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Reacting to the Coronavirus: A Case Study of Science and Engineering Education switching to Online Learning in a Sino-foreign Higher Education Institution

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Abstract

Purpose – On December 31, 2019, the Chinese office of the World Health Organization (WHO) received the first reports of a previously-unknown virus allegedly behind a number of pneumonia cases in Wuhan, in the People’s Republic of China. University of Nottingham Ningbo China (UNNC) is a Sino-British campus situated in Ningbo, about 700km from Wuhan, with a student population of approximately eight thousand domestic and international students. Due to the restrictions placed on travel both from within and external to China, UNNC reacted quickly to ensure that the quality of teaching and learning (T&L) was upheld, and that students would meet their credit requirements to progress and/or graduate on time. This paper reports on an on-going study examining some of the major challenges faced when adjusting from traditional face-to-face teaching methods to the necessary online/remote teaching methods used within the Faculty of Science and Engineering (FoSE) at UNNC due to the sudden outbreak of the Novel Coronavirus, Covid-19, within mainland China.

Design/methodology/approach – Through a series of surveys, observations and interviews with both teachers and students, during the intervention, this study aims to identify both successful and less than successful strategies. Given that many subjects within FoSE are practical, often requiring hands-on interaction with specialised equipment, a goal of the study is to understand how the staff and student T&L experience was affected when students were unable to access the campus laboratories, studios, and other necessary materials and equipment.

Findings – The preliminary findings of this ongoing study indicate which online/remote teaching methodologies appear most suitable for the teaching of practical workshop-based subjects that include laboratory experiments, free-hand sketching, model making, prototyping and testing, project-based learning, and CAD modelling. The findings of this study will provide both guidance and understanding on the challenges and successes that can occur when switching from traditional face-to-face teaching to online/remote teaching methods, both from the teachers’ and the students’ perspectives.

Originality/value/implications – This is the first time that a Sino-British campus within mainland China has encountered this scenario: namely, a large number of teachers experienced in traditional classroom-based T&L suddenly having to

adopt and adapt to distant experiential learning. This study provides insight into the major challenges and successes that occurred during the sudden switch of instructional setting. The study outcomes aim to aid the larger teaching community when adopting online methods to augment their teaching whilst mitigating potential negative impacts on the students' T&L experiences.

Keywords: online-learning; Covid-19; quality assurance; student engagement.

1 – Introduction

The World Health Organization (WHO) was first alerted to several cases of pneumonia in Wuhan, a city in the Chinese province of Hubei, on December 31, 2019. According to the first WHO Situation Report (WHO, 2020a) on the coronavirus disease, the cases of pneumonia had no known cause and totalled 44 by January 3, 2020. By January 7, the exact strain—a new type of coronavirus—was identified and initially named 2019-nCoV. By January 31, there were 213 deaths and 9,720 confirmed cases in mainland China. In February, WHO officially began calling the disease COVID-19 (WHO, 2020b). On March 11, the WHO was deeply concerned both by the levels of spread and severity, and by the levels of international inaction. WHO then made the assessment that COVID-19 was a pandemic (WHO, 2020c).

University of Nottingham Ningbo China (UNNC) is China's first Sino-foreign campus and is situated in Ningbo, approximately 700km from Wuhan, with a student population of approaching eight thousand domestic and international students (UNNC, 2020a). As a global university, UNNC also had many overseas students on exchange at its campus at the time of the initial outbreak.

On February 14, UNNC announced that from a delayed start of term on March 2, all modules would be delivered online to ensure that students could meet their progression requirements and progress in their studies (UNNC, 2020b). Due to the restrictions placed on travel both from within and external to China, UNNC had reacted to ensure that the quality of teaching and learning (T&L) would be upheld, and that students would meet their credit requirements to progress or graduate on time. This move was also necessary as the virus had struck during the world's largest annual migration, the Chinese Spring Festival, during which many staff members travelled outside of China.

With the support of teaching staff and support teams, such as the Library, Research and Learning Resources (LRLR), E-Learning Support (ELS), and IT Services (ITS), UNNC staff were able to deliver 100% of their modules online (initially postponing some laboratory-based sessions). By March 16, UNNC had delivered 469 modules online to 7,788 students, 9% of whom were located outside of mainland China. In addition to core taught modules, UNNC also delivered Physical Education, Mandarin and Chinese Culture classes online.

However, this period has not been without challenges, encountered by both staff and students. This paper reports on an on-going study that, we hope, will offer insights into

the major challenges identified during the transition from traditional face-to-face T&L to online and remote T&L. Particular attention is paid to the delivery of practical/skill-based subjects within the Faculty of Science and Engineering (FoSE) at UNNC.

