

Back to what? What STEM and Health teaching academics learnt from COVID-19

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The COVID-19 pandemic brought about an era of innovation in higher education that was extraordinary both in its scale and suddenness. Our study, carried out in STEM and Health disciplines of a multi-campus Victorian university, asked the teaching academics in the eye of this storm to reflect on what they had learnt from this experience. In particular, we asked what had worked, what had not worked, what they planned to retain in their teaching post-COVID-19, and what they would be relieved to discard. Above all, we found the experience of COVID-19 learning and teaching to be highly variegated. Academics reported some online activities which were predominantly successful, others which were predominantly unsuccessful, and still others for which the experience was quite different, depending on the context. Our data suggest that future learning and teaching policy should allow for discipline and cohort nuances and cannot be one-size-fits-all.

Keywords: online teaching, online practicals, online tutorials, flexible delivery

Introduction

From early in 2020 the rapidly spreading COVID-19 virus had an ever more profound effect on higher education around the world. In Australia the academic year began with Chinese students unable to enter the country to take up or continue their studies, and mechanisms developed to allow these students to study at least some subjects online. At La Trobe University, as in higher education institutions around Australia, Semester 1 began otherwise normally. Two weeks in, however, in response to the rapidly degenerating health situation, the University suspended classes for a week, after which all teaching was to continue fully online, with campus access only available to a small number of staff granted exceptional status. During this pause week, staff did their best to upskill, share practice, investigate technological options supporting online teaching, record lab videos, etc. At La Trobe staff were accustomed to the automatic recording of lectures through Echo360 in classrooms equipped with this technology, but its livestreaming facility was only activated later in the year. Zoom was universally available, though used mostly for cross-campus meetings, and before the pandemic only used for teaching in a few fully online degrees. Microsoft Teams was only made available to all staff and students a few weeks after the switch to online. A tech library of some 80 tablet computers and a range of audio-visual equipment was available to staff in one of the University's two Colleges, the College of Science, Health and Engineering, and these resources were quickly fully assigned to teaching staff. Lightboard studios were also available to staff on two campuses, one city and one regional. A small number of staff retained access to these studios throughout the pandemic, as well as to labs, for recording video presentations. The vast majority of staff had had very little training in online teaching, and no choice but to make the transition to virtual instruction extremely rapidly. After the initial period of nationwide lockdown, which extended until the middle of the year, closed international borders meant that much of Australia was able to return to some level of normality for the remainder of 2020. Not so Melbourne, where a second wave of the virus led to a second, 112-day lockdown which extended for most of the rest of 2020. In Victoria, the first half of 2021 was also punctuated by uncertainty and two shorter lockdowns in reaction to virus outbreaks. Our data were gathered before the extended lockdowns in New South Wales and Victoria in the second half of 2021.

What have we learnt about learning and teaching in higher education from the experience of the COVID-19 pandemic? Government directives during the pandemic led to higher education institutions moving their teaching and learning activities largely or completely online. Fully online learning is of course not new, and best practice principles are by now well-established. Large cohorts of students who are unable to access face-to-face

and blended course offerings have been well served by online alternatives for decades now. What was new was that online learning was no longer a choice for students or a niche market for institutions: all teaching staff and students were forced online, often for long periods, depending on the jurisdiction. The usual substantial resource investment in the design of high quality material and activities was not possible as the shift to online teaching had to occur instantly and often could not go beyond offering face-to-face activities through online means. While a great deal of literature has emerged in 2020 and 2021 on how academics, disciplines, and institutions adapted to the restrictions affecting higher education, relatively little has been written about what this period of profound disruption might mean for tertiary learning and teaching in the future.

A survey of teaching staff in the College of Science, Health and Engineering at La Trobe University (n = 138) aimed to find out what participants had learnt from their experience of teaching during COVID-19, and what this means for their understanding of learning and teaching in a future, post-pandemic world. Experience from the coalface is a vital source of information for institutions grappling with the future shape of learning and teaching in their programs.

The following research questions were investigated:

1. To what extent (if at all) do teaching academics imagine returning to pre-COVID-19 learning and teaching arrangements?
2. Where is there consensus for an emerging new model of learning and teaching after the pandemic?
3. Where is there disagreement?

