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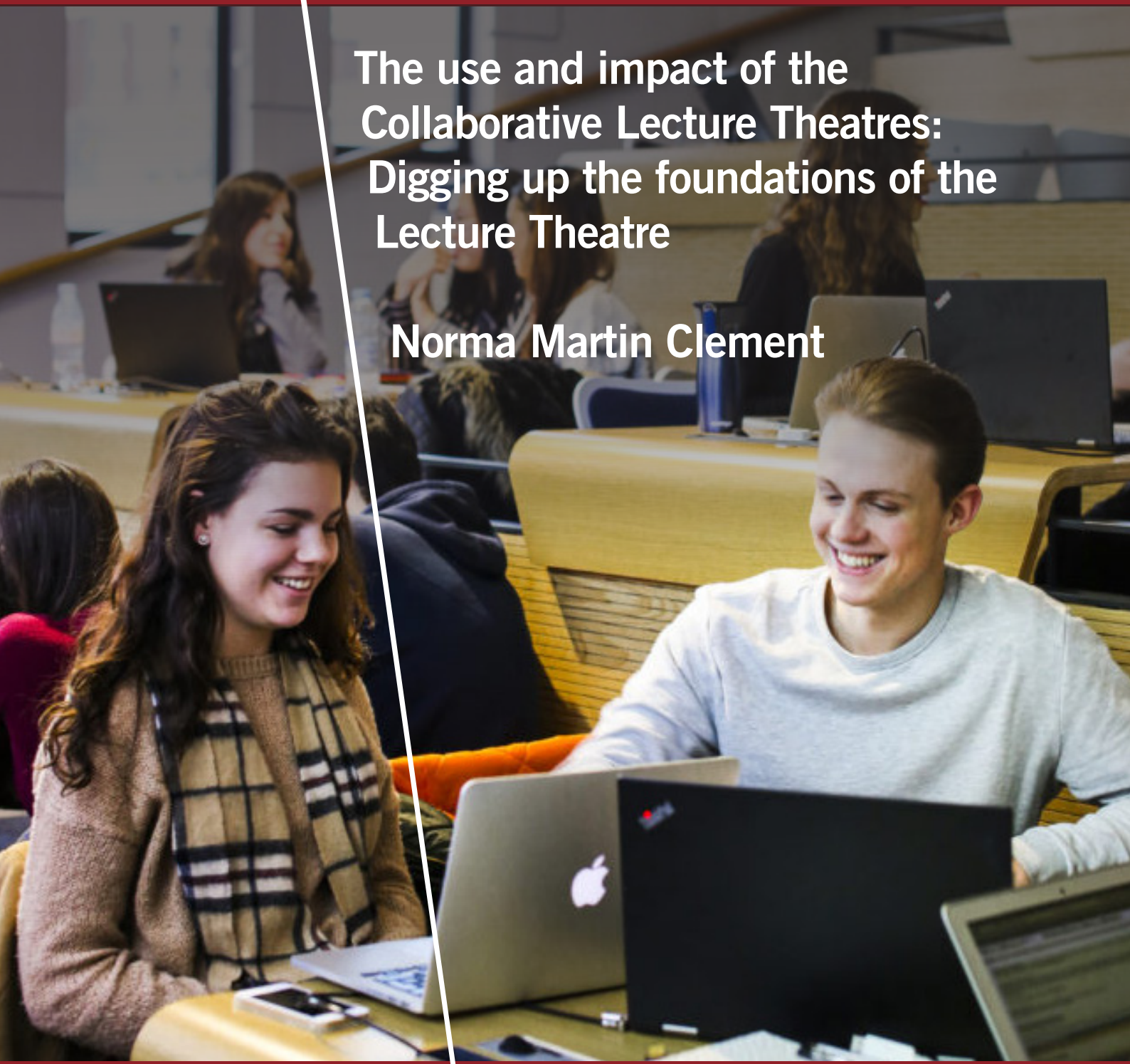
The use and impact of the Collaborative Lecture Theatres: Digging up the foundations of the Lecture Theatre

Norma Martin Clement



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Executive Summary

Introduction

This report summarises a Leeds Institute for Teaching Excellence (LITE) Teaching Enhancement Project (TEP) undertaken from 1 September 2017 to 31 August 2018. The aim of the project was to investigate and evaluate the uses and impact of the three Collaborative Lecture Theatres at the University of Leeds.

Methods

This was a qualitative project which was focussed on staff rather than student use and perceptions. The first element of the project consisted of seven case studies drawn from a range of disciplines. In addition to classroom observations, staff experiences of using the Collaborative Lecture Theatres were elicited through in-person semi-structured interviews. The aim of this part of the research was to develop an understanding of the extent to which the materiality of the learning space was shaping teaching practice and supporting curriculum innovation and reform.

The second element of the project also used in-person semi-structured interviews of the key stakeholders, the student education leaders. The aim for this part of the project was to examine the "managerial" decision-making in sponsoring these lecture theatres and to identify the institutional factors that might promote or hinder the adoption of different instructional strategies and delivering broader curriculum change.

The third part of the project endeavoured to benchmark the innovation at Leeds against what is happening across the UK higher education sector more generally in relation to innovative learning spaces. As well as desk-based research, there were visits to the University of Glasgow, the University of Sheffield and City University, London.

Findings

1. The case studies provide rich details of how staff were using the Collaborative Lecture Theatres in relation to pedagogy, technology and space. The concept of "activity strings" developed by Ramsey et al (Ramsey et al, 2017), provides a good framework for understanding the typical teaching patterns adopted in the Collaborative Lecture Theatres. The research also uncovered issues of hierarchy and power which reflect the tiered structure of the room and expectations about role which come from the privileged position at the front of the room. This played out particularly around the role of "wingers" or classroom assistants and their "voice" in this space.

2. The key finding from the second element of the project was the value placed on lecturer autonomy at the University of Leeds and the acceptance that any shift to collaborative delivery within the lecture classes was likely to be incremental and a gradual transition.

3. There are two features of the investment in Collaborative Lecture Theatres which place Leeds in a vanguard. First, the fact that there are three such lecture theatres using pod or cluster style seating whereas elsewhere there tends to be a single example. Secondly, the integration of digital technology, particularly the desk-based laptops, is unique in the United Kingdom. This is more common in flat-floored Technology Enabled classrooms than lecture theatres.

Recommendations

1. There is scope, with imagination, to make more lectures interactive and collaborative. The Case Studies provide exemplars of different types of modules which can be transformed to work within the Collaborative Lecture Theatres.
2. There should be a rule of thumb of a minimum of one "winger" per 80 or100 students and their work should be acknowledged as part of their workload.
3. The ideal layout in the Collaborative Lecture Theatres is for the sofa-style pods rather than individual chairs and at least two vertical aisles to maximise staff mobility. However, this may run up against the need to preserve capacity where possible. The benches at the back should be retained. Consideration should be given to storage space to clear coats and backpacks off the floor.
4. Equity of access means that future Collaborative Lecture Theatres should include the desk-top computer and other features that should be retained are: the digital whiteboard (touchscreen if possible); dual projectors; pod microphones and lights. Wireless control of presentations should be enabled.
5. In relation to timetabling, earlier confirmation of availability and more flexibility with respect to units of time would give staff more confidence to redesign the delivery of their modules.
6. Staff training should be re-visited with a focus on pedagogy rather than technology and also there should be appropriate institutional support for, and recognition of, staff engaged in pedagogical innovation within the Collaborative Lecture Theatres and other innovative learning spaces.

Conclusions

Collaborative Lecture Theatres should be acknowledged as a key element of the "mixed economy" or spectrum of learning spaces of many different sizes and types across the campus. Innovation in formal physical learning spaces should not just be about tiered lecture spaces, but also include more typical TEAL (Technology Enhanced Active Learning) classrooms, flat-floored spaces where the students do not sit in linear rows. Both types of innovative learning spaces and other experimental spaces such as the Abercrombie Sandpit at the University of Sydney, (Wilson, 2018), have a role to play in encouraging more staff to innovate and experiment with active learning pedagogies and thereby improve the student experience by fostering students' active engagement in their own learning.

Should the University of Leeds continue to invest in Collaborative Lecture Theatres? My view, based on the research I have carried out, is unequivocally yes, there is value in expanding the number of re-designed Collaborative Lecture Theatres, acknowledging that the key demand from staff is for additional large Collaborative Lecture Theatres.

List of Figures and Appendices

1. Introduction

1.1 Aims and Objectives

The aim of the project was to investigate the use and impact of the Collaborative Lecture Theatres at the University of Leeds.

The objectives of the project were to:

- Develop an understanding of the extent to which the materiality of the learning spaces shapes teaching practice.
- Examine the managerial decision-making in "sponsoring" the lecture theatres and identify the institutional factors that might promote or hinder the adoption of different instructional strategies and deliver broader curriculum changes.
- Benchmark the development at the University of Leeds against what is happening across the sector in terms of innovative learning spaces.

1.2 Report Overview

The report will summarise the project as follows:

- Section 2 provides the background to the project, putting the re-design of the Collaborative Lecture Theatres into context at the University of Leeds and placing this within a broader review of the literature on learning space innovations.
- Section 3 is a summary of the project methodology.
- Section 4 reports on the case-studies looking at teaching practices, which form the first element of the project.
- Section 5 reports on the findings from the managerial decision making element of the project.
- Section 6 reports on learning space innovations around the United Kingdom.
- Section 7 summarises the conclusions and recommendations from the project.

2. Background

2.1 The re-design of the Collaborative Lecture Theatres at the University of Leeds

In 2016, the University of Leeds invested £2.8 million in redesigning three tiered lecture theatres across the campus. All were due for periodic refurbishment, however, the initiative to redesign came out of the University's 2013 Digital Strategy for Student Education. Objective 4 of the strategy states that students and staff will be able to "benefit from use of multi-functional, consistent and adaptably physical and virtual learning spaces for personal, social, informal and formal learning." Specifically, in terms of outcomes the strategy committed the University to deliver:

- Flexible physical learning spaces where students and staff can make full use of PCs, laptops and mobile devices for communication, collaboration and presentation;
- Physical spaces configured for personal, social and informal learning, providing digital technologies allowing for and encouraging individual or group-based learning;
- Virtual learning spaces for individual or group-based activity, for communication and/or collaboration and for storage and use of learning objects, assignments or professional development assets (University of Leeds, 2013).

In 2014, the University had introduced a lecture capture system across 260 central teaching spaces capturing audio, presented screen, and video (the latter in a limited number of rooms). In addition, the system allowed for personal or "at desk" capture thereby allowing staff to create recordings and upload them to the virtual learning environment. The University Dean of Digital Education, Professor Neil Morris, has explained how the lecture capture project led to the proposals to redesign the lecture theatres. "There are lots of teachers who have now 'seen' literally, just how passive didactic teaching is and want to do more flipped learning. They want to use media capture tools to create digital content for pre-session viewing and use contact time, namely the time spent in the lecture theatre, for active learning." (Pure AV, 2017). Although aware of the development of collaborative lecture theatres elsewhere in the sector, Professor Morris's vision was to embed digital technology in the spaces, which had not been done before.

The University web pages describing the rationale for the re-designed lecture theatres included a reference to the 2006 JISC paper 'Designing Spaces for Effective Learning: a guide to 21st century learning space design' (JISC, 2006). In particular the six principles for learning space design were said to be embodied in the lecture theatre redesign (Snowden, 2017). The principles are:

- Flexible – to accommodate both current and evolving pedagogies
- Future-proofed – to enable space to be re-allocated and re-configured
- Bold – to look beyond tried and tested technologies and pedagogies
- Creative – to energise and inspire learners and tutors
- Supportive – to develop the potential of all learners
- Enterprising – to make each space capable of supporting different purposes (JISC, 2006, 3).

The extent to which the principles are indeed embodied in the collaborative lecture theatres may be gauged through the description which follows. One key point to note at the start is that the lecture theatres are dual function in that they support both didactic instruction and collaborative interactions between students and between students and instructor(s).

Details of the physical features of the three collaborative lecture theatres are given below, followed by information as to the technology installed.

2.1.1. Roger Stevens Lecture Theatre 8

This is a generic lecture theatre in the main Roger Stevens Lecture block. Designed by Chamberlin, Powell & Bon (probably best known as the designers of the Barbican Estate in London) the lecture theatre block was completed in 1971. It houses 25 tiered lecture theatres and has Grade 2 listing (Historic England, 2010). The description by Historic England specifically references the individual carpeted doors leading off the staircases into the rows of seating as an innovative feature of the design. Lecture Theatre 8 is one of the 16 smaller lecture theatres and was designed to hold 75 students. The University had to obtain permission from Leeds City Council and English Heritage to alter the lecture theatre. As can be seen from Image 1 (University of Leeds, 2018), there are a number of differences between the configuration of this lecture theatre and the other two re-designed lecture theatres (Images 2 & 3). Firstly the shape and layout of the desks is different. Although the

shape is still trapezoid, the desks are orientated perpendicular to the front of the room. In terms of seating there four or five individual chairs without arm rests at each desk, with four orientated perpendicular to the front of the room and the fifth chair at the narrow end of the table facing front. The chairs are not on wheels so this means that chairs at the sides of the desk have to be picked up and physically moved to face the front of the room, or the student has to twist their upper body to face the lecturer if they are standing at the front of the room. In total there are 11 pod desks arranged in four tiers or terraces rising from the front of the room plus two benches at the back of the room so at capacity the room holds 53 students. There are low barriers between each tier. In terms of movement by staff into the audience there is an aisle next to the outer wall with windows, but the configuration with the barriers and the individual chairs means it is difficult for the lecturer to talk to students at their level. Unless the lecture theatre is not at capacity, so there may be chairs free, they either have to crouch down beside a table or manoeuvre behind a row to face the next row up. As it is a generic lecture theatre it is used by a wide range of subjects (27 areas in total) across the University though the usage figures for 2017/18 show that Law modules were taught in LT8 for 15% of the time, followed by Communication Studies for 10.3% and then Music at 9.4% (Dixon, 2018).

Image 1: The re-designed Roger Stevens Lecture Theatre 8

2.1.2. Dental Lecture Theatre, Worsley Building

The Worsley Building was constructed in 1979 and houses the School of Medicine and School of Dentistry. Given the nature of the curriculum, including time spent at clinical placements, it would be difficult for dental students to have lectures spread across the

campus so they have a dedicated lecture theatre. It was therefore agreed at the time of the redesign that the School of Dentistry would have "first call" on the lecture theatre for 60% of the time. The usage figures show that for 2017/18 Dentistry used the lecture theatre for almost 55% of the time followed by ad hoc one-off bookings for events such as applicant visit days at 17.3%. Use for teaching by other areas within the University was generally at low levels, ranging from 1 to 22 hours (Dixon, 2018).

The configuration here is very similar to collaborative lecture theatres elsewhere in the sector in terms of the style of desks and sofa-style booths. The front of the lecture theatre drops by three steps down from the entrance for the lecturer and then the two side aisles for student access dog-leg up. So there are three desks for the first two tiers, followed by one desk at each side and two in the middle for the next four tiers. This gives a total of 20 pods. Each pod can hold up to 5 students, although this would be a squeeze. With the two benches at the back of the room the total capacity is 122. Unlike LT8, this room is fully wheelchair accessible. There is enough space between the sofa back and the front of the desks to allow staff to move across the rows as well as up and down the aisles (University of Leeds, 2018).

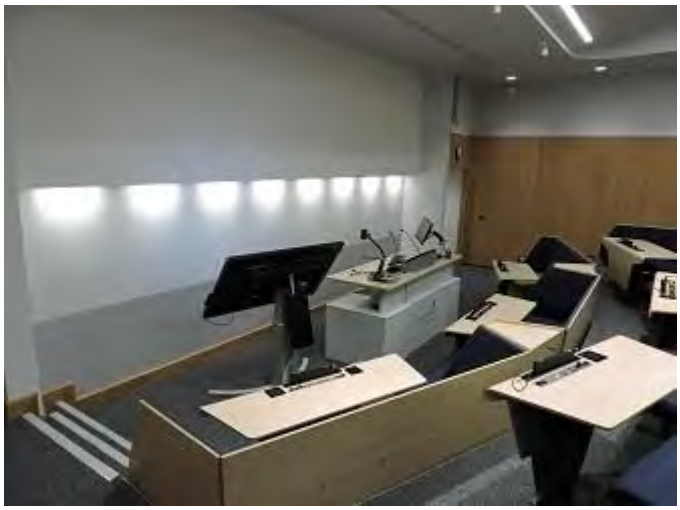

Image 2: The re-designed Dental Lecture Theatre

2.1.3. Mechanical Engineering, Lecture Theatre B

The Engineering building was completed in 1963. Mechanical and Civil Engineering sit next to each other, facing out to Woodhouse Lane. Each school has two large lecture theatres. The redesign for Mech Eng B is similar to the Dental Lecture Theatre although the room is

more steeply raked with seven tiers or terraces. There are six tiers of single pods at each side of the room, adjoining an aisle. In the centre, the pods are stepped with three rows of two at the front, followed by four rows of three and again two benches at the back. As with the Dental Lecture Theatre there is sufficient space for the lecturer to move across the aisles in front of the desks as well as up and down the aisles. The total capacity of the room is 128, so it is the largest of the three re-designed lecture theatres. It is also the most well used as the usage data from 2017/18 shows it was occupied for 691 hours, with Civil Engineering accounting for some 216 hours or 31.3%. Use by other areas of the University is generally at higher levels than in the Dental Lecture Theatre with Food Science, the Business School and Mechanical Engineering the highest users after Civil Engineering (Dixon, 2018). As with LT8 there are windows along the outer wall whereas there is no natural light in the Dental Lecture Theatre (University of Leeds, 2018).

Image 3: The re-designed Mechanical Engineering Lecture Theatre B

2.1.4. Integrated Technology

As noted earlier, the innovative feature of all three lecture theatres is the integrated digital technology. The decision not to use a Bring Your Own Device approach was based on equity of access. Professor Morris explained further, “Not all of our students have mobile devices that would work in these rooms, and we wanted a level playing field where digitally-enabled group work is instantly possible for everyone in the room without any technical discussion.” (Morris, 2016). All desks are equipped with an internet-enabled touchscreen hybrid laptop, ‘touch to talk’ desk microphone, built-in speaker, spotlight, HDMI input, USB charging and power. The microphones are off by default so students can push a button to speak although

the person at the lectern can also control all desk microphones. When a pod activates the microphone, the audio is reproduced through the speakers of all the pods. The laptop security cable is long enough to reach everyone in the group and when not in use the laptop can be slotted into the storage compartment at the back of the desk.

In terms of the front of the room there is a standard lectern PC, control panel, lecture capture light and pause button, visualiser, blu-ray player, lapel microphone and a presentation wall - all common equipment. What is new is the addition of a large height and tilt-adjustable digital whiteboard and dual projectors. This allows the lecturer to display their presentation content via one projector linked to the lectern PC while simultaneously displaying the digital whiteboard content via the other projector. The lecturer faces the room, can use the stylus to annotate content displayed on the whiteboard and the content is captured as video. There are no other whiteboards or blackboards in the room. The lectern control panel has all the usual controls, including lighting and volume but also has a plan of all the pods which are numbered. The touchscreen enables the lecturer to select an individual pod to display their laptop screen or their own device on one or both of the projectors. With Displaynote software allowing the lecturer to send work to groups of students and get it back to display to the larger group, this allows for two way collaboration and interaction between the lecturer and students.