2 – Background

UNNC, the first Sino-foreign higher education institution (SfHEI), was established in 2004 (Feng, 2013). It was established as part of China's ongoing investment in improving both the quantity and quality of its higher education provision (Mok and Jiang, 2017) and has been identified as both an innovation and a centre of innovation (Towey, 2014). UNNC has encountered (and overcome) many challenges over its short history and has also seen many pedagogical innovations. UNNC comprises three faculties: Business; Science and Engineering; and Humanities and Social Sciences. The Faculty of Science and Engineering (FoSE) consists of ten departmental units, each specialising in a different area of science and engineering ranging from Architecture to Mathematical Science, offering both undergraduate and postgraduate degree programs. These programs were predominantly taught face to face until the recent outbreak of Covid19, when all programs had to suddenly adopt and adapt to online T&L.

The authors of this paper are an interdisciplinary team at UNNC who identified challenges in the T&L provision as a result of the sudden shift to online teaching, especially for (practical) FoSE subjects relying heavily on specialised equipment or environments.

2.1 – Online Teaching

While distance education has existed for many decades, the evolution of online learning has been growing rapidly in higher education (HE) (Barret, 2010). Online learning first emerged in 1982 when the Western Behavioural Sciences Institute in La Jolla, California, opened its School of Management and Strategic Studies; the School employed a computer conferencing system to deliver a distance education program to business executives (Rowan, 1983). In 2020, the global coronavirus pandemic prompted many universities to hastily transition to online T&L (Lau et al., 2020; Kamenetz, 2020). However, it appears that the adoption of online instructional technology has outpaced current knowledge of how it might best be used for instruction (Li & Akins, 2005; Stodel, Thompson, & MacDonald, 2006).

2.2 – UNNC Online T&L Tools

This section introduces the online teaching tools available to staff as provided by UNNC, when on March 2 2020, all degree courses and 440 modules moved online. These modules were delivered to approximately 8,000 students, involving over 440 teaching staff who were themselves spread around the globe. Teaching staff, together with the help of supporting teams (LRLR, ELS and ITS), developed online teaching strategies to deliver the learning materials. The online teaching tools available to staff and students at UNNC are described in the following paragraphs.

Table 1. Lecture Capture Tools

Interaction Level	Options	Technical Solution	Details
No Interaction	Pre-recording (asynchronous)	Panopto	<ul style="list-style-type: none"> · Academics use Panopto to record lectures and share on their Moodle module. · Students view lecture videos on Moodle module.
No Interaction	PowerPoint (asynchronous)	Presentation with Narration	<ul style="list-style-type: none"> · Academics use PowerPoint to record lecture slide with embedded audio file (narration) and share on Moodle module. · Students view PowerPoint Presentation on Moodle module.
Limited Interaction	Webcasting (synchronous)	Panopto + Zoom	<ul style="list-style-type: none"> · Academics use Panopto to webcast lectures. · Students join webcast. · Q&A available for two-way communication. · Session will be recorded in Panopto and can be shared on Moodle module.
Highly Interactive	Pre-recording (asynchronous) + Interaction (synchronous)	Panopto + Zoom	<ul style="list-style-type: none"> · Academics use Panopto to record lectures and share on Moodle module. · Students view lectures on Moodle module. · Academics and students use Zoom for interaction. · Zoom sessions will be recorded and shared on Moodle module.

2.2.1 – Moodle

Moodle (“Modular Object-Oriented Dynamic Learning Environment”) (Antonenko et al., 2004) is the University's virtual learning environment; it is the virtual location for teachers to share learning materials and to facilitate collaborative activities. UNNC teaching staff use Moodle to create lessons, manage courses, and interact with supporting teachers and students. Students use Moodle to review the class calendar, view learning materials, submit assignments, take quizzes and interact with their classmates and teachers (Moodle, 2020).

In addition, Moodle is the hub of other learning technologies used to support T&L across the University, such as Echo360’s ALP, Rogō, Turnitin, and Xerte Online

Toolkits. It is a familiar platform at UNNC, supporting T&L across all Nottingham University campuses since 2011.

2.2.2 – Microsoft Teams (MS Teams)

MS Teams is a cloud-based team collaboration software that is part of the Office 365 suite of applications. The core capabilities of MS Teams include business messaging, calling, video meetings and file sharing. As a business communications application, MS Teams enables local and remote workers to collaborate on content using different devices in both real time and near-real time (MS Teams, 2020).

One of the benefits of MS Teams is the organisation of communications in one place, rather than relying on long email chains that can easily result in miscommunication. Another advantage is that it is free for academic institutions.

