How University Teachers Are Impacted by The Design of Their Teaching Space

An Inquiry into the Introduction of a Collaborative Lecture Theatre in The School of Dentistry

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The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

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Abstract

In 2016, The University of Leeds introduced a redesigned lecture theatre in The School of Dentistry that involved a change in the layout to one that allowed for collaborative teaching, and the incorporation of educational technology. This study explored how the staff were utilising the new layout, the integrated technology, and explored the thought processes behind the pedagogical choices made by individual teachers. A novel model was created to combine theories of technology acceptance, technical and pedagogical knowledge and teacher conceptions in order to explore the situation in depth.

Following ethical approval, fifteen staff members from The School of Dentistry were interviewed regarding their perceptions of teaching within the new lecture theatre. Thematic analysis of the interview transcriptions using an iterative approach identified multiple factors that motivated change or facilitated new practices.

Findings indicated that the space alone encouraged six staff making significant changes to how they taught. They took advantage of the layout more than the technology. A further six lecturers expressed a strong desire to do make changes if adequate training and support had been provided.

Those that made changes were more likely to possess further educational qualifications and be student focused. The lack of institutional vision, traditional curriculum design and lack of pedagogical training were frequently blamed for changes not being made. Change would appear to be largely instigated by the individual, however, the institution has a critical role to play for all but the earliest of adopters.

The interface between learning spaces, beliefs and pedagogic decision making is under-researched. Existing models of technology acceptance and teacher conception fall short of explaining teacher choices and behaviours when presented with new spaces. The novel model presented provides a framework that can be used for further research and guide staff support during pedagogical change.

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List of Abbreviations

CK	-	Content Knowledge
CTF	-	Clinical teaching Fellow
CLT	-	Collaborative Lecture Theatre
DLT	-	Dental Lecture Theatre
FHEA	-	Fellowship of the Higher Education Academy
GDC	-	General Dental Council
MKO	-	More Knowledgeable Other
PCK	-	Pedagogical Content Knowledge
PGCAP	-	Postgraduate Certificate in Academic Practice
PK	-	Pedagogical Knowledge
SCT	-	Socio-Cultural Theory
SCTF	-	Senior Clinical Teaching Fellow
TAM	-	Technology Acceptance Model
TCK	-	Technological Content Knowledge
TEF	-	Teaching Excellence Framework
TK	-	Technological Model
TPACK / TPCK		Technological, Pedagogical and Content Knowledge
TPK	-	Technological Pedagogical Knowledge
TRA	-	Theory of Reasoned Action
UTAUT	-	Unified Theory of Acceptance and Use of Technology
ZPD	-	Zone of Proximal Development

1 Introduction

In his book “The Process of Education”, Jerome Bruner described the process of learning as having two components; (1) that which is required to be able to undertake a specific task, and (2) that which enables the learner to adapt and develop within new situations. (Bruner, 1960, p.17). When thinking who the “learners” in the University are, it is not just the students, but staff too are developing their teaching practices. When new teaching concepts are introduced, the staff members must learn new skills and new approaches in order to adapt.

In 2016, The University of Leeds introduced three “collaborative” lecture theatres which replaced traditionally arranged lecture theatres as part of the Digital Strategy for Student Education (University of Leeds, 2013). One of these was the Dental Lecture Theatre (DLT). Located within the School of Dentistry, the DLT was the main setting for theoretical learning and teaching within the school.

Shortly after the introduction of these redesigned lecture theatres, a press release announced that students “*loved the facilities*”, with high satisfaction scores and claimed that they were “*great for group work*” (Hamnett, 2017). The same press release included quotes that the innovative spaces had allowed students to work collaboratively and that some staff had been able to *“undertake the type of teaching they’ve wanted to do for many years.”* Whilst this may have been true for some staff, it was not known whether it was true for dental lecturers or whether the introduction had any other effects on their teaching practices such as workload or induced anxiety of using something new.

Despite research being available stating that staff are observed to behave differently when delivering the same lessons in different environments (Whiteside et al., 2010), less is known about the effect of changing a teaching space on the attitudes and reflexivity of staff with regards to their teaching practices. It could be assumed that, as with any developments, some staff members may embrace the direction of change, others may not feel quite so comfortable. It has been seen amongst schoolteachers that when learning spaces change, and technology is introduced, teachers can find the adoption of new pedagogical practices to be challenging (Carvalho et al., 2020).

This study aims to explore the impact that the redesigned space had on the staff that used the space, what they thought about it, whether they changed

their teaching practices, and how did they adapt to imposed change upon their teaching spaces.

