Vol 9 Issue 2 (2021) | pp. 169-180

JOURNAL OF
Perspectives in Applied Academic Practice

www.jpaap.napier.ac.uk

# A Rapid Transition to Blended Learning: The Journey of a Dental Degree Programme Pivoting Online

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## ABSTRACT

The University of Glasgow Bachelor of Dental Surgery (BDS) degree programme is a professionally regulated, practical clinical discipline. Given the mode of transmission of SARS Cov-2 the dental profession and associated degree programmes of study have like other university programmes been significantly impacted by the COVID-19 pandemic, necessitating a rapid pivot to online and blended learning. This case study shows how the work of early adopters of technology enhanced learning and teaching (TELT) at the dental school, and a timely staff-student partnership helped to lay the foundations for this pivot in response to the challenges brought about by a Global Pandemic.

A large amount of teaching required modification and adaptation to support remote delivery, and through collaboration, innovation and supported creativity, we were able to produce some very effective models for learning and teaching. To illustrate this, two specific examples have been presented: a novel approach to support the delivery of essential local anaesthesia training for second year dental students using collaborative wikis and online learning; and the use of Microsoft Teams to support student integration and a sense of community among our first year dental students through active, small group collaborative learning.

The challenges of the COVID-19 pandemic have provided the opportunity to align the teaching of practical skills with technology and instil a positive shift in institutional practices. The effectiveness of this shift within the BDS degree programme and the impact on the development of our students will remain the focus of the school's TELT partnership.

**Keywords:** Collaborative learning, o-production, Dental Education, lipped classroom, social constructivism.

## Introduction

The Covid-19 pandemic is one of the most significant events of our time regardless of who or where we are. It has, however, had very particular adverse effects on Dentistry. The restrictions that were enforced by the UK Government in March 2020 all but closed Dentistry down. The Bachelor of Dental Surgery (BDS) programme is a practical discipline professionally regulated by the General Dental Council (GDC). Given the mode of transmission of SARS Cov-2, the causative agent of coronavirus disease 2019 (COVID-19), the dental profession and associated programmes of study have faced multiple hurdles that have affected the delivery of dentistry and the teaching required to address essential Intended Learning Outcomes (ILOs). All routine dental procedures were suspended in March 2020 by the chief dental officers (CDOs) of the UK due to the risk of transmission of SARS Cov-2 in the dental setting via close contact with the oro-pharynx and use of aerosol generating procedures (AGPs). This, along with social distancing guidelines and ventilation requirements made it almost impossible to provide essential practical teaching. The backbone of clinical training for dentists involves close patient contact and development of practical skills, many of which are AGPs. The programme also incorporates a high volume of clinical simulation which requires large group face to face teaching, as well as the necessary underpinning knowledge-based teaching.

Throughout the UK, and indeed the rest of the world, Universities responded to the effects of the pandemic by moving to online models of learning and teaching wherever possible. This posed significant challenges for a practical programme like Dentistry, with the need to address Government and University guidance in relation to the move to online learning, while at the same time work within the requirements of a professional regulator for the demonstration of attainment of practical and clinical skills. However, by building upon existing blended learning advancements at the University of Glasgow Dental School, and by collaboration, innovation and supported creativity, we were able to make the pivot to the online and blended environment with some very effective models for learning and teaching. Academic staff were supported in the transition to the online environment and were encouraged to be

creative as they tried to address a practical discipline in a blended way. Students were also supported, and the examples presented highlight how they were encouraged to creatively collaborate to facilitate their learning.

This article documents the journey of the University of Glasgow BDS programme as it moved a significant amount of learning and teaching online. The paper offers three distinct but complimentary examples that, taken as a whole, provide the reader with insight into how the academic staff responsible for the delivery of the programme were able to react quickly to the dynamic situation to continue the delivery of a high-quality learning experience for our students. We begin by providing an insight into some of the work carried out at the school by early adopters of technology enhanced learning and teaching (TELT) prior to the COVID-19 outbreak which helped to prepare for this shift to online and blended delivery. The authors then provide a reflective commentary of a specific example from the year two course where a very rapid adaptation to an innovative blended model was necessary to deliver essential Local Anaesthesia (LA) teaching. Finally, the article reflects on how technology was harnessed by one BDS programme theme, biological and medical sciences (BAMS), to provide our new first year students with a sense of community through active small group collaborative learning. These specific examples cover a range of issues and solutions that were common to multiple areas of BDS teaching that required modification and adaptation over the course of the pandemic.

## Readiness for the pivot to blended learning

The University of Glasgow Dental School has a number of staff who, as early adopters of TELT, have laid the groundwork for our shift to online and blended delivery.

### *Microteaching and flipped classroom*

In 2003 a novel approach to learning and teaching was piloted within practical prosthodontic dental technology laboratory classes that was termed “microteaching”. Students were required to engage with procedural videos and complementary support material covering the theoretical basis of the tasks that were to be completed in the forthcoming practical session in order to better prepare for the task, leaving more time for tutors to provide personalised teaching and feedback. Cameron, McKerlie and Matthew (2006) reported that students who engaged in microteaching performed better in both written and practical examinations than those following the more traditional laboratory practical class methodology. This work was the precursor to the flipped classroom modality introduced to our simulated clinical skills teaching in 2014 and which now forms the mainstay of learning and teaching in this area (Crothers, Bagg & McKerlie, 2017). In a comparable way to microteaching, direct instruction took the form of online procedural videos made available in advance of simulated clinical skills group sessions via the Moodle Virtual Learning Environment (VLE). The displacement of instruction to the individual space freed up time in the group space for the students to work on supervised simulated practical clinical tasks at their own pace.

### *Staff-student partnerships in co-production*

In 2015 a TELT staff-student partnership in the form of a year five self-selected study module (SSM) in eLearning was established to co-produce new eLearning objects that could be integrated into the BDS programme using the flipped classroom modality (McKerlie, Rennie, Hudda, McAllan, Al-Ani, McLean, & Bagg, 2018). A student-staff partnership affords the student an opportunity to become involved in the development of new knowledge as an active participant (McCulloch, 2009). This successful initiative led to the establishment of a school wide TELT partnership in 2016. The main aim of the school TELT Partnership was to oversee the utility of technology within the curriculum to enhance the learning experience of our students. One of the partnership’s first projects focused on reviewing the school’s use of the Moodle VLE.