2.2.3 – Zoom

Zoom is a cloud-based video conferencing service that can facilitate virtual meetings using video, audio or both; it also allows users to record sessions to view later. Zoom is one of the largest online meeting tools currently in use, with an estimated user base of approximately 13 million, which grew by two million in 2019 and added 2.22 million active users in the first few months of 2020 (Tillman and Willings 2020).

Within the Zoom application there are Zoom Meetings and Zoom Rooms. Users can join Zoom Meetings using a webcam or phone. Zoom Meetings allows for one-to-one chat sessions, group calls, training sessions, webinars for internal and external audiences, and global video meetings with up to 1,000 participants. A free version of Zoom allows unlimited one-on-one meetings, but limits group sessions to 40 minutes and 100 participants. UNNC provided selected teaching staff with Zoom subscriptions which allowed an unlimited number of participants in a single meeting without a time restriction.

2.2.4 – Panopto

Panopto is a software-as-a-service video platform designed to help educators and companies livestream and create on-demand content. Panopto allows for easy recording and sharing of courses, lectures, and presentations. Recordings in Panopto are viewable on most web browsers and mobile devices. Regardless of the internet capability of viewers, the platform provides high-quality playback with minimal buffering delays. Furthermore, viewers can simultaneously stream multiple videos and can switch between sources during a live event (Panopto, 2020).

2.2.5 – Rogō

Rogō is the University of Nottingham e-Assessment management system used to create and deliver online assessments. This online system supports the full process from question and paper creation to the analysis of exam results and creation of reports. It is

also an open source project allowing contributions from interested volunteers (Rogō, 2020).

2.2.6 – UNNC Campus VPN

In order to provide easier access to the UNNC campus network, LRLR and ITS also provided both staff and students with a campus virtual private network (VPN). This has enabled staff and students to access all of the UNNC online resources and minimised connectivity issues.

Table 2. Active Learning Tools

Type	Technical Solution	Details
Quiz	Moodle quiz	<i>Teachers</i> - Prepare questions before class
	Zoom polling	- Release quiz to students <i>Students</i> - Answer quiz
	Panopto in-video quiz	<i>Teachers</i> - Review student responses and analyses
Assessment, Homework	Moodle Assignments	<i>Teachers</i> - Create Moodle Assignment/Turnitin Assignments <i>Students</i> - Submit essay/homework individually or as a group
	Turnitin Assignments	<i>Teachers</i> - Online marking
Engagement	Panopto data analytics	<i>Students</i> - View recorded lecture videos <i>Teachers</i> - See engagement data and analysis
	Moodle completion tracking	<i>Teachers</i> - Enable Moodle module completion tracking feature and set up for each resource and activity <i>Students</i> - Complete resources and activities <i>Teachers</i> - Track student progress through the module
	Moodle forum	<i>Students</i> - Ask questions anonymously <i>Teachers & other students</i> - See questions and answers

2.3 – UNNC Online T&L Strategies

To support online T&L, LRLR has provided campus-wide guidance disseminated on Moodle. This included online scenarios and corresponding recommended platforms,

tools and training materials. This represented a starting point for staff and helped them to identify which platforms could be best for different scenarios. The tables below were made available to staff via the Moodle Online T&L Guidance page and Library website (UNNC Library, Learning Technologies, 2020).

2.3.1 – Lecture Capture

Based on the required level of pedagogical interaction, plans were made to provide pre-recorded online lectures and webcasts in blended learning formats. The lecture capture tools used by staff at UNNC are presented in Table 1.

2.3.2 – Active Learning

Table 2 lists the UNNC strategies and tools that have been identified to support active learning and help to increase and track student engagement during online T&L as stated by UNNC Library, Learning Technologies (2020).

2.3.3 – Small Group T&L

UNNC Library, Learning Technologies (2020) states that small group interactive teaching has been linked to students' learning success. Therefore, the tools in table 3 were introduced as alternatives to face-to-face interactions; these online tools could be used for real-time group discussions, virtual meetings and one on one tutorials.

Table 3. Small Group Teaching & Learning Tools

Types	Technical Solution	Details	Prerequisites
Presentations	Moodle assignment	<i>Students</i> - Upload group presentations (any format) to Moodle assignment <i>Teachers</i> - Download/View and give online feedback	- Internet access to Moodle
Group discussion	Zoom	<i>Students</i> - Create chat group - Group discussion	- Internet access to Zoom - Zoom application installed

2.3.4 – Assessment

Quizzes on Moodle and Rogō have often been used during teaching for either formative or summative assessment purposes at UNNC (Online Teaching Moodle, 2020) and students typically complete these assessments in class. In the context of online T&L, quizzes can be published to students before or after class for preview or review purposes.