The clearest finding of this study was the sheer diversity in the respondents' experience of online teaching and how this experience impacts their plans for teaching post-COVID-19. Regarding the research questions, 22% (31 of the 138 respondents) expressed a desire to return to essentially pre-COVID-19 learning and teaching arrangements. The majority (78%) described a range of combinations of face-to-face and online activities, including 17 who wanted to remain fully online, and 25 who wanted to keep a fully online version of their subject as an option (together 30% of the total).

However, there was little consensus on what a model of post-pandemic teaching in the University might look like. The diversity of responses (and some cases explicit statements by survey participants) would appear to weigh against a simple formula for future learning and teaching arrangements. Institution-wide directives may need to incorporate a high degree of flexibility regarding online or face-to-face offerings or may need to be shaped by factors other than academic preferences.

Synthesizing the data provided by survey participants in this study suggests that in the view of academics at our institution, post-COVID-19 learning and teaching arrangements should be determined by:

1. The learning outcomes of the unit of study (including employability considerations)
2. The characteristics of the student cohort.

Literature review

Fully online learning is not new in higher education and best practice principles are well-established. These include precepts such as maintaining teacher presence in content delivery, providing a range of synchronous and asynchronous learning activities, and sustaining frequent direct communications with students (Stone, 2016). Others are enabling personalized learning, building a sense of community online, and managing collaborative opportunities to ensure participation (Reedy, 2019; Verenikina, Jones & Delahunty, 2017; Devlin & McKay, 2016).

While many studies have focussed on how disciplines and institutions adapted to online learning and teaching during the COVID-19 pandemic, few have drawn conclusions about how long periods of fully online instruction under corona virus restrictions are likely to change the landscape of higher education.

Some research has focussed on the effects of student perceptions of online learning during the pandemic. In a study of over 30,000 students in 62 countries, Aristovnik et al. (2020) found that students were most concerned with the effect of pandemic learning on their future employability and found studying during the pandemic boring and frustrating. While largely appreciative of the efforts made by their teachers, students did not feel they had progressed much during the time they were studying online. In contrast, in a study of 458 students at a Spanish university, Gonzalez et al. (2020) found a significant improvement in the performance of students under

COVID-19 lockdown, compared with earlier cohorts. Burki (2020) argues that if the pandemic has marked a general shift to predominantly online learning, universities will need to contend with students, particularly international students, questioning the fees they are paying, as face-to-face learning and access to campus facilities are typically considered major components of university studies. Thus, the drop in income due to the collapse of the international student market may never be recovered, an issue of particular relevance for universities in the U.K., U.S. and Australia which had become reliant on significant income from this source.

Blankenberger and Williams (2020) argue that institutional integrity will also be important as universities adjust to a post-COVID-19 normal. They highlight the importance of ensuring equivalence across different modes of attendance and warn of reversals in recent progress towards greater equity in access to higher education.

Regarding the altered landscape of university learning and teaching post-COVID-19, Lockee (2021) observes that while the exact features are unknown, innovations of the COVID-19 period may be here to stay including online labs and virtual field trips, greater variety in asynchronous activities, innovation in assessment types, and more flexibility in modes of learning. A study carried out in the medical faculty of a French university (Vatier et al., 2021) found that students were less disturbed by the transition to online education than their teachers, with 62% of students but only 39% of teachers rather satisfied or very satisfied with the online mode. In a similar vein 70% of teachers and 55% of students missed face-to-face classes, while 42% of students but only 10% of teachers wanted more than half of their classes online in the future. The study concludes that medical programs should include more digital content. In another discipline, Public Health, deficiencies in the professional response to the pandemic itself highlighted the need for educational reforms, including more practice-based learning, and developing skills in advocacy on behalf of equity groups (Resnick et al., 2021).

Student perceptions of online learning will clearly have a major bearing on institutional decision-making on how to proceed. Our study's contribution to the literature is its focus on the teaching staff experience, and what this might mean for the future of learning and teaching in higher education.

