Developing Interactive Digital Learning Resources- A Case Study for MSc Surveying Modules

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Key words: Education, Interactive, Digital, Remote Resources

SUMMARY

The Covid-19 pandemic altered the way module delivery was structured, resulting in accelerated digital learning resources for surveying. One of the initial measures implemented was a series of videos, which demonstrated how the different activities within the module were conducted. After obtaining initial feedback from the students, the authors found a need to further expand on these resources and create a new module, which embrace new technologies for digital learning.

The authors aligned this initial feedback to contemporary pedagogic practices and developed an interactive digital learning environment, which embraces inclusivity, with the support from specialist departments. To ensure the overall success of the new resources, further student feedback was obtained and assessed, to review the efficacy of the developed materials to enhance student participation, experience, and support.

A structured questionnaire allowed for analysis of the views of undergraduate and postgraduate students to quantify the benefits and shortcomings of the initial digital learning material, specifically looking into:
- Ease of access to resources,
- Depth and breadth of areas covered,
- How students utilised the resource,
- How it has expanded student appreciation and/or knowledge of the discipline,
- Accessibility for students with support plans,
- What platform was used to view the material,
- Overall benefit of the resource.

Designing the new module incorporated this feedback, specifically ensuring that students were able to interact with the module on various devices/platforms, the information was delivered in smaller components, enhanced interaction with the speaker, and ensuring examples were conducted on relevant equipment. After implementation of the module, a second questionnaire was undertaken by students, using the same questions as previously, with answers based on the newly developed material, to assess overall efficacy.

The authors developed a resource appropriate for multiple platforms, with the ability for transcripts to be presented in different languages, different font styles sizes etc for inclusivity.

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Although there were issues with accessing the resource remotely within the surveying field, due to poor signal/ connectivity, the resource provided the student to have a greater technical vocabulary prior to undertaking the works. To obtain full benefit from the resource, some prior academic experience with high end surveying equipment was required, but the resource did provide the ability to monitor and track student engagement, helping provide a strong resource before the student undertake the fieldwork.

Developing the resource expanded the authors knowledge within technical enhanced learning for students, including the capabilities and some developments of the area. Within the institution, the newly developed material lays out a template for good practice, helping provide enhanced ways of working for students with support plans, such as dyslexia or English as a second language. The development of the resources further expanded the team's knowledge.

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1. INTRODUCTION

Over the last two years during the pandemic, many students have had to access their studies using online lectures and tutorials, this has changed many aspects of learning and some students have benefited from the changes whilst others have struggled to adjust. Statistics from UNESCO state that Higher Education Institutes (HEIs) were completely closed in 185 countries and affecting 89.4% of total enrolled learners (Marioni, Land & Jensen, 2020). These cohorts of students have now returned to face-to-face teaching.

To maximise the student experience during lockdown, the University of Derby created a suite of online videos to support students with preparation for practical surveying sessions, these at during 2020 where focused on undergraduate work, as these cohorts had to study surveying as core modules. The aim of the development was to provide remote students with an insight into the fieldwork, either preparing them for delayed practical sessions, or in the case of international students, with travel limitations, providing a resource to be used with remote data, such as levelling or traversing work, providing an improved understanding, to support modular assessment.

During the original COVID support development the focus was on providing additional materials with the main modules being the first two years of surveying, as there was only going to be a limited time for practical work during the summer. The third-year students who were going to graduate, were prioritised for practical work in May 2021 prior to the examinations.

2. INITIAL MATRIALS AND MODULES

With the focus on years one and two and some of the cohort working remotely outside the UK the team worked to record both short demonstrations of practical tasks and supporting field data for work on Levelling, Topographical surveys, etc.

The two key modules were 4BU505 Site Surveying 1 taught to all Construction and Civil Engineering Students and 5HX508 Infrastructure Surveying and Asset Management mainly for Civil Engineers.

As the team had limited time and experience in the production of such online resources guidance as provide by the Media Team, with scheduling of recordings completed in just 4 days and a very quick turn around for the subsequent editing process.