University of Nottingham’s Quality Manual (2020), which outlines the University's policies and procedures relevant to teaching, explains that online summative exams must be held on Rogō. The technical feasibility of off-campus students taking summative exams online is currently under investigation. Table 4 shows the e-assessments tools used at UNNC.

Table 4. E-Assessment Tools

Types	Technical Solution	Details	Prerequisites
Formative Assessment	Rogō	<i>Teachers</i> - Create a paper/quiz with questions - Share link to students <i>Students</i> - Answer paper/quiz remotely	- Internet access to Moodle and Rogō.
	Moodle quiz	<i>Teachers</i> - View responses and mark	
Summative Assessment	Rogō	<i>Teachers</i> - Create a paper/quiz with questions <i>Students</i> - Attend exam in computer lab on campus <i>Teachers</i> - View responses and mark	- Must attend on campus
	Third-party solutions	<i>Teachers</i> - Create a paper/quiz with questions <i>Students</i> - Attend exam remotely on own PC <i>Teachers</i> - View responses and mark	- Solution feasibility being investigated

In summary, multiple tools and strategies have been provided to UNNC teaching staff to support them in creating their online materials. UNNC staff needed to assess their own situations, and to the best of their abilities, apply the most appropriate method to create meaningful, engaging content to meet learning outcomes and student expectations.

3 – Study Survey

A quantitative approach was initially adopted to determine the impact of using the UNNC-provided tools for the online delivery of practical subjects. Due to the size of the target population (UNNC FoSE staff and students), large-scale observation and interviewing were not considered feasible for the initial stages of the study. Instead, two descriptive surveys were used to collect the initial information (Mouton 1996): one that targeted staff and the other that targeted students. These surveys were developed

using Likert scale questions (Likert, 1935), with additional open, closed and multiple-choice questions. A goal of the surveys was to identify which classes and teachers were using each of the specific tools and to gather additional data concerning the impact of online delivery on T&L quality. There was also the intention to use the surveys to identify observation opportunities and interview candidates.

For inclusion in the staff survey, the following criteria were set:

- Employed at UNNC as academic staff
- Directly involved in teaching of practical subjects within FoSE
- Be mentally sound to consent to participant
- Be willing to participate in the study

Participation in the student survey had the following inclusion criteria:

- Be registered as a student at UNNC
- Be involved in a module highlighted in the staff survey
- Be using online teaching material
- Be mentally sound to consent to participant
- Be willing to participate in the study

In accordance with University of Nottingham's Code of Research Conduct and Research Ethics practice, ethical approval was sought and obtained before commencing. Furthermore, informed consent was obtained from all participants before collecting their responses.

The surveys were provided in English, and distributed using Qualtrics (2020), an online survey platform. The staff surveys were distributed first, which allowed for identification of modules that could be targeted for the student survey; this was then emailed directly to the students. Both surveys were made available online for two weeks.

The study population consisted of FoSE staff and students at UNNC, all of whom are adults. Of the 1,064 students emailed to participate in the student survey, 88 responded. All FoSE staff were contacted to participate in the staff survey: 22 responded, representing 27 modules across 10 departments.

An interpretivist approach was adopted for the open-ended survey questions. Interpretivism, according to Collis and Hussey (2009, 28), is concerned with providing qualitative interpretation of a social phenomenon within a particular context. Two major constraints of the study were the relatively short period of time since the current online T&L began at UNNC, and the relatively short duration of this study.

4 – Results

This section presents some of the surveys' results.

4.1 – Staff Survey

Of the 22 staff respondents, 16 were involved in teaching practical subjects, allowing for the remaining four to be excluded from the study (as explained in Section 3). The remaining 16 respondents covered a total of 27 different modules, involving laboratory and workshop sessions, sketching demonstrations, off-campus field work, and the operation of Personal Protective Equipment (PPE). The responses from these 16 are presented in figures 1 – 7 in the following paragraphs.

As shown in Figure 1, no respondents were involved in a class with 100% examination assessment. The majority of modules (44%) were assessed through 100% coursework, in-class tests (37%) or with a combination of coursework and exams (19%). Here, an in-class test is defined as an experiment or examination conducted for a specific duration within a controlled environment, such as a laboratory or design studio.