2.2 The Leeds Collaborative Lecture Theatres in Context: A brief literature review

In the context of the United Kingdom, the first major review of learning spaces in higher education was carried out by Paul Temple in 2007. The purpose of the review was described as “to inform the future design of learning spaces, in order to facilitate the changing pedagogical practices needed to support a mass education system with its greater student diversity” (Temple, 2007, 10). The publication date of the Temple review is significant. In terms of academic interest in learning spaces, Harrison and Hutton note that there was an “astounding ten year period in the UK when the debate about learning and space reached a sustained fever pitch before collapsing with the arrival of the 2008 world economic crisis” (Harrison and Hutton, 2013, 1). While this may seem at first blush an exaggeration it is borne out through close examination of the references gathered by Temple. In particular there were four landmark publications towards the end of this decade

in 2006. The three UK publications were included by Temple in his review: Space Management Group, *Impact on Space of Future Changes in Higher Education* (Space Management Group, 2006), JISC (Joint Information Systems Committee) *Designing Spaces for Effective Learning: a guide to 21st century space design* (JISC, 2006), and Scottish Funding Council *Spaces for Learning: a review of learning spaces in further and higher education,* prepared by AMA Alexi Marmot Associates and haa design. (AMA Alexi Marmot Associates and haa design, 2006) The fourth publication from the USA was an edited collection by Diana G. Oblinger *Learning Spaces*, published by Educause. The first part of the edited collection is headed Principles and Practice while the second part is a set of 28 case-studies, primarily from North America but with two drawn from the UK. The volume of case-studies reflects the significant investment in physical infrastructure, especially in the USA, since the start of the 21st century. The graph shown at page 6 in Sightlines *State of Facilities in Higher Education 2017 Benchmarks, Best Practices and Trends* shows this second wave of campus construction gathering pace from 2000, peaking in 2008 and thereafter experiencing a sharp downturn. In quantitative terms, "construction rose from 1.12 million square metres (12.1 million square feet) in 1990 to 3 million square metres (32.6 million square feet) in 2008" in the USA (Coulson, Roberts, Taylor, 2017).

We can witness a similar building boom in the UK from around 2013-14 fuelled by the increase in tuition fees for home students to £9000 per year from 2012 and the removal of the cap on student numbers in 2015. Increasing competition between universities on a global basis and emphasis on the student experience has led to substantial investments in capital infrastructure. A report by Biggar Economics in 2014 found that Russell Group Universities were planning to invest £9 billion between 2012/13 to 2016/17 (a similar amount to the 2012 London Olympics). This has continued. For example, University College London has announced a capital investment programme of £1.2 billion from 2018 to 2028 (UCL, 2018). Most of the other Russell Group Universities have capital programmes hovering around half that amount. Construction and renewal of the physical campus environment and learning spaces accounts for some of this investment. In the words of Stuart Croft, VC of the University of Warwick, "We need to open one new academic building a year from now [2016] to 2023." (Croft, 2016).

The most recent literature review of learning spaces in higher education is Robert Ellis and Peter Goodyear's 'Models of learning space: integrating research on space, place and learning in higher education' (Ellis and Goodyear, 2016). Ellis and Goodyear start by noting that the use of space in higher education is both under-researched and under-theorised. This echoes the conclusion reached by Paul Temple ten years earlier, albeit that he describes it as a "methodologically difficult area" (Temple, 2007, 74). This difficulty partly relates to the different research domains which have examined the relationships between space, place and learning. Ellis and Goodyear's review divides the literature into two broad categories: studies which focus on physical places and studies which focus on virtual places and digital tools/artefacts, recognising that there is "spillover" between the two (Ellis and Goodyear, 2016, 161). Within the first category, there are studies in architecture and environmental psychology, while the second category includes Human-Computer-Interaction (HCI) and computer-supported collaborative learning (CSCL). Learning sciences straddles both physical and virtual contexts.

Ellis and Goodyear identify seven research foci in the literature (Ellis and Goodyear, 2016, 164). Two are of particular interest in the context of this project, namely physical or formal learning spaces and what they term integrated or hybrid spaces where physical and virtual learning spaces are combined (Ellis and Goodyear, 2016, 169).

2.2.1. Physical or Formal Learning Spaces

A tension between form and function in contemporary formal learning spaces is identified as a core concern of much research into formal classroom spaces (Ellis and Goodyear, 2016, 165). The tension derives from the shift from older 'transmissive' teaching and learning practices, a form associated with lecture theatres in particular, to student-centred pedagogy and a concept of university learning as collaborative and co-created knowledge. This shift is sometimes simplistically captured in the adage from "the sage on the stage" to "the guide on the side". However, Ellis and Goodyear caution against the assumption that lecturing is just about the transmission of information, arguing that "many established pedagogical practices, such as the lecture, have multiple simultaneous purposes" (Ellis and Goodyear, 2016, 166). In an earlier article Ellis identifies some of those purposes and functions (Ellis, 2015, 29):

"It is also a site for students to meet, to update their sense of how they are faring with the course, by picking up subtle cues from other students. It is a structuring resource: part of the spatio-temporal scaffolding that helps them do the work of being a conscientious student. It is a place to watch experts think on their feet, improvise multiple explanations, give clues about what will come up in exams, reveal what they value, and, on a good day, share a passion."

Ellis also makes the point that those who claim that lecturing has not changed for millennia are overlooking the changes wrought by the ubiquity of laptops and other mobile devices used by students, the development of virtual learning environments, the accessibility of online resources and the growing use of 'lecture capture' and pre-recorded podcasts (Ellis, 2015, 29).

2.2.1.1 Innovative Lecture Theatres

Australia

Until recently there have been minimal innovations to the traditional configuration of lecture theatres (raked or stepped seating with a podium for the teacher at the front). As part of the Next Generation Learning Spaces project at the University of Queensland which took place between 2006-2018, an Advanced Concept Teaching Space (ACTS) was constructed with the specific objective of advancing the pedagogy of one-to-many teaching and using technology "to maximise the opportunities for interaction between the teacher and students; among students and between students and the learning materials" (University of Queensland, 2008). The architect explained that in terms of use it was assumed that the lecture or didactic mode would take up 80% of the time with small group discussion taking up the remaining 20% (University of Queensland, 2008, 6). The plan and photographs of the ACTS show a tiered space accommodating 100 students in shallowly arced rows (Images 4 and 5). The novel feature of the ACTS is that the three tiers have a double row of desks per tier or terrace and swivel chairs on castors to allow students on the front row to turn around and form groups of 4 with 2 participants at each level. Access for students is from aisles on either side. There were two lecterns (one at either side) and three screens (one large and two small) on the wall at the front. It was hoped that this

configuration would move lecturers away from the podium or lecterns and into the centre of the space.

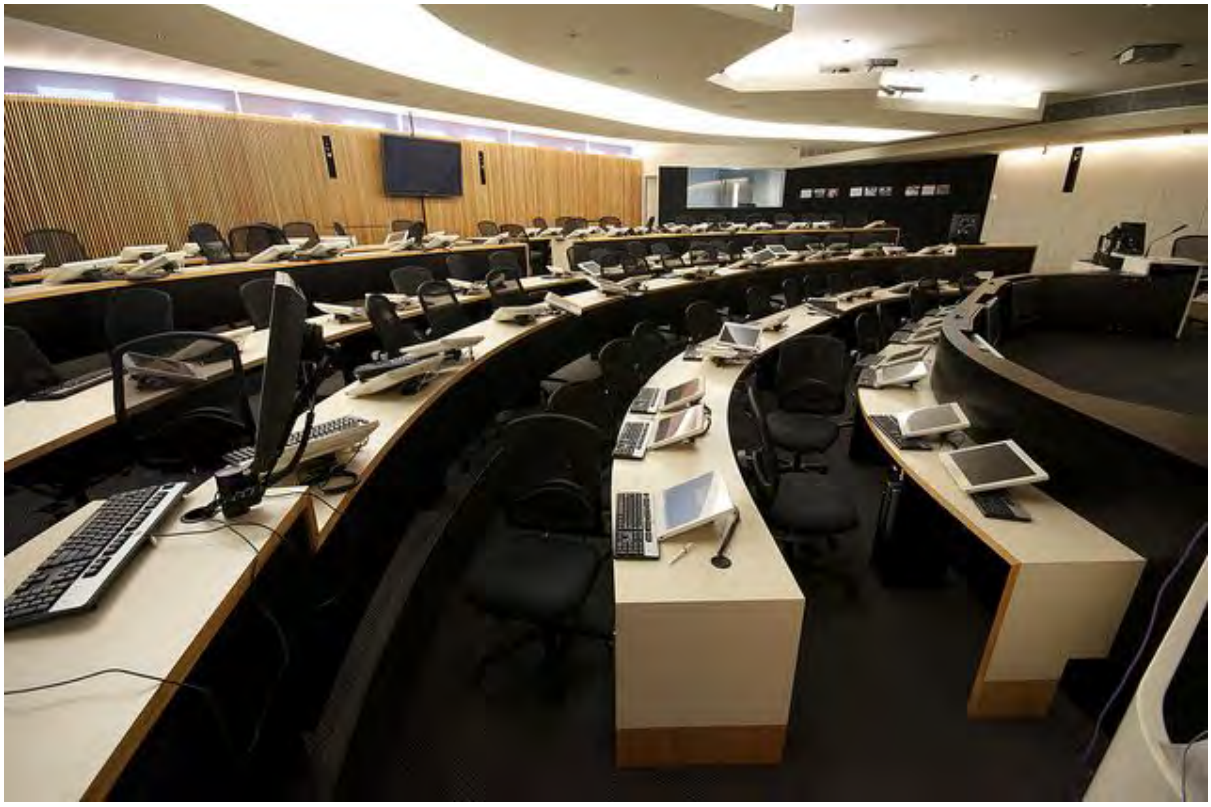

Image 4: Advanced Concept Teaching Space (ACTS), University of Queensland, showing terraces with double row of desk*s* (Munnerley, 2011)

A blogpost from Nigel Thomas who visited the University of Queensland in 2011 reports that one original idea which did not find its way into the final configuration was to have a central aisle or walkway to allow the teacher to move into the audience space (Thomas, 2011). However, it appears that a low wall with three preview screens (facing the lecturer) was installed. This clearly creates a physical barrier between the lecturer and the audience.

Image 5: ACTS, University of Queensland, showing the low wall at the front of the room (Thomas, 2011)

In terms of technology, the novel feature from the student perspective was that each desk had a tablet style PC with stylus. As the tablet was mounted on a swivel the screen could be turned when the students were working in groups. There were also innovative digital tools: a polling and voting application as well as the use of instant messenger to allow questions to be asked anonymously. Wireless networking and USB ports allowed students to connect using their own mobile devices as well as to display assignment work via the projectors. Lecturers were issued with RFID badges so that they would no longer need to log-in to the computer control system. As soon as they stepped to the podium the control system would recognise them and automatically set up the room to reflect their preferences. The room also had an innovative lighting system which could be used to direct attention and enable note-taking.

A striking feature of the ACTS was the inclusion of an observation suite with wide windows and a video camera at the back of the lecture theatre. Not only did this permit classes to be observed and filmed, the space also functioned as a third control point. However, the construction of the ACTS was not completed in time to allow it to be evaluated as part of the Next Generation Learning Spaces project. It does appear to have been evaluated by Trish Andrews and Lorrine du Toit but it has proven impossible to source the original report (Andrews and duToit, 2010). However, information on the evaluation can be gleaned from a summary explaining the methods of the evaluation and key findings in another report for the Australian Learning and Teaching Council and also from an article by Kenn Fisher and Clare Newton (Fisher and Newton, 2014). The latter more clearly identifies the "deficits" reported by Andrews and du Toit. Fisher and Newton summarise these as "lack of technical support; the perception that students would find it difficult to learn the new technologies; the lack of consideration of the importance of innovation in teaching and learning; the focus in the university on research and the rewards attached to that sector; the slight confusion around using the ACTS as a research tool to develop innovative technology-enhanced pedagogies; and the disciplinary nature of teaching and learning and the perceived difficulties of having a generic space for all disciplines" (Fisher and Newton, 2014, 918).

In terms of the use of the space, Andrews and du Toit noted:
"A more collaborative use of these technologies was mainly observed or documented in seminars or tutorials with class sizes of around 20 than during main lectures to larger groups. This indicated that the interactive aspects of the technologies are limited by a combination of the technical skills of teaching staff, the on-the-day functionality of the equipment and the design of the space" (Andrews and do Toit, 2011, 16 as cited by Kenn and Fisher 2014, 918).

This point is re-iterated in the ALTC report where the authors comment "technology-rich spaces can be both enabling and constraining" (Lee and Tan, 2011, 15). Although it appears that there were some changes in curriculum and pedagogical practice at the University of Queensland, it was too early at the time of the evaluation to say whether this amounted to long-term changes in practice (Lee and Tan, 2011, 12). Further the tendency of "developers and evaluators to work with early adopters of innovations" was noted. It is disappointing

(but not surprising) that there has not been a longitudinal study of the impact of the ACTS on teaching practice or student learning at the University of Queensland.

United Kingdom

The first major innovation appears to be the Design Lecture Theatre which was installed in 2012 as part of a new build for the Design School at Loughborough University.

Image 6: Loughborough Design Lecture Theatre, Loughborough University (Burwell Deakins Architects, 2012a)

The architect, Nigel Burwell, explains they worked with the Dean of the Design School and the Learning Environments Manager for the University to develop a lecture theatre which allowed didactic and collaborative learning. The objective was to maximise sightlines and allow a seamless interchange between didactic and group learning without reorganising the furniture or the student. The innovative seating style was based on the geometry of the Giant's Causeway in Northern Ireland, described as "repetitive yet informal".

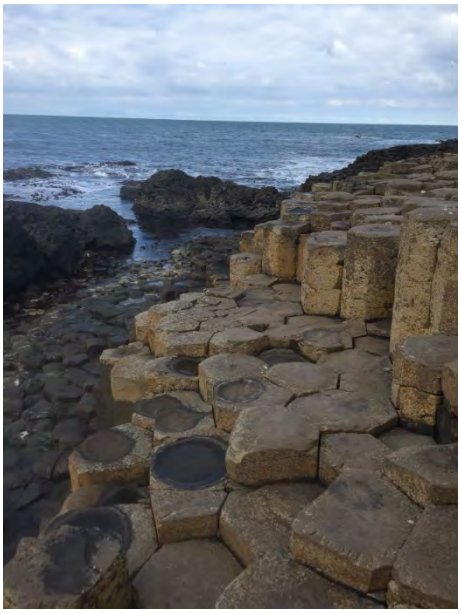

Image 7: Giant's Causeway, basalt columns (Clement, 2018)

A key aspect is that there is space horizontally to allow the lecturer to move across the rows as well as up and down the aisles (two on the side and one in the middle). The tables which seat four students are described as "snaking" across the auditorium and each is slightly offset (Burwell Deakins 2012b). The lecture theatre has been described as a Harvard Hybrid style (Pepper, 2015, 3). On the one hand it does not conform to the classic horseshoe configuration associated with Harvard but on the other it is quite shallow tiers, which is typical of the Harvard style.

A different innovation in seating was introduced at the University of Exeter, coincidently also in 2012. The Alumni Lecture Theatre has 360 degree swivel or "turn and learn" aircraft style seats. The seats have a folding writing table and power and wired data facilities in the armrests. It is the largest lecture theatre at Exeter with capacity for 400 students. The layout has a lot of space between individual chairs and has two rows per terrace.

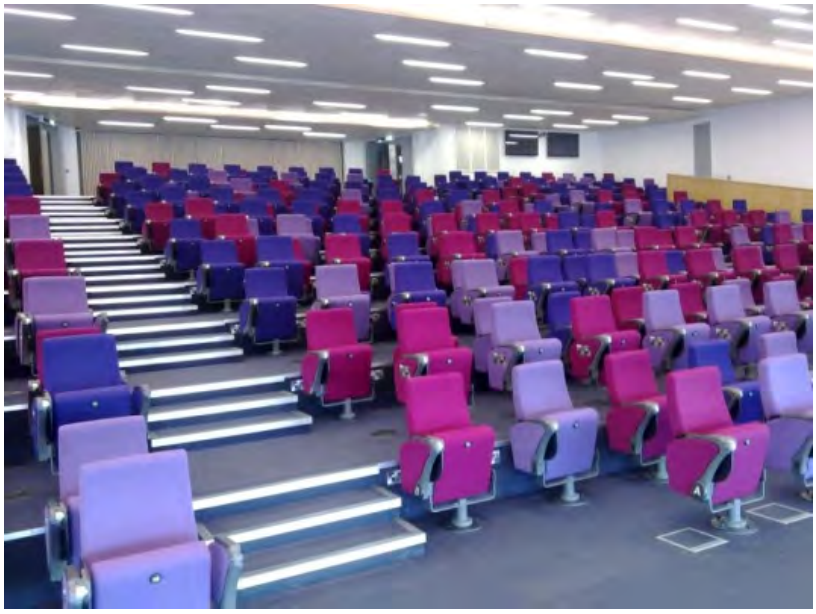

Image 8: The Alumni Auditorium, University of Exeter (FercoSeating, 2012)

This “Turn and Learn” style has been adopted in a number of other universities, including City University (in a horseshoe shape) (City, 2018), Aberystwyth (Aberystwyth, 2018), Kingston (FercoSeating, 2018) and Sheffield Hallam (Glover and Middleton, 2016).

The cluster or pod style of seating was also quickly adopted by other Universities. At Queen’s University Belfast it was installed as part of a refurbishment of the David Keir building in 2014. The lecture theatre is more steeply raked than Loughborough and an asymmetric design was used in terms of the placing of the pods with the middle aisle offset to one side. There are no side aisles for access. This means that unlike at Loughborough where the lecturer can move zigzag fashion up the horizontal rows, the lecturer in the David Keir theatre has to back track to the middle each time.

Image 9: David Keir Lecture Theatre, Queen's University Belfast (Facilities Photo Gallery 2018)

This was then followed by City University also in 2014. Like Loughborough this is not a steeply raked room and the design additionally had to take into account a large pillar.

Image 10: Cluster Lecture Theatre, City University (City University, 2018b)

Our final example is at Exeter University. This was part of a refurbishment in 2015 when they combined two small lecture theatres (holding 87 and 56 students respectively) into a 105 seater collaborative lecture theatre.

Image 11: Newman Collaborative Lecture Theatre C/D, University of Exeter, (University of Exeter, 2018)

What is common to all the pod or cluster developments in the UK is that while all have power sockets and wireless technology, the expectation is that students will bring their own devices. Unlike ACTS there are no integrated laptops or tablets. It is also notable that none of the lecture theatres installing pod seats have retained any standard bench seating at the back of the room. Further these appear to be "flagship" or experimental developments, being a single example at each location.

2.2.2. Integrated or Hybrid Learning Spaces

Ellis and Goodyear place examples of what are usually referred to as Active Learning Classrooms (ALCs) into this category where physical and virtual learning spaces are brought together. Research into ALCs has been carried out for around two decades. Two American universities are identified as pioneers: North Carolina State University and Massachusetts Institute of Technology.