Throughout, the recording were limited to short videos with none exceeding 7 minutes, as recent research had indicated that short videos are more effective for student retention (AFIFY, 2020). Although the resources had little planning time the team ensured that any video resource

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captured key aspect of the process and each practical session was merged with an embedded lecture, ensuring that links were made back to the associated lecture (Reiss, 2008). All the recorded materials in the first tranche of recordings included direct delivery to camera, adopting an informal style.

When the examination boards had been completed it became clear that there had been some issues with engagement, as the overall performance was down on historic years although informal feedback did state that many student benefited from the additional resources.

2.1 Feedback and reflection from initial online materials

In devising further resources across all the stages of study and creating a full online Post Graduate module, lessons had to be learnt about the positive and negative aspects of the videos. The team sent out a questionnaire to the students who had completed the modules 4BU505 and 5HX508 during 2020-21 academic year. The original cohort size was 68 students, however the number of complete (online) questionnaires was only 24 of which 17 came from the 5HX508 module and the remainder from the 4BU505, this was disappointing but at 35% returns aligns to past research of typically 33% engagement (Nulty, 2008)

From the students who replied more than 50% used the additional video and online resources, this may seem lower than expected but that could be attributed to the fact that for both modules a week block of practical sessions was held at the end of the semester. Of the students who used the additional resources and videos, 93% would continue to use them in the future.

It was found that over 78% of those using the resources used both the videos and the remote data, this probably points to the two elements providing the student with better context of the processes. Almost 2/3 of the users used the resources at least twice when reviewing the resources which could point to a reflective learning style, typical of engineering students, past research demonstrates kinesthetics style is typical (Katsioloudis and Fantz, 2012) the resources are partly addressing this approach.

An interesting aspect that was questioned was the type of platform used, although half the sample used multiple platforms the other half mainly used only a PC/laptop to access the videos, which also reflects that all the respondents considered the media to be of good or excellent quality. In the original recordings the team were unsure what length recording would be suitable, although over 90% consider the length of the recordings to be sufficient or excellent (the recordings ranged from 2 to 7 minutes).

Of the students who accessed the resources through multiple platforms 80% of these went on to answer that being able to access the modules very easily, compared with 50% for those who only accessed via PC/laptop. One student having difficuly to accessing the material, who was also the sole respondent for accessing the material via tablet only.As for accessibility winthin the resources, there was only one respondent who had issues with the resource while the positive responses included comments like *"….easy,…normal….no issues…"*

In reflection the whole group of students who used the resources stated that they added to the learning experience and helped them to complete the assessment work. Although this is a positive response at least it shows that the efforts are appreciated.

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The final question of the questionnaire considered whether or not the students would use this form or resources again even without a "COVID Lockdown" and the response was yes (96%) the only negative response did not provide a reason.

The outcome of this exercise strongly supported the development of new materials and expansion of the provision, it would also indicate clearly that the current package provides an easy access resource to support practical sessions and provide a strong revision package.

3. DEVELOPMENT OF THE POST GRADUATE DIGITAL LEARNING RESOURCE

Using the feedback from the initial videos and online resources above, a similar base format for the material was adopted to ensure continuing success around accessibility and ease of use shown in the previous examples. However, additional specialists, including film and production specialists, content producers, learning designers and project co-ordinators were seconded into the development to ensure a robust and professional end product. The package of resources created needed to reflect the content of a full module, supporting both online and on campus provision for students. The module best suited for this wast the post-graduate module 7BU507 Geomatic Monitoring and Asset Engineering.

3.1 Creation of online modules at the University of Derby

Creating a module for online students is often more time-consuming than creating material for face-to-face teaching as, according to Devlin and McKay (2016, p. 1) "there is less emphasis on the notion of the educator as sage on the stage and more interest" in their role as a "guide on the side". Also, as online delivery forces academics to move away from the traditional role of the lecturer and adopt the role of mentoring, coordinating and facilitating learning (Boling *et al.*, 2012, as cited in Bryson & Andres, 2020). Therefore, more time is needed in developing online learning content and more people are required to be involved in the process. Table 1 shows a brief overview of the different people involved in creating online modules at University of Derby.