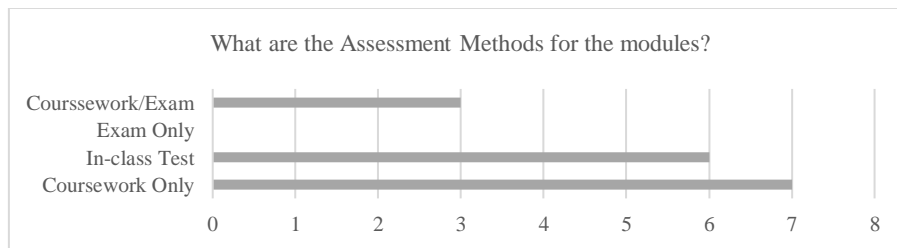


Fig. 1. What are the Assessment Methods for the module?

As shown in Figure 2, Moodle (26.4%) and Zoom (18.6%) were the most popular platforms of choice by lecturers. Moodle is the University's standard virtual learning environment and the online material created was hosted and accessed through Moodle. Conversely, Zoom was the predominant virtual meeting platform and live streaming service.

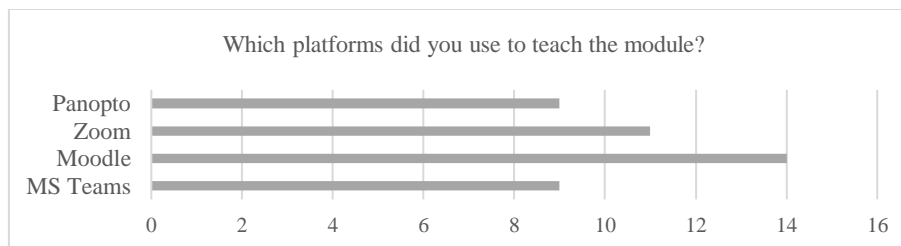


Fig. 2. Which Platforms do you use to teach the modules?

Figure 3 demonstrates that 88% of the staff surveyed have had to make changes to accommodate practical T&L this semester, with 75% planning to delay content or activities until students returned to campus (demonstrated in Figure 4).

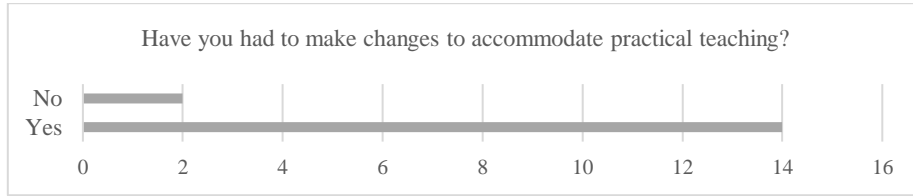


Fig. 3. Have you had to make changes to accommodate practical teaching?

Fortunately, only one respondent cancelled their practical offering whilst three were able to hold the learning exercise online.

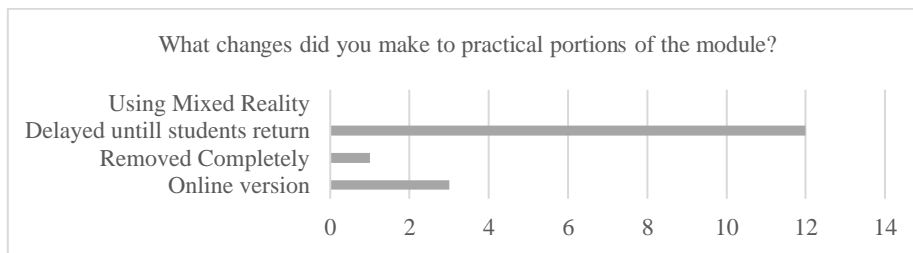


Fig. 4. What changes did you make to the practical portion of the modules?

Figure 5 demonstrates that the majority (56%) of FoSE staff did not recommend online teaching for other modules with practical content, with a further 31% unsure. Only two (13%) responded that they would recommend this method of delivery.

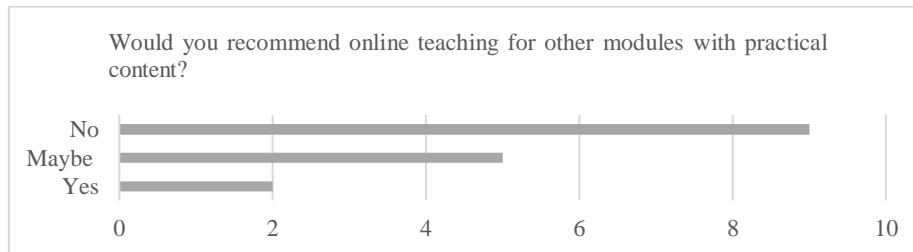


Fig. 5. Would you recommend online teaching for other modules with practical content?

Figure 6 demonstrates that 88% of the responding staff reported that the online teaching tools were not sufficient for their practical subjects' needs, with only two respondents replying that they did suffice.