Professor Robert Beichner at NCSU is widely credited as the developer of the SCALE-UP project dating from the mid-1990s. While SC has consistently stood for Student-Centred, the 'ALA' and 'UP' abbreviations have been through various manifestations. Originally it stood for Student-Centered Activities Large Enrolment Undergraduate Physics as Beichner initiated this approach with his introductory physics courses; then it became Student-Centered Active Learning Environment Undergraduate Programs as it was adopted more broadly in STEM subjects. Now as the concept of the 'flipped' classroom has gained

currency, 'UP' has been re-named as Upside-down Pedagogies (North Carolina State University, 2018). The innovative aspect of SCALE-UP was the adoption of collaborative studio-based learning more traditionally associated with architecture or design compared to the typical lecture/lab combination used in science and engineering. SCALE-UP's typical room configuration is a large flat-floored room with round tables for groups of 9 students with one computer per group of 3 students, whiteboards around the room and the instructor's podium somewhere in the middle to allow easy access to all groups. The 'Large Enrolment' element meant that at NCSU this was used for classes of 99 students. In terms of pedagogy, Beichner describes student teams working on 'tangibles', hands-on activities or simulations, and 'ponderables', interesting questions or problems, while the instructor roams between the groups (Beichner, 2018, 1).

Image 12: A SCALE-UP classroom at North Carolina State University (NCSU, 2018)

The approach adopted at MIT in 2000 also originated with introductory physics. Called TEAL or Technology-Enabled Active Learning, this drew on the SCALE-UP experience and the classroom configuration was similar in form, if slightly larger with 13 tables. In terms of pedagogy, TEAL added computer-generated visualisations to help students understand complex concepts and processes. To assess outcomes the TEAL project used standardised multiple-choice conceptual tests and conversation analysis of students' interaction in the TEAL classroom together with a focus group survey. Importantly there was a control group taking the same course with traditional lectures and demonstrations as well as two experimental groups. Dori and Belcher found that the failure rate for the TEAL groups

decreased substantially while the learning gains almost doubled compared to the control group. They concluded that the TEAL students "significantly improved their conceptual understanding of the subject matter." (Dori and Belcher, 2005, 274).

Following SCALE-UP and TEAL, a number of US universities embarked on reconstructing their learning spaces along similar lines. The University of Minnesota started with two pilot Active Learning Classrooms in 2007 which were rapidly added to by the construction of a new Science Teaching and Student Services building in 2010 (Whiteside et al., 2009). According to the NCSU SCALE-UP website, this is the largest SCALE-UP installation in the world (North Carolina State University, 2018). Other significant projects include the University of Iowa's TILE (Transform, Interact, Learn, Engage) project which started in 2009 and now has 10 TILE classrooms and Indiana University's Mosaic project (to express the goal of having a mosaic of active learning spaces to support a variety of pedagogical strategies) with 60 Mosaic classrooms constructed from 2015. Both Universities put significant emphasis on professional development for staff teaching in the active learning classrooms (Morrone et al., 2017).

In terms of research on the impact of ALCs, there is a growing body looking at student perceptions and academic performance as well as staff reaction to the experience of teaching in the ALCs in terms of changes in their pedagogy. While Ellis and Goodyear refer to some of this research, there are two important studies missing from their round-up.

The first is a meta-analysis of 225 studies which reported on student examination performance and failure rates in undergraduate STEM courses between 'traditional' lecturing and active learning. The conclusion was that students in active learning classes perform better in examinations and are less likely to fail and that active learning should be regarded as "the preferred, empirically validated learning practice in regular classrooms" Freeman et al., 2014, 8410). In a widely reported reaction to this article, Eric Mazur (progenitor of flipped classrooms) said "This is a really important article—the impression I get is that it's almost unethical to be lecturing if you have this data. It's good to see such a cohesive picture emerge from their meta-analysis—an abundance of proof that lecturing is outmoded, outdated, and inefficient" (Bajak, 2014). However, it is clear that the authors of

the meta-analysis used a very narrow concept of what they called 'traditional' lecturing ("continuous exposition by the teacher") (Freeman et al., 2014, 8414) and their definition of active learning ignored where the learning was taking place. Their definition of active learning simply referred to engaging students in the process of learning through activities and/or discussion in class (Freeman et al., 2014, 8413-8414). Accordingly, there should be some caution in accepting their conclusions as it seems unlikely that all 225 studies were using exactly the same definitions of lecturing and active learning.

The other study is by Pit Ho Patrio Chiu and Suuk Han Cheng of City University, Hong Kong (Chiu and Cheng, 2017). This was a two year study involving analysis of 35,000 questionnaire responses. It is probably the largest empirical study undertaken to date. The participants were taking what are called "General Education" courses, which are open to all 1st and 2nd year undergraduates without prerequisites. Notably, the range of GE courses spanned the arts and humanities, social science and business as well as science and technology. Around 10% of the courses took place in an ALC, called the GE Lab, with 10 hexagonal tables for 5 students per table and the ability to reconfigure the tables and chairs. There were no table-top computers but wireless networking supported the use of student laptops and tablets. Unfortunately there is no information in the report as to which disciplines were represented within the 10% of courses using the ALC. The remaining 90% of courses took place in a "regular classroom" with students sitting in rows facing the teacher at the front. It is important to note that the survey was designed to elicit the students' perceptions of their learning experience. The key finding was that students thought their creativity and innovation was enhanced by their experiences in the ALC compared to a regular classroom and this perception was held across all levels of academic attainment. However students in the ALCs did not perceive any significant encouragement to develop their critical thinking skills compared to students in the regular classroom (Chiu and Cheng, 2017, 276).

3. Methods

3.1 Previous Evaluations of the Collaborative Lecture Theatres

The first evaluation of the re-designed lecture spaces was undertaken between March and August 2017 by Lewis Clark and Bronwen Swinnerton. Two surveys were undertaken of students and staff, together with staff interviews. The focus of the evaluation was staff and student use and perceptions of the Collaborative Lecture Theatres and the impact of the Collaborative Lecture Theatres on pedagogy. Surveys were sent to 4,040 students who were registered for modules taught in the Collaborative Lecture Theatres over the academic year 2016/17 and some 206 responses collected. Although more than 185 members of staff had used the Collaborative Lecture Theatres, only 38 responses to the survey were collected. In addition 9 members of staff were interviewed.

Some initial headline findings in terms of satisfaction are that a majority of students (68.4%, n = 143) were satisfied with the quality of the teaching and learning tasks used in the Collaborative Lecture Theatres. While some 23.4% (n = 48) would prefer all their lectures in the Collaborative Lecture Theatres, rather more preferred traditional lecture theatres over the Collaborative Lecture Theatres (32.5%, n = 68). In relation to staff, a clear majority (66%, n = 38) thought that using the Collaborative Lecture Theatres enriched their teaching experience. A similar percentage disagreed with the statement 'I prefer instructing in traditional lecture theatres than Collaborative Lecture Theatres' (Clark, 2017). However, given the response rate it is difficult to conclude that these views are representative and to some extent, particularly as those wishing to use LT8 had to make a case to do so, the respondents might be more predisposed to the underlying philosophy of the Collaborative Lecture Theatres.

We will return to some of the findings with respect to perceptions as to use of time in the discussion of the findings from the second element of the evaluations.

3.2. The Use and Impact of the Collaborative Lecture Theatres

The second evaluation which is the basis for this report was undertaken, under the auspices of the Leeds Institute for Teaching Excellence, between September 2017 and August 2018. Light touch ethical approval was granted (LTLLAW-035). During semester 1 a desk-based study was undertaken which led to a literature review putting the Leeds development into context (see Section 2 of this report). All field work was concentrated into semester 2.

There are three elements to the empirical aspects of the project.

3.2.1. Case Studies

The aim was to have a number of different case-studies across a range of disciplines with staff who had chosen to teach in the Collaborative Lecture Theatres. The methods included class observation together with in-person semi-structured interviews. Classes in four modules were observed. However, interviews with module leaders for three additional modules were carried out and have contributed to the findings.

The aim for this element of the project was to develop an understanding of the extent to which the materiality of the learning space shapes teaching practice. A protocol was used to record the nature of the teaching and learning activities taking place, alongside a record of the position of the teacher within the space (Appendix A: Table A1 and Table A2). Consent forms were distributed to students attending the observed classes and returned on the day. The semi-structured interview questions were intended to tease out whether the experience of using the Collaborative Lecture Theatres had influenced the teacher's view of learning and their professional role and the extent to which the experience of teaching in the Collaborative Lecture Theatres had influenced curriculum development and innovation. The initial intention was to carry out two interviews at two points in time. As this was not possible, the questions were combined into a single interview. The interview questions can be found in Appendix B: Table B1. The interviews were intelligently transcribed and the written-up case study was sent to all interviewees with an invitation to check, change or delete what I had written.

3.2.2. The Managerial Perspective

The second element of the project was linked to the fact that two of the re-designed lecture theatres were located in specific disciplinary areas within the campus. It therefore sought to examine the managerial decision-making in "sponsoring" these lecture theatres and to identify the institutional factors that might promote or hinder the adoption of different instructional strategies and delivering broader curriculum change. The methodology was again in-person semi-structured interviews with key stakeholders, including Pro-Deans for Student Education, Directors of Student Education, Blending Learning Champions, Learning Technologists and a University Timetabling Officer. The Interview Questions can be found in Appendix C: Table C1. Again the interviews were intelligently transcribed.

3.2.3. Learning Space Innovations around the United Kingdom

The objective of the third and final element of the project was to try to benchmark Leeds against what is happening across the sector more generally in terms of innovative learning spaces. As well as desk-based research, there were visits to the University of Exeter, University of Glasgow, University of Sheffield and City University, London.

3.2.4. Reflections on the research methods

If I was to repeat the research, I would change the observation codes protocol by simplifying it, limiting the number of categories and more sharply differentiating between teacher and student behaviour. It became clear that there were some blurred edges between the categorisation of different items, especially in relation to questions and answers, and some categories, for example students taking on-line quizzes or tests, did not feature in any of the classes observed. A catch-all category of "miscellaneous" with a note to detail what is happening would cover this and other niche activities. There is some benefit to being physically present in the class as opposed to relying on lecture capture recordings in terms of being able to form an impression of student engagement and recording the lecturer's position within the room when they have moved away from the podium. I would also modify the consent form provided to students as it was more suitable to an interview or one-to-one context rather than a mass scenario.

Since constructing my classroom observation protocol, I have found some pre-existing examples in the American literature. The simplest example can be found in Appendix G in

Van Horne and Murniati, *Assessing Teaching and Learning in Technology-Infused TILE classrooms at the University of Iowa* (Van Horne, 2012). A more complex example recording activity in five-minute intervals and with Excel codes was developed by Dr. Christopher Brooks at the University of Minnesota (Brooks 2012). Although the link to the instruments in the article does not work, they can be found at a temporary Google site (University of Minnesota, 2016). As well as collecting data on instructor behaviour, position and classroom activities, the protocol covers student behaviour, including an assessment of being on-task. Brooks notes that within the five minute interval "it was not uncommon for multiple activities, modes of deliverance, instructor and student behaviour, and environmental conditions to be recorded" (Brooks, 2012). The advantage of the Minnesota protocol is that it explicitly records the position of the lecturer. The final example is COPUS or Classroom Observation Protocol for Undergraduate STEM, which was developed by researchers at the University of British Columbia and University of Maine and also is focussed on staff and student behaviours, but recorded at 2 minute intervals (Smith et al., 2013).

Probably due to the fact that all three examples are quite dated, none focus on the technological affordances within the classroom. Only COPUS refers to clicker questions (the use of clicker devices has tended to be associated with STEM teaching). While the Iowa and Minnesota protocols were primarily developed as research tools, COPUS was intended to provide data to support individual teachers as well as to feed in to professional development programmes. The latter is also the focus of ALCOT (Active Learning Classroom Observation Tool) developed at Indiana University in relation to their MOSAIC classrooms (Birdwell et al., 2016). ALCOT does consider spatial arrangements, technologies and pedagogies and was developed to allow faculty developers an opportunity to support staff teaching in that space. Although the observer does use a Chronological Note-taking Instrument, it simply records Time, Description and Comments; this seems to be more of an aide-memoire for the observer when they complete the ALCOT and the data is not shared with the instructor (Birdwell et al., 2016, 33).

Looking at all these examples it should be possible to take insights from all to modify and refine the classroom observation protocol for any future research.

4. Case Studies

4.1 Case Study 1

4.1.1. Introduction

The case study is based on a first-year study skills module in a social science programme with an enrolment of 55 to 60 students, taught intensively over the first four weeks of Semester 1, in both the Dental Lecture Theatre and Mechanical Engineering LTB. The module forms a bridge to introduce all students, irrespective of their previous educational experience, to the concept of independent learning in higher education as well as acquiring practical skills in reading, note-taking, time-management and preparation for assessment including essay-writing, presentation and examination skills.

4.1.2. History

The current lecturer had inherited the module and delivered it via a standard lecture/seminar format for two years. He thought as it was a skills module, "it would be good if the students could practice those skills as they are learning them a bit more." As seminars lagged behind the lectures, the idea was to bring "the practice and the instruction together as much as possible." On hearing about the Collaborative Lecture Theatres, he thought they would provide a space that would facilitate that.

4.1.3. Module redesign

The structure of the module changed from 9 lectures and 4 seminars to 3 lectures and 6 interactive lectures. The three remaining conventional lectures comprise the module introduction and review classes plus a guest lecture from the Careers Centre. The interactive lectures are timetabled for 90 minutes and were held in the Dental Lecture Theatre and Mechanical Engineering Lecture Theatre B as predicted enrolment was likely to exceed the capacity in Roger Stevens LT8. The content as a whole remained the same but some of the sessions were consolidated, for example, independent learning and critical thinking were brought together in a single session.

4.1.4. Assignment of students into groups

As part of the assessment was a group presentation it was decided that the students had to be pre-assigned to groups of four and sit in their groups in the interactive lectures. Although the pods are numbered, there is no map with numbers available as part of the room information on the web. This is important as the pods on the side walls of both lecture theatres seem slightly smaller than the central pods if the groups are going to be of standard sizes.

Inevitably there were complications such as students re-taking the year who were not on the register and who therefore had to be assigned to groups on the spot. Additionally. at the start of the year it is sometimes unclear if a student is absent because they had deferred or transferred to a different course. Over the duration of the course and as attendance shifted, some students had to be moved temporarily into different groups, rather than sitting by themselves. This meant that they might not know anyone in their new group.

4.1.5. Lesson Plans and Activities

Initially the plan was to incorporate three activities within the 90 minutes, but it soon became clear that this was too much. The pattern that emerged was for a shorter activity followed by a longer activity. The lecturer explained that in the back of his mind he had an image of a graph of a student's attention span in a lecture and remembered the drop around 18 minutes so he planned for the first short activity at around 20 minutes, then the longer activity at around the 45/50 minute mark lasting between 20 - 25 minutes. Frequently the first activity was based on some advance preparation by the students and involved a group discussion of the preparation task. The second activity was often based on worksheets, which were uploaded by the students from a folder on Minerva.

One example of such an activity related to referencing where the task consisted of a list of publications and working as a group they had to provide the correct references on the worksheet opened on the laptop. There were also more complicated tasks, frequently based on the travails of a fictitious student, Graham, who was earnest but struggling. One activity involved planning Graham's timetable where he had two assessments due by particular dates, various social activities planned, information about when he worked best

etc. The lecturer thought this activity worked particularly well, because it became clear to the groups that it was impossible to fit everything in, so decisions had to be made as to how he should spend his time. The lecturer commented on the students' response: "they more or less ignored the rule about when this student works well, and they more or less ignored what he wanted to do, all his social activities were out and his time was basically blocked with a huge amount of reading." From the discussion it became clear that the groups were willing to put this fictitious student through this gruelling regime of reading for 12 hours a day for two weeks, but were much less clear on what they personally would do. So it brought out questions about how to balance regular social activities with studying – do you work all the hours when you feel you need to or do you try to stick with when you work best? The lecturer felt that "the messages came organically out of the activities" and it was more effective than if he had "said it off the slide."

Another example which did not work so well involved the groups trying to organise Graham's ragbag collection of notes into a coherent essay plan. Here the issue was continuity between classes. The students had deconstructed the essay question in a previous class and the lecturer assumed that they would carry that knowledge forward to the next session, so he had not included the question on the worksheet. After 10 minutes when it became clear that confusion reigned, the lecturer had to step in and remind the students of what they had previously worked on. In retrospect he thought it was expecting too much of "students who have just landed at university who are doing five different modules at once" to recall what they had been doing in previous classes.

4.1.6. Transitions

The lecturer quickly realised there were advantages to having an orientation slide at the start of every lecture. This gave basic instructions: "please log in, please go to this, please open this document, please open the internet browser and find this …." This enabled the class to start more quickly.

In transitioning between instruction and activities, the lecturer used a visual cue using a different colour for the slides setting out the task or activity. This was in addition to the auditory cues of the introduction and explanation of the task.

4.1.7. Movement and position

The lecturer commented that he felt that he shifted position less in the didactic element of the class compared to a conventional lecture. He said his normal mode is to "float around a bit" but he felt more drawn to the centre in these classes, as he did not want to "venture too far away" from the interactive whiteboard.

In terms of position during group work activity, the lecturer had a module assistant, a PhD student, acting as a winger. During the first short burst of activity, the lecturer and winger would stay at the front of the room. During the second longer activity, they would take half the room left to right and would move up and down the aisle to talking to groups. He said that it was easier to go up and down than across laterally in both rooms given student bags around the pods. Although both rooms had sofa style booths and there was frequently space to sit down as the groups were between 3 and 4 students, the lecturer commented that although he occasionally would sit, he would also kneel down and lean on the table next to the groups. The key was the visibility of the laptop screen so that he could see what progress the group had made with the activity.

4.1.8. Use of Technology

One of the key innovative features of the technology is the ability to share student work from their laptops to the whiteboard. In terms of frequency, the lecturer said this happened a couple of times. He identified and primed the groups chosen to display their work as part of his movement around the room. He noted that there were some technical issues with displaying word documents in terms of the size of the font and ability to zoom which made it difficult to assess whether everyone could see the work. He was disappointed that this process did not spark wider engagement and discussion across the class and this also meant that he did not use the whiteboard as much as he had anticipated in terms of jotting down ideas and key points from whole class discussion.

He did point out that there were differences between the software on the interactive whiteboard and on the desktop but this was a niggle rather than a major concern.

He felt that the students did not really engage with the microphones or lights on the desks, although the functions had been explained in the first interactive lecture and he adjusted the lighting down during the group tasks.

4.1.9. General reflections on the Collaborative Lecture Theatres

The lecturer was very clear that it was "the architecture of small groups" rather than the technology (albeit useful) that was the main advantage in using the Collaborative Lecture Theatres for this particular module. He thought it made it easy to stop and do some group work whereas in a conventional lecture theatre the interaction would be limited to talking to your neighbour. He commented "I went to these spaces with a particular end and objective in mind. I didn't go to these spaces thinking, oh I've always wanted to teach like this. I went to them thinking, for this module it would be really useful to do this." He noted one subtle shift to his perception of learning. He said that he approached the classes as "too cut and shut" as it was "basically lectures with activity tasks and they met at certain points." Acknowledging that in the best sessions the "messages came out organically from the activities", he felt that he could trust more to the tasks and activities.

He noted that whole group discussion, which he thought was a perennial issue, "wasn't magically solved" in the Collaborative Lecture Theatres. Interaction tended to be vertically from a student or pod to the lecturer and back rather than sparking wider discussion and there seemed to be reticence on the part of students to talk to the whole group.
The presence of the "winger" was regarded as invaluable, allowing more time to be spent with each group and also having someone to talk to about how things were going in the classes more generally.

In terms of broader curriculum impact, he noted that this is difficult where you are not the module leader and there is team teaching. For him the study skills module was his "little laboratory" and he thought in time there would be spill over and a gradual process of change. Having experienced the space he could see how social science modules, which are about thinking through problems, could use the affordances in a Collaborative Lecture Theatre.