3.1.1   Roles and responsibilities within online module design

The Project Co-ordinator manages the scoping and timelines of the module and acts as a liaison between all the parties involved in creating the module. This ensures that the module is created on schedule with all content available to students at the start of the delivery trimester as part of the University of Derby regulations for online learning.

The academic is responsible for producing the written online content by the agreed milestone dates in order to allow sufficient time for all of the later processes. The Peer Reviewer and the Learning Designer (LD) work closely with the academic to ensure that learning content is fit for purpose. The reviewer focuses on the actual content of the material whereas the LD suggests how the content can be designed to support and enhance student engagement so that students

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get the most out of their learning. The LD may suggest changes to activities, narrative voice, resources, the structure of the content and the visual layout.

At the University of Derby, Online Content Producers (OCP) transform learning content from a Word document to our LMS (Learner Management System). They review the authored content to ensure the content is accessible and free of copyright infringement. They also suggest how content can be presented and what interactivities might be suitable

For modules that require bespoke media elements, Learning Media Producers (LMP) work with academics, LDs and OCPs to create films, audio recordings, animations or 360^0 images to bring learning content to life for students. This can allow students to experience practical situations which would not otherwise be possible in online learning. Likewise, Learning Developers work with members of the team to create bespoke interactive elements that have specific coding requirements.

When the content has been checked, it is sent to be proof-read. Once the academic has made any required changes, the OCP builds the content and the LD and academic review the build. Once content has been built, OPPs export the content to printable templates to enable students to access the content offline and to provide inclusive access. It is the responsibility of the online tutor (who may or may not be the academic author) to check the module content prior to delivery.

Table 1 Overview of the roles and processes in online content production

Stages	Academic	LD	Peer Reviewer	LMP	OCP	Learning Developer	Proof	Project Co-ordinator
Planning	Planning	Reviewing the plan	Signing off the plan					Setting milestones
Authoring	Attending coaching meetings	Coaching						Checking progress
	Authoring	Reviewing authored content	Reviewing authored content	Advising on bespoke media elements	Reviewing authored content	Advising on bespoke interactive elements		Checking progress
	Making changes	Checking changes						Liaising between different parties
	Making proof amends						Proofreading authored content	Liaising between different parties
Building	Reviewing the built content	Reviewing the built content		Creating bespoke media elements	Building the module	Building bespoke interactive elements		Checking project completion
Delivery preparation	Setting up for delivery							
	Updating future iterations	Reviewing updates			Making updates			Checking project completion

3.2 Updating and enhancing video materials

To ensure the quality of the videos produced, specialist film producers for education settings were brought into the project, to help guide through the many methods available of producing video content, within the time, resource, and budget constraints within the project. Whilst methods differ per Filmmaker, there is a standard format which was used to specify, design, and produce the content, which breaks the process down into pre-production, principal photography, and post-production.

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3.2.1   Pre-production

This is the planning stage of the production, where the foundation for the videos are outlined. Pre-production will differ on every production depending on the type of asset being created and the creatives involved but some key elements will need to be established regardless of the production.

The first stage of the project was creating an appropriate brief, that describes the project's goal and outlines the narrative, which may involve writing a script or a treatment for a video. The brief should provide an extensive picture overview of the project, which we can then use to continue the rest of the Pre-production planning. The films created for the Geomatics Monitoring and Asset Engineering Module for University of Derby, a simple word document was created which outlined the number of films we needed to develop and identifying the content covered in each video and the learning goals for those videos. Once the brief is identified, agreed, and documented, costs of the project and deadlines were agreed upon with all relevant stakeholders, including the creation of a schedule, which outlines all the key dates throughout production, from production meetings, shooting days and edit reviews. The schedule can be adapted as the production unfolds, and some dates can be agreed upon later, but it is always best practice to decide upon the schedule at an early stage.