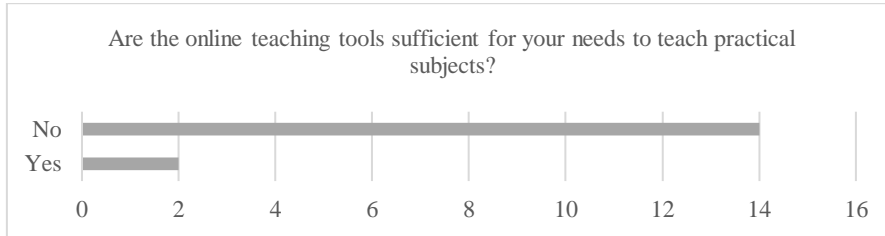


Fig. 4. Are the online teaching tools sufficient for your needs to teach practical subjects?

Figure 7 shows that this event has encouraged 69% of the FoSE staff to engage with online teaching for the first time in their career as an academic.

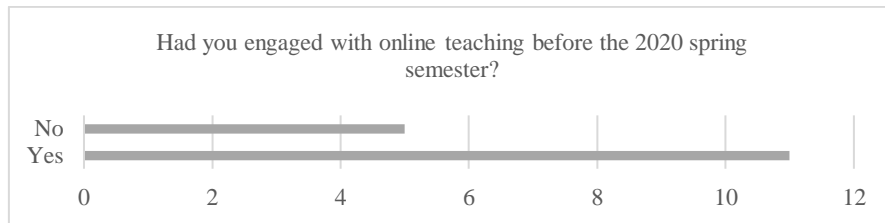


Fig. 7. Had you engaged with online teaching before the 2020 spring semester?

This section has demonstrated that a high proportion of practical teaching is assessed by coursework and Moodle was used to facilitate this form of instruction. 88% of staff found that they did not have sufficient tools for their needs when delivering online tuition and 56% did not recommend the practice.

4.2 – Student Survey

In total, 27 modules were identified from the staff surveys and 1,064 students in these modules were contacted through email to invite them to participate in the student survey; accordingly, 88 responded. Clearly this represents a small response rate; nonetheless, the responses have been examined as part of the analysis.

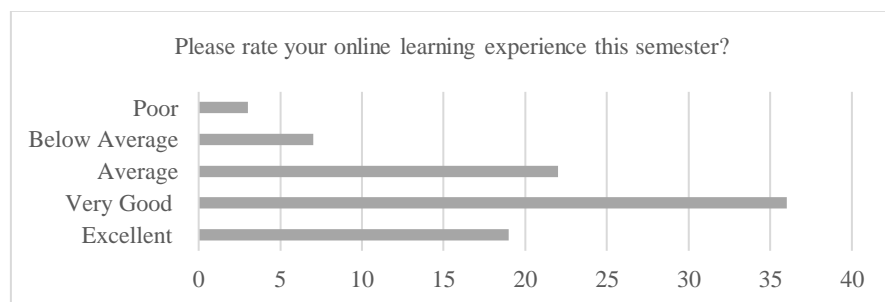


Fig. 8. Please rate your online learning experience this semester?

Figure 8 shows the student rating of their experience so far, with the majority rating it “average” (25%) or “very good” (40%). Only 12.5% rated the experience as “below average” or worse.

Figure 9 demonstrates that the majority (79%) of students rated the ease of adapting to online T&L as being between “Fair” and “Very Easy”.

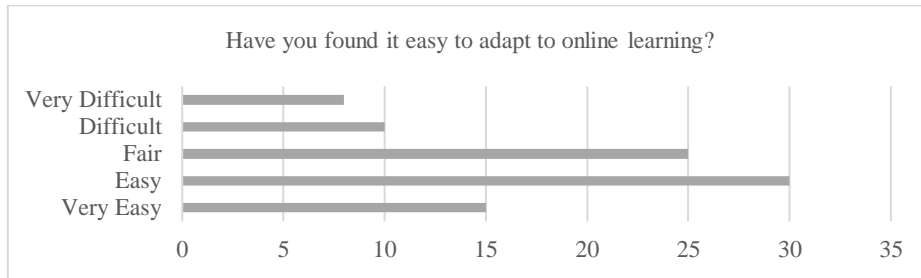


Fig. 9. Have you found it easy to adapt to online learning?

Figure 10 shows that when students were asked if they preferred online to classroom learning, a slight majority (56%) indicated that they preferred classroom learning.

