Examining learners' engagement and barriers to interaction during synchronous teaching throughout the COVID-19 pandemic

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Abstract

The COVID-19 pandemic caused major disruptions to educational experiences worldwide including UK Higher Education (HE). Most universities replaced face-to-face teaching with online and remote teaching and learning. For students, online learning had a significant impact on their learning environment, which affected their participation, engagement with content, and classroom interaction. Hence, we conducted a pilot study to gain insights on factors that improved or discouraged participation in an online teaching environment and collected feedback on possible improvements. The students of the Integrated Medical Science (IMS) programme at University College London (UCL) participated in an online questionnaire-based survey and interviews comparing various aspects of online synchronous learning environments to face-to-face learning environments. Thematic analysis was conducted on their answers to draw relevant insights. Our findings revealed that task-based teaching structures promoted interactivity, while faculty-led and/or activity-based small group tutorials were the most rewarding for students. More importantly, classes that utilised two-way webcams maintained focus and participation, while the lack thereof resulted in reduced interaction and increased distraction. Although students indicated that online teaching was more convenient - in terms of travel, managing familial responsibilities, time management, and navigating unforeseen circumstances - most students still said they would prefer/preferred face-to-face teaching. Based on the findings, recommendations were extrapolated and presented to the faculty to create more equitable access and participation in online learning environments.

Introduction

The COVID-19 pandemic led to major disruptions, impacting the global economy, healthcare, and politics. More specifically, it led to changes in quality of life, mental health, and education. The pandemic caused drastic changes that disrupted the norm, from moving education online to increase accessibility, to campus closure and reduced in-person activities for safety. University students were affected by the shift to online learning, as well as campus closures, with many foreign students returning home (Brahams, 2020). For these students, the shifts to online teaching have significantly impacted learners' engagement and interaction during synchronous teaching. With hybrid learning continuing in the academic year 2021/2022 and with plans to continue while the COVID-19 pandemic is unresolved, it is necessary to investigate the effects of a changing educational landscape on faculty and students alike.

Learner engagement is the tendency of the learner to interact with other learners, teaching members, and course elements. Engagement has a crucial role in effective learning, keeping the students connected with their course, and consequently, with their learning (Swan *et al.*, 2000). To adapt to online learning, teaching members and learners use a variety of methods

to communicate during synchronous sessions, including two-way texts, voice, and webcams. Visual clues from the learner's video feed help the teaching members evaluate learner understanding, motivation and engagement. University College London (UCL) has heavily implemented a variety of learning and teaching tools including Lecturecast, H5P (abbreviated from HTML5), and SCORM (Sharable Content Object Reference Model) packages. Lecturecast is UCL's platform used to capture lectures. In addition to the regular recording and viewing of lectures, this platform allows academic personnel to create interactive learning resources for students to engage with. Additional features provided by this platform include, but are not limited to, taking notes, providing captions, asking questions and live streaming. H5P is a plugin used by UCL's academic staff with the main purpose of creating interactive learning materials including lectures in the form of presentations, quizzes, and others. Course leaders and tutors often make the H5P interactive activities within Moodle, which is the main virtual learning environment used by UCL. SCORM is employed to authorise e-learning materials from external organisations outside Moodle and other virtual learning environments. SCORM packages from external organisations can be uploaded to Moodle by course administrators, leaders, and tutors.

As a result of the adaptation to the COVID-19 pandemic, students faced new challenges and benefits with online learning. Students and faculty were able to attend to personal matters with greater flexibility, spend time with their family and continue to work in a safer environment. Online learning allowed flexible remote learning and prevented the discontinuation of teaching (Hew *et al*., 2018), while remote learning further encouraged students to develop their own style of learning and academic experience (Karkar *et al*., 2020). However, there were also challenges associated with online learning, such as issues of internet access or connectivity, time zone clashes, reduced social interactivity, burnout and more.

Social interaction and visual cues diminished extensively as education shifted to online learning. During this period, we noticed that students were more reluctant to engage during online learning sessions, either vocally or through using two-way videos. Issues with such methods have been raised by Gruenewald *et al.* where possible conflicts with the learner's privacy, equity and inclusion are discussed.

As suggested in the literature, there is a relationship between interactivity and engagement during online learning. Although some studies suggest asynchronous discussion may be overwhelming (Picciano, 2002), more recent studies have found evidence of a statistical relationship between interactivity and learning outcomes so long as the discussions are geared toward those outcomes (Kent, Laslo and Rafaeli, 2016).