4.2 Case Study 2

4.2.1. Introduction

The case study is based on a first year key skills module in an applied science programme with an enrolment of 123 students, taught over the full academic year. The module is seeking to equip students with a range of academic and practical skills around the use of laboratories and equipment, experimental work, the use of statistics and Excel spreadsheets as well as technical report writing. Critical thinking and evaluation is developed through a group-based project in semester 2 looking at how the subject is presented in the media. Throughout the module there is an emphasis on employability skills, such as presentation, group work, developing a CV and commercial awareness.

4.2.2. History

The current lecturer had delivered the semester 2 group work element in conventional lecture theatres but when the re-designed Mechanical Engineering Lecture Theatre B was opened at the end of 2016 she thought the module would work well in that space and so booked it for the second semester. Having had that experience and taken over as module leader she then requested a Collaborative Lecture Theatre for semester 1 for 2017/18 and again secured Mechanical Engineering LTB. She thought that some of the skills materials can be quite dry and she could recall “seeing their heads dropping” following a conventional lecture. She therefore hoped that using the Collaborative Lecture Theatres would promote better student engagement as well as provide scope for more peer learning.

4.2.3. Module redesign

There were no changes to the structure of the module but there were changes through introducing new activity within the lectures. Previously, students were expected to consolidate learning through private study, now they put the learning into practice in the class following on from the instruction. This applied both in terms of step-by-step explanation of mathematical calculations but also in relation to learning how to correctly record experimental work through a lab report.

4.2.4. Assignment of students into groups

For the first semester the students sit in their own groups, the only rule being that they should be between 4 and 6. For the second semester they were assigned to groups of 5 or 6 using a random number generator.

4.2.5. Lesson Plans and Activities

There was no set pattern of activities. The lecturer commented "One day I come and literally everything's interactive and another day might be 40%, 60% me teaching. It varies and just depends on what they've got to do."

A good example of an interactive activity is the transformation of a didactic lecture into a quiz. The lecturer explained, "Why do I need to tell them that, let them go and look for it themselves." She developed 28 questions, one per pod and students use internet research to find the information needed to answer the questions. The expectation was that they would research the answer to their numbered question first as they would be expected to feedback that to the whole class and then progress to answering some of the other questions if there was time. In terms of whole class feedback the lecturer took answers in turn from the pods and would write them on the whiteboard which displayed a giant version of the quiz. For the lecturer the answers *per se* were not really the point of the exercise: "what they needed to learn was all those places they'd visited to answer the questions."

A further example related to the protocol for lab reports and this session was completely rewritten. Rather than giving a lecture and expecting the students to write up an example in their private study time, the students were asked to write the report in class as a group using a pro-forma downloaded from Minerva. In that class the lecturer had a "winger", the Laboratory Manager who had set the practical. The experience proved challenging as there were lots of questions, students getting stuck and with only an hour's class, it was difficult to resolve all the queries in the time. In terms of forward planning, the lecturer thought that next time she would have extra "wingers" to help deal with questions and she would also provide a FAQ document for the students to review in advance of the class and use as a

reference within the class. Notably in terms of submitting the report, students were given a choice of either submitting individually or as a group.

In relation to the semester 2 assessment based on group work, the students were given time in the class to work together on preparing their assessment. As they were two hour classes in semester 2 this gave the lecturer sufficient time to check in with all 22 groups. She noted "it didn't really work without the booths. When we used to do it in the Roger Stevens lecture theatre, the students used to say, can we come and sit at the front and they'd come and sit at the front in little groups and sit in a circle on the floor to try and separate themselves out."

4.2.6. Movement and position

The lecturer explained that she would normally stand at the lectern and write on the whiteboard and generally she would not walk around the class. She also said that even in the Collaborative Lecture Theatres it is difficult to come out from the lectern because all the controls are there. However she did say that when viewing student work projected to the screen, it was necessary to move out as otherwise you could not read it.

4.2.7. Use of Technology

The lecturer made full use of all the technology, especially the interactive whiteboard. She introduced the students to different tools, including Padlet, Kahoot and Wikis, through a gradual process. In terms of group working, students were asked to switch on their spotlights to show that they had completed the exercise. Although there were occasions when student work was displayed, where students were asked to present their work, they were required to leave the pod and come down to the front of the room as this was seen as part of developing their skills prior to the assessment at the end of the second semester.

4.2.8. General reflections on the Collaborative Lecture Theatres

The lecturer was very clear that the changes made the learning more concrete and deeper and that this was reflected in the marks which were higher than previous years. In terms of peer learning, a couple of sessions were designated as "help" sessions and the students seemed more willing to sit together and work through difficulties in a Collaborative Lecture Theatre compared to sitting in a seminar room. She also noted that there was less demand

for one-to-one support as students were forming their own study groups. So the changes did seem to promote the development of peer learning.

In relation to interaction, this tended to be from a pod to the front and back again. The lecturer noted that when she invited the wider group to respond, "a couple of brave students would interject but in the first year they find that really difficult. I've not got a student turning on a microphone and saying "actually", and I think perhaps that's because they're not used to that kind of environment, they wouldn't speak out in a normal class." The lecturer had experience of using Roger Stevens LT8 for a limited number of sessions for a different module and noted that the students "hated it in there, asking why did we have to go to that one instead of Mech Eng B?" This was for a group of 54 so LT8 would have been at maximum capacity and the lecturer said it felt more enclosed, not as airy and really hot.

In terms of the impact of teaching in the Collaborative Lecture Theatre, the lecturer noted that she had changed her practice in normal lecture theatres, incorporating more interactive activities through students using Padlet or Kahoot on their mobile phones. In terms of broader curricular change, her enthusiasm has already influenced colleagues to move their teaching to Collaborative Lecture Theatres and she was planning on using a School Teaching Away Day to encourage more staff to think about collaborative learning. Her concern is that with a limited number of Collaborative Lecture Theatres, more demand will mean some staff will not be able to access them and she would be keen for the University to develop an additional large Collaborative Lecture Theatre.

4.3 Case Study 3

4.3.1. Introduction

This case study is based on two linked modules, an introductory module for around 150 first year students and a more advanced module for around 130 second year students. The modules involved applied mathematics and an understanding of computational tools used for modelling, including some coding and the use of specialist software for numerical

computation and visualisation. Both classes took place in Mechanical Engineering Lecture Theatre B. Two classes were observed.

4.3.2. Observation

Both observed classes required students to open a specific section on Minerva together with the specialist software. Most pods used the desk laptop although many students had their own laptops as well. In each class the lecturer was working through theoretical mathematical problems step by step. Standard didactic instruction took under 30% of the time but whole class questions and answers accounted for between 25 to 40% of the remaining time. As might be expected there was more group-based activity for the second year module at around 33% of the time whereas this was about 20% for the first year class.

In terms of position, the lecturer was stationed at the front of the room for around 85% of the time for the first year group whereas this dropped to 60% of the time for the second year group. The lecturer did move between the lectern PC display and the whiteboard in both classes, using the whiteboard to annotate and work through example solutions. In terms of moving between groups during the group activities, there was no fixed pattern, using both aisles and moving laterally across rows. The only example of a work from a pod being displayed on the screen was in the second year class and this group also appeared more willing to ask questions compared to the first year class.

Information derived from the interview:

4.3.3. History

The modules have been evolving over a number of years. With the delay in installation until January 2017, although some lectures did take place in Mech Eng B in the second semester, this year was the first year for all sessions to be timetabled in the collaborative lecture theatre. The module leader had seized the opportunity to use the Collaborative Lecture Theatres as he had found the space in conventional lecture theatres problematic. It was difficult for students to engage in the short bursts of group based activity which he was incorporating into the classes and it was also difficult for the lecturer to move around the room to talk to the different groups.

4.3.4. Module redesign

The lecturer updated the lecture content by incorporating more opportunities for students to use the specialist software to run the coding and see the visualisations on the large screen during the lecture rather than in their private study time. Material which had previously been covered in workshops in computer clusters was pulled across into the lectures. The specialist software was installed on all the desk laptops and the students had licences for their individual laptops as well. The lecturer recognised that although it takes time to set up and the lecture classes were only an hour, "once they've made a start on it in the lecture, you're on the journey to doing it; you've got over the barrier." For him this was the value of the lectures: "they're getting over that initial boundary of what the problem is and the group work aspect of that sets them up well."

4.3.5. Assignment of students into groups

Students were free to sit where and with whom they wished. As the lecturer was aware that the room was at capacity with the first year class, he did not want to restrict where they sat.

4.3.6. Lesson Plans and Activities

As this was the first year that the software had been used by the students in the lectures the lecturer took the decision not to have a tight lesson plan but to let activities run. In terms of the observed classes, the second year class had two periods of group-based activity, a short period around 15 minutes into the class and then a longer period from around 30 minutes through to the end of the class. For the first year it was more interspersed but with most of the group-based activities happening in the first 30 minute segment of the class. For other classes, not involving the use of the software but which do have group activities and tasks, the lecturer does have a lesson plan with more clearly defined timings for the various elements.

4.3.7. Movement and position

Data relating to the lecturer's movement and position derived from the classroom observation is noted above. In terms of his normal mode, he said he likes to wander around

the lecture theatre because “in as friendly way as possible that’s how I can tell what they’re doing.” The lecturer made a number of interesting observations about the space, “In terms of the space itself, it’s quite good to move around. I feel like there are a couple of channels which you can move across and you have to skip over people’s legs a little bit. I don’t have a problem with that but I think it is quite interesting you realise there are certain ways you move around the space. And the angle of the tier, I had noticed the ones at the back feel a little bit like over a dip and initially I thought I feel a bit far away when I’m teaching so I didn’t feel quite as connected.”

4.3.8. Use of Technology

The lecturer commented that he used the dual projector and the interactive whiteboard in every class. Given the long-standing adherence to traditional whiteboards in science and engineering, he admitted that he was quite cynical about the switch but now he is a fan of the digital whiteboard. He would have liked to use more of the screen sharing from students at opportune points but noted “you want to think about what they can show and in an amount of time which is meaningful, because you’re conscious of eating up a lot of time in the lecture with quite a big class. So… I’ve used it as more a way of checking engagement rather than people looking in detail at what’s on people’s screens.” It is also notable that he used a lapel microphone so that even away from the front of the lecture theatre it was possible to hear him clearly.

4.3.9. General reflections on the Collaborative Lecture Theatres

The lecturer thought that using the Collaborative Lecture Theatres allowed him to do what he was planning to do in lectures and for him the key feature was “you can do group work and you can lecture in the same space and it fosters them working together.” In particular he contrasted this with group work in computer clusters where the talk content is more difficult in that space. “You do want to claw everyone back together in those spaces to go, ‘Right, let’s just reflect on where we are. Is everyone at the same point?’ But it’s quite a big deal to do that because you’re actually disrupting everyone while you’re doing it.” With the Collaborative Lecture Theatres, it is easier to flip between the two modes “I’m in charge now. You’re in charge now.”

In terms of whether there should be more Collaborative Lecture Theatres, he wondered if there was a half-way house as it is obviously "very high end". In particular he thought that standardisation or consistency of facilities was essential; "You're a bit more conservative when you don't know what the space is going to have."

4.4 Case Study 4

4.4.1. Introduction

This case study is based on a second year core module for 70 students on a humanities programme. One of the module objectives is to introduce students to quantitative and qualitative analysis of a corpus of texts using specialist software programs. The module is taught in Semester 2 with two lecture classes per week with accompanying seminars. The lectures were variously timetabled for conventional and collaborative lecture theatres, depending on the activities to be undertaken in that class. Both the Dental Lecture Theatre and Mechanical Engineering Lecture Theatre B were used.

4.4.2. Observation

Three classes were observed, two in the Dental LT and one in Mech Eng B. The first class observed was the first one held in a collaborative lecture theatre (the Dental LT) and was the students' introduction to one of the software programs. The students were given a detailed handout with screenshots taking them through various activities. However, the initial instructions "download a zipped folder containing three files from Minerva to your University drive" took quite a bit of deciphering for students who had never seen a zipped folder or used their University drive. Some 23 minutes was spent getting all the pods to having the software program open and ready to investigate the data. At this point there was a short lecture and then the pods started on the activities set out in the worksheet. As the class was only an hour long, there was a sense that the students had just started to get engaged in the task when the time was up.

The other two classes were at the end of the module, after Easter. The first was a "Hands On" session designed to develop students' computer tools capabilities and hone their textual analysis skills. Again a detailed handout and worksheet with tasks was provided. In

this class time was evenly distributed between the instructor demonstrating the different features of the tool, the pods working on the tasks followed by different pods showing a screen cast and talking about their findings. The overall balance of the class was two-thirds interactive to one-third instructor led.

The final class observed was also billed as a "Hands On" session, planned as a surgery to explore further features of the software as well as a showcase of student work. As before, there was a handout and worksheet with three alternative activities students could choose from. There was a demonstration by the instructor of the process to follow for one of the tasks followed by a Question and Answer session before students started working in their pods. The final 20 minutes of the class was the Showcase of student work. The instructors uploaded powerpoint presentations which students had prepared and delivered in seminars to the lectern PC. Individual students were invited to talk to a particular slide to explain their analysis. The students were working on three different corpora and the instructors identified examples of work from each corpora.

In all three classes, there was an instructor who led the activities and a "winger", another member of academic staff who co-taught the module and delivered some of other lectures. In all the classes observed, both actively moved around the room engaging with the different pods when the students were working in their groups. There was no fixed pattern although the winger tended to take the aisle closer to the door and the instructor the aisle closest to the lectern. Both would sit down in the pods if there were 3 students together or lean across the desk if the pod was made up of 4 students. In the first class observed the instructor spent most of her time at the lectern or at the front of the room whereas the winger spent half the class moving between the pods. In the second and third class both were positioned at the front of the room during the "show and tell" elements and both commented and asked questions relating to the student work being presented.

Information derived from the interviews with both members of staff:

4.4.3. History

The module has been taught for some years and previously the software teaching element was delivered in a computer cluster. One of the lecturers explained "they are not really designed for teaching, they're flat rooms, it's too difficult to get round people even though we asked the students to collaborate with people next to them and gave them little worksheets. They'd just sit in front of the computer, there was no dialogue and with two members of staff it's not possible to support 70 to 90 individual learners in the room."

However, it was not just practical difficulties with the computer clusters which prompted the shift. As one of the lecturers explained, not only would the collaborative lecture theatres "make it easier to cope with for us as teachers but also much better, a much more collaborative experience for students because we do think that they can learn quite a lot from mucking about with it, the stuff and playing together. And we also felt because of the way the interactive lectures are set up it allows you to show and tell what students are doing and therefore drives the narrative content for some of the later lectures. It makes it much easier to hand control of the learning over to them mid-way through the module."

While some of the classes moved into the collaborative lecture theatres for Semester 2 in 2016/17 not many slots were available so this was the first year for full use of the collaborative lecture theatres.

4.4.4. Module redesign

The key element in redesigning the module was getting access to the collaborative lecture theatres. One of the lecturers said it was a case of planning the curriculum around the availability of the Collaborative Lecture Theatres. The curriculum structure within the School is very rigid in terms of timetabling and it would be very difficult to move the lecture times of the module to fit with the availability of the Collaborative Lecture Theatres. The two members of staff worked collaboratively in planning and delivering the module. They contrasted that with team teaching in a traditional lecture where you come in to deliver your classes and you do not necessarily know what other people of the team are doing. One said "this is much more organic, that we can kind of plan on the run, certainly this year we have because we have more slots and then they were new."

4.4.5. Assignment of students into groups

In the first class observed, students were free to sit where they wished but the lecturers did ask them to sit in the pods with other students, rather than sitting on their own. For the next two classes, students were asked to sit with others who were working with the same corpora so they were working with the same material. One of the lecturers gave an example of how this benefited an international student who had previously felt very lonely on the course. In the latter classes she had seen this student smiling and talking to other students. In her view the experience of "sharing an endeavour" through working with the same material gives "a real opportunity to interact with other students" in a way that is not possible in conventional lectures or seminars.

4.4.6. Lesson Plans and Activities

The classes timetabled in the collaborative lecture theatres had detailed handouts/work sheets which provided clear information to students in a step by step fashion in terms of getting started and then using the various computer tools. The information was anchored through tasks requiring students to work together and share their findings. One of the handouts had a skeleton timetable setting out what the class was going to cover and the expected time for running the tasks. However the observation revealed that the initial task which was intended to take 10 minutes overran and took almost 30 minutes. This meant that later tasks were omitted or compressed.

One of the lecturers explained that the lesson plans were used for the technical classes "because we have to try to keep a track of it and to give the students a sense of reassurance and to accommodate the different speeds."

4.4.7. Movement and position

The division of labour in terms of who was leading and who was the winger was the same in all three classes observed. The lecturer who was the winger explained that she thought this reflected their different styles and different strengths and weaknesses. She thought her colleague was better at facilitating in a workshop or seminar style format and the technical sessions were "kind of like a giant seminar".

The leader explained that she typically would stand at the podium because of the location of the control panel but said that she "would move out of that, into the front of the students, so that they can see it's a different kind of speaking and listening." This was apparent from the observations where the leader moved in front of the lectern when setting up an activity and explaining to students what they needed to do.

In terms of movement within the lecture theatre, the leader said "the beauty of it is you can walk behind them, you can see what they're doing" whereas in the conventional lecture theatres, "the nearest you can get is the barrier of the first row." She also commented that "you can actually go and work with them and see what's on their screen and work out what problem they've got and they must feel that you're working with them, rather than making them do things."

Both felt that the classes would not be workable without the presence of the winger. The leader explained, "Because we are getting the students to work with software, as soon as one person presses a button and the next person presses a button, they get to a different screen. So it's not the case that you can predict what everyone's doing and they're all going to create different problems so to try and problem-solve on your own, whilst directing the session and keep time is not manageable." However the additional hours are not counted in the workload model within the School.

One key difference between these classes and other classes with a winger was the interaction between the two members of staff. It was clear from the observations that there was interaction and dialogue, particularly in how they shared their responses to the "show and tell" elements of the classes. The winger explained "the double act is quite good for the students because then we're involving them and they're doing the same in a mini way and I think it's quite good for them to see us, one makes a mistake and the other picks it up and we just made a joke of it and that was fine and it's a much more inclusive experience for the students."

In comparing the experiences of using both lecture theatres, it appeared that the Dental Lecture Theatre was preferred as it seemed "more compact, more manageable' although

both noted the location of both on the peripheries of the campus was not ideal where students had back to back classes on the other side of the campus.

4.4.8. Use of Technology

The dual projectors were used regularly in the observed classes and also the pod microphones were used when students were presenting. Although screencasts of student work was shared in one class, the presentations were loaded from folders on the lecturers' drives rather than from the laptop. In relation to the interactive whiteboard, the leader thought it was a bit slow switching between the two interfaces. The winger thought that "the lecture theatres are challenging because no matter how IT literate you are, when you are faced with that array of buttons and 70 to 90 students and the thing is not doing what you think it should there is this sense of panic which comes through and you have to learn to ride with that." She thought that she hadn't really mastered the use of the interactive whiteboard although she could see its benefits particularly for annotating and then capturing material for a different module.

