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New Instructors Perspectives on Remote Teaching Methods

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Abstract
With the swift transition to remote learning due to the spread of COVID-19, instructors have inconsistencies on how to deliver remote instructions for their classes. Instructors have had their own motivations to pursue a particular remote teaching approach. These motivations vary between personal preferences and class-driven factors. We surveyed 13 new instructors to learn their perspectives on teaching remote engineering classes from spring 2020 to fall 2020. The survey responses were then content-analyzed. The instructors were evenly split between choosing traditional lecturing versus choosing to flip their classes. The urge for a fast transition to online classes motivated some instructors to adapt a traditional lecturing style as it requires less time and effort to prepare. On the other hand, the nature of the topic being taught, efficient delivery, and alternative use of class time were the primary motivations for instructors to flip their classes. However, none of the surveyed instructors opted for asynchronous meetings. The most frequently reported challenge in a remote classroom was the lack of student interactivity. The results indicate that simple active learning approaches helped increase interactivity in electrical and computer engineering classes.

1. Introduction

The COVID-19 pandemic has affected education in different ways. Because of the closure of universities and schools, in-person instructions transitioned to online instruction. Instructors and students had to adapt to remote teaching swiftly. Previous studies on distance education have shown that online teaching requires a different pedagogy and set of skills from that of the in-person classroom [1], [2]. Educators are faced with new pedagogical issues regarding student interactions and communications, course content design and delivery, adopting new types of assignments and performance expectations, and different assessment and evaluation techniques [3].

This new teaching environment urged decisions and adaptations to fulfill not only the expectations of students but also the requirements of course learning objectives and the circumstances in which schools had to operate [4], [5]. Nevertheless, these adaptations are being done with no to minimal formal training on remote learning. As a result, there have been high variability among instructors on how to deliver remote instructions for their classes. Instructors have had their own motivations to pursue a particular remote teaching approach. These motivations vary between personal preferences and class-driven factors. However, and regardless of the meeting mode (i.e. synchronous vs asynchronous), most of these approaches fit under two main pedagogical paradigms: traditional lecturing and flipped classrooms with synchronous activities. Both approaches have their pros and cons.

Traditional synchronous lecturing is the closest to the conventional in-person model. In synchronous lectures, new concepts are presented during the online lecture time, and the students apply that learning through homework assignments. Thus, it is easier to manage and prepare for a synchronous classroom than a flipped classroom. However, working remotely challenged this traditional approach, and instructors needed to consider other factors. Working from home added

plenty of challenges and distractors to the students that were not present in a physical classroom. Most students' attention span dropped below normal levels due to ample distractors outside the conventional class. This motivated instructors to adopt different active learning activities during class time. The benefits and effectiveness of active learning for student problem solving, conceptual gains, exam scores, and engagement are well established [6]–[9]. Thus instructors hoped that active learning might help better to grasp students' attention in a virtual classroom. Besides, many instructors allowed the recording of their synchronous lectures in case some students needed to refer back to the lecture content at their convenience.

On the other hand, flipped instructions rely on completing instructional videos before class and focusing on class discussions and activities. In recent years, the flipped classroom started to gain popularity among engineering faculty [10]. Flipped classrooms allow students to go through the course contents at their own pace then share their opinions during discussions encouraging higher engagement and exposing gaps in understanding [11], [12]. Previous research suggests that student learning is improved in the flipped compared to the traditional classroom [13], [14]. To ensure that students complete the video lectures before the class, readiness assessment techniques, like quizzes, can be adopted. In a remote setup, the flipped approach seems to address the challenges faced by the synchronous model. However, this method adds an extra workload to the instructors. They have to pre-record and edit the video lectures, design quizzes to enforce understanding of the video materials, and design remote-friendly active learning activities for the class discussions.

As universities continue to offer online courses in response to the pandemic, educators can enrich online instructions if they are aware of current research on remote education. In this work, we study the perspective and experience of 13 new faculty on the use of different approaches for online teaching. The study focuses on the practices adopted in over 30 various courses that were taught over the period from Spring 2020 to Fall 2020, at the electrical and computer engineering (ECE) department, in the school hosting this study. Instructor surveys and interviews were conducted to quantify their motivation to pursue different remote teaching approaches. These will be content-analyzed to determine the instructors' perspectives on different teaching approaches and meeting modes. Supported by students' end-of-semester feedback, the authors recommend best practices to effectively manage and lead synchronous and asynchronous classrooms.