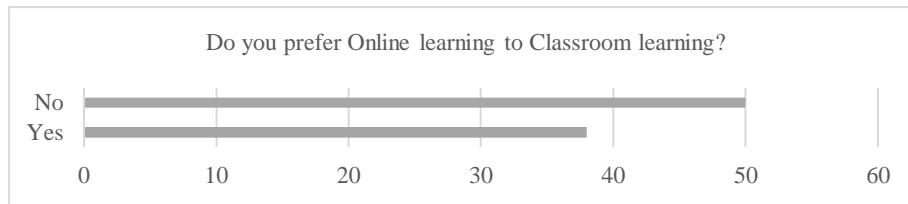


Fig. 50. Do you prefer Online learning to Classroom learning?

Figure 11 demonstrates that when students were asked if they would recommend online learning to other students, the majority (49%) replied “maybe”, with the remainder evenly divided between “yes” (27%) and “no” (23%).

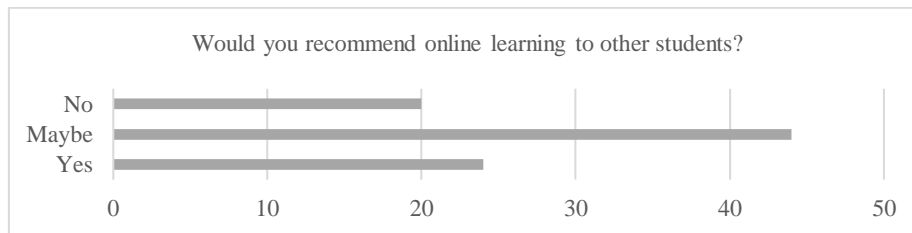


Fig. 11. Would you recommend online learning to other students?

Figure 12 shows that the majority (60%) of students reported that this was their first experience with online T&L.

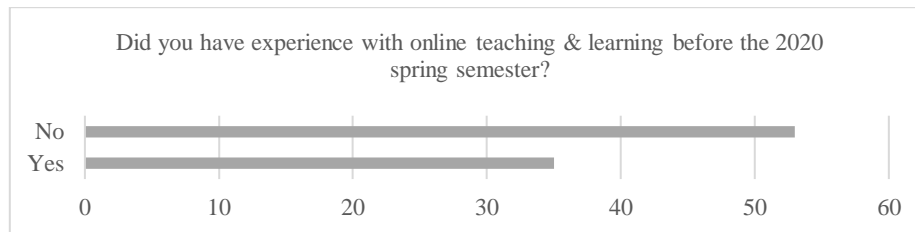


Fig. 12. Did you have experience with online teaching & learning before the 2020 spring semester?

In open question responses, students elaborated on some of the technical difficulties they have when accessing the online T&L materials, these included:

- Limited internet access
- Poor audio and video quality
- Coursework files being difficult to download
- Moodle-hosted videos being difficult to download and stream
- Durations of lectures appearing reduced, and class times not being fully utilised
- Some teachers only publishing slides with audio, or only reading slides in pre-recorded videos
- Lack of interaction with teachers and students during live streamed classes
- Lack of practical classes for international students

Overall, students indicated that they found online learning easy to adapt to and that their online experience was average to very good; in spite of this, students indicated that they wouldn't advocate online teaching.

5 – Discussion

An aim of the surveys was to identify the experiences and challenges faced by both staff and students during the T&L of practical subjects whilst using the online teaching tools provided by UNNC.

The initial surveys were distributed to staff and students during weeks 7-8 of the 12-week spring semester. At this point, it was not known when the students would be returning to campus; however, it was presumed that they would return before the end of the semester, because of the steps taken by UNNC and the local government to re-open the university. Given that most staff preferred their practical subjects (labs) be delayed until the students returned to campus, it would have been interesting to understand how the teaching of practical subjects would have taken place without this presumption. Clearly, delaying the practical classes if a return were not possible would not have been a viable option. The timing of the surveys was critical to the study because staff, at the time of surveys, had been informed that students would soon return to campus.

The assumption governing this research was that the student experience would be generally negative, and that the staff experience would be positive. However, it appears that the students enjoyed a better experience than the staff, who appeared dissatisfied with online T&L delivery. Interestingly, most students remained unsure about online learning but only a minority indicated they would not recommend it to others. One possible reason for the lack of staff satisfaction may be that many did not alter their approach to T&L, and imitated in-class practices when delivering content online; previous studies have strongly advised against this approach (Fawns et al., 2020; Gewin, 2020). That Panotpo and Zoom were heavily used during online delivery suggests that staff were predominantly focused on creating pre-recorded video lectures and/or live streaming lectures (which are the primary functions of these tools).

