Journal of Learning Spaces
Volume 10, Number 3. 2021
(cc) BY
ISSN 21586195

Collaborative lecture theatres: Does redesign of teaching space impact on pedagogy?

Bronwen Swinnerton
University of Leeds

This paper focuses on a UK higher education institution (HEI) which redesigned three lecture theatres as 'Collaborative Lecture Theatres' (CLTs). Using Radcliffe's framework for designing and evaluating learning spaces and using his three related components; pedagogy, space and technology it will explore how the redesigned rooms (*space*) and the introduction of *technology* has influenced *pedagogy*. The study utilises surveys and interviews with staff in different contexts within this institution, using the redesigned rooms. The data show that changing the design of the room and the technology within it does not necessarily lead to a change in pedagogy for all.

Introduction

The 'traditional' tiered lecture theatre denoting teacher-centred didactic instruction in which students are passive learners in fixed rows of seating facing the instructor as the 'sage on the stage' is still the main approach to teaching in higher education. Turner (2015) describes it as a '*teacher-centred, transmission approach'* [p. 164]. This approach depicts the role of the teacher as one of transmitting information from those who have knowledge to those who wish to acquire knowledge, and suggests passivity on the part of students. Freire describes this approach as the banking concept of education. This depicts the teacher as the knowledgeable narrator providing information to the student as the listener being filled by knowledge from the teacher. (Freire, 1970). Such approaches are becoming less common as part of the shift towards student-centred pedagogies and more active learning approaches, and a recognition of the prior knowledge and experience that learners bring to the classroom However, there is a tension between a desire for more collaborative active teaching approaches and the existence of spaces originally designed for a more transmissive approach (Ellis & Goodyear, 2016). As a result, considerable investment is being made in the (re)designing of learning spaces, in particular by higher education institutions (HEIs) (Elkington in HEAdvance, 2019; Pantidi, 2013). This allows for more student-centred, active learning approaches and a move away from the relative inflexibility of traditional designs (Ellis & Goodyear, 2016; Fisher & Newton, 2014; HEAdvance, 2019, Jones, 2007; Twigg, 1999).

Bronwen Swinnerton is Senior Research Fellow, University of Leeds, United Kingdom.

This paper focuses on a UK HEI which redesigned three lecture theatres as 'Collaborative Lecture Theatres' (CLTs) in the summer of 2016. The spaces were reconfigured in two different ways, in their physical design and in the provision of digital technology within them. Staff from across the university used these redesigned rooms extensively in the 2016/17 academic year. Towards the end of the 2016/17 academic year an evaluation of these newly designed lecture theatres was carried out using surveys and interviews with staff.

Changes in teaching approach and mismatch between space and pedagogy

Collaborative learning, argued to play a vital role in how students link new knowledge to previous knowledge in order to create deeper learning (Trigwell, Prosser & Waterhouse, 1999) has largely replaced the behaviourist view that learners are blank slates to be filled with information by a teacher (Jones, 2007). Whilst opinion is divided, research evidence overwhelmingly demonstrates the value of active learning teaching sessions to improve learning outcomes (Baepler, Walker & Driessen, 2014; Thai, De Wever & Valcke, 2017; Freeman, Eddy, McDonough, Smith, Okoroafor, Jordt, & Wenderoth, 2014). The SCALE-UP (Student-centred activities for large enrolment in undergraduate programmes) at North Carolina State University, and the TEAL (Technology-Enhanced Active Learning) project at Massachusetts Institute of Technology both suggest positive impacts on learning (Nordquist, 2016). Increasingly, traditional lecture theatres and didactic lecturing approaches are thought to have limitations. They include inflexibility (Twigg, 1999), a transmissive approach, and restriction on the use of digital technology (Jones, 2007).

Digital technology

Increasingly pedagogies which encourage student-centred teaching approaches utilise and are supported by digital technology (AMA, 2006), which is a key factor in the redevelopment of learning spaces (Leonard, Fitzgerald, Bacon & Munnerley, 2017). The last two decades have seen a growing trend in developing classroom space and infrastructure with the addition of educational technologies such as laptops, computers, and response systems (Chiang et al., 2016), whilst students increasingly bring their own devices (Sharples, Adams, Ferguson, Gaved, McAndrew, Rienties, Weller, & Whitelock, 2014). Tamim, Bernard, Borokhovski, Abrami & Schmid's (2011) analysis of 25 meta-studies, provides evidence that using technology in the classroom has a small to moderate positive impact on learners' performance compared to classrooms where no technology is used. Other studies have also found positive effects for technology integration, for example, Dziuban, Graham, Moskal, Norberg, & Sicilia's (2018) study of blended learning.