Methodology

A survey asking teaching staff to reflect on their experience of teaching under pandemic conditions during 2020 and into the first semester of 2021 was run in the College of Science, Health and Engineering (SHE) at La Trobe University in April/May 2021. Of approximately 800 teaching academics in the College, 138 completed the survey (approx. 17% response rate). Survey respondents also had the opportunity to participate in focus groups to discuss issues in more detail. Twenty staff members took part in four (4) focus groups held in June 2021. The College of SHE is one of two Colleges in the University, teaches around 24,000 students, and comprises the Schools of Allied Health, Human Services and Sport; Engineering and Mathematical Sciences; Life Sciences; Molecular Sciences; Nursing and Midwifery; Psychology and Public Health; and Rural Health. The study was run by the learning and teaching unit in the College of SHE, hence did not extend to the schools in the other College of our University. The vast majority of La Trobe's degree programs with a laboratory, practical, or clinical component are housed in the College of SHE. Because such practice-based disciplines were impacted most severely by the pandemic-mandated shift to online teaching, we believe this study will be of broader interest, despite its limited scope. Ethics approval was sought and granted by the University's Human Research Ethics Committee (reference: HEC20487).

Given the novelty of the study and the paucity of similar surveys from which to predict likely responses, it was felt that free-answer survey questions would produce the highest quality and richest data. For this reason, the survey consisted of some demographic information but was largely comprised of open-response questions. This meant that the data collected were almost entirely qualitative, and so were coded according to both manifest and latent themes. Manifest themes related to the specific questions asked while latent themes appeared as broad over-arching issues that were evident across questions. A particular code was only applied once to any given respondent, regardless of how many times that person addressed the theme. The number of counts next to an individual code therefore represents the prevalence of the theme across unique individuals.

Participants were asked about the changes they had made in their teaching in each of three semesters: Semester 1 2020, Semester 2 2020, and Semester 1 2021. Participants were only asked to comment on those semesters in which they had taught. Responses across all teaching periods were combined in the analysis.

For each semester, participants were also asked which of the changes they thought were worth keeping after COVID-19, and which did not work well and should not continue. Then in a section reflecting on their overall experience, participants were asked what they felt the key lessons from teaching online were; what aspects of

online teaching they were planning to keep, and why; whether they were planning to resume face-to-face teaching, and why; and how they were planning to integrate online and face-to-face teaching into a coherent learning experience for all students. Respondents were also asked how they would see an institutional approach to teaching moving forward if they could design this.

Because the focus groups took place after the initial analysis of the survey data had been completed, discussion could drill down on particular issues raised in the survey. For this reason, and because of the comparatively small number of participants, focus group data were not deemed comparable to survey data, and were not coded in the same way. Rather they were used to provide further insight into certain issues.

Results

The survey results bear witness to a great diversity in individuals' experiences of teaching during the COVID-19 pandemic. Staff members were prompted to describe the changes they had made to teaching activities, such as lectures, tutorials, practicals or lab classes, communication with students, assessment, feedback, etc. In some cases, the trialled activities were associated with a broad consensus as to their utility, in other cases opinion was more divided. The results are summarized in Figures 1 and 2 below.

Respondents reported trying both pre-recorded and synchronous online lectures with roughly two-thirds happy with the results (18 for pre-recorded and 33 for synchronous) and one-third not wanting to continue with the format (11 and 15 respectively). Increased student interaction was one of the reasons cited in support of synchronous online lectures:

Having the opportunity to post chats during the lecture increased the engagement of students by 100-fold compared to their engagement during live in-person lectures (a psychology lecturer).

Fourteen respondents opted for pre-recorded lecture vignettes (short snippet recordings) on the basis that it was considered a more engaging format, and it was one with which they were happy to continue. Lecture vignettes were typically interspersed with interactive activities such as online quizzes (also 14 respondents).

Opinion was much more divided over the value of synchronous online tutorials or workshops. Equal numbers (33) of those who tried them wanted to discontinue them as wished to retain them. Seven respondents had trialled team-teaching in synchronous sessions and wanted to retain this, although it was sometimes conceded that the additional workload implied may not be sustainable.