## Moodle VLE re-design

The virtual learning environment (VLE) is crucial for the success of blended learning. A longstanding issue with VLEs is the tendency to use them as little more than file repositories of resources for students to download, with low usage of the wider functionality (Lambropoulos, Faulkner and Culwin, 2012). Discussions at Glasgow Dental School identified issues from both staff and student perspectives on the layout and functionality of the Moodle VLE. These fell under the two broad categories of layout and navigation, where both staff and students experienced difficulties locating information. Although some early adopters of eLearning were engaging with blended and flipped classroom techniques (Crothers et al., 2017), some tutors found the Moodle VLE layout made it more difficult to use active learning models. Consequently, a TELT staff-student partnership, consisting of two students, two academic staff, and one learning technologist, undertook a revision of the Moodle VLE structure between 2018-2020. Careful consideration was given to membership of the partnership to bring diverse perspectives and experience to the team. This approach had the advantage of centering stakeholder roles within the transition and aligned with the Adekola, Dale and Gardiner (2017) framework. Lack of time is regularly cited as a major barrier to staff adoption of learning technologies (Kowalczyk 2014; Phillips, Schumacher & Arif 2016), and the long lead time of the Moodle VLE revision allowed for a full review of the underlying problems and development of resolutions.

Following ethical approval (University of Glasgow, MVLS Ethics Committee Ref: 200180187) both students and faculty were surveyed to measure baseline user experience and confirm where concerns lay. The survey (appendix 1) received a 21% response

rate from students and 51% from faculty. Four main issues were identified with the existing Moodle VLE setup. There was a broad consensus of difficulties relating to organisation, layout, poor engagement/communication and lack of/difficulty in using resources beyond lecture slides. The most striking statistic (Table 1) was that only 15% of student respondents agreed that they could find the online resources they needed for a lesson. This may have been because 48% of faculty respondents were unclear where to upload their resources for a lesson.

**Table 1** Data on question "I can always find the resources I need for a lesson" (Student) or "I always know where I should put resources my students will need for a lesson on Moodle…" (Staff)

| | Strongly agree | agree | neither | disagree | Strongly disagree |
|---|---|---|---|---|---|
| Student | 2 (3.3%) | 7 (11.5%) | 10 (16.4%) | 38 (62.3%) | 5 (8.2%) |
| Staff | 0 | 10 (40%) | 3 (12%) | 12 (48%) | 0 |

The BDS Degree is an integrated programme, taught over five years and split across three teaching themes: Biological & Medical Sciences (BAMS), Clinical Dental Sciences (CDS) and Patient Management & Healthcare Promotion (PMHP). Due to this structure within each BDS Year all teaching was organised into three Moodle VLE themed areas. This led to large collections of inadequately indexed resources, without clear structure. Poor housekeeping of curated teaching resources, in the form of inconsistent naming and location conventions, duplication of files and old files not being deleted from the system, resulted in the number of resources growing year on year. This lack of clarity made it difficult for students to locate and interact with content.

The team adopted a two-phase approach: phase one included a redesign of the VLE structure in a way that made sense to both students and faculty; phase two set out to encourage greater use of active and blended learning. Following review of the existing structure, the team focused on CDS, the largest of the teaching themes, to pilot the re-design. CDS was chosen because of its size and diversity, but it was also the area that would reap the most benefit from the introduction of more active approaches because of the practical nature of this theme.

Influenced by the Biggs (2003) approach for constructive alignment of teaching, the team broke the CDS theme into clear sub-themes. Each of these sub-themes was given its own Moodle VLE page, broken down into sub-topics (Figure 1) and aligned with specific headings and sessions as described in the undergraduate timetable. A blank template was developed with standard headings of "pre-session activity", "session materials", "post session activity", and "additional resources". Completion tracking was enabled to allow students to mark off resources they had accessed and give faculty an overview of engagement levels to help identify areas needing further refinement (Figure 2).