4.4.9. General reflections on the Collaborative Lecture Theatres

For both members of staff reflections on the collaborative lecture theatres were tightly bound up with their reflections on the module itself. In thinking about the three conceptions of learning in higher education identified by Ellis and Goodyear (Ellis and Goodyear, 2016, 155), (learning as acquisition, learning as participation, learning as knowledge creation), by the end of the module it is the latter which comes to the fore. Both saw the module as students going on a journey. As one explained. "we think that the millennial generation is very techy, but actually our experience is that they're not and they're quite fearful of technology. So what we want to try to do is to foster a kind of enthusiasm for new approaches, get them out of their comfort zone into something new and by the end of the module, think that these are technologies that I might use for my own research because that is how we use them." She continued "the stuff we are doing in the lecture theatres, it's real data, it's not just experimental stuff, we're not just teaching them skills, we're teaching them skills so then they can apply and use to argue with. It's really moving them from a theoretical model of language to one where now I can generate new ideas and nobody's written about this, there aren't any articles you can go and read."

The other lecturer used a very interesting metaphor in describing how she saw the classes; "we've dug the whole foundations of the lecture theatre and we're throwing up the rocks. Whereas I think some other people are more on the pinnacle and it looks flashier, ours is more earthy, it's much more elemental to what we're trying to and that's probably what makes it quite hard. You know it would have been easier to do something less elemental but then that wouldn't achieve what we want it to achieve and I don't think the students would have gone on the same journey. Because I don't want them to be entertained, I want them to be absolutely engaged. We tell them that you know that you are creating the knowledge, you know that it's not just about us telling you."

4.5 Case Study 5

4.5.1. Introduction

This case study is based on a first year module taken by 130 students. While the module is compulsory on a few programmes, it is optional on other programmes and it is also available as a discovery module, providing that students have taken a prerequisite module in Semester 1. The objective is to introduce non-specialists to tools and techniques relating to one aspect of accounting which they may come across working in a business or organisation in the future. The module is taught in Semester 2 with 11 weekly lectures, timetabled for 90 minutes, and 10 one-hour seminars. All the lectures took place in Mechanical Engineering Lecture Theatre B.

4.5.2. Observation

One class was observed for the full 90 minutes and a further class was observed for 50 minutes. The first class was a flipped class, with students required to complete some preliminary work and the second class was a conventional lecture. As might be expected there was substantially more time spent on interactive tasks in the flipped class with the instructor presenting for around 55% of the time compared to 90% of the time in the conventional lecture.

The flipped class started with the instructor asking the students in their pods to quickly identify key points from the podcast which they had accessed in advance. Then different pods were called on by number to state what they viewed as a key point. Students were

reminded to use the microphone when responding. The instructor then provided a brief recap of the questions which students had struggled with on the pre-lecture multiple choice quiz. In terms of the new material covered in the class, the students were provided with a detailed handout taking them through a complex worked example, step by step. There were blank spaces on the handout which students were expected to fill sequentially. Although asked to use pod lights to signal when they finished, most pods forgot to do that. The instructor had the handout on her iPad projected via a VGA cable and as the students were completing the work, she filled in the blanks. She then called them back into plenary to review the answers and introduce the next section before starting them off again.

In the conventional lecture the lecturer also included interactive elements. For example, students were asked to identify examples of products at different stages of market maturity and to use Padlet to record their choice. The class-generated list or "wall" was displayed via the interactive whiteboard. At the start of this class, students had also been asked to join a meeting via a weblink to the Meetoo app. Meetoo supports polling and quizzes although the use of this tool was not observed in the first 50 minutes of the class.

In the flipped class there was a winger as well as the instructor. The winger was the member of staff who taught all the seminars for this module. During the presentation sections the winger was positioned at the back of the lecture theatre and then moved around the room during the group work activities, checking on progress and sometimes sitting with groups to deal with difficulties. The instructor spent some time away from the podium while the pods were working although she also used some of this time to fill in the blank spaces on the handout ready for the plenary. Although the winger interacted with different groups, she did not communicate with the whole class at any point.

Information derived from the interviews with the lecturer:

4.5.3. History

The module had existed for some time and the lecturer took over as module leader in 2013/14. Although the lecturer felt that "there wasn't a pressing need to fix a problem" as

module evaluation and student performance measures were all fine, she thought that the students were not as engaged as they could be. She conferred with the seminar leader who felt that she was spending the first half of each seminar repeating some of the basics. So the goal was to make the students more engaged during the lectures which would benefit the seminars and allow more space for discussion in the seminars.

4.5.4. Module redesign

It is commonplace within the School to have lectures timetabled for 90 minutes so that did not change. One additional seminar was added to correct a historical anomaly.

The main change was the introduction of a flipped class design to around half the lectures. The lecturer had a general level of awareness of flipped methods but the specific stimulus was a presentation at a conference from a lecturer who had introduced flipped learning to an advanced final year class in a technical subject. She thought "well if she can do it with that subject, there is absolutely no reason why I can't do it with this subject. Because I think this level and this subject is more conducive to a flipped approach than what she was doing." She also spent time in the Collaborative Lecture Theatres, playing around and trying to understand how they worked and she talked with a colleague who was already using a flipped learning methodology.

In determining which classes were flipped, she thought it "was a happy accident that it fell quite neatly" into about half the lectures. She had taken feedback prior to making the changes from the previous group of students and was aware that they were more nervous, than negative. So that supported her decision not to make the whole course flipped. She commented "I am quite cautious, I have a bit of a reputation as an innovator, but I don't go crazy, I'm quite measured, I'm not usually first and I don't go to the extreme."

She reckons it took around 3 days solid work to convert the lectures to flipped learning. Her experience working with MOOCs meant that she could script and create videos relatively quickly and she already had a suite of revision videos. Where she felt was time well spent was in "visualising things that might not go very well." This had benefits in terms of feeling

more relaxed in the classroom but also she thought it was useful having a few Plan Bs up your sleeve to call on if needed.

Her technique for persuading the students to do the preparatory work is to "make a deal" with them. In the first lecture she explains that the pattern is for 30 minutes preparation prior to the lecture every other week. The time is spent viewing a short video (around 10-15 minutes) followed by a multiple choice quiz, which is not purely recall but applying some of the material covered in the podcast. She emails the class 24 hours before the lecture to remind them to complete the preparatory work if they have not already done so and also keeps track via Minerva. The pay-off for the students is that this reduces their seminar preparation time proportionately.

4.5.5. Assignment of students into groups

Since the students were not being assessed in a group in the module, they were free to sit where they wished. She noted that frequently students on the same programmes would sit together. Early on in the module she had been contacted by some students on the autistic spectrum who said they felt very uncomfortable with the format and thus the two benches at the back were invaluable as a way to meet their needs.

4.5.6. Lesson Plans and Activities

For the flipped classes the lecturer did full lesson plans, in 10 to 15 minute chunks. Initially she thought for the more complex examples, she would let the students work for around 20 minutes. However because groups were working at different paces she felt "this caused more problems than it solved". Chunking also reflected the sequential nature of the technique whereby subsequent steps built on the earlier steps and if students got stuck on step one, 20 minutes was a "long time to be cast adrift".

A new feature introduced this year was extension activities for groups who completed the set tasks quickly. The handout with the extension activities was not distributed at the start of the lecture but could be collected by the groups from the front of the room when they were ready to move on.

The lesson plan tended to follow a standard template, as described in the observation. There would be a recap of the preparatory work, then the worked example would be introduced via the gap fill handout, students would set off to complete the first two tasks, then the whole class would reconvene to review the answers before repeating the process over again. In reflecting on the experience of the particular example in the observed class, the lecturer noted that the challenge was the pacing. "There's a lot of what seems like weird and repetitive calculations, but they're not, they're all different and there's all sorts of elements within that process that are quite tricky. So I can see that 20 of you are absolutely fine and quite on board now and 20 of you are just thinking 'I don't know what's going on here.'" This meant that there was insufficient time in the class to cover an alternative method as specified in the syllabus. Going forward she thought she might try to push the pace by a slightly less complex example in the lecture and shifting the more complicated examples into the seminars.

4.5.7. Movement and position

The lecturer said that normally she is a "walker and a talker". However in the collaborative lecture theatres she tends to stand behind the lectern when talking to the whole class because all the device controls are there. As there is no facility for mirroring the iPad she uses, she feels effectively tethered to the podium.

When the pods are engaged in the tasks, she tries to loop around the room, starting the loop at different points so that she can speak to different students.

The lecturer felt strongly that the winger provided significant added value to the classes she came to. She explained that last year the winger came to every flipped class but this was not accounted for in her workload and she felt that she could not ask her to do that this year. It was the winger who asked which classes would be most valuable in terms of the additional person. For the lecturer, "when it is me and 130 students and I'm trying to manage a series of activities, that is quite tough, I find that quite difficult."

The lecturer and winger had worked together for several years and the winger had provided guest lectures on the course as well as leading all the seminars.

4.5.8. Use of Technology

The lecturer said "I deliberately use a technological blend that I didn't feel stretched me too far because I thought the stretch was more about managing the room." As she used Padlet and polling in conventional lectures, using them in the collaborative lecture theatres did not stretch her too far.

She generally did not use the interactive whiteboard as she had tried it a few times and "found it difficult to use, I found it quite sticky." She had what she considered a better alternative in her iPad. She said "because I teach with the iPad in all sorts of rooms, I'm just so much more comfortable with using that iPad. I use it a lot when I do seminar teaching. And for me, the elements of the lectures where the students were doing examples were a bit more like a seminar."

The lecturer explained the reason she did not show student work is that she wanted to give students the option to work separately or together either using the desk laptop or their own devices or on paper. So it would be tricky to show work in pods where the students had chosen paper.

4.5.9. General reflections on the Collaborative Lecture Theatres

The lecturer thought the advantage of teaching in a Collaborative Lecture Theatre is that she felt closer to the students. "I feel there's less of a distance, I don't feel like they're all plastered to the back row. They seem to be quite willing to come and sit down in the pods at the front." She recognised that there were still times when students were not engaged so "it's not a silver bullet" but overall there was more interaction. For her, it was a case of "you're not working against the room, you're working with it."

In terms of future configurations, she thought that interactive touchscreens might be better and more responsive than the interactive whiteboard. The ability to mirror her iPad would free her from the podium and would be welcome. She thought that there is probably an upper limit in terms of capacity within Collaborative Lecture Theatres unless it was possible to have wingers so that the staff student ratio was about 1:100. Overall she believed "there is an element of some rooms being quite flexible and others perhaps being of a particular

structure. But then it's about access to the rooms for the people who want to do that. I think that particularly with these collaborative lecture theatres the demand outstrips the supply."

4.6 Case Study 6

4.6.1. Introduction

This case study is of a third year optional module in the social sciences for 19 students. It is a theoretical and synoptic module which seeks to develop students' capabilities to approach any topic within the discipline and, in the words of the module leader, "have the vocabulary and the tools and the wherewithal to be like 'I can bring a perspective on this.'" The module is taught over two semesters and all the classes took place in Roger Stevens LT8. The classes were timetabled for two hours.

4.6.2. Observation

One class was observed. All classes were predicated on preparatory reading by the students with one or two different extracts per class. The first 30 minutes of class consisted of reflection by the instructor on the reading and questions raised by students about what they had read. The instructor did not use powerpoints and was able to refer directly to sections within the reading via Minerva. Some of the key concepts and issues raised in the discussion were noted on the interactive whiteboard. This was the only class observed where the instructor used a short YouTube video of one of the authors talking about his work. The instructor then recapped the key points for students to centre their discussion on and noted them on the whiteboard. For the next 45 minutes the students worked in their pods. The instructor waited for 5 minutes for the students to start their conversation before moving to each of the four pods in turn, spending around 10 minutes with each pod. The instructor then brought the class back together for questions and answers relating to their discussions. The visualiser was used to highlight sections of the text under discussion and the whiteboard was used to jot down student responses. For the final section the instructor introduced the next topic and provided a context for the next set of readings. Overall the didactic element of the class was under 30% of the time and the interactive

elements, including students working in their pods, accounted for more than 60% of the time.

When the students started working in their groups the lecturer moved around the room. Where there was space she would sit beside the students, alternatively she stood on the row below the terrace and leaned her elbows on the desk so that she was at the same level as the students.

Information derived from the interview with the lecturer:

4.6.3. History

The programme had a compulsory final year theory module for many years. It was a polarising course in that while some students loved it, rather more detested having to do theory. A curriculum redesign removed this module and incorporated more theory into new modules in years 1 and 2. This then opened up the possibility of having a more advanced, optional module for the final year.

4.6.4. Module design

This is an example of a module created for the Collaborative Lecture Theatres. The instructor explained "I was really, really conscious if it was a lecture theatre it would be a lecture and were it a seminar, it would end up being a seminar. And I wanted to make it as clear as possible that it was neither of those things in isolation." She deliberately called all classes in the Roger Stevens LT "classes" rather than lectures to reinforce that conceptualisation and to encourage attendance. She found out about the Collaborative Lecture Theatres "in passing" and when she first went into the space, could immediately see the potential to flip the classes. She decided to cap the places at 25, although in both years the module has run, numbers have been just below 20. With that number she found the space adequate.

One change made after the module ran for the first time in 2016/17 was to increase the time from 90 minutes to two hours and reduce the number of classes overall. She had

found she was rushing to finish in the 90 minutes and that there was a tendency to spill over as individual students were coming with questions at the end.

4.6.5. Assignment of students into groups

From the second class onwards the students were sitting in randomly assigned groups. The lecturer used the face cards in a deck of cards the first year and then a four-sided dice last year to allocate the class into four groups. The membership was then re-shuffled by the lecturer just before the end of semester 1 with a further change planned for mid-way through semester 2. As the module was divided into three main topic areas, this meant that group membership was fixed for each topic. The rationale was to refresh the group dynamics to give quieter students more opportunity to participate by circulating dominant personalities between groups.

From the observation it was notable that this was a very diverse group of students, the majority being international students.

4.6.6. Lesson Plans and Activities

The lecturer confirmed that the pattern observed in terms of the limited level of lecturer led exposition interspersed with a mix of interaction involving the whole group and student discussion in pods was common for all classes she led in this space. She did have one guest lecturer who spoke for slightly longer before the class moved to questions and answers. Ideally the lecturer would like to have more guest speakers so that the students heard more voices but she recognised that the workload model was not sufficiently flexible to accommodate that.

In relation to the preparatory work, the lecturer said “if they haven’t done it they just don’t come, they just don’t show up and they take their chances with the lecture capture.”

4.6.7. Movement and position

Having started the pods off with their discussions, the lecturer waited before approaching a group. She said the practice of giving the students “a little breather” came from experience

as the first year she ran the course she "used to blunder in and they'd be like 'We haven't really got started yet.'" She would change the sequence of visiting the pods in each class as often the last group towards the end of the time would have more to say.

The lecturer explained that she did not like looming over the students and this explained why, if there was space, she stood on the terrace below the groups. She did not find the lecture theatre particularly easy to move around and when there were four or five students per table, plus backpacks and coats, it was quite crowded. If the group was smaller, she might pull up a chair. She said "I usually say "Can I join you?', and they kind of shuffle about. I tend to be quite polite when I come into their space as it does feel like their space."

The lecturer also commented on the benefit of being in a tiered lecture theatre so that when she is at the front "you can see everybody, there's no hiding."

4.6.8. Use of Technology

The lecturer used the interactive whiteboard throughout the observed class. She said that she found it reasonably intuitive to use and although she did not use it for much more than a glorified whiteboard, "the benefit is I never have to look away from them and that just facilitates discussion an awful lot better than if you're up and down writing on a board. I find that eye contact thing, not having to turn my back really, really helpful."

She commented that people have been surprised that she uses what she called "a tech laden space" for a theory class. "They're like, 'Really? Why do you need all that tech?' and first of all, you don't need it but it's helpful to be able to have that little clip in the background or being able to go 'I'm just going to Google this and show you this' or 'Well, let's look. I don't know, let's look' and download the article and find the page, 'You guys talk amongst yourselves and I'll find it' and then you get it up and you can put it on the screen or you can put stuff on the visualiser."

Originally she had planned to use the facility to display student work but in practice this has not happened. She noted "there's been a general reluctance on the part of the students to

(a) plug their own machine into the system or (b) boot up the thinkpad. Part of that is probably because they've got their own notes on their machine. It's increasingly rare that they have highlighted reading." She also commented "I don't think they're keen on the idea of their screen being on the big screen" and she thought this partly related to lecture capture. "It's probably a double exposure that is not just exposure but permanent" as it becomes part of the recording.

4.6.9. General reflections on the Collaborative Lecture Theatres

In reflecting on the configuration in the Roger Stevens Lecture Theatre, she commented that she had planned to have groups of five but "there's no space on the table."

The lecturer contrasted the experience of teaching this optional module with the previous compulsory course, "By comparison the opportunity to do an elective, over two hours you're not time pressured, you're not zipping through slides, you don't need to be a sage on the stage, so to speak, because it is open for contestation and in fact, that's often the point, that you can talk to people who are there because they want to be there." She continued "Circumstantially that's made the practice of teaching different and that is possibly more formative than just the space." However she noted that "the space itself is good in that I think it does facilitate a certain manner of teaching, you probably noticed the class is fairly conversational, it's all quite comfortable."

4.7 Case Study 7

4.7.1. Introduction

This case study relates to a unique research placement module within the humanities. It is a compulsory second year module for one programme but it is also available as a discovery module for all undergraduate students. The module seeks to give students experience of doing hands-on research, working as part of a group. Academic staff or external organisations specify projects and students bid for projects they are interested in. Although it was planned that all the two-hour workshops would be delivered in Roger Stevens LT8 in 2017/18, only the first semester workshops were, with second semester workshops moving to flat-floored rooms across the campus. There were three members of staff present in

most of the workshops, the module leader, plus two other members of staff who had practical experience in research engagement and working with external organisations.

4.7.2. History

The module had been running for around four years as a discovery module with groups of around 20 students. In 2017/18 the number of students increased to just over 40 as the module became a compulsory requirement for students on a particular programme. The module teachers recognised that they needed to scale up what they were doing to cope with a larger group but additionally, they had never been fully satisfied with the flat-floored rooms they had used previously. They did not want to teach the module twice so they decided to try a different larger space.

4.7.3. Module redesign

A further feature which attracted the team to the Collaborative Lecture Theatres was the possibilities they offered for students to use the technology to share what they were doing. Previously the students would stand at the front with a giant Post-it Note or a flipchart sheet and the team realised this would not work with the bigger group. The technology that they introduced was a module Padlet board. Other than using Padlet as a way for students to post work in advance of the workshop, the other changes were more about tailoring the activities to what could be done within the room rather than devising new activities.

4.7.4. Assignment of students into groups

The students were pre-assigned to groups of between two and five linked to a specific research project. One of the first sessions required students to meet others in their group and to sit at a numbered pod. This meant that their location was fixed for future workshops in the Roger Stevens LT8. There was a difficulty in that there were twelve groups but only eleven pods. The module leader commented, “We were suddenly faced with a physical constraint of that room influencing what we would want to do.” Although the practical solution was for two of the smaller groups to sit at one pod, he thought this raised issues about “equity of experience.”

4.7.5. Lesson Plans and Activities

The module team noted that the pattern varied from week to week. Sometimes the module leader would talk to a Prezi and that would lead in to a group activity. Other weeks the workshop would start with students presenting their preparatory work which they had uploaded to Padlet. Sometimes students would be required to come to the front to present and sometimes they would sit in the pods and use the spotlight and microphones. One of the activities which the module leader thought went particularly well was when the students were required to bring examples of posters to the workshop. There were lots of images on the front screen and so the module leader could select one and then invite the group who had uploaded it to talk about why they had chosen it and what features made it a good poster. Over time the team realised that they did not need to have all twelve groups to present to the others and that three might be sufficient.

4.7.6. Movement and position

Although the module team did share the presenting duties, most of the time the module leader was the primary presenter at the front of the room. While that was happening, the other members of the team were "slightly loitering at the front, there's no real spare chairs for us". There is also an accessibility issue with using the back benches for larger people.

