21_01

The narrative map (Figure 3) illustrates how the challenge that Alex faced led to their behavioral adaptations. Alex's experience with being unable to utilize physical learning objects within the classroom setting due to the pandemic forced them to adapt their behavior and they began brainstorming how to get the most out of those objects in an online setting. This included considering a wide range of alternatives, then taking pictures and writing comments about each individual object. This was a positive experience for Alex, and they were encouraged to continue to work on this project moving forward, in the hopes of eventually finalizing the compendium for use by the students in the class.
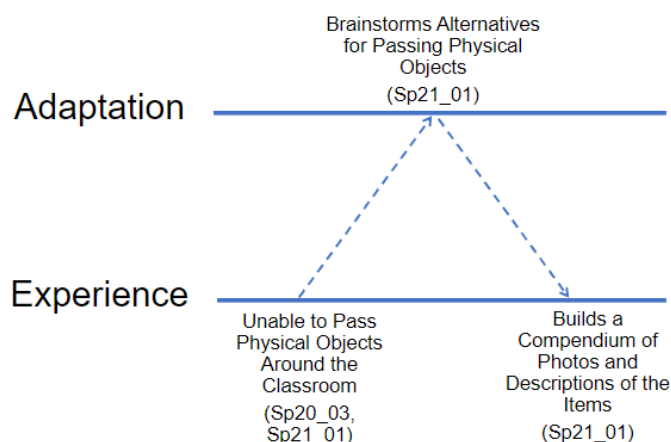

Figure 3. Spring 2020 to Spring 2021 Physical Learning Objects Narrative Map

Alex also had to deal with the challenge of administering exams remotely using the University's Learning Management System (LMS). This abrupt change to fully remote learning in Spring 2020 forced them to utilize new methods of proctoring exams, rather than relying on the traditional in-class method. As Alex demonstrated in the Sp20_01 Challenge quote (Table 4), they expressed concern with having to make this transition in exams. That was their main concern moving forward during the fully remote Spring 2020 semester, as illustrated in the quote "...the only thing...that's going to be hard is setting up the exam".

Alex addressed this challenge by experimenting with a wide variety of options for remote exam administration, shown in the Sp20_01 Behavior quote (Table 4). Alex discusses three different possibilities for administering remote exams that they considered using, eventually settling on using the LMS for remote exams due to the ease of access and equity for both the students and

themself. Alex found success through this method, as shown by the Sp20_03 quote in Table 4. They explicitly said that though it was not normal, the exam went smoothly, and they were able to administer the exam successfully for all of their students.

Table 4. Spring 2020 LMS Exams Quotes

Challenge	"I felt like, well, everything that I'm doing, the only thing you know that's going to be hard is setting up the exam."	Sp20_01
Behavior	"I thought about the lockable browser and I thought about... giving them an exam they can download and print and then scan and resubmit, kind of a take home. Anyway, yeah, just different versions of how I could administer an assessment, and the canvas option seemed to me to be the most equitable and the easiest for me in the long run, and probably the easiest for the students as well."	Sp20_01
Success	"I mean, the only big difference was...administering that Canvas exam. And just kind of making sure that that went normally or went smoothly. It wasn't normal, but it went smoothly."	Sp20_03
Behavior	"The other big change would be you know my first two exams were in person in class last year, and now they'll be delivered by canvas and uploaded as assignments basically. I'll put out a PDF file they'll work the file and re-upload it."	Sp21_01

This challenge, adaptation, and success are illustrated on the Narrative Map (Figure 4). The need to create exams that could be administered remotely was the primary challenge that Alex experienced due to remote instruction. They adapted to this challenge by weighing the pros and cons of a variety of possible methods of proctoring the exams, eventually settling on using the University's LMS. The exam was successful, leading Alex to continue to utilize this method of exam administration for the rest of their time during pandemic-impacted teaching.
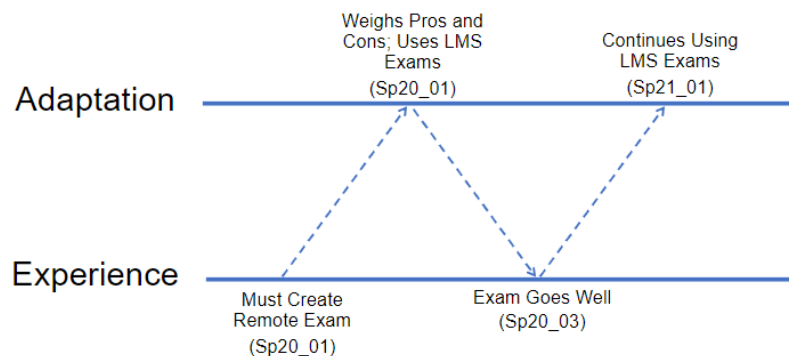

Figure 4. Spring 2020 LMS Exams Narrative Map

Discussion

The pandemic created challenges for Alex with utilizing new course delivery tools effectively. Some of these challenges proved more difficult to adapt to and persisted across the course of pandemic-impacted teaching, whereas others were simpler and were solved early on. For example, moving the course content to PowerPoint slides rather than handwritten notes was an

adaptation that was made quickly and easily, whereas building a photo index of physical devices that would typically be passed around a classroom proved to be a longer process.

Regardless of the difficulty level of these problems, Alex illustrated behavioral adaptability to overcome them. The change in course delivery directly impacted the use of new remote delivery tools, which also led to new successes. The successes with using these tools largely came from students' understanding of the material and appreciation of the format in which the course was being delivered. Because of these successes, the behaviors were continued throughout the remaining semesters.

Limitations and Implications for Practice

This case study only examined the relationship between behavioral adaptability and teaching challenges and successes relative to remote delivery tools. Exploring additional themes found in behavioral adaptability as well as the emotional and cognitive aspects of adaptability would allow for greater understanding of the instructor experience during the pandemic, especially when exploring how they utilized resources, conversations they engaged in about teaching, changes they made to teaching methods, and overall positive and negative experiences they had throughout the course of pandemic-impacted instruction. Future work exploring these various aspects of adaptability and pandemic-impacted instruction can be used as a learning tool for professional development during future crisis situations, as well as in regular teaching situations. The role that adaptability plays in managing classroom challenges is vital to success as an educator. Understanding this relationship between adaptability and university instruction is particularly important when it comes to developing supports for instructors who demonstrate varying degrees of adaptability.

This work is a case study that represents the experience of a single instructor during pandemic impacted instruction who generally demonstrated adaptability. Data collection in this study was focused on what instructors were experiencing in the moment rather than looking retroactively at how this compares to their teaching pre-pandemic, leading to a focus on the more adaptive moments that the instructor experienced. Due to the voluntary nature of this method of data collection, participants were most likely those instructors that were experiencing positive adaptations in their classrooms, making it difficult to encompass the full spectrum of positive and negative adaptability practices during pandemic-impacted teaching. Future work developing more case studies will allow for a holistic picture of the overall engineering instructor experience during pandemic-impacted instruction. By developing studies in this manner, it will be possible to identify the areas in which instructors need support to become more adaptable. Identifying adaptable moments can lead to guidelines for faculty development that prepare instructors for challenging times.

Conclusion

The COVID-19 pandemic greatly impacted engineering education. With the move to ERT and beyond to pandemic-impacted teaching, instructors faced new challenges, and had to adapt their behaviors accordingly to meet students' learning needs. This case study adds to the understanding of how engineering instructors experienced pandemic-related teaching in terms of

challenges and behavioral adaptations that led to successes, which is an important step in building better support systems for instructors when teaching during a crisis.

Acknowledgement

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