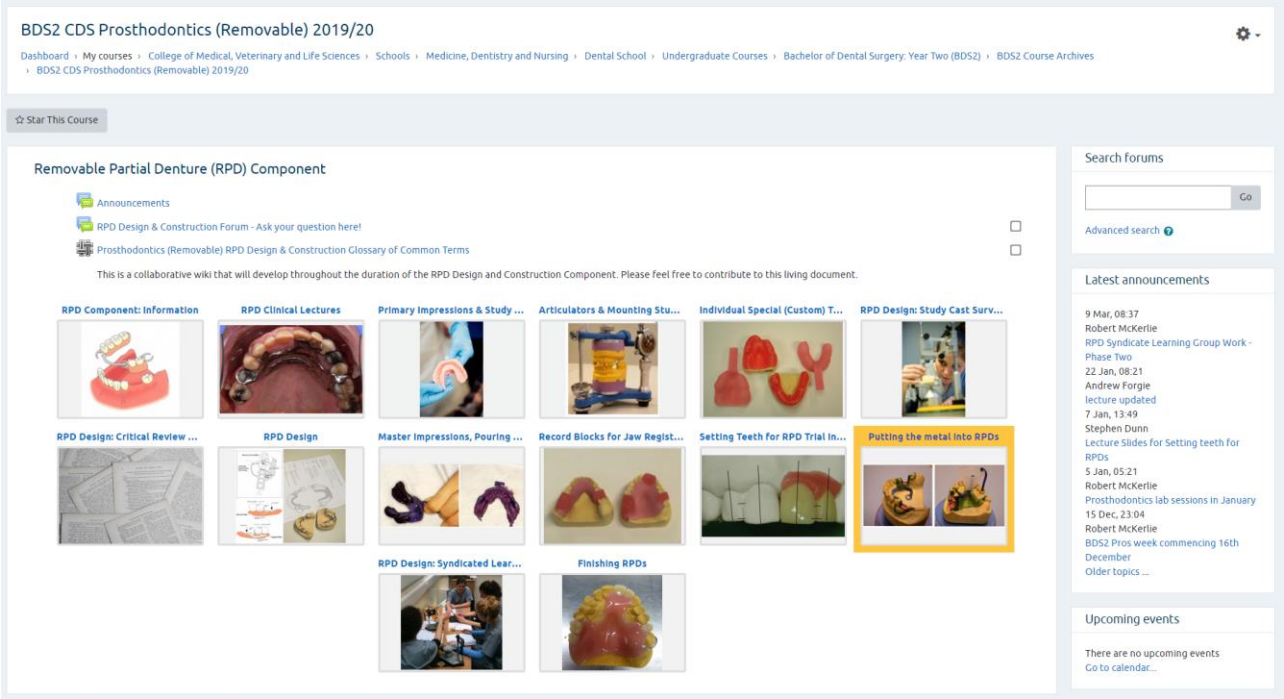


**Figure 1** An example illustrating the new Moodle VLE layout

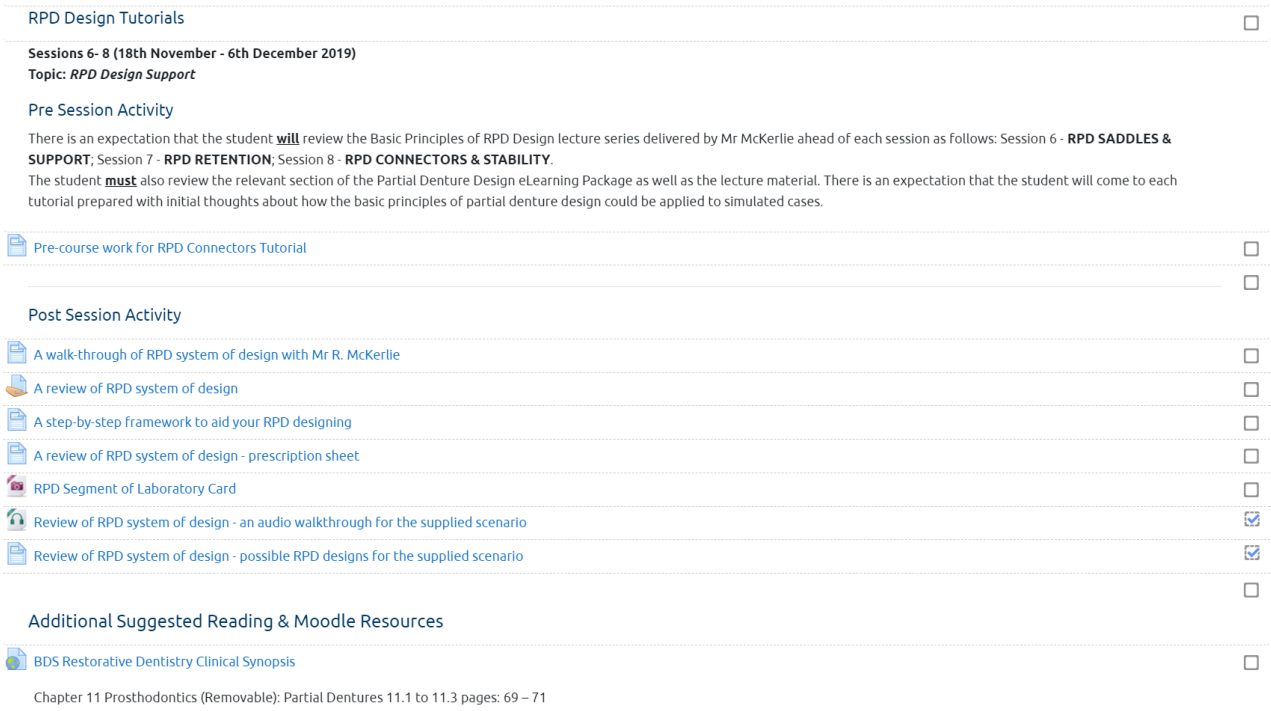


**Figure 2** New Moodle VLE template with activity tracking enabled

As a result of limitations placed on surveying students during the pandemic the team was not able to carry out a post-change evaluation. Anecdotal feedback in relation to the changes was positive allowing the roll-out of the new structure and templates to the other BDS theme areas in time for academic year 2020/21. There are plans to carry out an evaluation of the implemented changes at the end of the current academic session. Early indications from course evaluation surveys appear to show the changes have been well received with the new structure making it easier for students and staff to find resources. The completion of the initial phase of the Moodle VLE revision occurred just in time to support staff and students facing significant changes to the delivery of teaching and assessment in response to the effects of the pandemic.

These early initiatives formed the bedrock of a school-wide approach to move the majority of the didactic teaching online within a limited timeframe and develop creative ways of teaching and assessing practical elements using a blended approach. The careful balance of the blended approach allowed the programme to satisfy the dental regulator by addressing ILOs that could not otherwise have been achieved. With the practical nature of dental education, moving the programme fully online is not possible but the current circumstances have encouraged the development of some innovative blended learning models that have engaged both students and staff, as evidenced in the following examples.

## A novel approach for delivery of a local aneasthesia symposium: the introduction of anatomy wikis

The administration of local anaesthetic (LA) is one of the most common procedures performed by Dental Surgeons and is a key skill in Dental training. For students in Year 2 of the BDS programme, the LA symposium is an essential component of simulated practical clinical training which allows students to begin to administer LA to their patients in a safe and effective way. With a National lockdown imposed the week before the symposium was due to be delivered an immediate solution was required.

The original LA symposium comprised three distinct elements: knowledge-based teaching delivered in large group lectures by a variety of dental specialties, including Oral Surgery, Paediatrics and Special Care Dentistry, to provide students with the essential theoretical knowledge; practical clinical teaching in groups of approximately 10 students with one facilitator, using LA simulators in mannequin heads to demonstrate the different techniques; and an anatomy component for consolidation of pre-existing anatomical knowledge where in small groups, the students were guided through the relevant anatomy using 3-D software.

### Knowledge-based teaching

A shift to online delivery of lectures was relatively straightforward, although this had to be completed within a short time frame. Lecturers pre-recorded material which was made available to students in the Moodle VLE. Having asynchronous material available online enabled students to engage with their learning in a flexible way (Nordmann, Horlin, Hutchison, Murray, Robson, Seery, & MacKay, 2020) and most of our students indicated a preference for asynchronous delivery in course evaluation surveys. However, some lecturers opted to deliver lecture content online in real time due to the nature of the material and a perception that students might engage more fully with the content. This had the advantage of students being able to ask questions during or immediately

after the session. Where pre-recorded lectures were used, a question-and-answer session was arranged afterwards to allow students to meet with the lecturer in the virtual environment and follow up with questions.