Initially story boards and short lists were created as a tool for helping keep track of what needed to be captured on each day of filming and to help visualise what the final product will look like for all stakeholders. Throughout the pre-production, regular meetings were held with all stakeholders to ensure all aspects of the planning stage were covered, one of which included a site recce day at the location of filming, which gave all parties a chance to discuss precisely what was to be filmed and what would be achieved on a successful day of filming. Finally, before arriving on the first day of filming, documentation was created for kit lists and props to ensure the filming day was successful.

3.2.2   Principal photography

With the planning completed capturing of raw footage can begin, following the call sheet, which outlined everything that needed to be filmed and the order that everything is to be filmed in. However, before any recording can begin, the scenes had to be rehearsed and outlined to allow everyone involved to have a clear picture of what the video will achieve and identify the correct setup of camera shots and other equipment set ups, including lighting and microphones.

Once the setup is complete the recording can be completed, including any additional takes which to achieve the desired result. After the first setup is completed, the camera is repositioned to shoot the same material from a different angle or onto the next scene, repeating the process above until all scenes and takes are achieved. To ensure the success of this, the production team worked with shot list, outlining all shots to be taken, which were broken into two categories: A Roll, which consisted of the core materials, such as the shots of the presenter talking to the camera and B Roll, consisting of shots which you be used to intercut with the core footage.

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3.2.3 Post-production

Once the raw footage has been captured, the process of editing the final videos must begin, firstly by creating the rough cut. To do this, a review of all the footage captured must be undertaken for each video and placed in a rough sequential order. This resulting product in most cases is too long, with no rhythm or flow, however, does give an indication of the final product. Following this, the editor goes back through the video and cuts out all irrelevant material, tidies up the cuts and transitions, and rearranged the video, ensuring there is an engaging flow, that achieves the desired result.

Once the editor is mostly happy with the fine tune cut, all relevant stakeholders must review the edit, to ensure the videos are achieving the pre-production brief effectively. After all stakeholders have reviewed the fine tune edit, all notes and changes are applied, and further reviewed in an iterative process until all parties are happy, after which point the edit is signed off as finished or "locked". With the fine cut locked, the editor can continue to add visual effects, motion graphics, balance the sound, ensuring that voices can be heard clearly and putting on accessibility features, such as subtitles, and ensuring that there are no large and sudden changes in volume, which may offend the audiences' ears. Finally for the editing, colour grading is undertaken, by adding in a much larger spectrum of control over the colour when compared to the raw video footage, changing the feel and look of the video, to best fit the mood for each learning environment.

With all the post-production elements now complete, relevant stakeholders must again complete the iterative review process, with the editor making changes, as necessary. When all parties are happy, the videos can be exported and uploaded onto the digital learning environment for the student to watch and supplement online lectures and in person practical activities.

3.2.4 Utilisation of the videos

The final videos produced were published to the students prior to undertaking the residential, to allow for a greater understanding of the tasks they would be conducting on the trip. In addition to this, the in-person students also had access to the videos, allowing them to consolidate and refresh their skills when writing their assignment post-residential. One of the main factors considered throughout the video processing was to allow the produced media to be as accessible as possible. To aide this, when transcribing the videos for captions, the captions were made available in a variety of languages, font styles, and font sizes to best fit the students' visual needs.
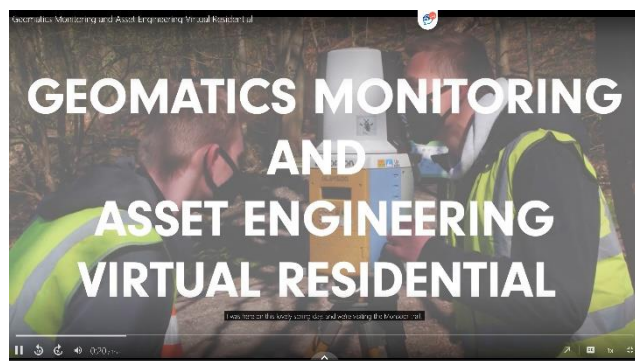
Figure 1Example final production video with captions

