Teaching Continuity of Electrical and Computer Engineering Courses under Covid-19 Pandemic

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The current Covid-19 pandemic forced the academics to adopt the online teaching methodology. The requirement of making the sudden changes in delivery methods resulted in ‘trial and error’ approach without lack of coordinated efforts to standardise the online content delivery. Academics took various ‘routes’ to accomplish the teaching delivery in the Spring 2020 semester with the different approaches having their pros and cons. In this paper, we discuss one approach that was used in a transnational educational setup where a hybrid of synchronous and asynchronous delivery methods was used for the teaching of Electronics and Electrical Engineering courses. We share some of the strengths and weaknesses of such a hybrid approach with the help of student and staff feedback and make our recommendations for future improvements.

Background:
The teaching of the technical courses in the Electrical and Computer Engineering courses such as Computer Networks, Stochastic Processes, Signal Processing demand student engagement through the mathematical derivations, simulation tools, problem solving etc. Meeting the amplified interactivity requirements becomes a greater challenge when face-to-face teaching is replaced with online delivery. Moreover, there are additional challenges to respect the accessibility and inclusivity requirements which may appear due to digital divide among the students. Before we proceed with the presentation of a hybrid approach that aimed to address these challenges, we would like to present the two extreme scenarios that could be used by academics under current disruptive circumstances. On the one hand, the instructors may only have provided the students teaching resources such as lecture slides without additional support. This approach comes up with minimal interactivity but has the advantage that it will work even with a slow Internet connection. On the other side of the spectrum, the instructors may use a live lecturing approach with full-duplex audio and video connectivity to maximise the student interactivity; this approach, however, demands a reliable Internet connection that can support high data rate audio/video streams.

Hybrid teaching methodology:
Keeping in view the above challenges and with the aim to strike a balance between student interactivity and network connectivity, a hybrid approach was employed at a UK-China joint degree program. In this approach, both synchronous (live) and asynchronous (recorded) delivery methods were used to deliver the course contents.

Asynchronous Mode – the instructors would prepare recorded videos and upload them to the learning management system on the timetabled lecture schedule.

Synchronous Mode – a week after the lectures are made available online, live interactivity sessions are conducted where the students have the possibility of discussing the contents and making queries.
The hybrid approach could meet the acceptable level of student engagement without strict requirements of high-speed internet connections.

**What was done:** A 90-minute lecture was segmented into a number of small videos with the preference of making each video length within 5-10 minutes. The aim of producing short videos was to reduce video download/play times while keeping the student focus intact when a video is being played as the average student engagement time lasts for 2-5 minutes. Autogenerated subtitles were made part of the videos to address the accessibility aspect.

During the live interactivity sessions, the students joined 45-minute Zoom webinar sessions with their videos and microphones set to off status by default. The Q&A and ‘chat’ options were used to take student questions however the instructors could allow the students to share their screens and take part in verbal communication. The instructors verbally responded with the aid of teaching material through screen share. The instructors could use the ‘whiteboard’ Zoom feature for solving problem etc., depending upon the availability of proper hardware support such as iPads. The recorded Zoom sessions would later be shared with the students for record, reference and replay reasons.

**What worked well:** The students enjoyed the flexibility of ‘attending’ the lectures on their own convenience and pace. Some instructors did include the auto-generated subtitles which was liked by many students as it helped them understanding the lecture contents better. Likewise, some instructors uploaded/included their recorded lectures on Microsoft Stream that generated a transcript. Encouragingly, this transcript was not only editable but also searchable. So, students enjoyed this feature while searching for any particular term of interest and the transcript took them directly to the respective position within the recorded lecture.

In the webinars, the students could ask questions without being noticed by fellow students as the fear of public speaking in some cultures restricts student class participation. Some staff would include in-video quiz/polls which was important to timely assess the student learning and engagement.

**What didn’t work well:** On some video sharing platforms, the video download option was not available, and the students didn’t like it as they would like to repeat/refresh the contents offline without the need and availability of internet. The cases where staff had no access to digital writing pads, the interactivity was difficult to manage as mathematical contents, for instance, are extremely difficult to follow without proper derivations.

**Some results:** In the Fig. 1 we present some of the interesting results found from the survey of around 200 students. The students mainly responded with the disagreement on whether the proposed teaching approach was useful for their learning. However, students liked the fact that they could “replay the video content of classes” and that “we (they) can have more freedom in the schedule”.

To the question, whether the current approach could replace face to face teaching in future, the students didn’t particularly seem to favour the idea of online learning with only 11% of the students agreeing/strongly agreeing to the statement. Students comments were like, “It does not work that well” and “not satisfying”.
However, there were some positive signs noted by the students as well when around 46% of the students either agree or strongly agree to the usefulness of the online learning through the development of independent learning skills. The students shared comments like, “We are enabled to access various online resources”, “independence. I learnt to search information from the Internet”, and “I find much more time for self-learning and more flexibility in time”.

Fig. 1: Student response to some survey questions

What should be done: based on the learning for Spring 2020 exercise, following measures could be taken to improve student engagement and interactivity:

- Internet limitations should be kept in mind while designing any teaching approach
- Proper interactivity software and hardware should be given to the staff and students
- The gap between asynchronous delivery (video upload) and subsequent synchronous activity (live session) should be reduced from a week to adjacent timing slots
- More tutorials should be included in the course delivery to keep students engaged throughout the semester
- Some video platforms like YouTube, Microsoft Streams have restrictions/face connectivity issues in some geographical regions and this fact should be considered while sharing the videos with the students.

Concluding remarks: Finally, the student engagement should be put at the heart of any methodology adopted for future online delivery. As noted by one of the academics “keeping students as well as myself engaged” was the biggest challenge of online delivery.

Thus, the pedagogy of online student engagement should be the focus for next semester teaching beside the technology to support the academic interventions. A particular comment respect to the transnational education provision could be to engage the students by “cognizing with the local culture” and prepare engagement activities accordingly that could enhance student engagement.