Impact of space on pedagogy

Radcliffe's influential framework for designing and evaluating learning spaces has three related components; pedagogy, space and technology (Radcliffe, 2008). Dobbin, Diaz & Brown (2014) refer to these components as the three legs of the stool required to bring about effective teaching and learning. Radcliffe explains that each of the three components influences each other reciprocally; the space encourages certain pedagogies, and particular pedagogies suggest particular arrangements of space; technology can enhance the pedagogy and the pedagogy will use particular technologies; technology can impact how a space is used and the space can determine what technology can be included. (Radcliffe, 2008). Several reports and papers have encouraged the redesign of spaces to encourage active and student–centred learning and have made the case for space being a transformative force. A Jisc report on learning spaces suggested that '*Spaces are themselves agents of change. Changed spaces will change practice*.' (2006, p.30) Space, and changes to the way learning spaces are designed, can be seen as '*authorizing and enabling certain behaviours over others*' (Jamieson, 2003, p. 122). Oblinger (2005) stresses that particular layouts suggest particular types of teaching. For example, a traditional lecture theatre suggests '*pouring content into students' heads'* whereas a more active collaborative approach suggests a different kind of space (p. 14). Several studies have found that the design of the room encourages different teaching approaches (Brooks, 2011; 2012). Spaces can also restrict the activities that take place within them. Jamieson (2003) further notes that in traditional tiered lecture theatres students are expected to stay seated and lecturers are unlikely to teach in highly interactive ways '*and, importantly, students would not expect such an approach in that environment*.' (p. 122). Several empirical studies have explored the impact of space on pedagogy. Beery, Shell, Gillespie and Werdman's (2013) study of nursing education found no significant increase in the use of active learning pedagogies in collaborative classrooms, and suggested this was because teachers teach how they prefer whatever the space. Other studies have found that the environment did impact teaching practice. Brooks (2012) found that traditional classrooms encouraged a lecture approach but was not effective for active learning approaches. Similarly, he found that the active learning classroom was not effective for lectures. Haines & Maurice-Takerei (2019) found that when placed in a classroom designed for group work and equipped with technology, they reconsidered their 'lecture' approach. They characterised this response as being on a continuum from '*recognizing problems with content delivery in new space*' to '*structuring and supporting group activity*' (p.18) Whiteside, Brooks & Walker (2010), found when observing the same teacher in a traditional lecture theatre and an active learning space, despite trying to behave in the same way, he behaved differently in each room; he lectured more in the traditional room, remained at the front for longer, whilst in the collaborative space he moved around more and discussed with students more.

Gap in literature

As a result of the developments in the design of learning spaces, there are increased calls for research around the relationship of physical space design to pedagogy (McNeil & Borg, 2017). McDavid, Parker, Burgess, Robertshaw & Doan (2018) who explored staff self-efficacy across spaces and its relationship to learning outcomes also note that '*the mechanisms that link the learning spaces (the context) and pedagogy (behavior) remain relatively unexplored'* (p.30). Other studies which have focused on the impact on pedagogy have tended to compare different types of rooms (Brooks, 2012; Whiteside et al., 2010). However, this study is novel in that it compares the same type of rooms being used by staff from different disciplines, and different conditions of use. It contributes to this area of research by exploring the extent to which redesigning the spaces has led to changes in pedagogic approach, and how this has manifested in different circumstances.

Redesign of lecture theatres

Three tiered lecture theatres at this HEI were reconfigured to allow for more collaborative teaching, and in reaction to staff calls for more appropriate and flexible learning spaces

Figure 1. ***CLT1***

(Morris, 2016). The traditional lecture approach has dominated in this institution as it has across higher education generally. However, collaborative active learning approaches were being used in this institution before these rooms were redesigned. The lecture theatres were refurbished in the summer of 2016, in preparation for the 2016/17 academic year. The University chose to retain the tiered nature of the spaces. Seating was reconfigured to allow for groups of five students to sit in a 'pod' around a desk, whilst still allowing all learners to have a good 'line of sight' to the front of the room (Morris, 2016). This configuration also allowed teachers to be able to move between the pods. Each of the desks has an internet-enabled laptop, microphone, speaker, spotlight, HDMI input and USB charging and power. The front of the room has a lectern-based PC, a control panel, lecture capture camera and controls, a lapel microphone, a large and adjustable whiteboard, dual projectors and a presentation wall (Morris, 2016). These rooms were not intended to *impose* a specific pedagogical approach; they were designed to enable a student-centred and collaborative approach and although the emphasis was on flexibility labelling them collaborative lecture theatres further encouraged this type of approach.

The three rooms are in different areas of the institution and are accessible under different conditions. The smaller lecture theatre (CLT1, see Fig 1) is available to staff from across the university as it is located in central teaching space. The two larger spaces are located in departments, both of which are in the STEM discipline (CLT2 and CLT3). CLT1 is available for anyone to book, and preference was given to those who intended to exploit the collaborative affordances. CLT2 was mostly available to the STEM faculty in which it was located but was also used by those asking to use it. CLT3, however, was timetabled for the same sessions as it had been in the previous year, and access to the room was not voluntary.

Research questions

According to Radcliffe, the design of a space should encourage certain pedagogies, in this case student-centred and collaborative, This study will test Radcliffe's theory by exploring the extent to which the space has influenced pedagogy in these redesigned spaces. In doing so, more will be learned about the impact of redesigning spaces with the aim of encouraging more collaborative, active pedagogies.

The overarching research question is **What impact has the redesign of these rooms had on pedagogy?** This is explored using the following sub questions:

- To what extent and in what ways have staff used the CLTs, and does this vary according to conditions of using the space (voluntariness vs timetabled)?
- What are staff perceptions of the CLTs?

Methodology

Survey

A survey was developed and refined with the help of colleagues (see acknowledgements), consisting of 25 questions (and sub-questions) relating to: demographics, prior experience with technology, use of the CLTs, teaching in the CLTs, time spent on activities in the CLTs, use of the technology, impact on students and satisfaction with the redesigned lecture theatres. This paper focuses on time spent on activities, use of each piece of technology, perception of redesign on teaching and learning, and staff satisfaction. Consent was obtained from all respondents, and ethical approval for the research was obtained from the institutional Research Ethics Committee LTEDUC-089. A link to the survey was sent to all staff users of the redesigned lecture theatres through electronic mail between 7th May 2017 and 19th June 2017 allowing six weeks to complete the survey. The timing of the survey was at the end of the first academic

Table 1. Demographics of sample (n = 38)						
Gender	**Male**			**Female**		
	22 (57.9%)			16 (42.1%)		
Age (years)	**29 or less**		**30-39**	**40-49**		**50+**
	0 (0%)		8 (21.1%)	15 (39.5%)		15 (39.5%)
Role	**Professor**	**Senior Lecturer / Assoc. Prof**	**Lecturer**	**Senior / Teaching Fellow**	**Research Fellow**	**Other**
	2 (5.3%)	14 (36.8%)	8 (21.1%)	9 (23.7%)	1 (2.6%)	4 (10.4%)
Discipline	**STEM**		**Arts / Humanities**	**Business**		**Medicine / Health**
	16 (42.1%)		8 (21.1%)	4 (10.5%)		10 (26.3%)

year of the redesigned lecture theatres being available for use.