With the pandemic shifting the learning environment towards and increasing the popularity of hybrid learning, it is crucial to understand new barriers to student engagement and interaction, to improve the academic experience for lecturers and students. Thus, we investigated the interactivity of undergraduate students in UCL through online questionnaire-based surveys and interviews to understand factors that restrict and encourage student engagement and participation in class.

Project aims

- Build a consistent, equitable and inclusive strategy during synchronous teaching and learning in response to the pandemic.
- Address challenges faced by both teachers and students adapting to a new style of teaching and learning.

- Understand students' behaviour/experiences during online teaching and consequently implement strategies to lower any barriers and empower students to engage via audio or video (webcams) during synchronous teaching.
- Explore the existence of any learner-centred reason for the use of webcams and explore any other ways for active learner engagement.
- Establish a partnership approach to understand learner behaviour online which should generate some useful insights that can be shared more widely with the team.
- Seek suggestions from students and teachers to propose ways how to engage students during online teaching.
- Identify ways to overcome challenges in synchronous online teaching concerning engagement from a learner and instructor's perspective.

Methodology

The study participants included undergraduate students from UCL's Faculty of Medical Sciences, primarily focusing on students from the Integrated Medical Sciences (IMS) program (n=76).

Participants completed an online questionnaire containing questions that evaluated the quality of online teaching in the academic year 2021/2022 and identified student engagement barriers in online teaching. The questions were structured to compare online synchronous learning environments to face-to-face learning environments and their preference for either option. The questions were also designed to obtain insight into students' independent learning via their preferred platforms and rationale for their preferences. The main section of the questions focused on the modes of learning, platforms, and class structures during online synchronous sessions that they perceived were the most engaging. The final section of the survey investigated the role, frequency, and type of technical difficulties that impacted their learning experience. Upon completion of the survey, five students were selected for an interview to provide further feedback on their answers. Of the five students, four were in the Cancer Biomedicine program and one was in the Applied Medical Sciences programme. The students were selected based on their replies to the question prompts, additional comments, and their availability.

In conducting the focus groups, participants were provided with five open-ended questions. Question 1 discussed their reasons for their hesitancy or acceptance to turn on their camera and audio. Question 2 explored their perception of face-to-face classes and online learning via the advantages and disadvantages of each delivery. Question 3 elaborated on their preference for specific delivery platforms (i.e., SCORM packages, H5P, etc.) Question 4 asked participants to discuss perceived flaws and factors in teaching that reduced interactivity and motivation. Finally, Question 5 provided a platform for feedback by asking for solutions for improving interactivity in classes. Interviews were recorded and transcribed, before deleting the recording for data privacy. The transcripts were analysed using a method of thematic analysis adapted from Kiger and Varpio (2020). Recurrent themes were agreed upon by research group members.

Major findings

Our survey consisted of a total of 76 students from the Faculty of Medical Sciences, of which 36% were in their first year, 40% were in their second year and 24% were in their third year. From our data analysis, we have obtained several new findings.

Students generally perceived that face-to-face teaching was more interactive and efficient compared to online delivery methods. A majority (61.3%) indicated that face-to-face teaching was better than online teaching, in the context of interactivity and efficiency. Interestingly, 21.3% of students were indifferent to either option, and the remainder (17.3%) preferred online teaching as a more interactive option. It may be important to note that students might have also used this question to indicate their preference for online or traditional face-to-face teaching.

With regards to preparatory work, a slight majority (53.3%) indicated that they prefer Lecturecast as a delivery method, while 26.7% indicated that they preferred to use H5P. PowerPoint with Audio and SCORM packages were the least popular, with 8% of students indicating it as their preferred method of studying. A large majority of students (70.7%) mentioned that they selected their preferred pre-recorded format due to convenience and ease of use, while a substantial number of students (21.3%) indicated that compatibility with their study method was more important. Further investigation might be required to understand how H5P and Lecturecast provided ease of use and compatibility to students' study methods to determine if SCORM or PowerPoint are innately inappropriate for delivery, or if the delivery platforms are used inappropriately.

Nearly half of the participants (48%) indicated that they were willing or currently spending two hours or less on preparatory material, per module per week. 32% were spending three or more hours, 16% spent an hour, and 4% did not do preparatory work at all.