## Practical clinical skills teaching

For the practical component of safe and effective LA administration, we were mindful of trying to recreate an authentic context to aid students' understanding. Short narrated videos were produced to demonstrate relevant practical skills (Figure 3). These allowed students to visualise the steps involved in different LA techniques and the bespoke nature of the resources ensured that content was accurate and aligned with ILOs. Videos were uploaded to Moodle VLE and time allocated to students for viewing of resources.

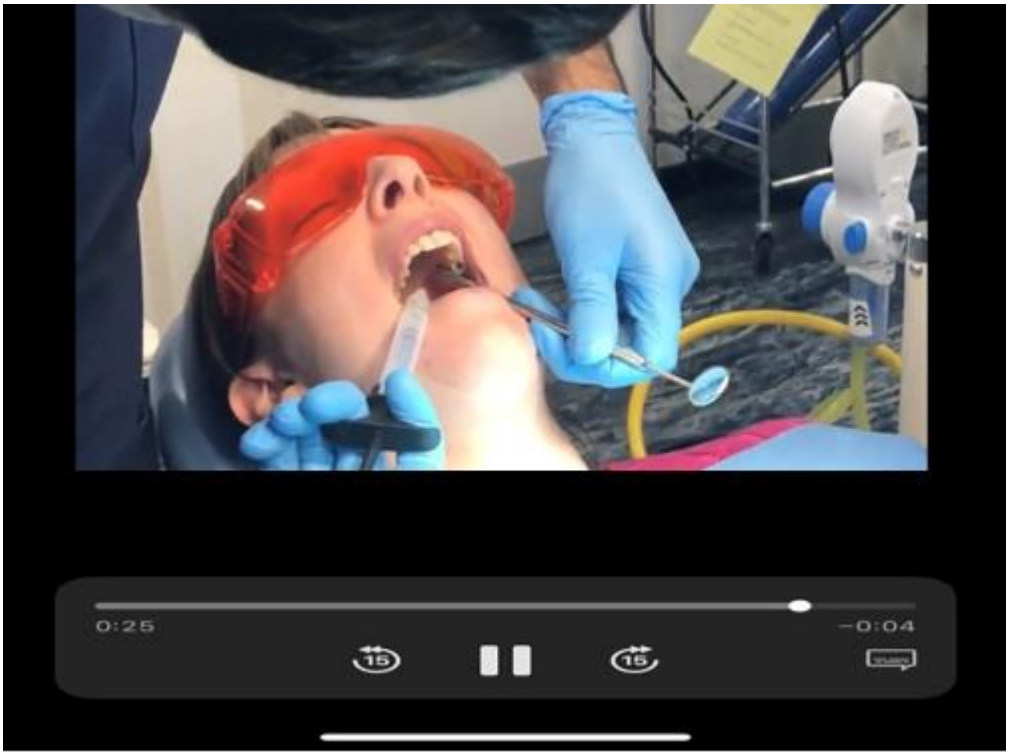


**Figure 3** Still image from LA Video

Students subsequently attended virtual small group teaching sessions on Zoom to ensure engagement with the material. Two facilitators per group of ten students; one oral surgeon and one restorative dentist, allowed for different specialty perspectives. Facilitators viewed online content beforehand and met to discuss ILOs and ensure a standardised approach to teaching.

The sessions focussed on clinical scenarios to ensure students were able to apply the knowledge they had already gained and to discuss any concerns. These sessions also aimed to make students feel included and encourage a sense of online community, as part of the Community of Inquiry Model (Garrison, Anderson, & Archer, 1999), and so maintain student engagement (University of Glasgow, 2021a). The Community of Inquiry Model was particularly suitable in this case as it combines three separate presences: i) the social presence that was supported by the follow up engagement sessions with the virtual small group teaching allowing for opportunities to discuss the material and ensure accurate understanding; ii) the cognitive presence that enabled students to connect the different concepts from the bespoke practical skills videos and construct own new meaning regarding this new clinical material; and iii) the teaching presence that merged the above, with the support of tailored video resources in the VLE, facilitating the overall online learning experience for the students (Garrison, Anderson, & Archer, 1999).

## Anatomy teaching – collaborative wikis

A semi-synchronous approach, combining online live synchronous sessions with a student-directed asynchronous element, was employed for the Anatomy component of the symposium. To our knowledge, this semi-synchronous pedagogical style has not been reported previously as a method of delivery of dental undergraduate teaching. Capitalizing on the student-directed element, learners were able to co-create, in small groups, authentic collaborative wiki entries on clinically relevant anatomy topics as described below.

### *Wikis in educational settings*

Wikis are instantly editable co-authored online documents, with multiple contributors, that are used to facilitate collaborative online learning and peer interaction (Augar, Raitman, & Zhou, 2004). Wikis promote the processes of production and development (Biasutti, 2017), aligning well with the methods envisaged for the virtual anatomy component of the LA symposium.

### *Preparatory teaching sessions and activities*

In preparation for the anatomy wikis session it was vital to ensure that all learners had a solid knowledge base of fundamental related anatomy topics, which included detailed anatomy of the trigeminal nerve, supplemented with active 3D exploration of its course and interrelationship with important surrounding structures. This was achieved with the teaching that had already been delivered in advance of the symposium, just prior to 'Lockdown'. This comprised two traditional lectures on the relevant anatomy followed by a linked laboratory session in the licensed anatomy laboratory with professionally prepared human cadaveric specimens. Although these sessions are not part of the symposium the teaching is designed to construct a basic scaffolding of anatomy knowledge upon which learners can build in order to enhance their fundamental anatomy knowledge and construct new understanding (Steffe and Gale, 1995)~~,~~. This was put into practice during the collaborative wikis (Vygotsky and Cole, 1978) where student-directed work was used to gain a better understanding of how 'pure' anatomy links with clinically relevant topics in the context of local anaesthesia. However, disparity between the mode of delivery for on-campus pre-symposium preparatory sessions and the online symposium, coupled with the relative unfamiliarity of staff and students with wiki development, was deemed a potential technological barrier for the anatomy wikis. To overcome this perceived barrier, a practice wiki was set up, with step-by-step visual and text-based instructions on how to post entries, including texts, images and videos, released via the Moodle VLE a week in advance of the anatomy wikis. Topics for the practice wiki were also based on pre-existing subjects such as the anatomy of the trigeminal nerve. The aim was to maximise familiarity with wiki technology and associated instructions, eliminate potential accessibility issues, empower learners to acquire and/or develop relevant technical and digital skills, ease potential anxieties associated with posting and editing wiki entries and give an opportunity to address questions from students.