Survey responses were organised and grouped as appropriate and n numbers and percentages (%) were calculated from the data using Microsoft Excel and SPSS. The attitude questions used a 5-point Likert scale: Strongly agree, Agree, Neutral, Disagree, and Strongly disagree, with the addition of a 'Don't know' option to try to ensure the neutral option is actually neutral. 'Don't know' responses were recoded as missing data.

Sample

A total of 38 academic staff participated in the survey, which reflects 21% of the total population of academic staff in the University who had used the redesigned lecture theatres in that first year (n=185). Participants reported their faculty and their job role. Participants were grouped into discipline according to their faculty and into their most appropriate job role if they entered a role different to the predefined options.

This study focuses on whether there are any differences in activities and perceptions between those who asked to use these rooms (CLT1/2) and those who were timetabled in the room after the redesign, i.e. had not specifically requested to use the rooms. (CLT3). The demographics of each of the two groups show that the gender split was almost even in CLT3 (5 male and 6 females), whereas there were more males in CLT1/2 (17 male and 10 female). The CLT3 sample is older than the CLT1/2 sample (7/27). The spread of roles is not especially different for each room sample. However, the users of CLT3 are from Medicine and Health (9/11) and two from biological sciences, whereas the CLT1/2 sample come from across all faculties.

Whilst the whole sample has some experience of technology integration such as PowerPoint and videos, and almost all have some experience of using web-based resources in their teaching, more of the group requesting to use the CLT1/2 have experience of blended learning, a flipped approach (and more years' experience of this), collaborative teaching approaches and online distance learning. Some of this group also has some experience of MOOCs, whereas the CLT3 group do not have any.

Interviews

Sample

Eight semi-structured interviews (Cohen, Manion & Morrison, 2017) lasting around one hour each were carried out by a research assistant (see acknowledgements) with staff using the CLTs. The interviewees were a subset of those who completed the survey and consisted of staff who volunteered to be involved in this part of the data collection. Of the eight interviewees, seven used CLT1/2 and one used CLT3. There was a reluctance amongst those timetabled into CLT3 to give an interview. The interviews took place in June and July of 2017. They were recorded, transcribed, and analysed using inductive thematic analysis to tease out the main issues (Braun & Clarke, 2006). This approach was used to search for themes within the interview data in an inductive manner. This allows the themes to emerge from the data rather than a deductive approach which would use theoretically derived themes to structure the analysis. This approach was used as I wanted themes to emerge rather than be predetermined.

Results

Surveys

The proportion of time shown in Figure 2 is the time spent on each activity (on average) for each group of staff. The lighter the column the more an activity took place, the darker the less it took place. The activities in rooms CLT1/2 indicate more active, collaborative teaching than in CLT3, which tends towards a more traditional didactic style of teaching. The staff using CLT3 spent more time with the instructor