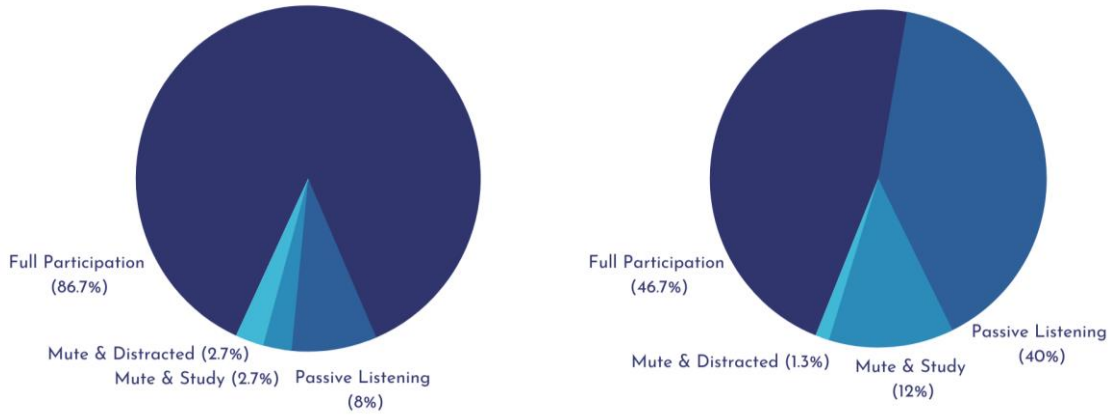

Figure 1: Comparison of student engagement with cameras on (left) and cameras off (right)

With a focus on interactivity and camera usage, a majority of students perceive that turning their camera on encourages them to be engaged and more interactive in a lecture or tutorial. A large majority of students (86.7%) indicated that with their cameras on, they were fully focused and participating in the lecture. Conversely, in lectures with the camera off, the number of students that fully focused and participated declined substantially to 46.7%. More commonly, without cameras on, 40.0% of students were letting the lecture run in the

background while conducting other activities, while 12.0% muted the lecture and were studying. Therefore, reported student behaviour during interactive or live events indicates that turning on the camera increases accountability and participation as the faculty or their peers are able to see and monitor each other's activity.

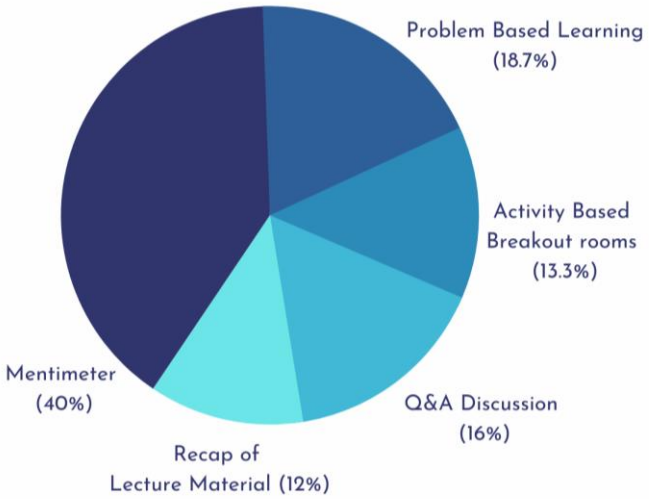

Figure 2: Student perception and preference of the most engaging teaching method

The curriculum and teaching structure of online virtual delivery methods is an integral part of maintaining teaching efficiency and student satisfaction (Woo, 2007). In the context of virtual delivery methods, 45.3% of students felt comfortable interacting and having their cameras on in small group faculty-led tutorials and 40% of small group activity-based tutorials had their cameras on and participated. Only 9.3% of students were comfortable with large group lectures and 5.3% were comfortable with lectures and workshops. Furthermore, a considerable amount (40%) of students mentioned that Mentimeter encouraged them to engage the most at these tutorials or lectures. 18.7% of students also indicated that problem-based learning encouraged them to engage the most at tutorials. In a separate question, 37.3% of students suggested that they were more willing to turn their camera on during a break room activity.