1.1 The setting

The Dental Surgery programme within The School of Dentistry at Leeds University is a five-year programme, with 90 to 100 undergraduate students in each year. All 29 modules in the programme are compulsory, and the curriculum design is closely aligned with and monitored by the UK General Dental Council (GDC). The GDC have produced a guidance document "Preparing for Practice" (General Dental Council, 2015), outlining the learning outcomes that students are required to demonstrate by the time of qualification. Amongst those outcomes, team-working and communication skills appear alongside clinical abilities and professionalism. These learning outcomes are mapped against the modules within the programme.

Teaching in The School of Dentistry consists of four main teaching modalities; large group lectures, small group seminars, clinical skills teaching in specialist facilities and real-world treatment of patients under supervision. Lectures provide most of the knowledge-based learning. Each year group receives four 1-hour lectures per week, all taking place within one morning, which makes up approximately 20% of the students' time at university.

Prior to redesign, DLT had a “traditional” lecture theatre layout with students in rows (Figure 1-1). From conversations with students, the majority of teaching they received followed what could be described as a traditional, didactic lecture style of a 50 minute to 1 hour presentation of PowerPoint slides with a short period of time for questions at the end. Typically, students were provided with handouts of the slides in advance to annotate during the lecture. The redesigned lecture theatre (Figure 1-2) incorporated features to facilitate a wide range of learning and teaching styles.

Figure 1-1 Original layout of the Dental Lecture Theatre (faces blurred to preserve anonymity).

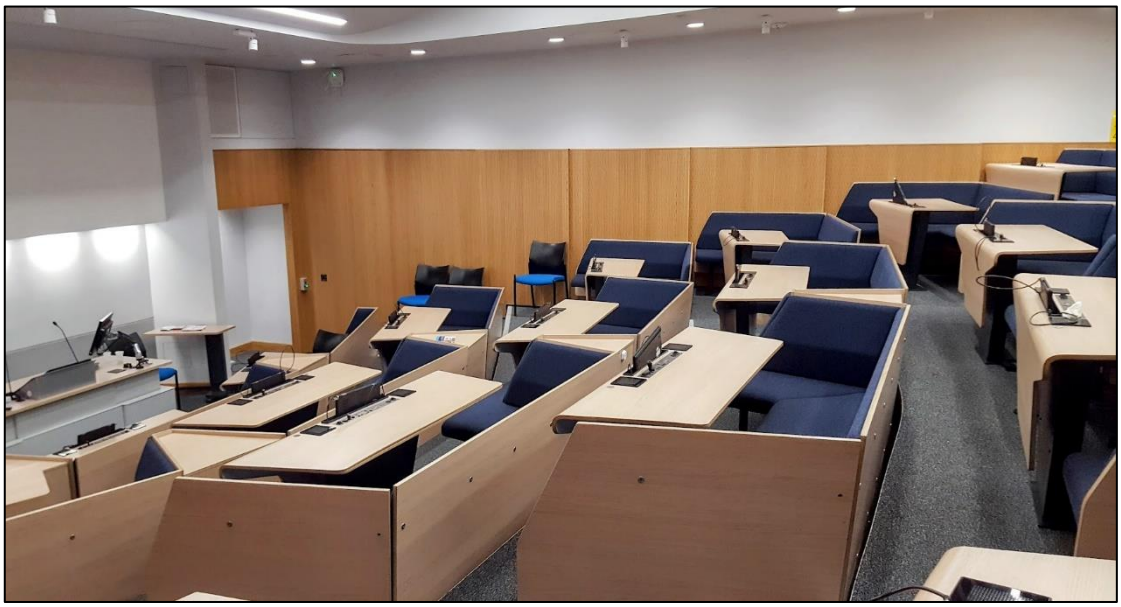

Figure 1-2 The Redesigned Dental Lecture Theatre

The general layout of the redesigned lecture theatre is on 6 tiers with students arranged in booths, known locally as “pods” that can accommodate 4 to 5 students. This is intended to allow for easier group discussion and collaborative tasks (Figure 1-3) as they can face each other and are positioned around a shared laptop (Figure 1-4) or their own devices.

Figure 1-3 - Students chatting together in a “pod.” (Consent has been provided by the students displayed in this picture).

Figure 1-4 - Student booth showing incorporated laptop.

The students have various controls in their booths (Figure 1-5) that allow them to communicate with the teacher and with each other. The incorporation of charging points and readily available Wi-Fi allows them to communicate with the wider world using their own devices. A light can be used for illumination of the bench but also can be used as a signal to the teacher that they want attention. The microphone allows the rest of the room and the lecture capture systems to hear what they are saying.

Figure 1-5 - Student control panel including; A-Microphone device, B-microphone push button, C-HDMI cable, D-power sockets, E-light switch, F-USB sockets, G-loudspeaker

The lecturer's podium (Figure 1-6) shows a wide array of digital technologies at the teacher's disposal. The three projectors can be used for dual as well as central projection.