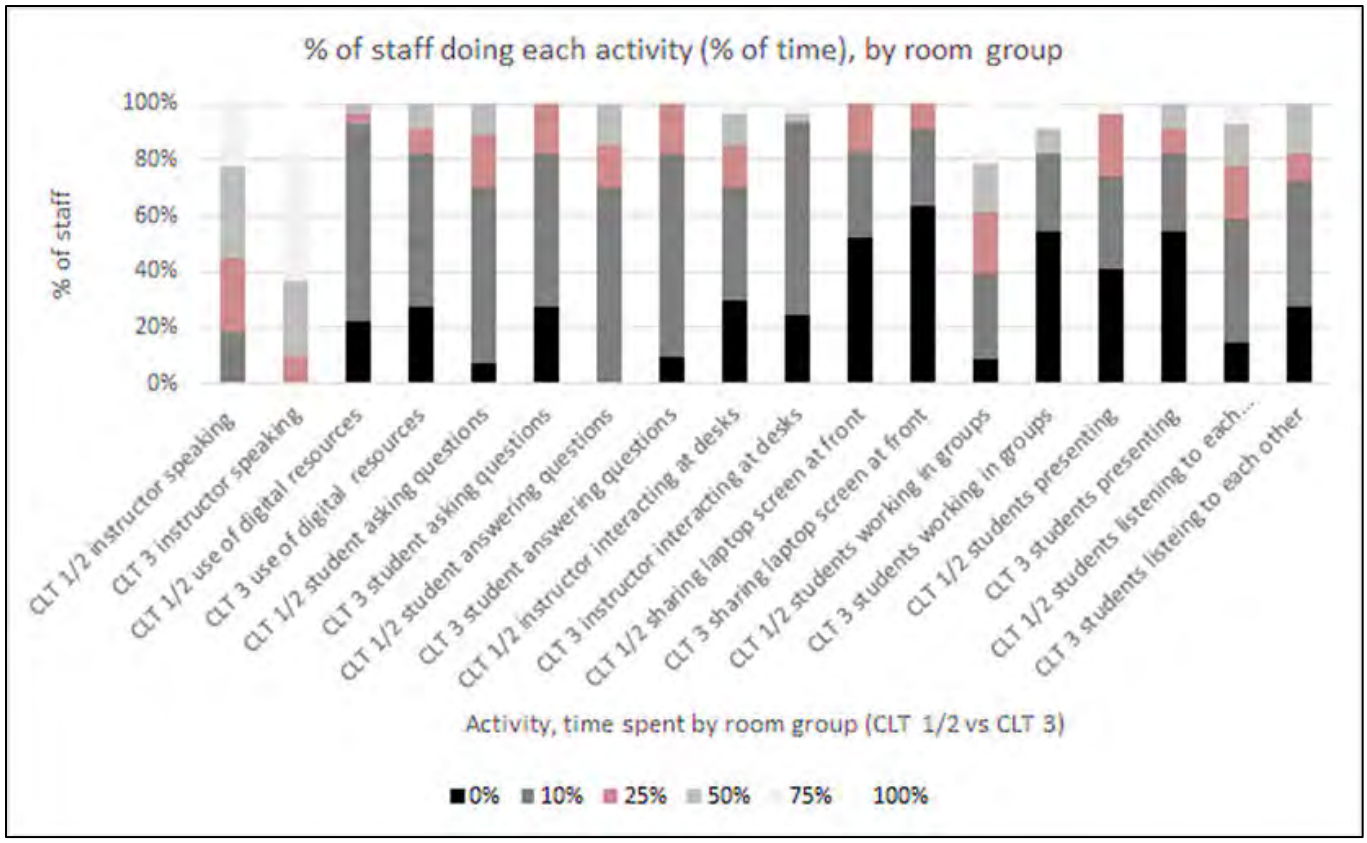

Figure 2. Proportion of staff doing each activity, with % of time, by room

speaking (median 75%) than those in CLT1/2 (median of 50%) and this difference was significant (Mann Whitney *U*= 65.500, *p=0.006*). All other activities took place less in CLT3. The collaborative activity of 'students working in groups' was the only other difference which was significant however, with a median time of 0% in CLT3 and 25% in CLT1/2 (Mann Whitney *U*= 193.500, *p=0.012*).

The technology used the most in all three spaces are PowerPoint, controlling overhead lighting and lecture capture, whilst the lapel microphone and sharing student's laptop screen at the front are used the least (Table 2). However, the CLT3 group use the desk-based microphones (54.5% vs. 77.8%) and the interactive digital whiteboard (54.5% vs. 77.8%) much less than the staff in CLT1/2, suggesting a more interactive approach in CLT1/2. However, none of these differences is statistically significant.

All staff are fairly confident in using technology and are most confident using PowerPoint and lecture capture (Table 2). Staff using CLT1/2 are more confident than staff using CLT3 (except for controlling overhead lighting), although these differences are not significant. However, they are more pronounced for new pieces of technology, such as lapel microphone and sharing students' laptop at the front, whereas existing technology reveals very little difference. As noted earlier staff using CLT1/2 have generally more experience of using technology in their teaching than staff using CLT3, which may have impacted on confidence in using new technology. For the newer pieces of technology (not the established technology), use is correlated well with confidence. This suggests lack of confidence may be a barrier to use although correlation does not mean causation.

Users were asked if they had attended the training related to using the collaborative lecture theatres, which in part included training on how to use the new pieces of technology. 20/27 (74.1%) of those using CLT1/2 and 7/11 (63.6%) of those using CLT3 had attended training. However, there does not seem to be any relationship between attending training and confidence (correlation).

There is general agreement that the grouped seating makes it more likely that collaborative activities are incorporated into sessions, that communicating and interacting with students, and students communicating with each other is easier. These views are slightly more positive by the CLT1/2 group (Table 3). Similarly, perceptions of the impact of the space on teaching experience is more positive from those using CLT1/2 as is perceptions of the usefulness of the technology. For this group, space is thought to have a greater impact than technology These differences, however,

Table 2. % staff using each piece of technology in all or some sessions, by room
(Strongly disagree (1) to Strongly agree (5)), mean confidence of staff using each piece of technology, by room (Strongly disagree - 1, Strongly agree – 5), and correlation of use with confidence

	% staff answering SA/A		Mean confidence of staff		Whole sample	
	CLT1/2	CLT3	CLT1/2	CLT3	Spearman's Correlation	Sig
Controlling desk-based microphones	77.8	54.5	4.12	4.00	0.475	0.003**
Interactive digital whiteboard	77.8	54.5	3.81	3.78	0.563	<0.001**
Dual projection	85.2	63.6	4.52	4.20	0.575	<0.001**
Lapel microphone	59.3	36.4	4.63	3.80	0.455	0.007*
PowerPoint	88.0	100.0	4.88	4.82	0.189	0.263
Sharing students' laptop at front	60.9	36.4	4.19	3.75	0.639	<0.001**
Controlling overhead lighting	92.6	90.9	4.46	4.55	0.089	0.602
Lecture capture	92.6	81.8	4.62	4.45	0.302	0.069

are not significant, apart from 'students communicate with each other more easily in grouped seating'.

The data in Table 4 show responses by group to a range of questions which focus on potential barriers to using the CLTs.

The data show that generally users think the rooms allow them to teach in their preferred way, and are appropriate, as well as challenging them to think about their teaching and develop it, whilst users of CLT1/2 agree more strongly about most of these issues. Barriers to using the CLTs are felt more strongly by the CLT3 group. For users of both rooms the impact on workload is the strongest. None of the differences is significant.

Interview results

Several themes emerged from the interviews.