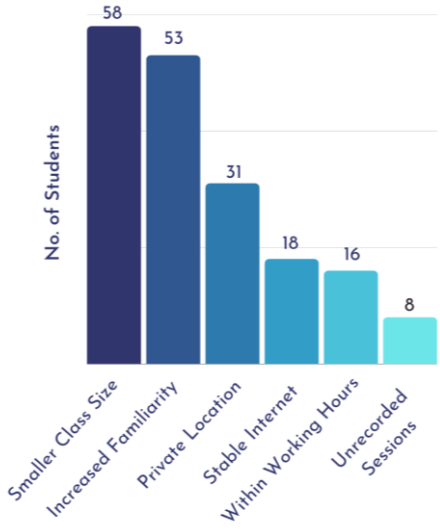

Figure 3: Factors that would improve engagement

To explore how barriers to participation and engagement may be lowered, questions were raised on existing barriers that prevented students from participating, as well as on what actions might be taken. Students strongly stated that having a smaller class size (76.3%) and increased familiarity with their classmates (69.7%) made them feel more comfortable with turning their cameras on. Although those are both important reasons, some students (40.8%) also indicated that having a private location that is not in a shared space is important for participation. Stable internet connection and having a lecture during working hours at their local time also encouraged students to participate with cameras on, however, they were not integral reasons for participation (21.1%). Only 10.5% of students mentioned that reduced privacy concerns were a factor in reducing engagement.

We asked participants to expand on class familiarity and the social turning point for encouraging video in a class. There was no distinct result, as students were equally divided on the minimum number of students that would need to have their cameras on to turn their cameras on. However, students were more willing to put their cameras on if cameras were required to be on throughout the entire session (57.9%), or if the lecturer preferred it (34.2%).

Students' concern for privacy was hypothesised to play an important role as a barrier to student participation. Surprisingly, students were generally indifferent to the recording of online teaching. 19.1% of participants indicated that they were more willing to turn their camera on during an unrecorded lecture, and 38.2% of participants indicated that recording did not matter. To support the results from the previous question, 55.1% of participants mentioned that they were willing to use their microphone when asked, regardless of the lecture being recorded. 3.4% of the students indicated that they were only willing to use their microphones when the lecture was unrecorded.

Finally, the role of internet stability as a barrier to student participation was a concern. A majority of students (52.8%) had encountered disruptions or quality issues in their online synchronous classes when using audio or video, and 23.7% of students indicated that having a more stable connection would improve engagement. With regards to platforms, 37.1% of students encountered difficulties when using Blackboard, 32.6% had difficulties when using Zoom, and 28.1% of students had difficulties using Microsoft Teams. 53.3% of students encountered issues that affected their learning experience less than 5 times per term, 25.8% encountered technical issues less than 10 times per term. 11.2% had technical difficulties more than 10 times per term. In contrast, 11.2% of students signalled they did not have any disruptions.

Through the interviews and open feedback sections, students have further indicated that online methods of delivery allowed better convenience in terms of travel, familial responsibilities, time management and navigating unforeseen circumstances. They also stated that text-based supplementary preparatory material was extremely helpful, as well as utilising video material with transcripts (e.g., Lecturecast) as it avoids repetitive replaying. However, preparatory materials without pictures or diagrams were challenging to understand and process.

Interview results

In our focus groups, students elaborated on their answers and feedback that was submitted in the surveys, as well as answered selected questions we posed to them. The questions sought out insights and details that our survey was unable to acquire. We focused the questions on factors that made them hesitant to turn their microphone and camera on, factors that might reduce their hesitancy, their preferences on delivery platforms, their recommendations for teaching, and the advantages or disadvantages of online and face-to-face learning.

As a result, students generally echoed the insights we gained from the survey. Students felt intimidated about turning their cameras on, even if they wanted to, due to the lack of familiarity with their coursemates, or if no one else had their cameras on. Students also provided insight on their reasons for the lack of camera and audio usage. Some mentioned that a home environment meant that they were not looking presentable during the lecture. More importantly, cameras were not required for the format of teaching, therefore it was not crucial for students to use them. Students stated that making cameras and audio a requirement would encourage them to turn theirs on too.

Students indicated that face-to-face classes were very engaging and socially motivating while allowing flexibility in discussion and group work. They mentioned that face-to-face classes discouraged passivity, encouraged better time management and a focused environment compared to online learning. However, some participants have also noted online learning might allow better tailoring to their study methods and pace, without distraction from their peers. Online learning also allowed them to ask questions privately, without fear of judgement from their peers.