When they moved to group activities, as part of the seating plan each member of the module team was assigned four groups who were sitting in close proximity. One member of the team commented that "because of the space you feel a bit more intrusive – it's a bit harder to have conversations." The module leader explained "we had our backs to one group whilst we were trying to talk to another and you couldn't sit alongside them." Also because the locations were fixed, there was a concern that the students sitting in the middle pods did not have as good an experience because it was so difficult for the module team to get to them.

4.7.7. Use of Technology

The module leader commented that the technology used most frequently was Padlet. He did not use the interactive whiteboard and it seemed that many students brought their own

laptops rather than using the desk laptop. One of the module team thought they had difficulties finding volunteers to sharing their screens at the front of the room. She wondered whether that was a function of the timing of the workshops (9.00 a.m. Friday) or perhaps embarrassment and a concern that they will be judged.

4.7.8. General reflections on the Collaborative Lecture Theatres

The module leader felt that while some aspects of the room work very well, others were inhibiting and the greatest drawback was that the layout stopped interaction between the groups. In a flat-floored space, a group could test out their plans by moving over to another group's table and talking to them. This could not happen in the Collaborative Lecture Theatre and explained why the decision was taken not to use it in Semester 2 for the workshops. As a member of the module team said "It's not quite right for our group. It might be better for a different type of module where it is not necessarily a workshop; it's more of a seminar or hybrid."

She also raised an interesting issue about perceptions of power and status within the space as between the module leader and support staff. She felt "at the front I feel like I'm meant to be an expert whereas in the past I've sat on one of the tables with the students. I feel there is more of a hierarchical thing in the lecture theatre." She stressed it was her feeling rather than anything the module leader or other member of the module team or even the students would be conscious of.

4.8 Discussion of findings from the case studies

4.8.1. Pedagogy

The range of case-studies involving disciplines across the University demonstrate the potential scope for using the Collaborative Lecture Theatres. So looking at case studies 1 and 2, both were 1st year skills modules in quite different disciplines. The approaches used could be adapted to other study or key skills modules. Case studies 3 and 4 both involved students using computer software and the Collaborative Lecture Theatres offered clear advantages over computer clusters. Again other classes currently using computer clusters to demonstrate use of specialist software could use the Collaborative Lecture Theatres.

Case studies 5 and 6 involved elements of flipped learning and illustrated how the space could be used for large 1st year modules as well as small 3rd year discursive modules.

Case study 7 might be considered an "anti-case study" where some aspects of the Collaborative Lecture Theatre constrained what the module team were trying to achieve. Perhaps the difference lies in the nature of the group work, which was a central aspect of the module in case study 7. Even though case studies 4 and 6 used groups within the Collaborative Lecture Theatres, the focus was not the group work *per se* as the preparatory work and assessments were undertaken by individual students. Case studies 1 and 2 did have group work components, but in both instances there was not the same need to share learning between the groups as appears to be the case for case study 7.

The classroom observations threw up some potential differences compared to the previous quantitative research, which focussed on staff perceptions of how they used time. That research suggested that staff believed that they were spending just under 50% of the time speaking. That finding is aligned to the experience for one of the classes observed for case study 4 as well as for the class observed for Case Study 6, but the other classroom observations suggested that it was more common for lecturers to spend more than 50% of the time talking, even in the Collaborative Lecture Theatres. However, even in the two instances from case study 3 and case study 5 where the lecturers spent between 80% and 90% of the time speaking, there were still interactive components present in both classes and they were very far from being 'chalk and talk'.

The description of the typical teaching pattern for the case studies, especially case studies 1, 3, 5 and 6, looks remarkably similar to the findings from a study of staff and student experience in an Active Learning Classroom at Pennsylvania State University (Ramsey et al., 2017). In that study the researchers found that staff developed "activity strings", activities which are strung together to create "instructionally diverse learning experiences" (Ramsey et al., 2017, 44). Further they found that "over time, activity strings and other practices become "instructional routines"" (Ramsey et al., 2017, 44).

The variety of pedagogies used across all the case studies show that it is not necessary to move to flipped pedagogy to introduce more interactive and collaborative activities in the Collaborative Lecture Theatres.

What was apparent from all observed classes, apart from the one instance in case study 5, which was closer to a conventional lecture, was the high level of student engagement as gauged by what was visible on their laptop screens. That does not seem to have been solely due to the presence either of a winger or myself as an observer at the back of the room. The group of students who were watching YouTube videos in the conventional lecture did not seem deterred by my presence and it was striking that that they selected to sit on one of the top benches at the side of the room rather than in a pod, signalling their non-engagement by their positioning within the room as well as through their behaviour.

There was an interesting observation from one member of the module team in case study 7 about perceptions of power and status within the room, which she linked to the hierarchical structure associated with this being a tiered room and the expectations as to role from being positioned at the front of the room. This description of the front of the room as being a "privileged" space is echoed by Chism (Chism, 2006).

Reflecting more broadly on the role of "wingers" this issue of power and status may play out in other contexts. The interaction and the dialogue between the two members of academic staff observed in case study 4 was very different from what was observed elsewhere or revealed through interviews. That might be down to the fact that the member of staff acting as a "winger" in these classes was the lecturer for other topics and this gave her "permission" or status to speak within the lecture space more generally. In other instances the winger was a silent presence and their "voice" was heard only in the pods.

One theme that came out from the interviews was the emotional as well as cognitive demands placed on teachers who were using the Collaborative Lecture Theatres. The lecturer from case study 6 summed this up when she said "I always leave those classes and I'm really tired, I find them quite demanding." One aspect comes from ceding control to the students, not in the sense of classroom management, but in terms of the sometimes

difficult questions emerging from the learning. Both the lecturer in case study 6 and one of the staff from case study 4 spoke about the need to acknowledge that they did not have all the answers or all the wisdom. The lecturer from case study 4 said teaching in this way "makes me feel vulnerable but that's not a bad thing. It makes me uncomfortable and I'm okay with that because I learn which is, you know when I stop learning I shouldn't be teaching them." In terms of coping with that emotional and cognitive burden, the lecturer from case study 5 gave a good example of how visualising what might go wrong and mentally rehearsing what she would do helped her feel more relaxed and less flappable in the classroom.

One feature which comes through strongly from the case studies is the duration of the classes. Active learning takes more time than conventional lectures and most classes, with the exceptions of case studies 3 and 4, were timetabled for more than the standard hour (or 50 minutes in reality).

4.8.2. Technology

Part of the vision for redesigning the lecture theatres was to support digital interactions between learners and teachers. Hence the desk laptop and the ability to project what is on the laptop screen to the full class was a key element of that vision. The quantitative survey indicated that lecturers perceived this was the least used functionality and the observations and interviews confirmed that. There appear to be a number of reasons for this. First not all pods used the desk laptop with more students bringing their own laptops to class. In case study 5 students had the choice of completing the computational tasks on paper, instead of digitally. Secondly in case study 1 and case study 3 there was a sense that the lecturer had to prime or 'cajole' the group so that they were not caught by surprise when they were called on. The only example observed where the lecturer called on pods by number to feedback was one of the classes in case study 5. Finally, the lecturer in case study 6 identified very real student concerns about exposure, in what is still a formal space, and what she called "double exposure" where their screen would be recorded as part of the lecture capture system. It was notable that the class in case study 4, which made most use of projecting student work, could have done this in a conventional lecture theatre. The

students had submitted their slides as part of a seminar assessment and the lecturers were able to upload the presentations from their drive.

In terms of the reliability of the laptops, staff mentioned that occasionally they would find that an individual laptop would not work and had to be unplugged and rebooted. If it still failed to work, then sometimes the group had to move pods if there was space.

A further novel feature of the Collaborative Lecture Theatres was the interactive whiteboard. The case studies showed that some staff used this all the time and appreciated the ability to keep eye contact rather than having to turn their backs on the students. However, other staff found launching the application and switching between screens clunky and slow and decided not to persevere with it, while one member of staff felt that she had not mastered its use. What is noteworthy is the lecturer in case study 3 who came from a Faculty traditionally wedded to conventional whiteboards, found that he did not miss them. Not only could the interactive whiteboard cope with mathematical formulae and equations but he thought there was value in that the content was included as part of the Lecture Capture recordings so that students could view it back. One point raised by the lecturer in Case Study 1 was that the Notebook software available to staff on their desktop to allow content to be prepared in advance differed slightly from the software installed on the Display screen and he found that this did cause some difficulties.

All staff interviewed were positive about the dual projectors allowing different material to be viewed simultaneously. Typically, lecturers used one screen for static content such as activity instructions and the other screen for dynamic content such as worked examples. Staff thought this was a feature which would be valuable in conventional lecture theatres as well as in the Collaborative Lecture Theatres.

The lecturers thought the pod microphones did enable students to participate without having to project their voices but found that they had to keep reminding students to switch them on before starting speaking. A few used the pod spotlights creatively to signal either that help was required or the exercise was completed.

The desktop computer for each pod was the feature which differentiated the Collaborative Lecture Theatres at Leeds from redesigns elsewhere in the UK. Clearly for case studies 3 and 4 the presence of the shared laptop was vital, but in the other case studies it was more typical for students to bring and use their own laptops. This raises questions about whether any new collaborative lecture theatres should include the integrated laptop or not and indeed whether they should be "lower tech" than the Collaborative Lecture Theatres, with wireless, visualiser and lecture capture only. Even the fixed microphones in the pods could be replaced by mobile alternatives such as Catchbox, already in use in the Centre for Translation Studies at the University of Leeds (Ciobanu, 2017).

When considering the position of staff within the lecture theatre, most explained that it was access to the control panel that kept them "tethered" to the podium at the front of the room. A hand-held remote control or the ability to control via an iPad for staff with tablets would make the lecturer more mobile within the space.

4.8.3. Space

There are two studies on layouts within teaching spaces in the Journal of Learning Spaces. The first by Henshaw, Edwards and Bagley reported on the introduction of swivel desks ('turn and learn') and cross-shaped wide aisles in a mid-size (48 seat capacity) flat floored classroom at the University of North Carolina in 2011 (Henshaw et al., 2011). The goals of the experimental classroom were to "1) promote face-to-face interaction among students, 2) facilitate instructor movement throughout the room and 3) minimize transition time between instructional modes." As part of the research, video recordings of class sessions for five instructors were analysed and a set of five diagrams produced that displayed the time spent by the instructor in various positions within the room as well as the interactions between students. All classes observed were discussion-style courses. As might be expected there was substantial variation in the time spent by instructors at the front of the room, with three spending between 70%-99% of their time in this area, but with one instructor teaching from the "rear" of the room next to a whiteboard and the other circulating throughout the room, spending less than 30% of the time at the front. In a survey of the students, Henshaw et al. (2011) found that where instructors regularly moved

around, students thought there was less of a barrier between the instructor and the students and that as there was “nowhere to hide” they paid more attention in class.

The findings from this study confirm the utility of the wide three-foot aisles crossing in the centre of the room in facilitating lecturer movement and interaction with students. This supports the impression within our Leeds study of the difficulties relating to movement within Roger Stevens Lecture Theatre 8, due to the existence of only one primary vertical aisle against the outside wall.

The other study by Charlie Smith considers how the geometry of learning spaces “affects the spatial hierarchy within the space and how that in turn impacts on the relationships between people in the room” (Smith, 2017). He examines traditional learning spaces as well as alternative configurations diagrammatically and evaluates them by reference to the principles devised by Finkelstein, Ferris, Weston and Winer at McGill University, Canada (Finkelstein et al., 2016). While none of Smith’s diagrams quite capture the layout in the Collaborative Lecture Theatres, what he calls a cabaret configuration comes closest as the students are sitting in clusters and the overall orientation is in one direction, towards the “front”. This consideration of the axis of symmetry within rooms helps to explain one of the findings from the classroom observations in the Collaborative Lecture Theatres. Predominantly, interactions within the whole class setting were uni-directional along a vertical axis, to and from the instructor. There was no interaction horizontally, across the space between the pods in the whole class setting.

In comparing the configurations of the three Collaborative Lecture Theatres at Leeds, all offer the ability to support multimodal teaching and all allow students to work individually and in groups. Two clear advantages of Roger Stevens LT8 is that it was discipline-agnostic and centrally located whereas the other two lecture theatres were associated with particular schools and on the peripheries of the campus. However, the physical configuration of Roger Stevens LT8 with individual chairs rather than sofa-style booths and one primary aisle, rather than two, was more limiting in terms of teacher movement and hence interaction in larger classes. Despite windows, there was more of a sense of an enclosed, cramped space in LT8, compared to the other lecture theatres. Both staff in case

study 7 mentioned the temperature in LT8 which made the atmosphere uncomfortably hot. While the lecturer in case study 6 had sufficient space with a smaller group to approach groups from the lower terrace, the experience in larger classes was of 'looming over' groups or having to crouch down, requiring a degree of physical agility and flexibility on the part of the instructor. By comparison, it was much easier for the lecturers to get to and to perch at the end of the pods in the other two lecture theatres, even if they were stepping over bags and legs to do so.

In terms of accessibility, both the Dental Lecture Theatre and Mechanical Engineering were wheelchair accessible, but Roger Stevens LT8 was not. A comment by a member of the teaching team in case study 7 about the narrow gap between the bench and desk at the back of LT8 reveals that this configuration does not accommodate different body sizes. While the inclusion of benches was a compromise to maintain higher capacity within the rooms, as noted by the lecturer in case study 5, it does support students on the autistic spectrum who may prefer to sit by themselves.

In most classes observed, students tended to sit in pods of three or four in the larger lecture theatres. There are questions about the comfort of students sitting at the side edges of the pods, especially if there are five students within a group. Research from Korea suggests there is a "golden zone" (centre front) and "shadow zone" (back row) in the seating in traditional classrooms (Park and Choi, 2014) and it would be interesting to see if the students at the edges of the pods felt their position placed them at a disadvantage or in a "shadow zone" in relation to their learning experience. This seems to raise questions about the overall capacity in the Collaborative Lecture Theatres. While on the one hand, the space per student is greater in the Collaborative Lecture Theatres, there are opposing pressures as class sizes increase and staff are reluctant to deliver material twice. However, if students at the margins do not have as good a learning experience, this might suggest that the density of all three collaborative lecture theatres should be capped at three to four students per pod rather than five. For the lecturers in case study 4 who had experience of teaching in both the larger lecture theatres, there was a slight preference for the Dental Lecture Theatre as being more compact and manageable.

There is certainly an issue about the size of the desks and whether they are large enough to accommodate four or five laptops, given that virtually all students seemed to bring a laptop with them.

A very practical issue, which cropped up in case study 1, was the fact that the lecturer did not know the pod numbers until coming into the lecture theatre. It would seem straightforward to provide a plan for each lecture theatre with the number assigned to each pod and its seat capacity as part of the descriptive information about facilities in the room provided on the University's Room Booking system.

5. The Managerial Perspective

5.1 Introduction

The second phase of the research project was examining the managerial decision-making in "sponsoring" the two Collaborative Lecture Theatres linked to their location within particular Faculties. In particular I was seeking to identify the institutional factors that promote or hinder the adoption of different instructional strategies within the Collaborative Lecture Theatres and in delivering broader curriculum change.

Temple in his 2007 review of the literature noted that this "throws almost no light on managerial decision-making about space issues affecting students or staff: *this is a topic where further work would be useful*" (Temple, 2007, 4). However to date very little has been published on this topic and nothing within the UK.

In the US context, there is one article by Sam Van Horne and Cecilia Titiek Murniati reporting on interviews with Heads of Departments and instructors using the Active Learning Classrooms (ALCs) at the University of Iowa (Van Horne and Murniati, 2016). Key findings were that it was an individual decision by an instructor to use an ALC rather than a "collective, departmental decision to change the curriculum" (Van Horne and Murniati, 2016, 80) and although department heads had information about positive learning outcomes from the instructors using the ALCs, they felt "there was insufficient experimental data showing that the classroom itself led to better outcomes that could not be achieved in other ways" (Van Horne and Murniati, 2016, 85).

There is also a published conference paper by Robert Ellis and Kenn Fisher reporting on a national workshop for university leaders in Australia and their perspectives on learning space design (Ellis and Fisher, 2014). The information was gathered through a workshop with the participants presented with a scenario of having sufficient funding to refurbish a floor in a building to develop a learning hub for students. The themes emerging from the workshop were "education issues, management issues and evaluation issues" (Ellis and Fisher, 2014, 130). In relation to management issues, the sub-themes were learning from

mistakes, practical drivers such as capacity and functions of learning spaces and stakeholder consultation and evaluation.

5.2 Findings from the interviews

It must be noted that the University of Leeds is not only a large and complex organisation, but is also highly devolved with schools being the primary academic unit. In total I interviewed 10 individuals, five based in the Faculty of Engineering, four in the Faculty of Medicine and Health and one individual based in University central services. Roles held by the interviewees included Pro-Dean for Student Education, Director of Student Education, Blending Learning Champion, and Learning Technologist. The interviewees are identified by numbers signifying their sequence within the set of interviews undertaken in the research project.

5.2.1. Lecturer Autonomy

The value of lecturer autonomy is very strong within Leeds. This came out clearly from the interviews with student education leaders. While they were happy to support early adopters of active learning or flipped pedagogy, they were not willing to mandate or enforce wholesale curriculum change within their schools. For example Interviewee 6 said, "When you've been doing a lecture course for a few years, and it's worked okay, why should you change it? Why put in a lot of work if you're not seeing the enormous benefit?" Similarly Interviewee 10 explained "I don't think I should force anyone to do it, because then the outcome isn't going to be the right one."

That individual autonomy extended to team taught modules. Staff from the Case Studies noted that unless you were the module leader and even then, if you could not bring your colleagues with you, it was more difficult to initiate changes in pedagogy. One of the lecturers from Case Study 4 commented, "if you're doing a module where no one else has committed to it and nobody else wants to take part or learn, then you're a bit stuck." In contrast, Interviewee 15 who was a module leader for two modules taught in the Collaborative Lecture Theatres commented, "there [are] other people teaching on the

module, so they are also using the space and have been keen to be involved in that. They wouldn't have had to, they could have been asked to be somewhere else."

5.2.2. Incremental curriculum change

There was widespread acceptance that change was likely to be incremental. Interviewee 8 said," there's a huge amount of effort and planning that needs to go into developing resources and changing the format of your teaching. It's more of a gradual process rather than a complete, right I'm going to completely change my style of teaching now." Interviewee 10 acknowledged, "It's going to be impossible to be a step change of normal delivery to collaborative delivery and it's not going to be possible to get all members of staff to buy into it. So, it's going to be a gradual transition."

One factor that constrained innovation was time, or the lack of it. Interviewee 4 admitted, "in all honesty, there is some negativity because there is a feeling of yes, this might be lovely in terms of the opportunity it presents, but we're so busy doing all the [ ] teaching stuff that we don't have enough freedom of opportunity to think creatively." Similarly interviewee 10 commented: "with the younger members of staff, that perhaps are not as heavily loaded with other activities, it's much easier to embrace new things and they've got the time and flexibility." He went on to say, "if we can demonstrate by a few examples that it's really valuable, the student experience is really good, then some more [staff] will come on board, but equally we would be able to determine what the resource implications are to developing material."

A further barrier was not so much risk aversion in relation to technology *per se* but the fear of embarrassment, or loss of control, if the technology did not work properly. Interviewee 11 said that in her experience "staff are reluctant to sign up to timetabling that room, because they haven't used it, so they want to be familiar with the technology before going live." This was echoed by interviewee 15 who commented "I'm very comfortable with technology, but if I haven't tested it out, I'd almost rather get in the room and have a play with it."