2. Methods: Assessment of Instructors Perspectives

The ECE department at the school hosting this study hired 13 new faculty in the past four years. These new faculty members were surveyed to gather their perspectives on the teaching methods they adapted since the university switched to totally online mode in March 2020 (mid-way through the spring 2020 semester). For the rest of the spring semester of 2020, the instructors used various web/video conferencing platforms like Zoom®, Microsoft Teams®, and Skype for Business® to deliver their courses contents. However, starting from summer semester of 2020, and supported by the University of Pittsburgh licencing and integration through Canvas, all the instructors used Zoom® for online class meeting. All lecture meetings were recorded and uploaded to a Panopto folder dedicated for each course.

These surveyed faculty taught over 30 classes during the spring semester of 2020 through the fall semester of 2020. Figure. 1 shows the distribution of number of classes being taught by a single

faulty member over the period of the study. The courses taught by the surveyed faculty spanned different student levels and included book courses as well as lab-based courses. Table. 1 indicates the number of faculty who taught only book courses, only laboratory courses, and both book and laboratory courses.

The instructors were introduced to the objectives of the study and then were asked to complete the survey hosted on Qualtrics. Participation in the interviews was voluntary. Human subjects' approval (PRO18060710) was secured for these various forms of assessment. The survey was composed of seven questions (see Table. 2) to identify the meeting mode and the pedagogical approaches adopted by each instructor. The motivation and obstacles in the adopted approach were also collected. Later, we interviewed the surveyed instructors to reflect more on their experience teaching remote classes, the problem noted in the survey results, and their approaches to overcoming these obstacles.

A content analysis of the instructor survey and interview responses ($n = 13$) was completed by two analysts to drive reliability [15]. The analysts independently content-analyzed the responses using coding schemes similar to those developed and used in [16] and [17]. The analysts then discussed each answer and the codes assigned to ensure consensus; thus, all responses were double-coded. The first-time inter-rater reliability score for the analysts indicated strong agreement beyond chance at Cohen's $\kappa = 0.82$ [18].

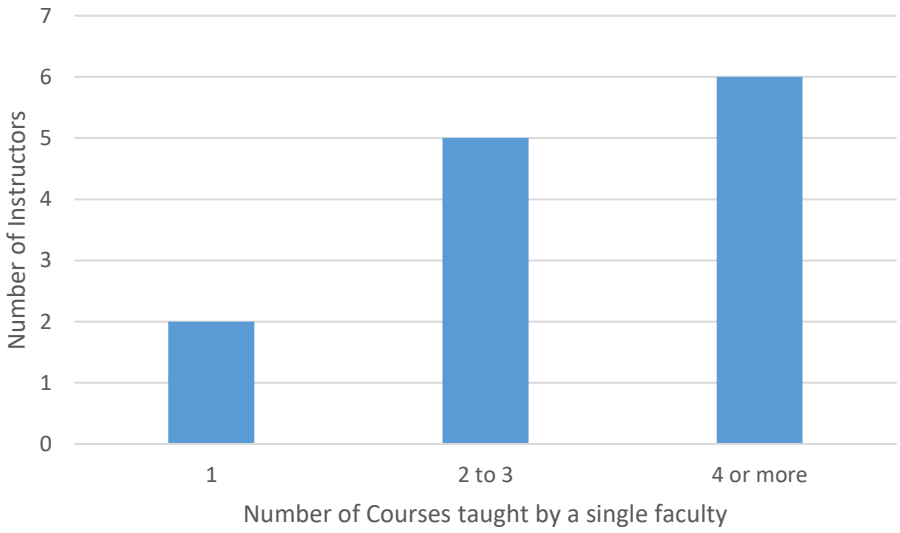

Figure 1. The number of faculty who taught 1, 2-3, or more than 3 classes throughout the study.