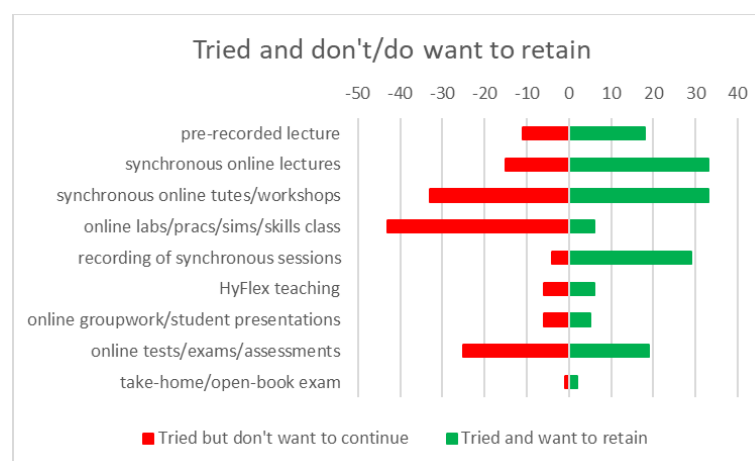


Figure 1. Number of survey respondents indicating that they did (green) or did not (red) want to retain post-COVID-19 a given teaching and learning activity that they had tried during COVID-19.

As might be expected, the great majority of respondents teaching in lab or practical-based subjects, or in subjects for which acquiring hands-on clinical skills was a major learning outcome, expressed a strong preference for returning to face-to-face classes. Of the 49 who had tried some form of online practical, only six (6) felt it was worth continuing with these (12%). A total of 56 of the 138 survey participants indicated they wanted a return to face-to-face practicals post-COVID-19 (i.e., including those who had dispensed with practicals altogether during COVID-19). Arguments in favour of face-to-face practical classes included

prioritizing the student experience, meeting intended learning outcomes, facilitating authentic learning, addressing employability considerations, and building research capacity. A small number of respondents teaching in lab-based subjects, notably some anatomy lecturers, felt that online practicals had worked well, and were happy to continue with a combination of face-to-face and online practicals post-COVID-19. It may be that anatomy practicals work effectively online because the main focus of learning is on three-dimensional relationships rather than lab skills as an explicit learning outcome. It is also pertinent to note that augmented and virtual reality exercises had already been integrated into several anatomy subjects at La Trobe via an institutional subscription to the [Visible Body](#) app. A number of respondents (12) who had trialled online practicals but wanted to return to on-campus sessions nevertheless felt that the online materials they had developed were worth retaining, either as preparation for face-to-face lab classes, or for consolidation or revision, or for unavoidable situations when students were unable to attend labs, such as illness.

Twelve respondents indicated that they had tried ‘HyFlex’ teaching: combining teaching face-to-face in the classroom with students joining synchronously online. Six felt it was worth continuing, including the contributor of the following quote:

In one subject where students work in groups, the Room and Zoom concept has allowed groups of students to work through role-played patient consults seamlessly, despite some of the group being faces on the smartboard and some being present in the class (a pharmacy lecturer).

The remaining six (6) indicated they did not intend to continue with the practice. In terms of thinking about post-COVID-19 teaching, 13 staff members felt HyFlex teaching had a place in their learning and teaching arrangements, though several were aware that the technological prerequisites for this to happen were not necessarily available in the physical spaces in which they would be teaching.

A small number of staff (11) reported having tried online student groupwork assignments, including presentations. Results were mixed, with six (6) against and five (5) in favour of continuing with the practice. Issues are likely to be very similar to those related to synchronous online workshops, discussed in more detail below.

Many respondents reported on their experiences with online assessments, including online exams, with 25 of the 138 respondents indicating they were unwilling to continue with the form of online assessment that they had trialled, and 19 deciding it was worth retaining. Only a small number (3) reported on their experience of take-home or open-book exams, and these experiences were also mixed. Eleven staff members indicated that they would like a return to face-to-face invigilated exams post-COVID-19, which included invigilated exams in computer pools.