5.2.3. Institutional constraints

There was recognition that the refurbishment of traditional lecture theatres into Collaborative Lecture Theatres had resulted in a loss of capacity in terms of fewer seats and this had the consequence of excluding some large first year classes. More generally the student education leaders were aware of the pressures of rising student numbers and acknowledged the importance at institutional level of getting the balance right between having more Collaborative Lecture Theatres and keeping capacity levels high. As Interviewee 10 bluntly noted it "would be shooting ourselves in the foot" if more Collaborative Lecture Theatres meant that capacity was lost.

There was a real concern about timetabling and the risks of making module changes predicated on delivery within a Collaborative Lecture Theatre when allocation was not guaranteed. Staff perceived the uncertainty as an institutional barrier to change. For example, Interviewee 10 was considering dividing the year group up into sections and then having class tutorials involving worked examples in the CLT. He thought that as staff would only need to develop two one-hour sessions over the year it would be a way to allow a gradual transition to more interactive delivery. However, he explained "it's trying to do that for next year, fingers crossed… The time when staff might have a bit of flexibility in which to develop material is over the summer break, on top of which they could do other research. And so, if we don't find out for another two months if we've been allocated that lecture theatre, then all of a sudden, it's just too close."

Interviewee 16 explained the allocation process as starting with a member of staff requesting a Collaborative Lecture Theatre from the School Timetable Officer and then the Central Team picking up that request in relation to room allocation. He remarked, "We will allocate as best we can to the three collaborative lecture theatres. It is a very manual process for the collaboratives because of course, we are trying to adhere to the policies, which say that if you used it in this slot last year, we're not going to pull the rug the next year and we will try and give you the same location the following year." The difficulty with this legacy policy is that it prioritises existing users over the future users of the Collaborative Lecture Theatres. He gave the example of a new member of staff who wanted to use the

Collaborative Lecture, but due to constraints of the timetable for their students, the timeslot they wanted was already taken, then they would not be allocated the Collaborative Lecture Theatre. For Interviewee 16 he saw this as not demonstrating that demand for the Collaborative Lecture Theatres had exceeded timetabling capacity and more about having too much competition for particular timeslots within the week.

5.2.4. Training

All interviewees were aware of the "drop in" orientation and training delivered by Organisational Development and Professional Learning (ODPL) and all appreciated its helpfulness. Although Interviewee 3 said "It's a bit daunting when you go in and see the two big screens", he felt that none of it was "massively technically challenging." While Interviewee 6 noted that "staff haven't got time for training, certainly don't bother, so they get on and do it", Interviewee 15 explained that came down to prioritisation: "people in [Faculty X] aren't great at going, 'oh, I'll go that training session' because they think 'oh, I can pick up that a bit quicker on my own'."

In terms of building on the initial training, the Faculty of Engineering have taken a number of steps. In addition to running a number of "show and tell" events under the aegis of Blended Learning, the Educational Technologist for the Faculty has worked with ODPL to create an online video demonstrating the different tools, software and pedagogies so that staff could view this at their desk, in their own time. A further step directed more to curriculum innovation is the creation of a "theme team" within one school encouraging interested staff to pilot and experiment with different activities within the CLT. The value was that these staff would provide feedback to the rest of the School on how long it took to develop the activities, how much support was required and so on.

There was some recognition that training to use the technology in the CLT was only part of the issue. Interviewee 7 commented "the staff training had been more about the technology and how to use the technology rather than the pedagogy of changing the style of teaching. And I think personally that's the bit that people are struggling with. I can press all these buttons but I'm not sure how I can make my lecture better by doing that." There

was support for this from Interviewee 9 who noted, “I’m not sure in some ways that the staff training could ever be sufficient, because I think so much depends upon in a sense the imagination of the member of staff in question and the discipline. You know the degree to which you can turn some material into something that’s better served by delivering it collaboratively in that sort of space.”

5.3 Final comment

It seems fitting to leave the final comment to interviewee 7. Despite the various barriers, institutional and otherwise, to delivering broader curriculum change through the Collaborative Lecture Theatres, there was a sense of optimism and opportunity coming through in all the interviews. Interviewee 7 seemed to sum this up by saying “it’s probably the start of an avalanche, but it’s not the avalanche itself. I think it’s got everybody thinking about ‘we could do this differently’ rather than carrying on the same. But I think for that avalanche to pick up some impetus, everything’s got to change….. I think it’s the boulder at the top.”

6. Learning Space Innovations Around the United Kingdom

6.1 Introduction

In setting the development of the Collaborative Lecture Theatres in context in Section 2 of the report, I reviewed the innovations in lecture theatre design in the UK from the University of Exeter's Turn and Learn Alumni Lecture Theatre through to the first lecture theatre using the Burwell Deakins pod seating design at the University of Loughborough to other examples of innovative lecture theatre design within the sector. In this part of the report, I also discuss broader developments at the University of Sheffield, City University in London and the University of Glasgow. I visited all three institutions and I am very grateful to Christopher Stokes at the University of Sheffield, Mike Sadler at City University and Donald Spaeth at the University of Glasgow for taking the time to show me around their campuses.

6.2 The University of Glasgow

As preparation for the £90 million investment in a new Learning and Teaching Hub due to open in 2019, the University of Glasgow has undertaken a number of pilot refurbishments to experiment with different styles of innovative learning spaces and different furniture and fittings.

In terms of innovative lecture theatres, the exemplar is the James Watt South Lecture Theatre. This uses the model of group seating arranged in a long zig-zag bench with a five-sided desk used to build the different groups. Thus it shares some similarities in design with the pod-based model but does not physically separate the seating between the groups.

Image 13: James Watt Lecture Theatre, University of Glasgow (University of Glasgow, 2018a)

In addition to this refurbished lecture theatre, the University also refurbished a number of flat-floored classrooms using a variety of styles of desks and chairs. The Hugh Fraser room is similar to the rooms in the Thackray building at Leeds, seating up to 60 students at 'petal' desks with monitors at the end of the petals with the instructor's podium placed at the centre of the room. The whiteboard is built into the podium so does not interfere with sight lines. The Gannochy room has Node or 'dalek' chairs, with three wheels and space underneath the chair for bags and belongings. The Hugh Fraser room has integrated technology and therefore is similar to Technology Enhanced Active Learning (TEAL) rooms which we see in North America and increasingly in the UK. However, rooms which were refurbished elsewhere on campus, for example in the Adam Smith building, introduced a range of mobile whiteboards rather than integrated digital technology.

Image 14: The Hugh Fraser Room, University of Glasgow (JISC 2018)

Image 15: The Gannochy Room, University of Glasgow (JISC 2018)

Image 16: Room 904 Adam Smith Building, University of Glasgow (University of Glasgow 2018b)

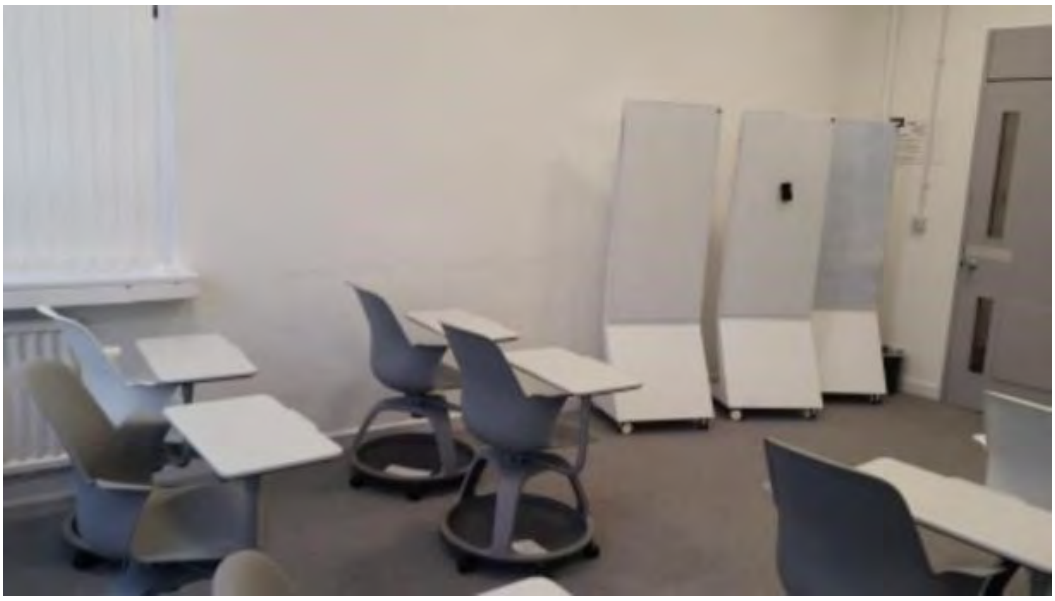

Image 17: Room 901 Adam Smith Building, University of Glasgow (University of Glasgow 2018b)

6.3 The University of Sheffield

In 2007 the Centre for Inquiry-Based Learning in the Arts and Social Sciences (CILASS) developed two technology-rich "collaboratories" located in the Information Commons building ("Collaboratories" is an interesting choice of word, created by combining

collaboration with laboratories, and thereby expressing the hybrid nature of the rooms). One of the collaboratories had figure of eight shaped desks while the other had standard rectangular but moveable desks. Both were equipped with 20 laptops together with an Access Grid Node (video conferencing facility enabling people to work collaboratively with students and experts from other institutions), Huddleboards and CopyCams (lightweight whiteboards that enable images to be captured and accessed via the web), and Sympodiums (interactive displays which allow users to make digital annotations). Although CILASS closed in 2010 the collaboratories still exist in the Information Commons building and are regularly used for staff training.

Image 18: CILASS rooms, University of Sheffield (University of Sheffield 2018a)

The Diamond

The Diamond which was opened in 2015 is home to the Faculty of Engineering. It cost £81 million and has specialist teaching facilities, a range of practical laboratories, computer labs, a 24/7 library, and 967 group and self-study spaces. In addition, on the top floor there is a Creative Media suite of rooms, with a TV studio, media booths for editing and a podcast booth. All these facilities are open to staff and students and more than 30 modules across the University are now using video for summative assessments.

The exterior of the building is quite striking with the outside panels harking to the heritage of the steel industry's association with Sheffield.

Image 19: The exterior of the Diamond, University of Sheffield (Twelve Architects, 2018)

In terms of teaching facilities, the lecture theatres and labs are designed to hold multiples of 80. The largest lecture theatre holds 400 students, with smaller lecture theatres holding 240 and 180 students. The large lecture theatres are in the basement of building so even though the Diamond is situated on the side of hill, they had to dig down to get sufficient depth for the lecture theatres. The large lecture theatre holding 400 students is quite steeply raked but the distance between the podium and the back row is only 9 metres so it felt much more intimate than usual in a lecture theatre with that capacity. It also had excellent acoustics and clear lines of vision from all seats. The use of colour in terms of the seating was deliberate, allowing for seats to be re-upholstered without worrying about exact matches. There is a lot of natural light in the room from the high level windows so it feels like a bright space.

The medium-sized lecture theatre was less steeply raked and was set out as a semi-circle with a single desk/bench for all rows but individual seats.

The first image below is of the large 400 seat lecture theatre and the second of the medium sized lecture theatre holding 240 students.

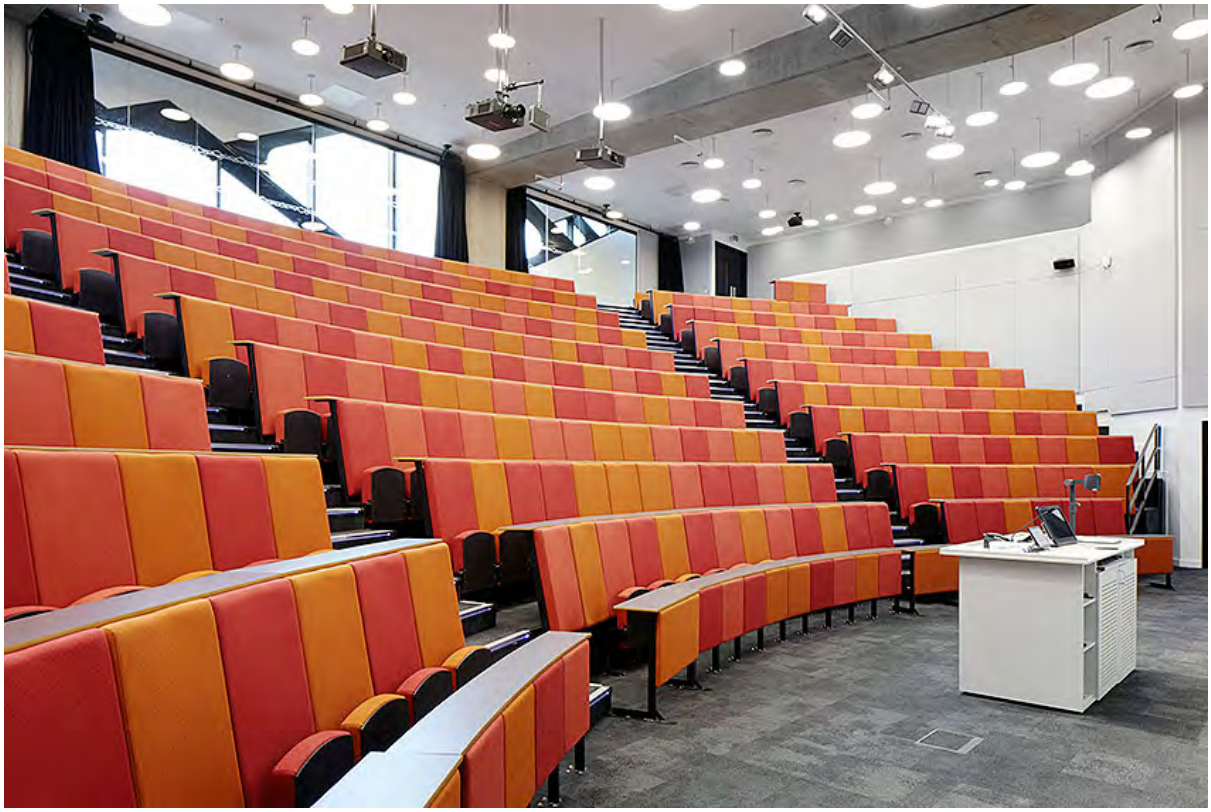

Image 20: Lecture Theatre 1, The Diamond, University of Sheffield (University of Sheffield, 2018b)

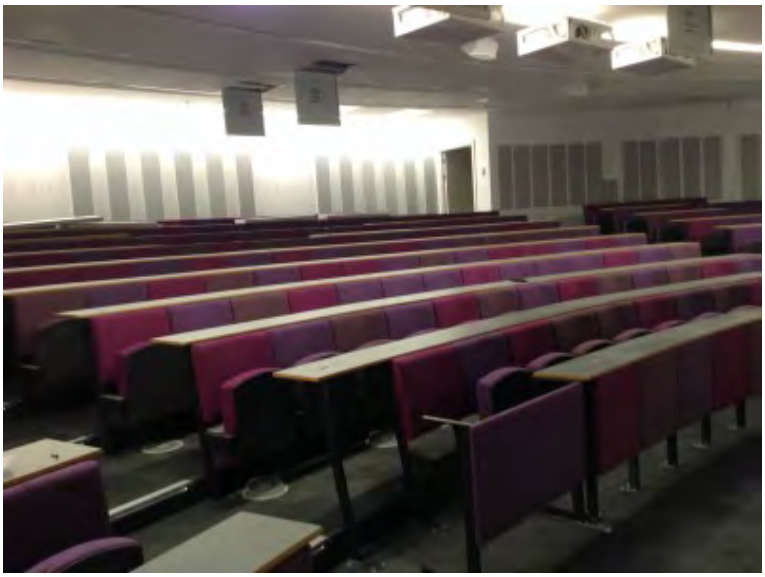

Image 21: Lecture Theatre 3, the Diamond, University of Sheffield (University of Sheffield, 2018b

Both lecture theatres are traditional in terms of their configuration so although the building in many ways is state of the art, the classrooms are not particularly innovative. Further information about the Diamond is available from this fly-through: https://www.sheffield.ac.uk/diamond/spaces. A research project examining learning in the informal spaces within the Diamond has been published in Higher Education with a key finding being that students actively create the learning atmosphere within the spaces (Cox, 2018).

6.4 City University, London

City University had a very active Learning Spaces group between 2014 and 2016 but when the leader of the group moved to Hong Kong University, the activity seemed to wane. It has recently been reinvigorated and is working on the Designing Active Learning Initiative (DALI). The Learning Spaces Group was behind the introduction of a number of experimental spaces, both tiered and flat-floored. In relation to the flat-floored spaces there are mixture of rooms with plectrum tables, Node or dalek chairs with integral tables, and circular tables with desktop computers. In relation to lecture theatres, they have both a turn and learn configuration (Image 22) and what they call a Cluster Lecture Theatre (Image 23).

Image 22: Room 308, Tait Building, City University (City University, 2018c)

Room 308 is an example of the Turn and Learn seating. Unlike Exeter where the seats are aircraft style with pull out tablets, here there are fixed benches.

Image 23: ELGO1, Drysdale Building, City University (City University, 2018d)

This is the example of the cluster lecture theatre. The view was expressed that the Cluster style lecture theatre was inefficient with respect to space usage compared to a conventional lecture theatre or even a turn and learn configuration. The feeling was that this would remain as their only example of this type of lecture theatre.

The newest lecture theatre which opened in 2017 is a 240 seater horseshoe shaped space (Images 24 and 25). As in the Diamond, there is natural light from high windows. The raking is shallow, with only 5 levels of seats. There are four entrances around the space and breakout space behind the walls so effectively the classroom has been built inside a box. In terms of integrated technology, there are three whiteboards strategically positioned around the room to ensure good sightlines from all seats.

Further details of the development of B200 together with 360^{o} panoramic photograph can be found at this website: https://blogs.city.ac.uk/learningatcity/2016/12/06/b200-

university-building/#.XBIcS-S7KUk. Both photographs below are taken from the blogpost by Vasanth and Pates in 2016.

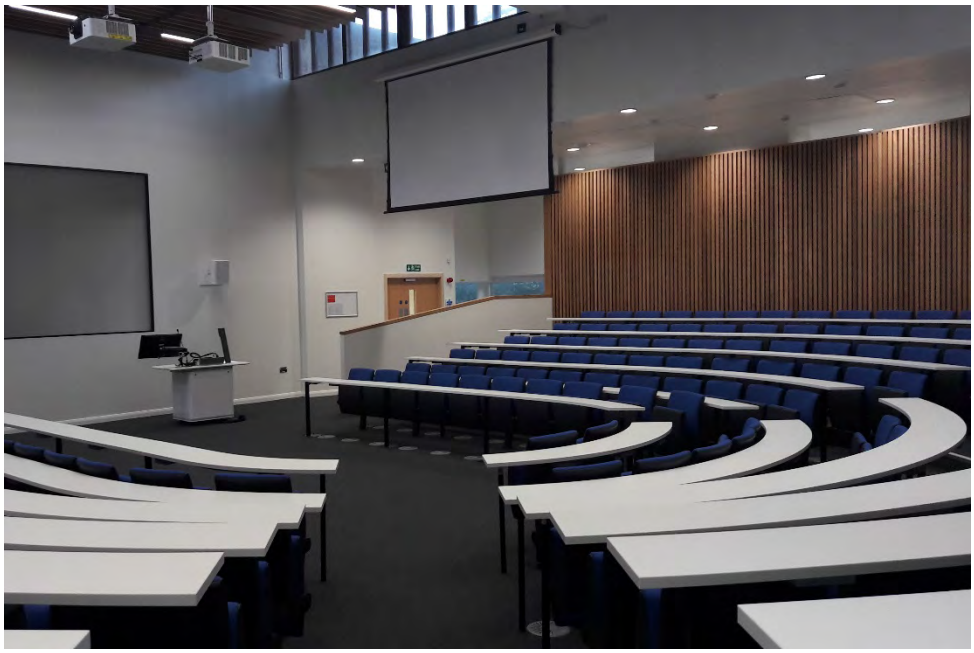

Image 24: B200, University Building, City University

Image 25: B200, University Building, City University, from an alternative angle

6.5 Conclusions

What is clear (when this work was undertaken) is that the Leeds Collaborative Lecture Theatres remain unique in the United Kingdom in their integration of digital technology with

pod or cluster style seating. In this respect they are closer to the Advanced Concept Teaching Space at the University of Queensland. On a recent visit the basic layout of the ACTS remained, the only change being that there are not separate keypads but tablet style computers on the desk.