Table 1. The number of faculty taught book courses, lab courses, or both.

Nature of courses taught	Book Courses	Laboratory courses	Both book and lab courses
Number of instructors	6	1	6

Table 2. Survey questions

What is the pedagogical approach that you usually adopt?	o Flipped instruction o Traditional lecturing
What is the meeting mode that you usually use?	o Online Synchronous meetings o Hybrid Synchronous meetings o Asynchronous
What motivated you to adopt these pedagogical approach and meeting modes?	
In your opinion, what are disadvantages of your adopted methodology? What did you do to overcome these disadvantages?	
In how many classes did you apply this pedagogical approach since COVID-19?	o 1 o 2 – 3 o 4 or more
What is the nature of your classes?	o Book course o Lab course o Both
Did you use any pedagogical or meeting approach other than what you have indicated above? If yes, what motivated you to switch your pedagogical/class meeting method?	

3. Results and Discussion

3.1. Meeting mode

In the spring and summer semesters of 2020, the university offered online-only classes. Therefore, the possibilities for class meetings were either synchronous or asynchronous remote meetings. In the fall semester of 2020, the university adopted a flex-mode in which students and instructors can participate remotely or in-person (up to a COVID safe capacity). Thus, a third mode of class meetings was added to the survey: Hybrid Synchronous meetings. In this hybrid model, the instructor chose to teach synchronously in the classroom or online. Some of the students attend in-person on campus, while others are participating remotely over zoom.

In our study, none of the instructors opted for asynchronous meetings. It was a concern that asynchronous teaching may amplify communication and connection with students and mentorship

issues in ECE classes. Therefore, the surveyed faculty decided to adapt synchronous meetings irrespective of their pedagogical approach of teaching, either with traditional lecturing or flipped instruction.

In comparison between complete online synchronous and hybrid synchronous modes, 62% of instructors preferred or were involved in a full online setup, while 38% chose to teach in a hybrid mode where they conducted their classes in-person from campus. Two instructors were involved in the two methods. Health concerns and convenience were the dominant factors in preferring a remote setup instead of being in-person in a hybrid one. One instructor indicated that he was neutral, but his class was scheduled as online-only by the registrar's office. On the other hand, "feeling connected" was the main reason for being in-person in a hybrid setup.

For synchronous online meetings, the frequently reported problems were related to technology, internet connection, and getting everyone to participate. However, when interviewed, instructors indicated that they would continue to pursue remote meetings until everyone is vaccinated. On the other hand, the need to wear a mask and teach for the entire class period was inconvenient for the instructors who opted for in-person hybrid mode. Also, coordinating between students attending online and their peers attending in-person was a little bit tricky and time-consuming. All instructors taught in a hybrid setup indicated that they would consider a remote online format and focus on designing class activities that engage the students.

3.2. Teaching pedagogy: traditional vs flipped instructions

Traditional and flipped instructions have their own advantages and disadvantages. Seven of the surveyed faculty preferred the traditional lecturing approach, while the remaining six adopted flipped instructions. Among the instructors who flipped their classes, three used partial flipping rather than a full flip of the course materials. Table 3 shows the distribution of instructors for different meeting modes and teaching styles. A content analysis of the responses to the motivation and challenges questions in Table 2, which gathered instructors' perspectives on their teaching pedagogy during the pandemic, is presented in Tables 4 and 5, respectively. Among the seven faculty who adapted traditional teaching methods in their online classes, five indicated that the primary motivation to adopt this approach was convenience. They noted that the traditional approach requires less effort and time compared to flipped approach. Also, with the quick transition, it was not possible for some of the instructors to redesign their courses in a flipped format. Two instructors indicated that it would be better to address student questions as they arise during the synchronous lecture instead of a potential struggle that may happen if students work on the material before the class time on a flipped style. On the other hand, the most-frequently stated motivation for flipped instructions was the nature of the course being taught, efficient delivery of course content, and alternative use of class time. The faculty stated that flipped instructions provided a streamlined approach that enabled them to tailor the class-time to students' needs and have more class discussions to gauge their understanding of the course topics. Also, flipped instruction helped them to be on track with their class schedule. Avoiding internet instabilities was once mentioned as one of the motivations to adopt flipped instructions.