### *Semi-synchronous anatomy wikis*

The Anatomy wikis component was structured around the motivational theory of Maslow to provide optimal conditions for students to achieve their full learning potential and encourage creativity during this activity. Maslow's hierarchy comprises five levels of need ranging from the most basic to the higher levels: Level 1 (physiological needs such as body comfort); Level 2 (needs such as safety and security); Level 3 (belonging to a group); Level 4 (esteem related to accomplishing tasks); Level 5 (self-actualisation with achieving full learning potential by fulfilling all previous steps in the levels) (Maslow, 1943; McLeod, 2018). The first two levels are also known as basic needs, while levels 3 and 4 refer to psychological needs (Maslow, 1943; McLeod, 2018).

A semi-synchronous model was adopted for delivery of wikis to allow flexibility and provide a balance between independent student-directed group work and live online teaching. Support was made available for the student-directed group sessions if required, to ensure a 'safe' learning space as outlined by Maslow's level 2 of safety and security as a basic need (Maslow, 1943; McLeod, 2018). In terms of lesson planning, the following sessions were delivered consecutively over the course of the symposium:

I. *Online Live Introduction (20 Minutes)*: A preparatory lecture introduced learners to their wiki topics and dealt with the logistics of assigning groups, reinforcing instructions on how to post wiki entries and providing contact details for technical queries arising during the student group work. Access to tutor support for information and technical assistance provided the level of safety and security already discussed. Wiki topics were not made available prior to the session since the aim was to achieve collaborative group work during the student-directed wikis, with no prior preparation required. Emphasis was placed on the goal of learners working together to develop a wiki entry on a clinically applied topic related to dental LA and students were reassured that the activity was not assessed in order to promote collaboration.
II. *Student-directed Wiki Development (60 Minutes)*: This novel approach to the symposium incorporated a student-directed session, during which learners developed wikis while working in small groups (n=4). Learners had flexibility to communicate with peers using any platform they felt comfortable with to maximise autonomy as they produced the content of their wikis. Within the time allocated groups were instructed to write a wiki entry of 200-300 words, which could include images and videos. Learners worked in their usual clinical groupings to maintain comfort and familiarity with peers, with the aim of providing a sense of belonging. Based on the motivational theory of Maslow's hierarchy, this describes level 3 and should encourage learners to achieve their learning goals (Maslow, 1943; McLeod, 2018). The session also empowered learners to use investigative skills and apply independent critical thinking skills that are core University of Glasgow Graduate Attributes (University of Glasgow, 2020).
III. *Online Live Student Presentations (30 Minutes)*: The final session brought the groups back together on Zoom to present their wikis. There was no requirement for a formal slide presentation and instead the groups were asked to focus on the wikis as the primary authentic output in three-minute presentations. Each group chose one student to present their wiki via screen sharing, followed by a short question-and-answer session. This activity provided learners with a sense of accomplishment aligning with level 4 from Maslow's hierarchy (Maslow, 1943; McLeod, 2018).

The development of wikis was based on social constructivist theory with learners using pre-existing knowledge from lectures and laboratory-based sessions to co-create entries of new knowledge (Terrell, 2006) on clinically applied topics related to dental LA via active peer collaboration and participation (Dewey, 1938; Kolb, 1984). The wiki component was designed to encourage learner-centred teaching (Terrell, 2006) and autonomy at group level, where group members had a sense of connection to each other by

sharing a common goal within the same wiki topic (Burgess and Ramsey-Stewart, 2014). The ultimate aim was to motivate learners for the task and promote independent learning and ownership of the final output. By fulfilling the first four levels from Maslow's hierarchy, learners were also able to achieve self-actualisation (level 5) by accomplishing their maximum learning potential (Maslow, 1943; McLeod, 2018).

### Catch up practical clinical skills teaching

Virtual learning cannot fully replicate on-campus teaching of practical clinical skills. When lockdown restrictions were eased in August 2020, this allowed for face-to-face sessions where students could demonstrate the practical application of skills they had acquired in the virtual setting (Figure 4). This novel wiki approach to the LA symposium provided an innovative and engaging alternative which enriched the subsequent on-campus practical sessions, so much so, that it will be incorporated into future teaching in this area.

**Figure 4** Subsequent on campus practical clinical skills teaching at the Louisa Jordan National Clinical Skills Hub

## Fostering online collaboration using Microsoft Teams

Throughout the pandemic multiple software solutions were adopted to enable faculty to maintain regular contact and engage with students across a variety of formats including lectures, live question-and-answer sessions and small group teaching. However, there were specific concerns regarding the transition of the new intake of first year (BDS1) students in September 2020, many of whom were attending University and living away from home for the first time.

BDS1 is dominated by Biological and Medical Science (BAMS) subjects, including histology, anatomy and physiology. Traditionally, these are taught on-campus in large classes, with technologies such as Mentimeter and Padlet typically reserved for in class student engagement activities. In response to the COVID-19 pandemic all BAMS subjects were adapted for remote delivery. This primarily involved embedding learning materials within our newly developed BAMS Moodle VLE to provide asynchronous, flexible access to course materials. Due to the traditional structure of the BAMS theme, there were few opportunities to incorporate small group teaching within our transition to remote delivery. The BAMS teaching team had no previous experience of delivering BDS1 BAMS teaching remotely but were cognisant of the importance of social interactions for promoting successful student integration, engagement and sense of community. Here we describe how Microsoft Teams was used to foster student engagement and a sense of community through active, small group collaborative learning.

Successful delivery of remote and blended learning depends on the ability to design social learning communities, where regular interactions provide opportunities to develop subject knowledge and attain valuable skills (Wenger 2000; Wenger, 2010; Exley & Dennick, 2004). As such, we adopted a similar approach to that of the LA and anatomy wiki symposium, in that social constructivist theories were utilised to inform the approach to remote learning and design of online activities to support learners to apply pre-existing knowledge to co-create new resources (Dewey 1938; Vygotsky & Cole 1978). Pedagogical research of successful online learning increasingly draws from social constructivist theories (Garrison et al 1999; Smith, Hayes and Shea 2017; Gunawardena, Hermans, Sanchez, Richmond, Bohley, & Tuttle, 2009) and evidences the critical importance of social learning communities for online learning; "*without the support and participation of a learning community, there is no online course"* (Palloff & Pratt, 1999).