Image 26: ACTS, University of Queensland, December 2018 (Norma Martin Clement, 06 December 2018)

More generally, it seems that in terms of innovation in relation to Learning Spaces, we could learn from the experience and exemplars at the University of Queensland and elsewhere in Australia and it seems more appropriate to benchmark ourselves globally, rather than simply against other universities within the United Kingdom.

7. Conclusions and Recommendations

7.1 Pedagogy

7.1.1. Curriculum Change

We need to be realistic about the extent to which there will be a shift to more interactive and collaborative learning across the curriculum as a whole arising from the investment in Collaborative Lecture Theatres. The evidence from the interviews with the student education leaders is that curriculum change is a long-term and gradual incremental process. It has to be recognised that not every lecture can be transformed, or indeed should be transformed, but that there is scope, with imagination, to make more lectures more interactive and collaborative without having to transform all lectures to a flipped classroom pedagogy.

7.1.2. Balance between didactic delivery and interactive and collaborative activities

In terms of the percentage of time students will spend working collaboratively within the Collaborative Lecture Theatres, we need to recognise that there will be a range and the outliers presently are the classes where staff talk for less than 50% of the available time. Perhaps we could have an assumption to help staff planning to design or redesign their classes that they should aim for no more than 70% didactic delivery and the remaining 30% of the time used for interactive and collaborative activities.

We also need to recognise that within a course, it might be possible to structure the sequence of classes so that some classes are more purely didactic and others involve more collaborative activity (as in Case Study 5). In the latter case the expectation might be that the time might be divided more evenly between the two modes.

7.1.3. The role of wingers

The work of wingers needs to be properly acknowledged and accounted for as part of their workload. This is part of recognising the full cost of delivering more active and collaborative lectures within the Collaborative Lecture Theatres and while this might be more resource-

intensive than traditional lecture courses this should be balanced by improvements in the quality of the student experience and outcomes. If there is a need for efficiency savings to balance the extra resources for wingers, then perhaps the overall balance between lectures and seminars should be reviewed. Case Study 1, for example, abolished seminars but kept workshops as part of the shift to collaborative lectures.

Perhaps there should be a rule of thumb that indicates there should be a minimum of one winger per 80 or 100 students, thereby recognising the need for additional support in larger classes. This is the approach being taken by the University of Glasgow in relation to their active learning spaces (Spaeth and Chan, 2017, 22).

7.1.4. The challenge of scaling up.

The Case Studies and the interviews with the student education leaders demonstrate that there are pockets of innovation across the University. The question therefore is how to upscale the pedagogic changes beyond a "show and tell" approach, taking into account that there are only three Collaborative Lecture Theatres and 52 standard lecture theatres within the University (Dixon, 2019). The difficulty with trying to mandate change from a top-down perspective is that it runs up against the value of lecturer autonomy. However, there is scope to look again at the training and move beyond familiarisation with the technology to look at the underlying questions about pedagogy and learning outcomes.

7.2 Space

7.2.1. Seating

In relation to the different seating arrangements across the three Collaborative Lecture Theatres, there is a clear finding from the observations that the sofa-style pods in the Dental Lecture Theatre and Mechanical Engineering Lecture Theatre B are superior to the individual chairs in Roger Stevens LT8. The sofa-style pods enable the instructors to join the conversation with the students at their level in a relatively unobtrusive manner rather than looming over them.

Ideally the pods should seat no more than four students, although this will run up against the need to maximise capacity. Limiting the number per pod to four would maximise sightlines and give sufficient desk space for students to use their own devices.

However, installing sofa style pods and limiting the pod capacity to four students may result in a substantial reduction in capacity in relation to any future lecture theatre refurbishments. Perhaps one mitigation might be to use individual chairs with wheels to allow students to more easily switch orientation between the front of the room and working in their group or alternatively to use the zigzag bench design as at the University of Glasgow.

The benches at the back of the lecture theatre should be maintained not only in relation to maintaining maximum capacity within the room but also because this gives a safe space for students with autism who may be uncomfortable if required to sit in a group. However, there should be some consideration given to the distance between the seat and the desk to accommodate different body shapes.

7.2.2. Room configuration

Ideally the room configuration should be one central vertical aisle if the student seating area is divided into two sections, or two vertical aisles (slightly off centre) if there are three sections. This maximises the ease of staff mobility across the terraces as well as up and down within the room. The single vertical aisle at the left hand side of the room as in Roger Stevens 8 should be avoided where possible, as staff either have to backtrack or exit the lecture theatre and come back in via the side doors to move across and up a row.

7.2.3. Storage

There also needs to be sufficient space across the terraces to allow staff to manoeuvre avoiding trip hazards such as student coats and rucksacks etc. The need for better storage for coats and bags to be designed into the building specification accords with a finding from the original CLT built at the University of Loughborough (Pepper, 2014, 76).

7.3 Technology

7.3.1. Integrated or BYOD?

Some of the student education leaders and indeed some staff from the Case Studies questioned the need for the sophisticated integrated technology in the Collaborative Lecture Theatres. With the growth of Bring Your Own Device (BYOD), there is a question whether there is still a need for the integrated computer in relation to equity of access. However, where classes require students to use a laptop such as Case Studies 3 and 4, then the principle of equity of access would seem to mandate that those classes are scheduled in Collaborative Lecture Theatres with integrated laptops. This also remains the unique feature of the Leeds rooms.

7.3.2. Digital whiteboards?

There were mixed views as to the utility of the current smart whiteboards. If there are newer touchscreen versions that are more intuitive to use then they should continue to be a feature of new Collaborative Lecture Theatres. It seems unlikely that staff showing student work on the screens will become more common and again there is a question about the value of this feature. Staff could, of course, pause lecture capture which might assuage some student concerns about having a permanent record of their work.

7.3.3. Other technologies

All staff from the Case Studies praised the dual projector screens and this feature should be retained in future refurbishments. Likewise the integrated microphone for students should be retained and if not, then alternatives such as CatchBox should be supplied.

One of the surprises from the research was the extent to which staff felt tied to the podium and having hand-held remote controls would mitigate this. There would always be a risk of staff wandering off with the remote control clickers, so there would be a challenge to ensure that they stayed in the classroom. An alternative option for staff who used iPads would be to allow wireless control via their devices.

7.4 Institutional considerations

7.4.1. Timetabling

In relation to timetabling, it would be better if it was possible to give earlier confirmation about the availability of the Collaborative Lecture Theatres to enable staff to plan changes to delivery with the confidence that they will be allocated the Collaborative Lecture Theatres.

If possible this should be accompanied by more flexibility with respect to the standard time-slot, recognising the possibility of having 90 or 120 minutes in the Collaborative Lecture Theatres.

7.4.2. Recognition and Incentives to Innovate

Do we need institutional recognition and incentives to encourage more innovation? A different approach has been taken by other institutions, primarily in North America. There initiatives such as the Mosaic Fellows at the University of Indiana and the TILE instructors at the University of Iowa have accorded institutional recognition to staff using active learning spaces with the expectation that they will become ambassadors and mentors for new users. Perhaps this idea of building a community through fellowships could be taken forward by ODPL and LITE, building on the existing Special Interest Group on Learning Spaces.

If the Changing Landscapes website maintained by ODPL is updated, it might be worth copying an idea from McGill University in Canada. There all courses using their suite of Active Learning classrooms are listed on a room by room basis together with the number of students experiencing active learning in those spaces (McGill University, 2018). Of course, this would require regular updating and it is noted that the McGill list does not extend beyond Winter 2016.

In addition, at School level there needs to be recognition both in terms of the time commitment involved in changing pedagogy, which should be acknowledged through the workload model, as well as pedagogical innovation being linked to staff review and promotion criteria.

7.4.3. Larger Collaborative Lecture Theatres?

Do we need larger Collaborative Lecture Theatres? The research does not provide definitive answers to whether there is an upper size limit or even an ideal size of Collaborative Lecture Theatres. Certainly the preference from staff who had used both larger lecture theatres was for the layout in the Dental Lecture Theatre compared to Mech Eng B where the steepness of the raking meant that lecturers sometimes felt that the students at the back were over the brow of a hill. However the student education leaders, especially in Engineering, together with a number of staff from the Case Studies, expressed disappointment that many first year classes were simply too big and therefore could not be timetabled in the Collaborative Lecture Theatres. So, in my view, there would be value in experimenting with a larger Collaborative Lecture Theatre, with capacity around 300 students, which could accommodate some larger first year classes.

7.5 Conclusion

Should the University of Leeds continue to invest in Collaborative Lecture Theatres?

My view, based on the research I have carried out, is unequivocally yes, there is value in expanding the number of re-designed Collaborative Lecture Theatres. Unlike other campuses in the United Kingdom, where the Pod or Cluster Collaborative Lecture Theatre remains as a singular example, Leeds has already invested in three. However, this is a tiny fraction of the total number of tiered lecture spaces within the portfolio. The key demand from staff, as noted above, is for a further large Collaborative Lecture Theatre.

Thus, Collaborative Lecture Theatres should be acknowledged as a key element of the "mixed economy" or spectrum of learning spaces of many different sizes and types across the campus. This is part of a global trend evident in North America, Australia and Asia, towards creating more student-centric learning spaces. The rise of Mega Lecture Theatres as at the Oregon State University (capacity 630) and Klarman Hall at Harvard Business School (capacity 1000) is not a trend which Leeds should follow because it is impossible to see either space as student-centric. Equally, it would be premature to follow the University

of Northampton's lead and shut down all large lecture theatres. And of course, innovation in learning spaces should not just be about lecture spaces but also include more typical TEAL (Technology Enhanced Active Learning) classrooms, flat-floored spaces where the students do not sit in linear rows. Both types of innovative learning spaces and other experimental spaces such as the Abercrombie Sandpit at the University of Sydney (Wilson, 2018) have a role to play in encouraging more staff to innovate and experiment with active learning pedagogies and thereby improve the student experience by fostering students' active engagement in their own learning.

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Appendices

Appendix A1 | Protocol for Classroom Observation and Codes

Table A1: Codes for Classroom Observation

Codes for Classroom Observation

Code: Activity	Description	Numerical code
Lecture	The teacher may ask a few questions to engage students, but the activity is centred on the instructor delivering information. The instructor delivers new course content in a lecture.	1(a)
Lecture	The instructor re-caps material covered in a previous lecture.	1(b)
Lecture	The instructor re-caps material which has been provided to the students in advance.	1(c)
Class Announcements/ Housekeeping	The instructor delivers information about elements of the course that students need to know, but not about course content. This code applies to announcements about due dates, timetable changes and other housekeeping issues.	2
Digital resources	Students watch a digital resource for example YouTube or Box of Broadcast films or DVDs.	3
Collaborative activity	Students work together in small groups to complete work in class.	4
On-line quizzes or tests	Students take on-line quizzes or tests. This includes any feedback from the quiz or test.	5
Individual work	Students work on their own.	6
Student presentation	Students verbally present work to class either from small groups or individual work.	7
Questions	Students ask the instructor questions in front of the full class.	8(a)
Questions	The instructor asks questions to the full class.	8(b)
Answers	The instructor answers student questions in front of the full class.	9(a)
Answers	The instructor picks a pod to answer.	9(b)
Answers	The instructor picks an individual student to answer.	9(c)
Interaction with groups	The instructor visits the pods and interacts with them.	10
Sharing of student work	Student work is shared with the full class through the SMART notebook software	11
Miscellaneous	Miscellaneous activity which does not fit into any of the codes in the list with a brief description of the activity.	12

Table A2: Protocol for Classroom Observation

Classroom Observation Protocol

Date: Instructor:

Time: Module code:

Select activity from codes, note time and add any additional comments

Time	Activity code	Position code	Any other comments

Appendix B | Interview questions for Case-Study Staff

Table B1: Interview Questions for Case-Study Staff

Protocol for Semi-Structured interview Interview with Staff Member

Name:

Date:

General introduction

- What module did you teach in the Collaborative Lecture Theatre (CLT)?
- How many students are registered on the module?
- Which CLT did you use?
- What are the learning objectives of the module?
- Why did you decide to teach this module in the CLT?
- Was it the first time you have delivered this particular module?
    - If not, has it previously been delivered in standard LTs?
    - If so, did you change anything since it was delivered in a standard LT?
    - What did you change and why?

Planning and preparation

- Prior to teaching in Collaborative Lecture Theatres, did you attend training in a CLT on how to use the learning environment?
    - What was your initial response to the CLT?
    - How helpful did you find the training?
    - Did it lead you to reconsider what you were planning in any way?
- Prior to starting teaching, did you plan out interactive activities on a lecture by lecture basis?
    - Could you describe the range of activities you planned to incorporate into the lectures?
    - How did you see the planned activities relating to the learning objectives of the module?
- Prior to starting teaching, did you consider where you were likely to be positioned during the class?
    - Typically in a standard LT where would you be positioned?

- Do you tend to be static, or do you move around ("walk and talk")?
- If the latter, when do you move around?

Delivery

- Initial lecture
  - How did you support the students in familiarising themselves with the technology?
  - What types of interactive activity did you build into the first lecture?
  - Did you describe or explain your pedagogical approach?
  - Did you prepare the students for active learning? If so, how?

- In relation to the activities you planned to incorporate, how many did you use?
  - How frequently did you use interactive activities within a lecture?
  - To what extent did they map onto the following categories:
    - Flipped classroom where students prepared work in advance
    - Active learning where students worked through problems, examples
    - Student-instructor interaction
    - Student-student collaboration
    - Group collaboration?

  - How successful have they been?

  - Have you experienced any challenges or difficulties?

  - How do you manage the transitions between instructor delivery and interactive activity?

  - And between whole class activities and individual activities?

  - How did you assess student engagement and progress?

- Do you think you made full use of the technologies available within the CLT?
  - If there is something that you did not use, why not?

- Can you remember how you positioned yourself within the CLT compared to a standard LT?
  - Did you circulate beyond the front of stage?
  - When did you move?
  - Why did you move?

Use of a winger

- Did you use a "winger", an additional staff member?
- When did you decide to use a winger?

- Why did you decide to use a winger?
- Who are they in terms of the module teaching team?
- How did you use the winger in the classes?
- Did you brief and de-brief after each class?
- Generally where was the winger positioned? Were they ever at the front podium?
- In your view, what added value did the winger bring to the class?
- Would it have been possible to deliver the class as effectively without a winger?

Reflecting on the experience

- Can you recall a time when activity went especially well? Can you tell me more about that time and your reflections (at the time and now) on why that was the case.
- Can you recall a time when the activity did not go well? Can you tell me more about that time and your reflections (at the time and now) on why that was the case.
- What, if anything, would you do differently next time?
- Has your approach to using the technologies in the CLT evolved over the academic year? If so, how?
- To what extent do you think the experiences within the Collaborative Lecture Theatres helped students meet the learning objectives of the module?
- Compared to the start of the year, do you think you move around more frequently? Are you more conscious of where you are positioned?

Further reflections

- What do you consider to be the advantages of teaching in a CLT?
- Were there any disadvantages or limitations to teaching in a (or this particular) CLT? If so, what were they?

- Have your experiences changed how you see yourself as a teacher in higher education? How would you describe your role now?

- Has your experience changed how you use standard LTs in any way?

- Has it changed how you see students as learners?

- Has the experience influenced or contributed to any curricular changes you might be planning?

- Are there any changes you would like to see in the Collaborative Lecture Theatres or in learning spaces around the campus more generally?

- Is there anything about your experience in the Collaborative Lecture Theatres that you want to tell me about that I have not asked about?

Appendix C | Interview questions for Student Education Leaders Instructors

Table C1: Interview Questions for Student Education Leaders

Protocol for interviews with Pro-Deans for Student Education and Directors of Student Education

Name:

Date:

History

- How did you find out about the proposal to re-design Mechanical Engineering Lecture Theatre B/Dental Lecture Theatre?

- Did you attend the presentation by Neil Morris, Liz Britton and the architect in Roger Stevens Lecture Theatre?
    - Were any of your colleagues present?

- How did you make the staff in your Faculty/School aware of the proposed development?

- What was the initial reaction of staff?

- To what extent do you regard yourself as a "champion" of the Collaborative Lecture Theatres?
    - If so, why did you support the redesign?
    - What were you hoping to achieve?
    - Would you consider this to be a School or Faculty strategy?

- How would you characterise the views of staff in your School/Faculty at the point of the construction of the re-designed Collaborative Lecture Theatres?

Implementation

- Who determines who uses the Collaborative Lecture Theatres? How is that decision made?

- How would you characterise the views of staff in your School/Faculty to the adoption of the Collaborative Lecture Theatres
    - Has this evolved at all over the last year?

- To what extent are you aware of how staff in your School/Faculty actually use the CLT?
    - Do lecturers have full autonomy over how they will deliver their teaching?
    - To what extent have you promoted greater use of more interactive activities within the Collaborative Lecture Theatres?
    - If so, how have you done so?

- To what extent, do you believe that staff training has been sufficient to make full use of the technologies and space?
    - Have you supplemented the University-led training by more bespoke School or Faculty training or support?

- Have you attempted to promote staff sharing of experiences in any way?

- To what extent do you believe that there is evidence showing improved student outcomes and a positive student experience in the Collaborative Lecture Theatres?

- Do you consider there are any cultural factors or factors related to engineering or dentistry as disciplines which are influencing staff views and behaviour?

- Have you encountered any practical administrative obstacles or barriers?

- To what extent do you believe that the Collaborative Lecture Theatres can drive curriculum change and innovation?
    - Do you know whether any individual staff have changed the curriculum of their module or their pedagogical approach in response to teaching in a CLT?

<u>Future adoption</u>

- Would you support more widespread adoption of Collaborative Lecture Theatres?
    - If so, why?
    - If not, why not?

- What do you consider the role of Pro-Deans and Directors of Student Education to be in relation to an educational innovation such as this?

About the author and acknowledgements

About the author

Norma is a Professor of Law in the School of Law at the University of Leeds. From 2009 to 2017 she was Pro-Dean Student Education for the Faculty of Education, Social Sciences and Law and is currently Pro-Dean International for the Faculty. Travelling around the world and visiting different higher education institutions prompted an interest in learning spaces and when the LITE project to evaluate the Collaborative Lecture Theatres came up, she jumped at the opportunity to carry out some empirical research. With Bronwen Swinnerton in the School of Education, Norma runs the Leeds Special Interest Group on Learning Spaces under the auspices of LITE.

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