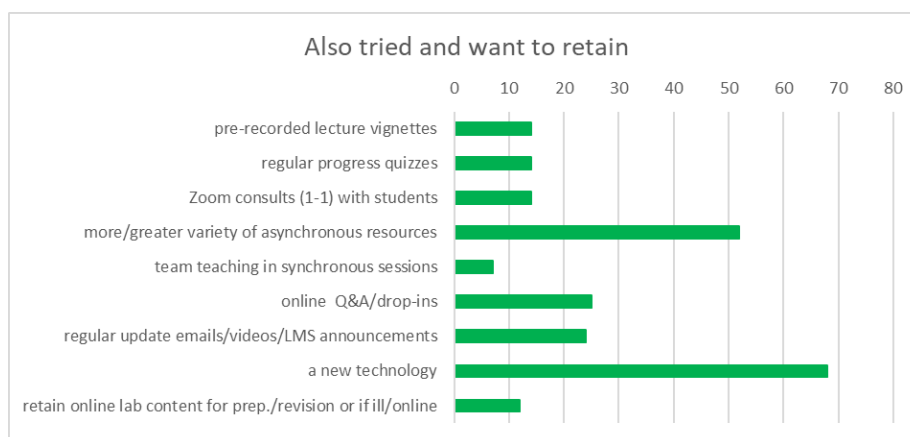


Figure 2. Number of survey respondents indicating that they wanted to retain post-COVID-19 a range of other teaching and learning activities that they had tried during COVID-19.

A common outcome of the COVID-19 experience for many academics was the development of asynchronous resources, with 52 indicating they intended to retain the resources developed, although one respondent expressed disappointment with the degree of student engagement with these in 2021.

Many survey participants reported on the usefulness of recording online synchronous sessions, either for students to refer back to, or view later if they were unable to attend. Twenty-nine had tried and planned to retain this practice, compared with only four who decided not to continue with it.

The online Q&A or drop-in session was a discovery that many academics found useful, with 25 saying they had tried it and would like to continue with this practice. A caveat is that attendance may have been driven by students in lockdown having nothing else to do, or no other way of engaging in social interaction during lockdown. Some lecturers also discovered online one-to-one consultation, with 14 indicating that they planned to continue with this practice.

A number of staff members (24) also had positive experiences with providing regular update messages to students, via email, LMS announcements or even as face-to-camera videos. This was one way of overcoming the isolation of not being on campus and coincides with well-established best practice in fully online teaching, as mentioned above.

Essentially all La Trobe staff teaching during the pandemic needed to learn to use Zoom, as the vast majority had not previously used it for teaching. A smaller number of respondents (13) also reported trialling teaching with MS Teams during lockdown. Of these, nine (9) felt it was worth retaining, and four (4) did not. Additionally, the pandemic pushed many respondents to try a wide range of new technologies, with the most popular being a polling software, typically [Mentimeter](#) or [Kahoot!](#) (17). The next most popular new technology reported was the use of a stylus-enabled tablet computer or iPad (14), followed by the lightboard studios to create teaching resources (6). Other technologies which teachers used for the first time during the pandemic and intend to keep using include [PebblePad](#), [Perusall](#), [SRES](#), self-correcting [Google Forms](#), [online escape rooms](#), [Padlet](#), [Jamboard](#), [Miro](#) and [Sway](#).

The second part of the survey asked respondents to reflect on the entirety of their experience (rather than semester-by-semester) and share how they envisaged learning and teaching developing post-COVID-19. These results are summarized in Figures 3 (general conclusions) and four (4) (more specific preferences). Thirty-one of the 138 respondents indicated a preference for a return to pre-COVID-19 teaching arrangements, although even of these 31, 20 mentioned that they intended to retain some aspects of their online teaching experience, including the more comprehensive asynchronous resources they had developed, or keeping the online mode as an option, or adding a HyFlex component. Seventeen respondents expressed a desire to remain largely or fully online (although this number included those with subjects that were already online) and 25 of the 138 respondents felt that the online version they had created should be maintained as an option alongside a blended version containing face-to-face classes. Fifteen felt that some face-to-face teaching was important, while four (4) thought face-to-face elements were important for some cohorts, and 3 recommended classes starting face-to-face for some period before moving online in the same semester.

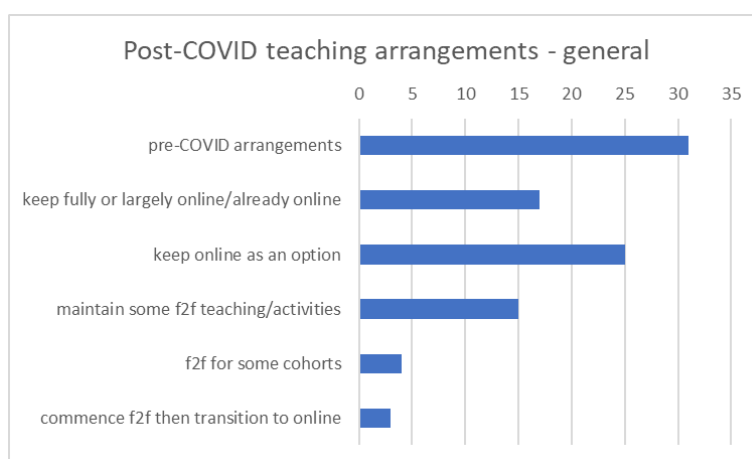


Figure 3. Number of survey respondents indicating their preference for given post-COVID-19 teaching arrangements in general.