Microsoft Teams is a communication and collaboration hub, that brings together different socially networked technologies and Microsoft Office 365 in one 'space', allowing students and staff to meet, learn, create content and share resources (Microsoft, 2020). Thus, Microsoft Teams provides an ideal platform to implement a socially constructed, collaborative approach to learning and teaching.

The 2020 BDS1 cohort comprised 74 students, all of whom were added to a single Team. Within online learning environments, group size can significantly impact learner engagement, with reports of less frequent engagement when students are in larger groups, while those in small groups engage more and perceive their interactions to be more conducive to learning and critical thinking (Hamann, Pollock, & Wilson, 2012). Moreover, small groups support a sense of group cohesion and community learning (Akcaoglu & Lee, 2016; Rovai, 2012) and represent the ideal approach to facilitate social learning (Mills & Alexander, 2013). As our goal was to encourage and facilitate student engagement and interaction, we assigned each student into 1 of 8 tutorial groups (8-10 students/group). Each group was assigned to a different Teams channel, with each channel representing the small group collaborative 'space' where students interacted and engaged in learning activities.

Learning resources hosted on Moodle VLE for asynchronous access included pre-recorded video lectures (broken down into small chunks of less than 20 minutes and including transcripts). Interactive virtual microscopy Moodle VLE lessons and virtual anatomy laboratory books were developed to allow students to achieve the ILOs (previously undertaken on-campus), asynchronously and remotely. For example, pre-pandemic, anatomy laboratories were 'hands-on' requiring students to interact with professionally dissected anatomical prosections. The adapted virtual anatomy laboratory books utilised e-book images of dissected cadaveric materials, digital histology sections and clinical imagery alongside the usual laboratory session questions. To facilitate small group collaborative interactions, both virtual microscopy lessons and virtual anatomy laboratory books included activities to be completed and shared on Teams. Tutor announcements in Teams were used to reinforce and remind students of learning activities, with deadlines set typically one week after the asynchronous session. In this way, learning activities hosted on the Moodle VLE were clearly communicated and linked directly with Teams.

In line with the model of constructive alignment (Biggs, 2003) the emphasis was on active learning using a variety of synchronous and asynchronous activities aligned to ILOs, with learning activities completed and shared via Teams  The initial approach was a simplified one in which student technological competencies were built over time. This approach aligns well with the 5-stage model for learning and teaching online (Salmon, 2013). Induction icebreakers provided an opportunity for students to meet and practice the digital skills required to use the technology effectively (Stage 1, Access and Motivation). A virtual escape room, where students worked collaboratively within their groups to investigate the relationship between tissue structure and function as they travelled virtually through the human body and progressed through different 'rooms', provided a fun and engaging activity to encourage group collaboration and engagement with learning materials (Stage 2, Online Socialisation). At later stages (Stages 3 and 4, Information Exchange and Knowledge Creation), groups engaged in a variety of asynchronous and synchronous activities, where they were required to contribute to open group discussions or produce and share artifacts such as annotated histological images, anatomical drawings, written documents, presentations and videos. In this way, students were engaged both with participation (acting and interacting) and reification (production of an artifact to represent their understanding), processes essential for the establishment of successful social learning communities (Wenger 1998; Wenger, White, Smith, & Rowe 2005).

Tutors were routinely active on the Teams platform and provided regular and prompt feedback for each group discussion and artifact produced. The tutors found Teams to be time efficient and effective for allowing easy access and review of student outputs and delivery of feedback. It is known that higher levels of tutor engagement contribute significantly to improved attainment of learning outcomes and higher course satisfaction (Boling, Hough, Krinsky, Saleem & Stevens, 2012; Driscoll, Jicha, Hunt, Tichavsky, & Thompson, 2012 ).

Student engagement and levels of interaction were high, as noted by Tutors and Teams engagement data, which indicated that from September 2020 to March 2021 there were 353 posts, 923 replies and 234 reactions. The majority of posts and replies comprised discussion posts and uploads of artifacts, the quality of which was extremely high and included group presentations such as PowerPoint or Zoom recorded video files. Some groups even created TikTok videos with background music. At this early stage of implementation (i.e., prior to any formal evaluation) the high levels of student engagement, interaction and creativity were considered to provide informal evidence that the use of Teams was successful in its primary aim to foster a sense of community through active small group learning and teaching. Anecdotal feedback from students indicated that use of the Teams platform was successful for supporting them to communicate and learn together. Overall, our approach provided new and previously unrealised opportunities for students to develop subject knowledge and attain additional valuable skills, such as digital literacies and self-directed learning. One important consequence of these endeavours was that formative assessment and feedback became integrated throughout the BAMS BDS1 course.

As tutors, we found this new approach of delivering teaching and supporting students to interact in small groups to produce artifacts that demonstrate their learning and understanding to be highly enjoyable and rewarding. Our personal (albeit virtual) interactions with students were substantially increased compared with previous years when teaching was delivered on-campus.

The University of Glasgow's Learning and Teaching strategy 2021-2025 outlines its commitment to student-centred active learning that is supported by a blended approach to maximise face-to-face on-campus activities with online learning experiences (University of Glasgow 2021b). Moving forward, we envisage that Teams will become an integral component of our transition to blended-learning, by providing opportunities to encourage students to actively engage with learning materials, to develop responsibility for their own learning and develop the collaborative skills necessary for group-work and team-learning, all the while developing essential digital literacies. The authors plan to conduct future qualitative research, using communities of practice as a framework for evaluation (Smith et al, 2017). We aim to develop a staff/student partnership to co-create learning experiences best suited for a blended approach to learning and teaching.

## Supporting staff

It is clear from our experience that both students and staff need to be supported when moving a traditional professionally regulated programme to a remote or blended method of delivery. Not only do staff require the tools and knowledge but they also need the confidence to make the move. To assist staff in preparing for the transition to a blended delivery method, the University of Glasgow ran a series of upskilling training events over the summer months. The College of Medicine, Veterinary Medicine and Life Sciences (MVLS) Digital Education Unit complimented the approach taken by university central services with additional specific platform training and drop-in sessions. The Dental School further enhanced this by establishing an area on both the Moodle VLE and MS Teams to provide a one stop shop to support staff. This offered, amongst other things, a series of 'how to …' videos covering common tasks on Echo360, Moodle VLE, MS Teams and Zoom. A limited series of weekly informal online events 'Let's Grab a Coffee and have a Chat about TELT' were established where our early adopters, alongside our student TELT partners, could showcase solutions to school teaching staff, share experiences and work through issues together.