Participants noticed a lack of motivation and disengagement from the lecturers and felt that reading from slides or transcripts ultimately affected the level of student engagement with the content. Repetitive content with a lack of clear goals was also de-motivating. The students mentioned that long lectures even with breaks were still tiring, and perceived face-to-face to be less tiring than online learning. They suggested that the application of knowledge was more interesting than summary, as well as being chosen to answer questions that allowed for heterogeneous participation. Finally, students mentioned that having a task to work on in small groups, while learning to apply their content, was preferred. This further reinforces the data collected from the survey.

Discussion and recommendations

Our data seemed to indicate that engagement and interactivity were not optimal during remote learning. However, the results have allowed us to pinpoint areas that could help increase engagement and interactivity.

Overall, students preferred to have small classes (figure 3) with a quiz-based system/activity (figure 2) with led discussion as a part of their learning model to encourage interaction. The survey results also showed that a majority of students felt empowered to use their cameras and participate in small group classes (either activity-based tutorials (40%) or faculty-led

(45.3%)). As seen in figure 1, encouraging camera use also enables faculty members to encourage accountability and focus during lectures. More importantly, turning on their video also increases students' participation and interactivity. We also notice that a conducive and comfortable environment increases student willingness to use cameras and interact in class, which in turn once again encourages focus and participation. The results from our survey seem to show there is a reciprocal and synergistic effect when cameras are turned on during online synchronous deliveries, as 62.7% of participants said that turning their cameras on encouraged them to be more interactive and engaged in a lecture. Therefore, to reduce barriers to interactive learning and capitalise on the positive feedback effect of a conducive environment, online classes must engage and entertain discussion. This could take the form of a faculty-led discussion - utilising breakout rooms with faculty switching between rooms and/or online quizzes (Mentimeter/Kahoot) to ensure focus, all while having a common task to promote discussion. This echoed the results of a previous study which showed that the use of quiz-based systems could improve participation, learning and motivation (Meguid, 2017).

Apart from the importance of class structure in improving interactivity (described above), general trends indicated that requiring camera use served as an important impetus for video usage. The use of stable media platforms with smaller breakout rooms might have a considerable effect on participation, especially for students with lower bandwidths and weaker internet connections. Another condition that increased students' willingness to be interactive was familiarity with their classmates (figure 3). Students who did not know each other or were unfamiliar with each other tended to avoid utilising more personal modes of communication, such as microphones and video. Furthermore, having a few students that are more comfortable with them having videos on and actively engaging in the conversation may incentivise other students to emulate their behaviour thereby increasing overall student engagement. The survey results did not indicate the minimum number of students that were required to initiate a domino effect. More investigation would be required to identify the minimum percentage of students required to create a comfortable environment for more reluctant students to participate.

We also noticed certain factors seemed to harm interactivity, and more specifically students' willingness to be interactive. Large group lectures and workshops were the least preferred mode of delivery, both in terms of interactivity and video usage, as 14.6% of students felt more comfortable in large group workshops or lectures, while the rest preferred small group tutorials. Similarly, summaries and recaps of preparatory material seemed to be the least popular option when we asked students which activity they felt most encouraged to engage with. This indicated that in these situations students did not feel comfortable or encouraged to interact, as they found themselves in an environment that promoted lowered focus and complacency. This came as no surprise as studies demonstrate that loss of concentration can occur after long durations, as students' attention spans begin to switch to a different activity (Risko, 2011). Results showed higher perceived interactivity in Q&As, online quizzes problem-based learning and reduced preference for lectures, which showed once again that task-based activities seemed to be crucial for interactivity. This may be linked to the idea that interactivity extends the attention span of learners (Geri, Winer and Zaks, 2017). Tasked-based activities encouraged discussions and promoted video and audio usage as well as active learning while avoiding repetitive recaps and one-way monologues.

In the survey, students also mentioned certain barriers that prevented them from participating were out of their control. Students indicated that having a more private location or not being in a shared space, as well as having the lecture during working hours at their local time would help boost interactivity. However, such factors are usually also out of the faculty's control and more related to either timetabling or the personal circumstances of the students.

It is important to note that although privacy was preferred, it was not essential. Only a minority of students strongly expressed their desire to not be recorded during activities that required video usage, 14 students preferred not to be recorded, one student mentioned insecurity, and another said, *"it feels like an invasion of privacy".* Therefore, although privacy was not as significant a barrier as large lectures, lack of familiarity with peers, or awareness of the material, it might be prudent to understand the demographic of students to adapt accordingly. It could also be interesting to know the effect of recording on student interactivity and discussion in practice.

