

Teaching Modalities During the COVID-19 Pandemic

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Abstract

Teaching during the COVID-19 pandemic demands social distancing with personal protection equipment for in-person classes or web enabled cameras for virtual classes. Five different teaching modalities are used at our university during the pandemic. The modalities are presented in this paper along with the choices made by the engineering and computer science faculty. The majority of the engineering and computer science faculty are found to prefer teaching virtually in a 'Remote Virtual' synchronous modality since this is the closest to in-person teaching. The 'Online' asynchronous modality is the second most-preferred option during the pandemic and requires the development of learning modules with video recordings. More faculty are teaching remotely in the Spring of 2021 as compared to the Fall of 2020 because many of their students are viewing the course materials from home instead of coming to the classroom and dealing with personal protective equipment with continued concerns of spreading the virus. Additional work is ongoing to assess the efficacy of the teaching modalities in individual courses and will be subject of future publications.

Introduction

Most engineering and computer science faculty members at our public university prefer teaching in a face-to-face format in the classroom instead of teaching virtually. However, during the COVID-19 pandemic, the faculty are asked to choose among five teaching modalities that cope with the pandemic. The teaching modalities offered by the university are 'Traditional Classroom/Laboratory,' 'Blended Hybrid,' 'Flexible mode,' 'Remote Virtual,' and 'Online.'

It is important to note that a complete learning management system [1] is widely implemented across the university. This system includes capable video conferencing and online collaborating tools that can support the offered modalities. This system is also upgraded to offer automated and live Americans with Disabilities Act (ADA) compliant subtitles of the lectures and the discussions in the class [2]. The team operating the learning management system also offers online teaching certification and support to the faculty for developing online classes [3, 4].

The engineering and computer science faculty are given a choice among these modalities that best suit their courses. All modalities include video recordings of the class work to allow asynchronous viewing

with ADA compliant subtitles and transcripts. This is available to all students but essential for those who are less tolerant of the risk of contracting the coronavirus. A description of each modality is presented. The choices by the faculty are also presented in two subsequent semesters.

Description of the Modalities

The Traditional, the Blended Hybrid, and the Flexible modalities include face-to-face instruction with social distancing and personal protective equipment. The Traditional and Blended Hybrid modalities utilize classrooms where social distancing measures can be implemented. The Flexible modality allows a small number of alternating students to be physically present in the classroom while others attend synchronously online. These three modalities (Traditional, Blended Hybrid, and Flexible) allow the faculty to continue teaching their classes in a classroom, using classroom equipment as they normally do. However, the student's physical attendance in the classroom is not mandatory throughout the duration of the pandemic. For that reason, cameras are installed in the classrooms to allow students who cannot be physically present in the classroom to attend the class remotely and synchronously or at a later time.

The Remote Virtual and Online modalities are performed online synchronously and asynchronously, respectively. They exclude any face-to-face contact. However, the two modalities are inherently different. The Remote Virtual modality requires the faculty's presence online during the class' hour while students who can attend synchronously are encouraged to do so. Others are allowed to watch the recording at a later time with no penalty. The faculty conducts the class in a very similar manner as they previously did in the classroom. The resulting Remote Virtual video recordings are posted in the learning management system according to the dates when they were delivered. The Microsoft Teams software is used for this Remote Virtual modality as the videoconferencing tool. Using Teams, the professor can see the students and the students can raise their hand and ask questions or make comments during the session by voice or by text.

The Online modality requires pre-recording lecture materials and streaming them, on demand, through the learning management system. Instead of delivering a complete lecture in one video at a scheduled hour, learning modules are typically created to host a multitude of short video recordings, each covering a specific area of a complete lecture. The short Online video recordings can be organized within a learning module to assist the students as they navigate through the course [3, 4].

Discussion boards can be used in all modalities but they are especially important in the Online modality for students to post questions and comments anytime. Other students, teaching assistants, or the professor can answer the questions and address the comments. A high level of activity in the discussion board gives an indication of interest in the course materials and helps the class to develop a sense of community as described by Ray and Tabas [5].

Office hours, for all modalities can be offered using Teams teleconferencing or simply by using the phone. However, the students seem to prefer communicating and getting answers by email in lieu of office hours.

Modality Selections by Faculty

The modalities implemented in the university's engineering and computer science school during the Fall semester of 2020 and the Spring semester of 2021 are shown in the university's public information system for each class [6]. The data is downloaded and the number of faculty members teaching in each of the different modalities are counted. The total number of faculty members teaching classes is 270 per semester (average for Fall 2020 and Spring of 2021) in the school of engineering and computer science. The modality selected by each of these faculty members are shown in Fig. 1, which is a plot of the percentage of faculty members teaching in each of the five different modalities. Several conclusions are drawn based on this data as described below.