## Conclusions

The effects of the Covid-19 pandemic demanded a speedy and effective response in order to deliver essential content for the undergraduate Bachelor of Dental Surgery (BDS) programme. This article provides two specific examples of this innovative and timely response in the form of a local anaesthesia symposium: the introduction of anatomy wikis and the fostering of online collaboration using MS Teams for Biomedical and Medical Sciences teaching. This quick response in a period of significant lifestyle and organisational upheaval has enabled immediate presentation as a reflective commentary which will be the subject of more in-depth investigation, analyses and further dissemination. The learning events presented provide examples of successful social learning communities (Wenger 2000; Wenger, 2010; Exley & Dennick, 2004) and demonstrate the practical use of social constructivism models, highlighting how effective they can be in the remote and blended learning environment (Dewey 1938; Vygotsky & Cole 1978; Garrison et al 1999; Smith, Hayes and Shea 2017; Gunawardena et al. 2009).

Furthermore, this article provides an insight into how the work of our early adopters provided the foundation that allowed for a practical professionally regulated degree programme to move to a successful online and blended delivery. In the light of a Global Pandemic the "enforced opportunity" of a blended approach to dental education has ensured the rapid and effectual development of a flipped classroom modality already in existence at the Dental School which will continue to expand within the BDS programme in the years to come. As a significant component of the early years BDS programme requires the students to develop practical skills, the flipped classroom approach enables the students' time in the skills laboratory to be fully utilised for practical skills development as the knowledge acquisition for the skill happens in the VLE. The close working of students with staff in partnership to co-produce learning materials and redesign the learning environment ensures ownership belongs to both students and staff. Our TELT Partnership has proven to be relevant, timely, and essential to the success of our blended BDS programme and it will continue into the future with some exciting new developments within the digital dentistry sphere. There are plans to complete the evaluation of the Moodle VLE re-design roll-out during the next academic session. We would commend all of the initiatives discussed to other degree programmes.

In conclusion, it is important to emphasise that the experiences of our early adopters aided and encouraged our Dental School Faculty to engage with technology to a markedly greater extent. This in turn has encouraged our students to familiarise themselves with VLE online teaching material prior to taking part in practical or online-live teaching sessions. It cannot be overemphasised how crucial it is to ensure that there is support provided to assist staff making the transition to a blended delivery and the importance of engaging students in the process. From adversity we have seized upon the opportunity to align the teaching of practical skills with technology and instil a positive shift in institutional practices.

### *Acknowledgement*

The authors would like to acknowledge all the staff involved in ensuring the ongoing delivery of the BDS programme, our TELT staff and student partners, and the staff at the Louisa Jordan National Clinical Skills Hub.

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### *References*

Adekola, J., Dale, V. H.M. and Gardiner, K. (2017) Development of an institutional framework to guide transitions into enhanced blended learning in higher education. Research in Learning Technology, 25, 1973. (doi: 10.25304/rlt.v25.1973)

Akcaoglu, M. and Lee, E. (2016). Increasing Social Presence in Online Learning through Small Group Discussions. International Review of Research in Open and Distributed Learning Volume 17, Number 3.

Augar, N, Raitman, R and Zhou, W. (2004). Teaching and learning online with wikis. In: Beyond the comfort zone: Proceedings of the 21st ASCILITE Conference, Perth, 5-8 December 2004, ASCILITE, pp. 95-104. Available from: https://www.ascilite.org/conferences/perth04/procs/pdf/augar.pdf.

Biasutti, M. (2017). A comparative analysis of forums and wikis as tools for online collaborative learning. Computers & Education, 111, pp.158–171.

Biggs, J. (2003) Aligning teaching for constructing learning. Higher Education Academy, pp.1-4.

Boling, E.C., Hough, M., Krinsky, H., Saleem, H., Stevens, M. (2012) Cutting the distance in distance education: Perspectives on what promotes positive, online learning experiences. The Internet and Higher Education, Volume 15, Issue 2, Pages 118-126 https://doi.org/10.1016/j.iheduc.2011.11.006

Burgess, A. and Ramsey-Stewart, G. (2014). Elective anatomy by whole body dissection course: what motivates students?. BMC Medical Education, 14(1), pp.272.

Cameron, D., McKerlie, R., & Mathew, B. (2006). A comparison of teaching methods for teaching dental technology to undergraduate dental students: a pilot study. *PESTLHE* 1(2): 73-93.

Crothers, A., Bagg, J. & McKerlie, R. (2017) The Flipped Classroom for pre-clinical dental skills teaching – a reflective commentary. *British Dental Journal* 2226 709–713.

Dewey, J. (1938). Experience and education. New York, USA: Macmillan Company.

Driscoll, A., Jicha, K., Hunt, A. N., Tichavsky, L., Thompson, G. (2012). "Can Online Courses Deliver In-Class Results? A Comparison of Student Performance and Satisfaction in an Online Versus a Face-to-Face Introductory Sociology Course." Teaching Sociology 40(4):312–31.

Exley, K. and Dennick, R. (2004) Small group teaching: tutorials, seminars and beyond. Abingdon: Routledge Falmer. https://doi.org/10.4324/9780203465066

Garrison, D.R., Anderson, T. and Archer, W. (1999). Critical inquiry in a text-based environment: Computer conferencing in higher education. The Internet and Higher Education, 2(2-3), pp.87–105.

Gunawardena,C. N., Hermans, M. B., Sanchez, D., Richmond, C., Bohley, M., & Tuttle, R. (2009) A theoretical framework for building online communities of practice with social networking tools, Educational Media International, 46:1, 3-16.

Hamann, K., Pollock, P, H., & Wilson, B., M. (2012) Assessing Student Perceptions of the Benefits of Discussions in Small-Group, Large-Class, and Online Learning Contexts, College Teaching, 60:2, 65-75, DOI: 10.1080/87567555.2011.633407

Kolb, D.A. (1984). Experiential learning: experience as the source of learning and development. New Jersey, USA: Prentice-Hall Inc.

Kowalczyk, N.K. 2014, "Perceived barriers to online education by radiologic science educators.", *Radiologic technology*, vol. 85, no. 5, pp. 486-493.