Concerns have been raised by educators, students and parents regarding how programmes delivered online might achieve the same outcomes as their traditional counterparts. Furthermore, the efficacy of student support during online learning has been questioned, with suggestions that online T&L may be isolating, or that students might be left to fend for themselves (Fazackerley, 2020; Thompson, 2017). Student comments support this theory, indicating that there was a lack of interaction between teachers and students during live streamed classes, that class times appeared reduced, and that (some) lectures were only slides with recorded narration. Unfortunately, these are not optimal forms of online T&L for practical subjects (Lieblein, 2000), and studies have highlighted the need for student interaction and collaboration to ensure effective online learning for simulated practical subjects (Corter et al., 2011; Jara et al., 2009).

The results cannot confirm the level of involvement or consultation of students when the online material was being created. Studies from Sandars et al. (2020), Bovill (2019) and Wycoff (2018) have shown that co-creation can lead to more engagement and higher levels of interaction between the educator and the student. Co-creation occurs when learners and educators work collaboratively to create online resources and activities (Bovill et al., 2016). Our future work will examine the level of student involvement in the online T&L materials and strategies development.

The responses also highlighted student issues with the quality of the online content: Several students reported poor audio/visual quality throughout their online learning experience. As stated by Ryan (2002), for classes to be considered equal, the quality expectations for online and lecture classes should be the same. Currently, there is not enough data to clearly identify what approach staff used when re-purposing content for online T&L. Although given basic guidance and introduced to the available online tools, staff had to decide by themselves in the space of two weeks how to address their own T&L needs. Our future work will also examine the approach, capturing-equipment and time taken for staff to create the online content. Because there was no standardised capturing-equipment and little to no online teaching training provided before switching to online T&L, another important area for our future work will be the impact it had on them.

No staff reported using Mixed Reality (MR) to create online content, suggesting that interactions were limited to pre-recorded, live streamed video-based content, meetings via Zoom, and static assessments/quizzes via Moodle/MS Teams. This may have been a missed opportunity; given the success MR had when been applied in learning factories to enhance T&L of practical subjects (Juraschek et al., 2018). Augmented Reality (AR), for example, can dramatically shift the location and timing of education and training (Lee, 2012). AR has strong potential to provide both powerful contextual learning experiences and serendipitous exploration of the connected nature of information in the real world (Johnson et al., 2010). Studies from Kimura, T&L (2006), Lee & Shea (2020), Cecep (2020) and Rizov (2015), have shown that use of MR learning models are a viable alternative for efficient and effective T&L for practical subjects, without disruption to curricular structures (Cliburn, Miller & Doherty, 2010). This is an area where training and investment could be beneficial to the university, staff and students; and will also be a focus of our future work.

6 – Conclusion

This paper has reported on preliminary results of an on-going study to understand and identify challenges faced by staff and students at a SfHEI in response to the COVID-19 situation that required all T&L activities move online, including practical and skill-based subjects that sometimes required specialist equipment or environments.

Preliminary data was obtained through survey responses that will be followed up on by interviews. Initial analysis of the data indicates that students may generally have had a better experience with online T&L than staff; this may be because students were able to adapt to the change more easily than their teachers. Nevertheless, the students appeared undecided about recommending online T&L to their peers.

This initial analysis of the staff data indicates that they chose to delay the majority of the practical subjects until the students were expected to return to campus and that most staff felt that the online teaching tools were not sufficient for their needs. The majority of staff would not recommend online T&L for other practical subjects.

The strategy of delaying subject delivery, or the practical parts of the delivery, until students return for face to face teaching does not address the needs of those students who could not return. The ongoing difficulties of travel to and within mainland China mean that overseas students may not be able to return, and many domestic students face challenges to returning. It is highly likely that online T&L will continue into the new academic year.

By early May, 2020, UNNC had resumed face-to-face T&L, and a large proportion of students had returned. This transition back to “normal” teaching has allowed for some reflection on the online delivery experience. In spite of the hardships endured, anecdotal evidence indicates that staff have done a good job. However, this has been an emergency action, not a planned and carefully delivered online T&L experience

(Hodges, 2020). Very few, if any, of the staff had training or experience in online T&L methods, tools, or platforms. Furthermore, clear opportunities for appropriate staff development and training are emerging (Walker, Towey, and Ng, 2018).

The institution should place more emphasis and support on creating online T&L content that includes simulation in an extended reality environment, whilst assisting staff with relevant training to become proficient with the technology and associated teaching methods.

The study reported here is ongoing, with interviews and observations to be conducted to gain a deeper understanding of the approach and capturing equipment used while creating the online T&L content. In addition, exploration of the simulated models will be conducted to understand their potential in supporting online T&L of practical subjects. With this data, it is hoped that an online pedagogy can be developed to aid creation of online content suitable for the T&L of practical subjects, within FoSE at UNNC, and elsewhere.

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