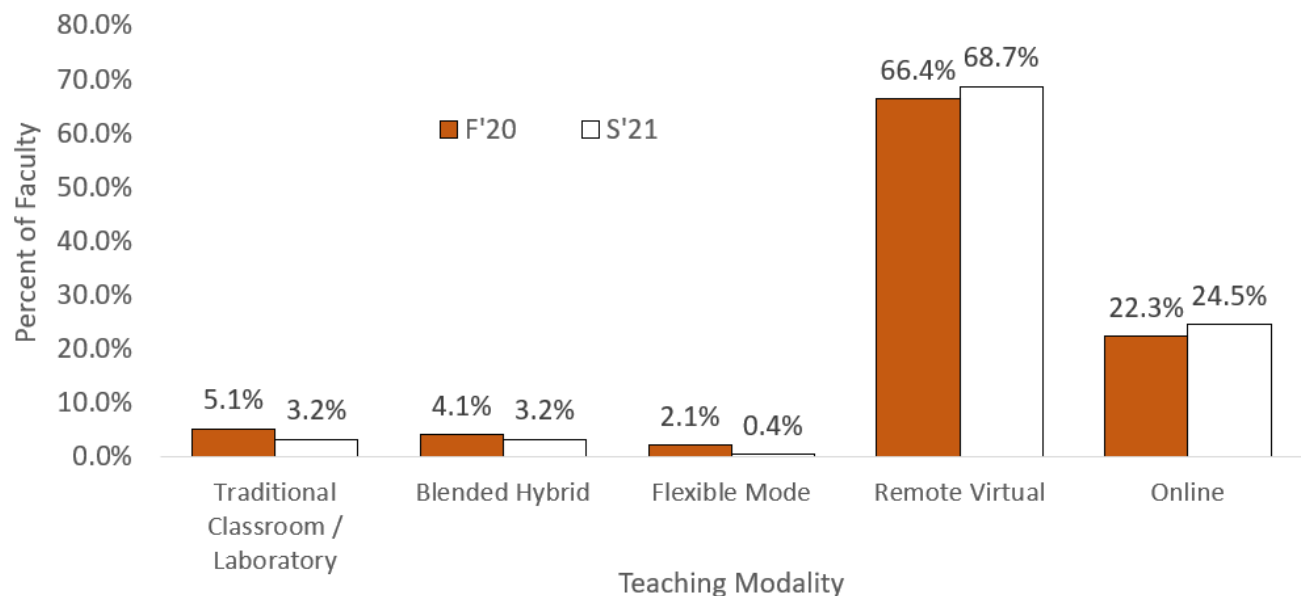


Figure 1. Teaching modalities selected by the engineering and computer science faculty during the Fall of 2020 and the Spring of 2021

The first and most obvious observation is that the majority of faculty prefer the Remote Virtual or the Online modalities during the pandemic. These two modalities correspond to no face-to-face contact among any of the people involved with the class. This observation indicates that the majority of the engineering and computer science faculty are highly concerned about the contagious nature of the virus. Their concern is legitimate according to the findings of Leidner et al. [7]. While several students at the university and the neighboring areas tested positive for COVID-19 during the pandemic, there was no spread within the school due to this preference.

Another observation is made in the split between the two virtual modalities. Specifically, about three times more faculty prefer the Remote Virtual (synchronous) modality than those who prefer the Online (asynchronous) modality. The reason is that the Remote Virtual classes are offered in a manner similar to that used in the classroom. The transition from the classroom to the Remote Virtual environment requires a pad, an overhead camera, or a white board in the view of the camera to replace the white board in the classroom. This modality is significantly more effective for delivering the complete

coursework without the need to pre-prepare online videos and online learning modules that are typically used within a course which is offered in an Online modality.

The least popular modality shown in Fig. 1 is the Flexible Mode. This is not, by any means, a negative indication of the effectiveness of this modality. However, this modality is not preferred by our faculty at this time, because it falls with others that require in-person teaching during the pandemic. Moreover, it adds burden on the faculty for splitting the students into groups that take turns between physically attending class and virtually watching the recording when only a few students chose to attend the class physically.

When comparing the data for the Fall semester of 2020 to the Spring semester of 2021 in Fig. 1, there is a reduction in the percentage of faculty members in the school of engineering and computer science teaching in all of the modalities that require in-person teaching (Traditional Classroom/Laboratory, Blended Hybrid, and Flexible Mode) and a corresponding increase in the virtual teaching (Remote Virtual and Online). This is because only a few students came to class, leaving the professor teaching with personal protective equipment to a large room with only a few students who are spaced apart and required to wear personal protective equipment while others watched the posting video recordings of the lectures at home. Specifically, even though most students desire to experience and enjoy the campus life, only a few students took the risk to be on campus during the pandemic.

A survey is deployed to the faculty, requesting reasons for their choice. Seventy-eight (78) responses are obtained between January 28 and February 8, 2021 where some offer detailed answers. One faculty member who chose the in-person modality wrote: “Since it is well known that more than 50% of communication is nonverbal communication, I think a lot of teaching quality is lost through online teaching.” Furthermore, faculty members who chose to teach in the Remote Virtual modality expressed that they wanted to have ‘live’ contact with students and relayed that the remote virtual modality offers “more effective interactions with students.” Other faculty members wrote that teaching in the Online Modality allows busy students, or those in other time zones, to watch lectures when best for them and allows the professor to edit and perfect the lectures without having to worry about technical connection issues as those do in the Remote Virtual modality.

The responses in the survey also addressed the shift from one modality to another. One faculty member wrote: “Last semester, the course was Remote/Virtual with live lectures every week. Since students can take the course asynchronously anytime, only half or even less attended the live lectures and participated in the lectures. But the course is not designed as an online course and it hinders the students' learning who take it asynchronously. This semester, I designed this course by following online course recommendations from engineering education perspectives. Hopefully, all students will benefit from it.”

Conclusions

Faculty members in the school of engineering and computer science at our university are given the authority to choose among five different modalities to deliver their classes. The majority chose to use cameras and teaching virtually over using other teaching modalities that can potentially spread the

virus. Among the two virtual modalities, the “Remote Virtual” synchronous modality is the highest used modality because of its similarity to teaching in a classroom. The “Online” asynchronous modality is the next most popular. More faculty will teach virtually in the Spring of 2021 than in the Fall of 2020, even though they desire to teach in-person, mainly because most students are avoiding the campus. The faculty’s assessment of the student’s work and the student’s course evaluations are course-specific. They will be subject of future papers.

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