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3.3 Producing written online content

Many students have shown weak persistence while conducting online learning, which has resulted in a significant decrease in learning effectiveness (Li, Wu, Yao & Zu, 2013). Therefore the university adopts a unit approach for each of the online modules, with 10 units together forming the overall module. When designing a module, the high level plan for the module is initially developed, consisting of the learning outcomes and knowledge, skills, and behaviours that the module must achieve. From this plan the 10 unit titles are decided ensuring alignment to the specific learning outcomes outlined in the module plan through a mapping exercise. Using these units, the content for the module can be created, each unit should consist of a range of interactive materials, broken down into media elements, interactive and collaboration sections and written academic content. The interactive materials should be underpinned by unit activities, where students must complete worksheets, reflections, polls, research etc to further ehnance their online learning.
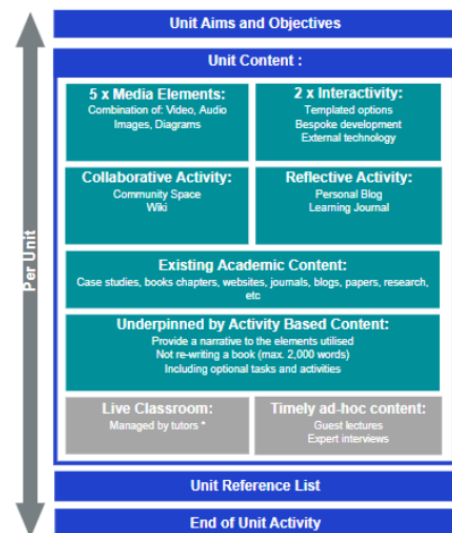

Figure 2 University of Derby Online Learning Unit Content Good Practice

3.3.1 Interactive Materials

Within student learning, engagement is considered a strong qualitative factor in determining overall efficiency of learning. Engagement can be considered a three-dimensional structure, consisting of behavioural engagement, such as how long the student can remain on a task, emotional engagement, such as the student becoming bored, and cognitive engagement which is having the undivided attention of the student (Jang, Park & Yang, 2014). Student attention and engagement has been studied in multiple papers previously, many of which detail large lapses in attention in lectures, and average attention spans ranging from 10-20 minutes (Sousa, 2011). Further research has been conducted into attention cycles of students, with the first lapses in attention being 30s after starting a task, with the next lapse at 4.5 minutes, followed by continually shortening cycles of attention lapses (Bunce, Flens, & Neils, 2010). While watching videos material, the length of material has shown to be one of the more important engagement factors, with the median student engagement time being 6 minutes, however with a video length of 9 minutes, often students make it less than half way through, prompting producers to urge instructors into splitting up lessons into chunks of less than 6 minutes (Guo, Kim, & Rubin, 2014).

Within the 7BU507 Geomatic Monitoring and Asset Engineering units, content was created by drawing on available resources and texts, of both in house and external materials, to provide a narrative for the module, and helping deliver a dynamic, self paced learning to help maximise

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engagement and attention of students. The narrative of the module was created by sectioning the unit into smaller sub-headings of the unit, each encompasing different learning methodologies, such as interative elemtns like pictures with pop out elements, short videos, traditional text and reading, and websties for the students to browse, all of which came together to maximise the focus of the student with different learning environments.
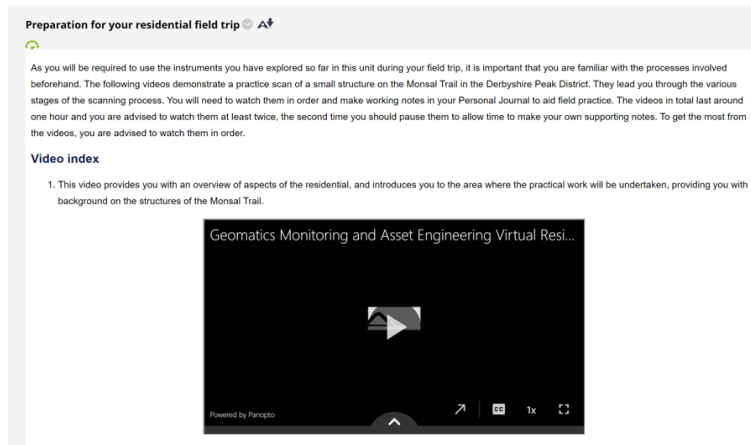