The CLTs are more appropriate for group work than traditional lecture theatres or flat-floored rooms.

Several interviewees suggested that the CLTs were more appropriate for group work than other spaces, and for one it encouraged them to try this approach.

> *Mainly because I wasn't happy with the delivery of the lectures in the previous few years when it was a very traditional tiered theatre. I felt it limited what we could and could not do. It limited my ability to interact with the students and I thought in such a practical module I wanted to try and do something about that.* [Int 1]

Whilst for others they provided a more appropriate space for the group work they were already doing or planning to do.

> *I wanted to approach this piece of work – this – this module in a particular way and realised that this new space would be ideal for what I wanted to do.* [Int 8]

For another lecturer, the room was requested for a specific module with a flipped approach, where students were working together on a group writing task. One lecturer said they chose one of these rooms for the planned group work as it allowed students to interact with each other more than in a traditional lecture theatre.

The CLTs acted as an impetus to develop pedagogy

For other staff these rooms, with their potential for teaching in a less didactic way, encouraged staff to think about developing their teaching approach. For example:

> *I think using these lecture theatres made me … change my teaching. So like now I don't go to a lecture and think, "Oh, I'll just repeat this." I'm like, "How can I make sure that the students have understood it? How can I do this?" And it – it just takes me, as a lecturer, to a different level, I think.* [Int 5]

Another interviewee requested the room in response to student feedback wanting more group discussion and claimed the rooms encouraged a different approach.

Several of the lecturers using the rooms used a flipped approach. Interviewee 2 was ambivalent about flipped due to the time involved in preparing the material and running

Table 3. Staff perceptions of appropriateness and effectiveness of CLTs
(Strongly agree=5, Strongly disagree=1)

	Mean Likert		
	CLT1/2	**CLT3**	**Sig**
Grouped seating means I am more likely to incorporate collaborative activities into the session	4.35	3.55	
Students are less likely to contribute in sessions when sitting a group	1.85	1.78	
Communicating with students is easier in grouped seating	3.67	3.20	
The grouped room layout is conducive to interacting with students	4.15	4.00	
Students communicate with each other more easily in grouped seating	4.48	3.70	P=0.023*
The heightened interactivity of sessions in CLTs keeps students alert and focused	4.00	3.67	
Personalised teaching is more difficult in CLTs	2.04	2.50	
Even when groups are well organised it is not an effective way of utilising time in sessions	1.85	2.44	
The CLTs enrich my teaching experience	3.93	3.36	
Perception of technology			
In-class activities are enhanced by the technology in the CLTs	3.85	3.67	
I am not enthusiastic about using the technology in the CLTs	1.93	1.91	

the two-hour session as usual and was sceptical about students actually engaging with the material before the session. However, they felt that the spaces were encouraging this approach.

The layout of the room allowed the staff member to get round the room more easily.

These rooms enabled a more interactive approach as they allowed the lecturer(s) to move around and interact with students more easily than in a traditional lecture theatre, and was referred to by two interviewees, including interviewee 6 who said:

> *… much easier … for me to get around the groups and address any sort of queries, questions and – and kind of misconceptions maybe that were coming up and I could kind of eavesdrop on stuff and, you know, so it was much better from that point of view as well. you don't have like a student trapped in – in the middle of a row.* [Int 6]

Role of technology

In addition to the impact of the physical characteristics of the room, the technology included in these rooms also impacted on pedagogy for some staff. In particular the ability to share students' laptop screens at the front, as described by interviewee 4:

> *It also allows us to identify incorrect usage, which is often common amongst lots of students, that were I going round, looking at people individually, I would be saying the same thing again and again. So it provided a fairly neat way of utilising the time in a far more efficient way than I'd done in the past, but also engaging students with discussion and allowing them to evaluate their own and each other's work.* [Int 4]

Although lecturers used the technology and took advantage of the layout, it seems that the layout had more influence on pedagogy as one lecturer explained:

> *'the first time I went in it I kind of realised it isn't, it isn't fundamentally about the technology what, what's most important about that space is, is the configuration. … it just feels fundamentally different because students are ... in clusters and so, you know, they can talk to each other more easily, you can get round the room more easily. ...it's less about the technology than I thought it would be.',* [Int 2]

However, they also stated the technology has allowed the session to be more interactive.

Overall impression

For many the experience was a good one, staff recalled feeling more in control and suggested the environment enabled a more facilitative approach. However, some mentioned negative aspects, in particular in terms of the time involved in both redesigning materials for a different approach and the time required to learn and practice using the rooms, *'you don't want to look like an idiot in front of your students.* [Int 2]

And Int 7 (the only interviewee who was timetabled into CLT 3) said:

> *staff have significant workloads …, and there's a question of finding the time to redevelop teaching materials to be able to use the lecture theatre effectively. There are lectures, say, on […]*

that have 60, 70 slides. It's not as easy to convert that quantity of content into something that's interactive and still deliver all of it. [Int 7]

Table 4. Potential barriers, by room
(Strongly agree=5, Strongly disagree=1)

	Mean Likert	
	CLT1/2	**CLT3**
The CLTs enable me to teach in my preferred ways	4.15	3.73
The CLT is an appropriate space for the course(s) I teach	4.22	3.55
The CLTs challenge me to develop my teaching	4.00	4.00
Teaching in CLTs encourages me to think about how I deliver course content	4.12	4.00
I require further training in using the technology in the CLTs	2.73	3.36
I do not have time for technology enabled teaching strategies.	2.19	2.82
Using the CLTs creates additional workload for me	3.22	3.55

Discussion

The redesign of the three collaborative lecture theatres at this HEI involved a new layout (space) and the introduction of new technology, both of which were intended to encourage a more collaborative, active approach to teaching, although the design allowed for flexibility of approach too (pedagogy). Radcliffe (2008) has suggested that the three aspects, space, technology and pedagogy, are reciprocally related.

