

A Discussion Forum for Online Education: Teaching Physics during the pandemic

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Almost all educational institutions were shut down in March 2020, as did much of the country, in an immediate response to the COVID-19 pandemic. Students were asked to vacate hostels and go home, teachers could not go to their offices and classrooms/ laboratories were shut. Caught unawares and unprepared, whatever teaching there was moved into an online mode. Teachers worked from their homes and students learned from theirs, both working with whatever resources were at hand.

Given the diversity in our country, the response to the online move has been very uneven. Different subjects requiring different pedagogies have been affected unequally. Internet connectivity in the country is highly variable, and thus its access to the students in cities and in rural areas is also uneven, regardless of where they are formally registered for study. Research across the board has been affected drastically, especially in experimental areas. Select laboratories in some institutions were kept open with very limited staff, but by and large the research enterprise of the country wound down abruptly.

A few months into the pandemic, it became generally clear that teaching would remain online for the next semester and perhaps beyond. It was not enough to look for short-term solutions, there was a gradual paradigm shift, as more teachers became resigned to having to teach online. We therefore came together to form the Discussion Forum for Online Teaching (or DFOT) [1] where the idea was to get together to talk and share experiences across the board, as to how teachers in different institutions were addressing different issues that this new medium of instruction had brought forward.

DFOT is a free, voluntary online platform for teachers to discuss problems of pedagogy with one another in order to find solutions, via social media such as GOOGLE GROUPS [2], SLACK, and Telegram. Biweekly panel discussions on different aspects of online teaching are organised on topics ranging from how to conduct laboratory experiments that are crucial in the sciences, to the difficulties of teaching theoretical physics, mathematics, or philosophy through the online mode.

Physical classrooms, regardless of the size of the institution, provide a platform for dialogue, debate and discussion, and also aim to offer all students equal resources. The reduction of the conventional classroom to an unresponsive laptop screen for the teacher, and to a five-inch smartphone display for the

typical student has been a very drastic step. In online teaching, on one hand, the quality of teaching material depends on the devices and internet resources available to the teacher, and on the other, to whatever devices students have access to. When a student accesses classes from home, both location and economic/social circumstances play a major role. In an attempt to understand the manner in which teachers adapt to the online mode of teaching, DFOT has conducted a voluntary and anonymous survey [3], the results of which have been fairly revealing [4].

Some issues affect all institutions. The interactive space provided by a physical classroom has been replaced by blank screen. The lack of audio-visual feedback has affected teachers across disciplines. Something like 25 % of all students in all institutions have not been able to attend online classes, so continuity has been a problem. Devices traditionally provided to teachers by their institutions such as desktops with wired LAN connections have not been suitable for online teaching, especially in the “work from home” mode. Very few institutions have given their teachers and students licensed software, leaving it to them to find free software which has its own limitations.

We found, via the DFOT survey, that teachers have been highly committed to ensuring that the students receive uninterrupted lessons, even to the point of investing a large sum of personal money to procure resources. Keeping multiple channels of communication open during a class was a strategy that many teachers have employed to ensure that students did not feel left out if there was a disruption due to poor internet connectivity.

Two areas where there have not been suitable solutions are online evaluation and Virtual Laboratories. Online assessment is not conducive for determining the extent to which a student has learned the subject, and in the absence of a proper proctoring procedure, most teachers are not confident that the online exams are adequate. Many students are barely able to attend class and cannot be expected to keep two devices and a camera on for the 3 hours of an exam. This aspect needs policies of academic institutes to be changed, and this is not easy for non-autonomous colleges- the bulk of the teaching institutions in the country.

Early in the lockdown there had been an attempt to get teachers to pen their thoughts on how they coped with the situation in the online journal, Confluence [5]. Laboratory

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courses have been deferred to the “next semester” in many institutes, but as the pandemic stretches out, other strategies need to be attempted. In this context, Yadav and Darbinyan [6] discuss the incorporation of virtual laboratories in a curriculum. Even prior to the COVID-19 pandemic, there have been attempts worldwide to create virtual labs, including the Vlabs [7] in India. However, there has been little or no pedagogical understanding or use of virtual labs on a large scale.

There have been some cases of conducting laboratory courses in an online mode.

- For instance, a video of the experiment being performed by a teacher/TA either live or pre-recorded, was shared with the students, along with instructions and experimental data collected by the teacher/TA. The students were asked to analyze the data and write a report.
- Alternately, students are given links to virtual labs where they can perform the experiments and write a report, or they are given links to virtual demonstrations of experiments and experimental data is shared with them for analysis.
- Some private universities have sent low-cost experimental kits to the homes of students, or designed low-cost experiments with household items (e.g. 100 gm soap being used as a weight) such that the concepts behind the experiments are understood by the students while having a hands-on feeling. The lacunae of such experiments (such as errors) are then discussed in a class.
- In all cases, the number of experiments that comprise a semester laboratory course has had to be drastically reduced since resources are inadequate.

At the same time, postponing laboratory courses makes it appear that experimental science is being relegated to a secondary position in comparison to theory. While it may be understandable from a logistic point of view in the present circumstance, attention needs to be paid to this pedagogic arrangement in the event that online teaching acquires greater emphasis in the coming days. This is quite likely, since the National Education Policy 2020 endorses online education.

These concerns extend to all aspects of tertiary education, including postgraduate teaching and research. During the

lockdown, institutions did allow a fraction of their scholars to stay back in the hostels so that some research laboratories could stay functional. Research scholars could work in the laboratories to some extent, and could communicate (via video calls) with their supervisors. Those pursuing research in theoretical or computational areas have usually been provided remote access to servers and libraries, but this is a small fraction of all students, especially in physics. Experimentalists in smaller institutions have been affected the most. Equipment that has been purchased in these places (usually with great difficulty!) may not be fully functional at the end of the lockdown, leading to not only a setback in overall research, but also a further delay in completion of PhDs by the scholars, who are already facing the prospect of a lost year without additional funding.

The main aim of DFOT has been to provide information pertaining to the resources needed by teachers for various aspects of online teaching. These have been collated on the website [8]. The unwavering commitment of teachers, with minimal or no systemic support, has been exceptional. The need for the administration (at all levels) to respond by providing support (including counselling) to students and teachers across the board is highly important. This support is crucial in several areas. Curricular reform, to adapt to then online mode (including exams), is crucial. Additionally, there is need to strengthen the teaching and research infrastructure in various ways, ranging from offering financial support for both students and teachers to make hardware and data affordable. It is also important to ensure the safe operation of research laboratories so that research students do not lose more time and opportunities.

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