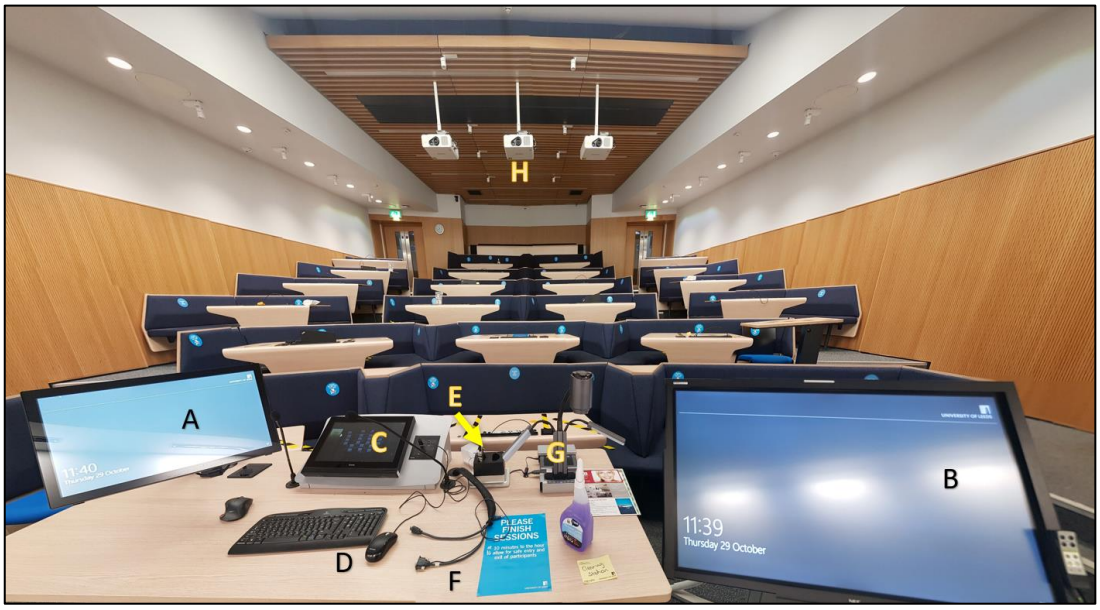

Figure 1-6 - View from teacher's point of view, showing: A-main presentation screen, B-digital whiteboard, C-command console. D-Keyboard and mouse switchable between PC and whiteboard, E-mobile microphones, F-cables for BYOD (bring your own device), G-visualiser, H-projectors.

The command console allows the teacher to choose the inputs to the screens (Figure 1-7), the room lighting and also can select individual student laptops to share on screen with the rest of the class (Figure 1-8).

Figure 1-7 – Command console showing selection of inputs

Figure 1-8 – Command console showing selection of student devices

As can be seen, the lecture theatre is laden with digital technology, along with what is provided, the connections available allow the lecturer to bring along any of their own devices or specialised equipment leading to a potential for a great range of different teaching and learning practices to be carried out.

The introduction of the redesigned DLT was accompanied by staff training sessions which were described in a report on the use of the spaces following their introduction, as being more about how to use the technology, than how to change pedagogy (Clement, 2018).

1.2 The challenges faced by dental teaching staff

In the School, teaching staff are mainly qualified dentists that have chosen to come and teach as a secondary career or scientists that have followed a more conventional academic route. Teachers are at all levels up to professor, but the largest proportion are clinical teaching fellows (CTFs). Their job plan consists of 70% clinical teaching (3.5 days per week), the remainder of their time (1.5 days per week) are to be used for general scholarship and administrative duties. Most staff either lead a module or co-lead with another member of staff. All staff have personal tutees and clinical staff are required to keep up to date with their own Continuing Professional Development to retain their registration with the GDC. This leaves very little time for teaching design or preparation. Lectures are generally provided in one-hour slots which comes out of other allocated time. Senior clinical teaching fellows (SCTFs), associate professors and professors receive a greater amount of administration time as they are required to undertake significant organisational and leadership roles within the school.

One of the challenges that staff face is to provide an excellent student experience. This is important, as with increasing competition for places, students paying high tuition fees and amassing large debts in order to complete their education, there is a necessity to give students an excellent experience for more than just collegiate pride. The student population is diverse, and teaching needs to reflect this by being flexible, adaptable and accessible. At the University of Leeds, students come from 170 different countries, with 11.4% registering a disability (University of Leeds, 2019). There are also increasing numbers of students who are carers and parents.