This paper answers two research questions:

- To what extent and in what ways have staff used the CLTs, and does this vary according to conditions of using the space (voluntariness vs timetabled)?
- What are staff perceptions of the CLTs?

The results from the staff survey reveal that the spaces were used for collaborative and active teaching approaches, with many teachers using new technology to do this. However, not everyone who used the rooms took this teaching approach and not everyone used all or even some of the new technology. However, the activities in CLT1/2 tended to imply more active, collaborative teaching than in CLT3. The staff using CLT3 spent more time with the instructor speaking which suggests a lecture style approach whilst the collaborative activity of 'students working in groups' took place much more of the time in CLT1/2. Other activities such as 'the instructor interacting with students at the desks' and 'students presenting work' took place for more time in CLT1/2 and further suggests collaborative or active learning. A similar pattern is found when examining the pieces of technology used. All staff tend to use the well-established technologies such as PowerPoint and lecture capture, but there are differences in use relating to newer pieces of technology. Those using CLT1/2 are more likely to use technology which suggests collaborative and active learning. These include 'controlling desk-based microphones' which are used for the students to be able to speak and be heard by everyone, and 'sharing students' laptops at the front of the room' used to show what the groups of students have been doing. PowerPoint, suggesting a more traditional approach, however, is used more by those in CLT3.

Perceptions of the rooms also differed between the two groups. Users of CLT1/2 tended to be more positive about the layout of the rooms and its impact on teaching approach. In particular the effectiveness of the layout was cited as encouraging collaborative activities, interaction between staff and students, and interaction between students. Those in CLT3 were positive overall about the layout, but less so. The perceptions around the technology followed a similar pattern with both groups being generally positive about technology enhancing in-class activities and being enthusiastic about it. However, those using CLT1/2 were more positive.

Impact of space on pedagogy

The interviews revealed a more in-depth perspective about the ways in which the rooms impacted on pedagogy, in particular by those using CLT1/2 who had asked to use the rooms. This is to be expected, as they contributed seven of the eight interviews. Some asked to use these rooms as their collaborative group work suited the rooms well, as they allowed students to sit in pods and interact with one another. For these staff the rooms did not impact their pedagogy as such but gave them a space to teach in the way they wanted to or had done elsewhere in the institution. For some, it enabled them to change their approach to a more collaborative interactive one because they felt the space was more appropriate in contrast to the more restrictive traditional lecture theatres. For these staff the rooms impacted their pedagogy as it allowed them to realise such an approach, supporting Graetz and Goliber's (2002) view that for 'meaningful and efficient collaboration' to take place an appropriate space is required (p.13). This also supports Jamieson et al.'s (2003) and Brook's (2011; 2012) views that spaces authorise and enable certain pedagogies. For others the newly designed rooms were an impetus to try something new, even if only for short periods of the session, and for these staff the rooms also lead to a change in pedagogy. This is supportive of the Jisc (2006) view that changing a space

will in itself change practice. Many of those asking to use these rooms were already teaching in this way, were looking for spaces to teach in this way or wanted to try something new, and these spaces supported them to do so. However, for many using CLT3 who hadn't asked to use these newly developed spaces, they continued to use a largely didactic approach and the changing of the space did not necessarily change their practice. This may be a result of the rooms being designed to be flexible so that a traditional lecture approach was also possible. The lectern at the front and a clear line of sight for all students meant that this approach was authorised too. The CLT's layout draws lecturers to the front and this is what many did. This may have been for pedagogical reasons as their lectures may be more appropriate as didactic type lectures (Prince, 2004). All the users of CLT3 came from Medicine and Health or Biological Science, and students who are studying medicine or dentistry in particular tend to have a full timetable of lectures, and there is little opportunity to access content in advance of the lectures. There is also a view that subjects such as medicine and dentistry require the reproduction of knowledge rather than discussion or reflection on knowledge acquired (Prince, 2004), and thus lend themselves to more didactic approaches.

Taking a traditional lecture approach may also have been due to an unwillingness to change something that these lecturers didn't think needed changing. Users of CLT1/2 increased their use of a range of digital resources, whereas those using CLT3 only reported an increase in use of online quizzes, suggesting that this group did largely tend to continue as before. As Nordquist (2016) suggests lecturers will teach in their preferred way irrespective of classroom design. This supports results from research by Beery et al. (2013) in the context of nursing which found no significant increase in active learning pedagogies in the collaborative classroom and concluded from informal data that teachers will teach in the way they want to by adapting the environment. However, this is in direct contradiction to Whiteside et al. (2010) who found despite trying to teach in the same way in two different rooms, the layout of the room impacted the teaching behaviour. These existing studies are useful in showing that the response to a change in design of a teaching space can impact on pedagogy but may not. This study has built on this work to show that the background and context of the teacher is an important factor influencing whether pedagogy is impacted and to what extent, and needs to be considered.