Lambropoulos, N., Faulkner, X. and Culwin, F. (2012), Supporting social awareness in collaborative e-learning. British Journal of Educational Technology, 43: 295-306. https://doi-org.ezproxy.lib.gla.ac.uk/10.1111/j.1467-8535.2011.01184.x

Maslow, A.H. (1943) A theory of human motivation. Psychological review, 50(4), p.370-396.

McCulloch, A. (2009). The student as co-producer: Learning from public administration about the student-university relationship. Studies in Higher Education, 34(2), 171-183. https://doi.org/10.1080/03075070802562857

McKerlie, R. A., Rennie, E., Hudda, S., McAllan, W., Al-Ani, Z., McLean, W., & Bagg, J. (2018). Facilitation of student-staff partnership in development of digital learning tools through a special study module. *International Journal for Students as Partners*, *2*(1), 121-129. https://doi.org/10.15173/ijsap.v2i1.3235

McLeod, S. (2018). Maslow's hierarchy of needs [online resource]. Available at: https://www.simplypsychology.org/maslow.html [accessed on 01 March 2021].

Microsoft (2020) Welcome to Microsoft Teams [online] Available at: https://docs.microsoft.com/en-us/microsoftteams/teams-overview. [Accessed 01 March 2021].

Mills, D. and Alexander, P (2013). Small group teaching: a toolkit for learning. The Higher Education Academy.

Nordmann, E., Horlin, C., Hutchison, J., Murray, J-A., Robson, L., Seery, M.K., & MacKay, J.R.D. (2020). Ten simple rules for supporting a temporary online pivot in higher education. PLoS Comput Biol 16(10): e1008242.

Palloff, R., & Pratt, K. (1999). Building learning communities in cyberspace: Effective strategies for the online classroom. San Francisco: Jossey-Bass Inc. pp29.

Phillips, J.A., Schumacher, C. & Arif, S. (2016) "Time Spent, Workload, and Student and Faculty Perceptions in a Blended Learning Environment.", *American Journal of Pharmaceutical Education*, vol. 80, no. 6, pp. 102.

Rovai, A. P. (2012). Building sense of community at a distance. The International Review of Research in Open and Distributed Learning, 3(1). Retrieved from http://www.irrodl.org/index.php/irrodl/article/view/79/152

Salmon, Gilly. *E-Tivities : The Key to Active Online Learning*, p46 Taylor & Francis Group, 2013.

Smith, S.U., Hayes, S., & Shea, P (2017). A critical review of the use of Wenger's Community of Practice (CoP) theoretical framework in online and blended learning research, 2000- 2014, *Online Learning 21*(1), 209-237

Steffe, L. and Gale, J. (1995). Constructivism in education. New Jersey, USA: Lawrence Erlbaum Associates Inc.

Terrell, M. (2006). Anatomy of learning: Instructional design principles for the anatomical sciences. The Anatomical Record Part B: The New Anatomist, 289(6), pp.252–260.

University of Glasgow (2020). Graduate attributes framework [online]. Available at: https://www.gla.ac.uk/media/Media_183776_smxx.pdf [accessed on 01 March 2021].

University of Glasgow (2021a). Remote and blended teaching – Glasgow's 7 principles of remote and blended teaching [online]. Available at: https://www.gla.ac.uk/myglasgow/anywhere/blendedteaching/ [accessed on 04 March 2021].

University of Glasgow (2021b). Learning and Teaching Strategy 2021 – 2025. Available at: https://www.gla.ac.uk/media/Media_775156_smxx.pdf [accessed on 15 March 2021].

Vygotsky, L.S. and Cole, M. (1978). Mind in society. The development of higher psychological processes. Cambridge, USA: Harvard University Press. Wenger E. (1998). *Communities of practice: Learning, meaning and identity*. New York, NY: Cambridge University Press.

Wenger, E. (2000). Communities of practice and social learning systems. Organisation, 7(2), 225-246.

Wenger, E. (2010). Communities of practice and social learning systems: The career of a concept. In C. Blackmore (Ed.), Social Learning Systems and Communities of Practice (pp. 179–198). London: Springer. doi:10.1007/978-1-84996-133-2.

Wenger, E., White, N., Smith, J.D., Rowe, K. (2005). Technology for communities. In L. Langelier (Ed.), *Working, learning and collaborating in a network: Guide to the implementation and leadership of intentional communities of practice* (pp. 71–94).

**Appendix 1 Moodle VLE baseline user experience online survey**

## Staff Moodle Opinions

This part of the survey uses a table of questions, view as separate questions instead?

Please select whether you agree or disagree with the following statements

| | Strongly Agree | Agree | Neither agree nor Disagree | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Overall, I am satisfied with how Moodle is used in the Dental Programme | ○ | ○ | ○ | ○ | ○ |
| I find Moodle easy to use | ○ | ○ | ○ | ○ | ○ |
| I find Moodle easy to navigate | ○ | ○ | ○ | ○ | ○ |
| I always know where on Moodle I should put resources my students will need for a lesson. | ○ | ○ | ○ | ○ | ○ |
| I make use of the additional functionality of Moodle beyond sharing presentations and handouts | ○ | ○ | ○ | ○ | ○ |
| I would like extra support in making use of the additional functionality available within Moodle to support learning | ○ | ○ | ○ | ○ | ○ |
| Using the additional functionality of Moodle helps enhance student learning | ○ | ○ | ○ | ○ | ○ |

## Student Moodle Opinions

This part of the survey uses a table of questions, view as separate questions instead?

Please select whether you agree or disagree with the following statements

| | Strongly Agree | Agree | Neither Agree nor Disagree | Disagree | Strongly Disagree |
|---|---|---|---|---|---|
| Overall, I am satisfied with how Moodle is used to support my learning in the BDS Programme | ☐ | ☐ | ☐ | ☐ | ☐ |
| I find Moodle easy to use | ☐ | ☐ | ☐ | ☐ | ☐ |
| I find Moodle easy to navigate | ☐ | ☐ | ☐ | ☐ | ☐ |
| I can always find the resources I need for a lesson | ☐ | ☐ | ☐ | ☐ | ☐ |
| Moodle gives me access to extra resources relevant to my classes | ☐ | ☐ | ☐ | ☐ | ☐ |
| My lecturers make use of the additional functionality of Moodle beyond sharing presentations and handouts | ☐ | ☐ | ☐ | ☐ | ☐ |
| Using the additional functionality of Moodle helps enhance my learning | ☐ | ☐ | ☐ | ☐ | ☐ |