Regarding specific learning and teaching activities (Figure 4), 10 respondents wanted to return to face-to-face lectures, 29 to face-to-face tutorials/workshops, and two (2) felt that a mix of some workshops online and some face-to-face would work best. As already mentioned, 56 respondents wanted a return to face-to-face practical,

lab, simulation, or clinical skills classes. A further four (4) felt that practical classes could be a mixture of face-to-face and online classes. Also mentioned above, 11 wanted a return to face-to-face invigilated exams (including in computer pools), and 13 expressed interest in HyFlex teaching.

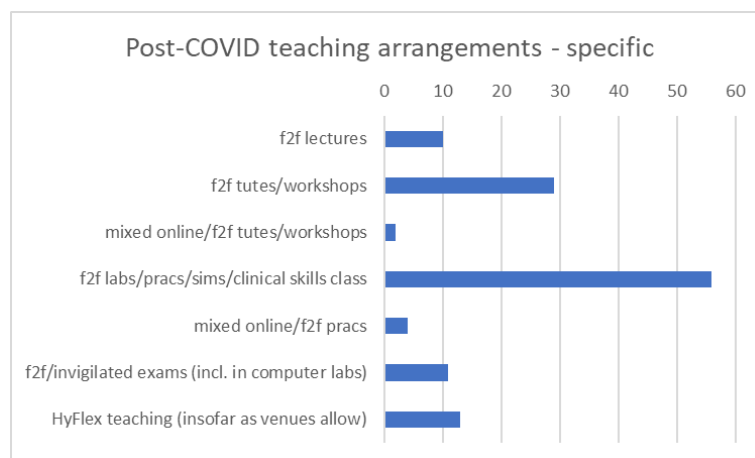


Figure 4. Number of survey respondents indicating their preference for specific post-COVID-19 teaching arrangements.

A number of issues raised by smaller numbers of staff are worthy of mention because of their more general applicability. Some respondents noticed a sharp improvement in face-to-face attendance in 2021, when that was once more possible, compared with pre-COVID-19:

The students are much more engaged in class time and much more keen to get involved in discussions. The rate of attendance is almost 100% for every class, a dramatic increase from past years (a dietetics lecturer).

Several respondents noted that they looked forward to being able to offer students a choice of blended or fully online attendance. Others, however, who had been able to offer students the choice of attending either face-to-face or online in Semester 1 2021, reported very negative experiences in terms of dramatically lower student engagement, including the following desperate observation:

This year [2021] had been the worst year for student attendance to lectures. When only face to face, or only via Zoom, attendance was great. This year, with a combined live stream and recording of the lectures that are running as face to face (due to the practical components involved), the students don't bother coming to the face to face lectures. They are not engaging. I have not met or seen or heard from many of them. ... They are not even bothering to come to the practicals. Terrible situation (an allied health lecturer).

Other staff members also flagged concerns with allowing students to feel they always had the choice between online and face-to-face classes.

Some staff members felt that creating online subjects and courses requires the careful design of all elements, not merely offering a face-to-face activity via online delivery means:

I think future-proofing the University courses relies on big changes to curriculum, not tinkering around with the best content that was created during an extraordinary time. Moving courses (or parts of courses) online in a way that will be efficient and sustainable will require a complete overhaul of content in most cases (a biochemistry lecturer).

Finally, only a small number of survey respondents expressed firm opinions about a possible new learning and teaching model. Most of these focussed on the many contextual factors that should be taken into account when deciding upon learning and teaching arrangements. Several urged that, in the words of a psychology lecturer, 'A one size fits all model won't work'. The contextual factors mentioned included discipline needs, learning objectives, cohort characteristics, staff competencies, and even benchmarking with competitor institutions.