Impact of technology on pedagogy

Users of CLT1/2 tend to have more experience and are more confident in using technology, in their teaching. In particular this applies to the new technology, which may be a contributor to why they use the newer technology more. However, as they are teaching in a collaborative or active way more often the new technology is more likely to be used to support such approaches. In contrast the lack of experience and confidence from the CLT3 group may explain why they use such technology less and concomitantly are then less likely to take a more collaborative approach, rather than it being a matter of preference or appropriateness. This supports Haines and Maurice-Takerei's (2019) findings that '*staff need to be able to use these new technologies with ease and design ways that new tools can contribute effectively to active student learning'* (p.19). It also supports McDavid et al.'s (2018) findings that self-efficacy in one type of space does not necessarily cross over to a different space, i.e., from a traditional space to a space designed for a collaborative approach. The overall positive attitude from CLT3 users about the potential of the space also supports this view and suggests that training in use and appropriate use could be a factor here. Around 70% of each group did report attending general training on the use of the rooms, and for those in CLT1/2 this seemed to be sufficient whilst those using CLT3 tended to suggest they needed additional support. This further supports Nordquist's (2016) and McDavid et al.'s (2018) view that there needs to be faculty development for change to take place. The interviews revealed that learning how to take a collaborative approach, how to use the technology in the rooms and how to redevelop teaching materials were all thought to take time. This ties in with workload which was also seen as one of the major barriers to changing teaching approach. This supports Svilha's (2015) view that adapting teaching materials to a new approach can take considerable time and needs to be considered.

The different responses to teaching in these rooms consisted of those who had been teaching this way and calling for more spaces specifically designed to support active collaborative learning as they had been doing this in less appropriate spaces, those who had wanted to try such an approach once the space became available, and those who were encouraged by the space to try something new, and those who continued to teach in largely the same way as they had in more traditional rooms. This suggests that responses to changed spaces are on a continuum which is impacted by the starting point of the staff member, which strongly supports Haines and Maurice-Takerei's conclusions from their 2019 study. This suggests when training or preparing staff for new spaces it would be useful to gauge where staff are on this continuum and develop training accordingly.

Limitations

This work is based on a small number of survey responses in the first year of the use of these lecture theatres and thus

the findings are not only tentative but may well have developed in future years. Of the eight interviews, only one was from a member of staff using CLT3, which limits understanding of their use of the room. However, the interviews generally do provide data about those wanting to use the rooms and the different reasons for doing so.

Conclusion

This paper shows that simply redesigning rooms in terms of the physical design and the technology within them does not automatically lead to a change in pedagogy. The activities which take place in teaching rooms is a complex relationship between space, technology, and context, but is also impacted by issues such as discipline and content to be conveyed, and experience in teaching approaches and in use of digital technology. The findings suggest that the space and the technology impact in different ways depending on who is using the rooms and whether they have chosen to use them, i.e. whether they have chosen to use a room with the capacity to teach in a collaborative, active way. For those choosing to use CLT1/2 this study found that they are more positive about the impact of collaborative, active approaches on student learning and the teaching experience than those in CLT3 and have more positive perceptions of the usefulness of the technology.

Acknowledgements

The author would like to thank Lewis Clarke, the research assistant on this project, as well as Professor Neil Morris and Professor Michalis Kontopodis for their valuable feedback on earlier drafts.

References

Alex Marmot Associates (AMA). (2006). *Spaces for Learning: a review of learning spaces in further and higher education*. A report for the Scottish Funding Council. http://aleximarmot.com/userfiles/file/Spaces%20for%20learning.pdf

Baepler, P., Walker, J.D. & Driessen, M. (2014). It's not about seat time: Blending, flipping, and efficiency in active learning classrooms. *Computers and Education*. 78, 227-236. http://dx.doi.org/10.1016/j.compedu.2014.06.006

Beery, T.A., Shell, D., Gillespie, G. & Werdman, E. (2013). The impact of learning space on teaching behaviors, *Nurse education in practice*. 13(5) 382-387. https://doi.org/10.1016/j.nepr.2012.11.001

Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101. https://doi.org/10.1191/1478088706qp063oa

Brooks, D. C. (2011). Space matters: The impact of formal learning environments on student learning. *British Journal of Educational Technology*, 42(5), 719-726. https://doi.org/10.1111/j.1467-8535.2010.01098.x

Chiang, F. K., Zhu, G., Wang, Q., Cui, Z., Cai, S., & Yu, S. (2016). Research and trends in mobile learning from 1976 to 2013: A content analysis of patents in selected databases. *British Journal of Educational Technology*, 47(6), 1006-1019. https://doi.org/10.1111/bjet.12311

Cohen, L., Manion, L. & Morrison, K. (2011). *Research Methods in Education*. (8th Edition). London ;New York: Routledge.

Dobbin, G., Diaz, V. & Brown, M. (2014). *Re-Imagining Learning Spaces: Design, Technology, and Assessment*, Educause Learning Initiative.

Dziuban, C., Graham, C.R., Moska, P.D., Norberg, A. & Sicilia, N. (2018). Blended learning: the new normal and emerging technologies. *International journal of Educational Technology in Higher Education*. 15(3), 1-16. https://doi.org/10.1186/s41239-017-0087-5

Ellis, R.A. & Goodyear, P. (2016). Models of learning space: integrating research on space, place and learning in higher education. *Review of Education*. 4(2), 149-191. https://doi.org/10.1002/rev3.3056

Elkington, S. & Bligh, B. (2019). *Future Learning Spaces. Space, Technology and Pedagogy*. AdvanceHE. https://s3.eu-west-2.amazonaws.com/assets.creode.advancehe-document-manager/documents/hea/private/downloads/Future%20Learning%20Spaces_1_1568037687.pdf

Fisher, K. & Newton, C. (2014). Transforming the twenty-first-century campus to enhance the net-generation student learning experience: using evidence-based design to determine what works and why in virtual/physical teaching spaces. *Higher Education Research & Development*. 33(5), 903-920. https://doi.org/10.1080/07294360.2014.890566

Freeman, S., Eddy, S. L., McDonough, M., Smith, M. K., Okoroafor, N., Jordt, H., & Wenderoth, M. P. (2014). Active learning increases student performance in science, engineering, and mathematics. *Proceedings of the National*

Academy of Sciences of the United States of America, 111(23), 8410-8415. https://doi.org/10.1073/pnas.1319030111

Freire, P. 2000. *Pedagogy of the Oppressed*. New York; London: Continuum

Graetz, K. A., & Goliber, M. J. (2002). Designing collaborative learning places: Psychological foundations and new frontiers. *New Directions for Teaching and Learning*, 92, 13-22. https://doi.org/10.1002/tl.75

Haines, K. & Takerei, L.M. (2019). The Impact of New Collaborative Learning Spaces on Tertiary Teacher Practice. *Journal of Learning Spaces*. 8(2), 12-21.