We noticed that encouraging or requiring the use of cameras and microphones would motivate students to be active and engaged in their learning. In addition, it would help replicate the live face-to-face sessions that students much prefer. Additionally, tasked-based activities would facilitate discussion and engagement. Small group faculty-led and activity-based tutorials helped create a purpose for using video and audio, while also increasing interactivity and avoiding the repetitive review of preparatory content. Of these task-based activities, students particularly enjoyed problem-based learning as this allowed them to apply and connect knowledge taught in class to real-life scenarios. Aside from encouraging the use of cameras, microphones, and task-based activities during online classes, increasing the number of breaks during longer classes could reduce screen fatigue and improve focus.

Administratively, it is key to ensure all synchronous activities are offered in a time zone that allows most students to be present. This would empower students to engage via audio or video, as well as allow students to avoid consistently attending sessions at unreasonable hours. If there are students from more than two time zones in the cohort then live debrief sessions at alternative times could provide an opportunity for all students to interact with each other and the lecturers. To reduce screen fatigue and monotony, shorter sessions throughout the day, with modules spread across the week (akin to a traditional school schedule) would prove more stimulating. Regular feedback sessions to evaluate student satisfaction after each week would provide more information regarding barriers to learning, while providing insight into teaching quality.

In terms of social relationships, icebreaker sessions, where students and faculty interact, can improve familiarity and confidence and in turn reduce barriers to participation. Recognition for interactivity, effort or academic excellence during online teaching will further incentivise participation and perpetuate a positive attitude.

Limitations

This study was conducted as a preliminary pilot study to drive interest and gain initial insight into education at UCL's IMS cohort. However, the study was conducted on a small cohort of students (n = 76), which contained an uneven distribution of participants from each course

and year. Therefore, sample selection bias may play a role in skewing the data, and it may not be representative of the whole cohort. In terms of the method employed, a more extensive and open survey could be generated, covering both attitudes towards only face-to-face, and online learning in an explicit manner. The questions provided only certain answers, presenting selected options or responses that were anticipated. Therefore, the survey might have omitted unique options, responses and perspectives that were not expected. For example, no insight was collected regarding the reasoning of students who spent one hour or less on preparatory work. This might have been because students were already familiar with the content; alternatively, they may have study methods that were not well suited to the preparatory material. Further questions are required to understand the rationale of their choice for data extrapolation.

Furthermore, it is possible that students may not be reporting truthfully or accurately about their engagement in class, or the time spent on preparatory work, due to social desirability bias. The survey did not collect data regarding participants' behaviour during in-person classes, therefore it was not possible to determine a baseline for students' behaviour. More importantly, first-year students also did not have any pre-pandemic in-person university experience for comparison. Although the first years could not compare the current setup with pre-pandemic methods, we still thought it was essential to get their insights to understand how they perceived hybrid learning and observe their approach to university to see if the pandemic had any effect. This data is useful beyond the scope of our research as the insight obtained from the first years will be useful to address any problems and mitigate barriers to entry for future students.

The study aimed to be explorative, yet only descriptive statistics were available as a method of analysis. No hypothesis was generated before conducting the study and no similar data was collected pre-pandemic for comparison. This may yield limitations in the statistical significance of this study.

Conclusion

Evaluating the academic experience of students with different modes of content delivery, class structure and barriers to engagement proved crucial in understanding the changes to learning during the COVID-19 pandemic. Our preliminary data gained critical insights that revealed some of the new challenges which students faced from online learning. Students encountered long hours of one-way, review-style lectures, minimal social interaction, and various social and circumstantial barriers. These barriers included large class sizes, lack of clear goals and activities in class, lack of familiarity with their peers, as well as external factors such as time zone differences and technical issues.

Upon addressing the social and technological barriers faced by students in the survey, we sought to apply the new insights we gained. To build a consistent, equitable and inclusive strategy, we reviewed possible measures that UCL can take on an academic and administrative level to further improve student engagement, motivation and focus during online learning.

Finally, despite the limitations stated before, the study retains merit in providing observations of online learning at the IMS program at UCL. It would be beneficial to conduct a centralised study with a larger sample size to explore if the trends in this study are reflected across cohorts and courses and to counter any possible bias due to sampling or methodology.

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Competing interests

We declare that we, the study authors, have no competing interests.

Availability of Data and materials

The study data presented, analysed, and discussed in this study is available upon request. However, in the interest of protecting participants' confidentiality and safety, the data has not been publicly made available.

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