Our research questions aimed to discover whether there had been a major shift in academics' perceptions of the most appropriate learning and teaching arrangements for their subject areas, as well as to find out where there was consensus – and where there was disagreement – concerning a possible new model of learning and teaching post-COVID-19. While our survey bore witness to broad support for reimagining lectures in the online environment, making recordings of synchronous sessions available online, providing a much richer array of asynchronous learning opportunities, and innovating with new technologies to engage students – and there was near universal consensus that practicals need to be face-to-face – in other areas experience was more diverse, and opinions were more strongly divided. These included synchronous online workshops or tutorials, and online assessment. In order to explore these divergences more fully, these issues were addressed in the focus groups.

Again, some focus group participants reported experiencing high levels of student engagement in synchronous online workshops, while others were confronted by mostly black screens and silence. Differences in engagement were attributed to student maturity, with later-year undergraduates or postgraduates more likely to engage; whether the content lent itself to differing opinions, or information transfer; how comfortable or uncomfortable students felt with the subject matter (e.g., one social work lecturer found students switched off their cameras when transformative learning experiences became overwhelming – an approach that works well in face-to-face teaching); and how well the students knew each other already. Some focus group participants were able to ensure high levels of engagement in synchronous online workshops through insisting cameras remain on for professional conduct reasons ('You can't nurse someone, apart from a basic telehealth thing, remotely, you need to be present in the room, and we just said that to them' – a nursing academic), or by adopting a problem-based learning approach. Others had success with team teaching, whereby modelling interaction between staff was found to generate student involvement.

It was also observed that there are aspects of face-to-face teaching that cannot be reproduced to the same extent in online synchronous workshops. These included building relationships, both student-student and student-staff, and therefore an effective learning community; the importance of overheard information, such as staff being able to correct misconceptions arising in group activities, or students picking up co-curricular information about deadlines, etc. from their peers or in-class questions; and socialisation, such as how to behave on a clinical placement.

The second area of divergence was on the topic of online assessment. For those in favour of keeping their assessments online a major factor was greatly increased marking efficiency, and not just with automatically marked quizzes: questions can be assigned to markers and marked far more efficiently than in the case of paper exams, reading poor handwriting is no longer a problem, and annotating submissions electronically is not just more efficient but means that the marker can retain a copy as well. For those who had a negative experience of online exams the main issues related to academic integrity, greatly increased workload (e.g., writing question banks), and technical difficulties. Nevertheless, for many staff members the shift to online assessments caused a rethinking which they acknowledge led to better, more authentic assessments, which are better able to evaluate learning outcomes. Having to write open-book exams, for example, demanded questions that test higher-order learning, not merely memorization ('facts' being easy to find on Google). Requiring students to prepare videos of themselves performing clinical procedures meant that they created a resource on which to exercise self-criticism and develop independent learning skills. Furthermore, reflecting on experiences of increased academic misconduct, many staff felt that greater clarity of information to students about academic integrity was needed: it was not always clear to students what activities are considered academic misconduct. Another popular suggestion was being able to run invigilated exams in computer pools, to counter contract cheating (as students can be identified) and collusion, but retain the marking efficiencies of online assessments.

Even activities which were not successful online nevertheless provided learning opportunities. Despite near universal consensus that practical, laboratory and clinical skills classes needed to return to face-to-face delivery, the online experience nevertheless provided a new perspective which highlighted for some focus group participants ways in which face-to-face practicals could be improved. Some academics observed that the development of theoretical knowledge, writing skills, critical thinking, and statistical skills had improved in online formats, and that in some cases students met learning outcomes more effectively following videos or simulations online, because in the lab there is a danger that students are merely following a recipe, and lose the big picture oversight of what is going on.

The final topic discussed in focus groups was that of post-COVID-19 student engagement. From our survey we had found that while many survey participants were looking forward to a future of greater study mode flexibility, a small number of staff who were able to offer such flexibility with the partial return to campus in Semester 1, 2021, reported very low engagement regardless of mode. Focus group participants identified with

this. They reported that students appear to find it confusing or difficult to manage if some classes are on-campus and others are online, or may simply miss the routine of coming onto campus. Another reason put forward for low student engagement in this semester was possible dissatisfaction with stop-gap teaching methods introduced in an emergency but continued into 2021.

Discussion

It is clear that the academics who participated in our study experienced teaching under pandemic conditions in very different ways. It is also clear that while there was significant consensus that certain innovations in learning and teaching arrangements worked well online and should be retained post-pandemic, there were also complex reasons why other changes only worked well in some cases, but not at all in others. Consequently, enthusiasm for a 'new model' of learning and teaching emerging from the COVID-19 experience needs to be tempered by a number of uncertainties.