Jamieson, P. (2003). Designing more effective on-campus teaching and learning spaces: a role for academic developers. *International Journal for Academic Development.* 8(1-2), 119-133. https://doi.org/10.1080/1360144042000277991

JISC. (2006). *Designing Spaces for Effective Learning. A guide to 21st Century Learning Space Design.* https://www.webarchive.org.uk/wayback/archive/20140613220103/http://www.jisc.ac.uk/media/documents/publications/learningspaces.pdf

JISC. (2019). *Digital experience insights survey 2019: findings from students in UK further and higher education*. https://www.jisc.ac.uk/reports/digital-experience-insights-survey-2019-students-uk

Jones, S. E. (2007). Reflections on the lecture: outmoded medium or instrument of inspiration? *Journal of Further and Higher Education*. 31(4), 397-406. https://doi.org/10.1080/03098770701656816

Leonard, S.N., Fitzgerald, R.N., Bacon, M. & Munnerley, D. (2017). Mapping next generation learning spaces as a designed quality enhancement process. *Quality in Higher Education*. 23(2), 168-182. https://doi.org/10.1080/13538322.2017.1358955

McDavid, L., Parker, L.C., Burgess, W., Robertshaw, B. & Doan, T. (2018). The Combined Effect of Learning Space and Faculty Self-Efficacy to use Student-Centered Practices on Teaching Experiences and Student Engagement. *Journal of Learning Spaces.* 7(1), 29-44.

McNeil, J. & Borg, M. (2017). Learning spaces and pedagogy: Towards the development of a shared understanding. *Innovations in Education and Teaching International*. 1-11. https://doi.org/10.1080/14703297.2017.1333917

Morris, N. (2016). *Reimagining traditional lecture theatres*. Campus Developments Blog, October 12 2016. University of Leeds. https://campusdevelopments.leeds.ac.uk/news/reimagining-traditional-tiered-lecture-theatres/

Nordquist, J. (2016). Alignment achieved? The learning landscape and curricula in health profession education. *Medical Education* 50, pp.61-68. https://doi.org/10.1111/medu.12844

Oblinger, D. (2005). Leading the Transition from Classrooms to Learning Spaces. *Educause Quarterly* No.1. 14-18.

Pantidi, N. (2013). *An Ethnographic Study of Everyday Interactions in Innovative Learning Spaces*. PhD thesis, Open University.

Prince, M. (2004). Does active learning work? A review of the research. *Journal of Engineering Education,* 93(3), 223-231. https://doi.org/10.1002/j.2168-9830.2004.tb00809.x

Radcliffe, D., Hamilton, W., Powell, D. & Tibbetts, B. eds. (2008). Learning spaces in higher education. Positive outcomes by design. *Proceedings of the next generation learning spaces 2008 colloquium*, St Lucia, Queensland: The University of Queensland.

Sharples, M., Adams, A., Ferguson, R., Gaved, M., McAndrew, P., Rienties, B., Weller, M., & Whitelock, D. (2014*). Innovating Pedagogy 2014: Open University Innovation Report 3.* Milton Keynes: The Open University

Svihla, V., Reeve, R., Sagy, O., & Kali, Y. (2015). A fingerprint pattern of supports for teachers' designing of technology-enhanced learning. *Instructional Science,* 43(2), 283-307. https://doi.org/10.1007/s11251-014-9342-5

Tamin, R.M., Bernard, R.M., Borokhovski, E., Abrami, P.C. and Schmid, R.F. (2011). What Forty Years of Research Says About the Impact of Technology on Leaning: A Second-Order Meta-Analysis and Validation Study. *Review of Educational Research*. 81(1), 4-28. https://doi.org/10.3102%2F0034654310393361

Thai, N.T.T., De Wever, B. & Valcke, M. (2017). The impact of a flipped classroom design on learning performance in higher education: Looking for the best "blend" of lectures and guiding questions with feedback. *Computers &*

Education. 107, 113-126. http://dx.doi.org/10.1016/j.compedu.2017.01.003

Trigwell, K., Prosser, M., & Waterhouse, F. (1999). Relations between Teachers' Approaches to Teaching and Students' Approaches to Learning. *Higher Education*, 37(1), 57-70. https://doi.org/10.1023/A:1003548313194

Turner, Y. (2015). Last orders for the lecture theatre? Exploring blended learning approaches and accessibility for full-time international students. *The International Journal of Management Education*. 13, 163-169. https://doi.org/10.1016/j.ijme.2015.04.001

Twigg, C. A. (1999). *Improving learning and reducing costs: redesigning large-enrollment courses. The Pew Learning and Technology Program*.

Whiteside, A.L., Brooks, D.C. & Walker, J.D. (2010). Making the Case for Space: Three Years of Empirical Research on Learning Environments. *EDUCAUSE Quarterly*, 33(3).