The course's nature has been stated as a motivation for both traditional and flipped instructions in ECE courses. Laboratory classes, in particular, would benefit from having synchronous instruction

to help with the hands-on experience and to make sure that students are on track with their lab experiments. On the other hand, programming courses would benefit from a flipped style. Students are asked to complete lectures offline and come to the class prepared to write programs for their assignments and use the class time to get the instructor's feedback on their codes or even ask for help with debugging. Also, courses that have theoretical components, as well as practical applications, can benefit from a flipped style. The students can review the theory before class time, and then the instructor can solve problems, answer questions, and show demos during class time.

Table 3. Number of instructors using different teaching pedagogy and meeting modes

	HYBRID SYNCHRONOUS MEETINGS	ONLINE SYNCHRONOUS MEETINGS
TRADITIONAL LECTURING	2	5
FLIPPED INSTRUCTION	3	3

Table 4. Summary of motivations discussed on using different teaching pedagogy.

	Traditional Lecturing	Flipped Instructions
Convenience & flexibility	**5**	1
Nature of course	2	**3**
Efficient delivery	0	**3**
Student poll	2	0
Instructor-student interaction	2	1
Internet issues	0	1
Alternative use of class time	0	**3**

Table 5. Summary of challenges discussed on teaching remote and hybrid classes.

Student engagement and interactivity	**11**
Reduced attention span	1
Reduced class attendance	3
Academic integrity and conducting exams	2
Unbalanced interaction with in-person vs remote students in the hybrid-mode	2

3.3. Challenges in the online classroom and approaches to overcome them

Table 5 summarizes the frequent challenges faced by the new faculty during their online classes. Irrespective of the teaching pedagogy, student engagement was the most-frequently stated challenge. Instructors struggled to get everyone in their classes to interact with them and engage during the lecture time. The consensus of all instructors that the use of simple active learning techniques in their classes helped ramp the class dynamics. Active learning also helped with the reduced attention span of students. The active learning techniques used in the courses under this study included think-share, interactive questions via polls or Top Hat, ask questions and randomly

pick students to answer them, and breakout rooms for group discussions. Surveys, like a mid-term survey, were conducted to gauge how students perceive class activities. The benefits and effectiveness of active learning in the traditional setup before COVID have been established [6]–[9]. Based on the responses we have, active learning in online classes seems to be beneficial in online classes too. However, further research on the effectiveness of active learning in online courses is needed.

Also, some concerns were raised that online teaching resulted in a reduced attendance rate; this could be due to conflict with other classes or a zoom-fatigue that their students may have developed. Therefore, instructors decided to record their class meetings so that students can refer to them. To motivate class attendance, instructors used pop-up quizzes during class time and offered bonus points to attempting questions during class time.

A noted challenge was the unbalanced interaction with in-person students versus those who participate online in a hybrid setup. Two instructors indicated that it's more appealing to interact more with those students who are physically in the same room with them. This issue can be approached by forming discussion groups that combine both in-person and online students. Academic integrity was one of the challenges raised. Depending on the nature of the class, open-ended questions can be used for exams. Also, some instructors decided to use different models for the same exam to reduce the probability of cheating.

4. Conclusions

The COVID-19 pandemic has impacted education at all levels in various ways. Instructors needed to adapt their teaching to comply with the challenges in online classes. We studied 13 new faculty members' perspectives on their experience and challenges teaching during the pandemic in this work. None of the surveyed instructors preferred asynchronous meeting as it works against the required level of interactivity for engineering classes. Some instructors used traditional online lecturing, believing that it is the closest method to what students are used to. Other instructors take online classes as an opportunity to flip their courses and then use the virtual meetings to foster understanding and communicate with students. Nevertheless, irrespective of their teaching pedagogy, class interactivity was among the apparent challenges in online classes. The use of active learning techniques increased the level of interactivity in the classes.

In future work, we plan to survey more faculty from other departments and other engineering schools to analyze their experience and share their points on how to teach an effective engineering class. Also, in a different study, we plan to investigate active learning effectiveness in online ECE classes.

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