Firstly, while many online activities worked well in a lockdown situation, in which students had few other distractions, and not many alternatives for social interaction, there is no guarantee that students will be as engaged after a return to normality. Study will once more compete with many other priorities for students' attention.

Secondly, as the example of synchronous online workshops demonstrates, the reasons why a particular online learning and teaching activity is successful in some cases, and not at all in others, are complex, and cannot simply be attributed to staff ability or training. Focus group participants suggested engagement can depend on the type of content (whether it is open to discussion or opinion, or on the other hand whether some students may find it confronting), the learning activity (e.g., problem-based learning, or break-out activities requiring information transfer), but also on the cohort itself (first-year or later-year, undergraduate or postgraduate). Interaction in online workshops may also depend on discipline-specific factors. Furthermore, while the importance of face-to-face classes for developing kinaesthetic skills is undeniable, other benefits of on-campus presence should not be overlooked. Building relationships among staff and students, and nurturing a learning community are among the most important. And as one focus group participant pointed out, the study regimes of some students may benefit from the routine of coming onto campus.

Thirdly, the very low engagement experienced by some academics offering flexible attendance options during the partial return to campus in Semester 1, 2021 is puzzling. Why, given the choice between returning to face-to-face classes or remaining with the online format created because of COVID-19, might student engagement be worse than when either format was offered in isolation? Three possible explanations are proposed. Firstly, as some study participants suggested, it may be that in 2021 students simply lost patience with poorly prepared online learning: what was appreciated in 2020 as an emergency measure, was simply unengaging in 2021. Secondly, it is possible that low engagement in either mode is related to fatigue with the ongoing pandemic, on the part of both students and staff, and is not the result of the teaching mode per se. A third explanation is that it may be due to students underestimating the commitment required for higher education learning. The assumption is often made that by making it easier for students to fit their studies in around the rest of their lives, we are doing them a service. But for some students it is possible that this might lead to them underestimating the weekly hours required, precisely because it appears as if they do not need to make much of a commitment to accommodate study.

Conclusion

To return to our research questions, we discovered that relatively few survey participants planned to return to pre-COVID-19 teaching arrangements. While 31 out of 138 expressed a desire to do so, two-thirds of these (20) nevertheless indicated that there were still elements of their pandemic teaching that they wished to retain, such as the asynchronous resources they had developed, or online study as a parallel option, or teaching HyFlex.

Secondly, there was broad consensus concerning lectures remaining online, in either synchronous or asynchronous format (e.g., lecture vignettes interspersed with quizzes); the need for practicals, laboratories and clinical skills classes to return to face-to-face; the usefulness of providing a greater range of asynchronous learning resources; and the value of exploring new technologies to engage students in their learning.

Regarding our third question, opinion was much more strongly divided over whether workshops or tutorials could be effective online (with some respondents finding they worked well, and others not at all); and whether online assessment was a satisfactory way of evaluating student learning.

Our results indicate that while a one-size-fits-all approach to learning and teaching arrangements may be appealing from an institutional perspective, it may not be best suited for students or for staff who have to deliver. The message concerning learning and teaching design that emerges from the data collected in this study is that two factors need to be considered:

1. The learning outcomes of the unit of study (including employability considerations)
2. The characteristics of the student cohort.

Further research is required into the factors that affect student engagement in certain online learning and teaching activities, in particular synchronous online tutorials/workshops, including the extent to which the discipline and the maturity of the cohort play a role. Further investigation is also required into the question of whether offering students greater flexibility regarding face-to-face and online modes leads to a change in student engagement, and why. Finally, more work is needed on understanding the impact of the pandemic on student and staff behaviours and expectations in general.

One major limitation to this study is the use of coding across several open-ended answers: the counts of these codes cannot provide the same certainty as a closed-answer survey, although efforts to minimise double-counting were used. This approach to the survey and analysis was chosen due to the novel conditions and the lack of previous studies that could be used to predict likely answers to our questions. Another major limitation is the single-institution context of the survey. Nevertheless, the survey does reflect the experiences and views of academic staff and there was considerable effort to quantify responses in an objective way.

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