Figure 3 Final Produce module content

3.3.2   Unit activities

One of the fundemental aspects of the online learning units, is activity based learning to help student internalise. This helps learners apply the learning and demonstrate their understanding, with feedback from the academic team. The unit activities should utilise a range of technologies avaialable within the content, enabling students to: summaries and list, apply, compare and contract, find other examples' ask or share with peers, further reading, and private and public reflections. Each unit typcially has 3 smaller in-unit activties, followed by an end of unit activity to conclude each module in which the students were able to summise and consolidate their learning from each unit.
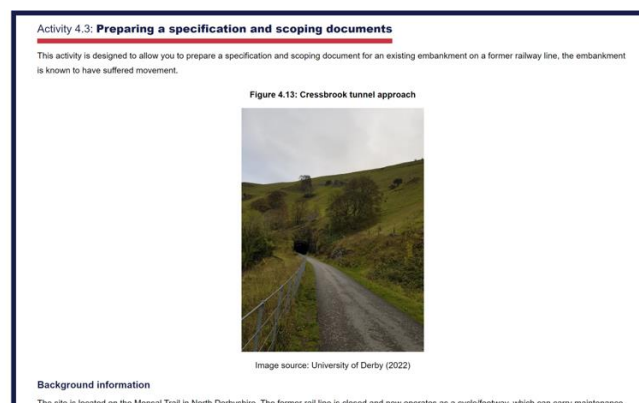
Figure 4 Unit 4 Activity 3 example questions

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3.4 Timelines for completion of online modules at University of Derby

As opposed to face-to-face delivery, in developing online learning content, all material must be prepared up front. Transitions between material that would be added spontaneously in face-to-face content have to be added into online content as part of the authoring process. Consideration also needs to be given to helping students navigate around the LMS and any external resources or tools to ensure that students can fully engage with the learning experience. As part of the authoring process, resources need to be sourced and checked for credibility, copyright and accessibility.

Within the University of Derby, 120 hours is allocated for authoring an online module. The timing for the other processes involved (including peer review, proof and support from LDs, OCPs, LMPs, Learning Developers and the Project Co-ordinator) have more flexibility according to the specific demands of each module. For example, different modules require a variety of learning design support packages, ranging from approximately 25 hours to 180 hours of learning design input. Similarly, OCP time is varied from around 30 hours to 80 hours allocation to build a module. LMP and Learning Developer time varies per module. Project Co-ordinator time is also variable depending on the level of support needed.
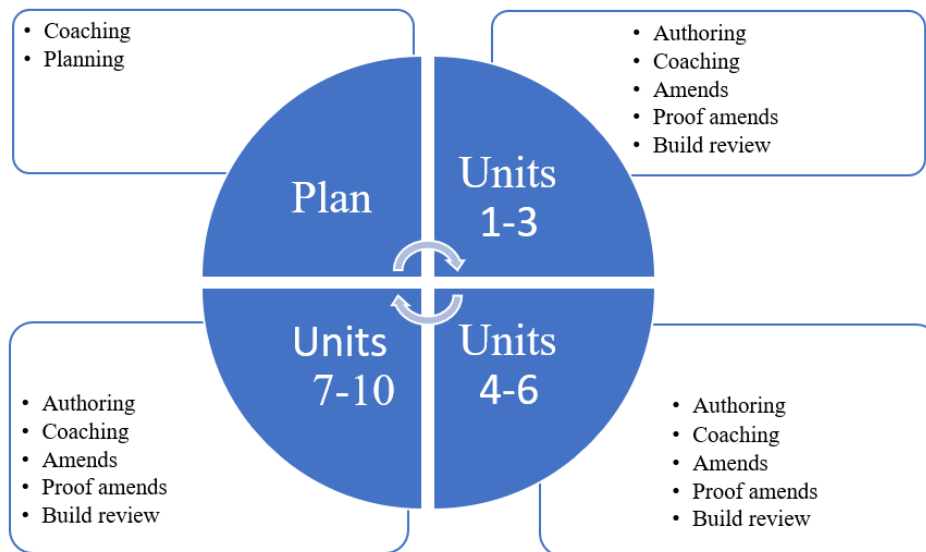

Figure 5 Online module authoring workflow

4. FEEDBACK ON DIGITAL LEARNING RESOURCE

The sample size for students on the 7BU507 Geomatic Monitoring and Asset Engineering only consisted of two students for the fully online module, therefore informal verbal feedback was sought, instead of traditional data collection methods as previously used. Several of the resources developed for the online version of the module were also used for the in-person version of the module, therefore feedback was also sought for this. All students highly praised the quality of the videos and film production with some stating "*it allowed me to prepare for*

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the fieldwork well" and several commented on the resource giving greater clarity of what is expected while undertaking the tasks. When undertaking the field trip, the internet signal strength was deemed to be relatively poor, which meant that some students struggled to access the content while undertaking the activities, but those who did manage suggested it was "*great to have access to video resources in the field...". S*tudents from both modules stated the benefit of having the media to consolidate and enhance their learning from the field courses, as they were able to easily look back at activities undertaken and "refresh my memory from the residential".

Both students on the online module highly praised the full content and overall learning environment, suggesting that the material *"provided a logical framework to work through remotely"*in a manner that best suited their working pace and styles.

The students who studied the module on campus were also provided with access to the resources and the video recordings were shown as part of a tutorial session. This session created interesting questions from the cohort, as the group profile was almost 60% international students who had had limited time using the higher end technology. They embraced the need for practical work but it was found that they need to access the videos to reinforce the field practice (Gulikers, Kester, Kirschner and Bastiaens, 2008). The fact that the videos could be viewed at varios speeds and with subtitles enhanced their learning experience.

5. CONCLUSIONS

Throughout the pandemic and educational changes resulting from the disruption to learning, a significant aim of the team was to ensure that the material created was as inclusive and easily accessibile as we could develop it, with varying constraints on development of material. The team produced a digital resource was developed, which was suitable for accessing on multiple platforms, as students have shown inceasingly they wish to view online materials using a variety of digital platforms. However, also included additional accessibility features, such as having transcriptions avaialble in different languages and different methods of viewing, such as larger font sizes, font styles and increased customisation to help the students have a perosnalised learning experience to best fulfil their needs, these features aligned well to some of the support plans in place for students with dyslexia and other learning conditions (Mortimore, 2012)

While the overall efficacy of the resource was very good and did help the students through greater understanding and wider subject knowledge prior to undertaking the field course, in order for the students to achieve the best results, some prior knowledge and experience of the equipment beforehand would have been beneficial. From a student engagement perspective, the resource allowed tracking of the amount of times students have accessed resources, alongside duration and when this was undertaken, allowing for the team to obtain a better understanding of how the students best learn. Therefore helping maximise the student engagement and develop a strong resource to successfully prepare them for undertaking the field work and supplementing knowlege for revision post activities.

The knowledge the team has within technical and digital enhanced learning for students, including learning more about technologies available increased significantly throughout the development of these materials, particularly from bringing in experts from multiple fields and

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collaboratively working to achieve the end goal. This project has helped pave the way for future practical modules by setting a successful template, which has proven to enhance student knowledge and provide greater accessibility for students to learn in ways which best fulfil their individual learning needs.

5.1 Areas of Future research

There needs to be more work on the adoption of mulitple platforms and ensuring that the resources are accessible in the field as many areas have poor internet coverage. Investiagtion needs to be carried out on larger chrts and the opportunity to extend the provisions to undergraduates.

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