One measure of the student experience is the Teaching Excellence Framework (TEF). TEF was introduced as a trial in 2017. Looking at parameters such as rates of dropout, student feedback and satisfaction and graduate employment rates, the framework leads to establishments receiving a rating of Gold, Silver or Bronze (UCAS, 2020). From 2020 these ratings may determine the level of fees that can be levied. They may also be used by prospective students in their decisions on choice of university (Bhardwa, 2019). One of the metrics that contributes to TEF is the National Student Survey known as the NSS which asks students a range of questions about

their overall experience, in 2020 there were 4 questions related to quality of teaching:

1. Staff are good at explaining things.

2. Staff have made the subject interesting.

3. The course is intellectually stimulating.

4. My course has challenged me to achieve my best work.

(Office for Students, 2020)

Students respond using a five-point Likert scale ranging from ‘Strongly Disagree’ to ‘Strongly Agree’. Although these questions relate to the whole range of teaching activities, there are some modules within the school of dentistry that are entirely lecture based, and thus the need for excellent teaching in lectures is vital.

However, there does have to be a balance between what students want from their education and what teachers judge to be effective educational practice. There is a risk that student satisfaction rather than good pedagogical practice is seen as the marker of quality for universities, and that quality assurance becomes more concerned with providing what students want, rather than providing them with what they need and the actual quality of the teaching (Blackmore, 2009).

1.3 Overview of the project

Within the first year of the refurbished lecture theatre being opened, informal discussions with colleagues revealed a general feeling of them being unaware of how they were expected to use it. In response to this I set up a meeting and sent out a general invitation for anyone wanting to discuss how we approached the lecture theatre to come along and discuss how we use the space as a teaching team. A number of staff attended, and subsequent discussion revealed that most felt some level of anxiety regarding the space. The key themes that came from that meeting were:

- To use the space as intended they needed to be using “*the technology*” but didn’t really know what it could do and how it could help them.
- Some didn’t know how to fit extra activities into their one-hour lecture and still deliver the amount of information they had felt expected to deliver.
- Some were afraid that the technology would fail in the middle of a teaching session, and they would look incompetent.

- Some said they just didn’t know how to do anything different than the traditional lecture delivery they were used to.
- A smaller number said they had tried something different to engage the students in a session but weren’t sure if they’d done it right or whether it had been successful.

Following the meeting this research project was devised to explore these expressions more rigorously to find out what sentiments, desires and constraints lay behind those statements.

Being a user of the space myself, I understood and shared the concerns raised by the staff and wanted to learn more about what issues and factors had led to anxieties being raised. Feeling no compulsion from the university or anyone else to change how I taught, I was keen to make use of a space that had been provided at great expense to its fullest, ultimately for the benefit of my students. The thesis will explore the journey that teaching in higher education has taken over previous years to reach the point where learning spaces are undergoing changes, and also the journey of staff members, like me, who are bringing their past experiences and knowledge of the subject area, and students to a new teaching space. Through those journeys it is hoped to be able to provide the reader with a greater appreciation of the areas where challenges arise and support is required when familiar learning spaces undergo radical change.

Successive reviews of the literature highlight the issue that learning spaces are both under-researched, and a lack of understanding of the interplay between spaces, teaching and learning processes exists(Temple 2007; Ellis & Goodyear 2016; Leijon et al 2022). Furthermore, the reviews highlight that most of that research relates to the influence of learning spaces on student learning, and very little on the practices of staff. Much of the available literature tends to look at outcomes rather than how the design of a teaching space can help to shape the activities that take place there (Yeoman & Wilson, 2019).

The choice of the DLT offers a unique opportunity to investigate how the change of a space affects the attitudes and teaching practices of dental teachers delivering lectures. The interface between learning spaces and pedagogical choices is a universal concept. Whilst the data gathered in this project is focussed on dental lecturers and the delivery of dental education, it is likely that many of the issues faced will be common across many disciplines in higher education and the findings could be transferrable across the whole education centre, wherever changes to learning spaces take place. of the changing landscape in higher education, followed by an exploration of

available literature on how teacher beliefs are shaped by internal and external factors. By using a starting point of various models that exist to predict, assist and explain staff adoption of new teaching practices and the adoption of technology a framework will be created to explore the phenomenon in greater depth. It is anticipated that the knowledge gained from this project will help inform educational leaders in all disciplines to provide frameworks for assisting staff through future changes in spaces and pedagogical practices.

2 Literature Review

In 2017 the Horizon Report into Higher Education looked at trends and challenges facing the sector over the ensuing five years (Adams Becker et al., 2017). The identified trends included:

- Redesigning learning spaces, to move away from "*traditional lecture-based lessons*" to spaces that allow for a range of pedagogies, to be more interactive and better resemble real world scenarios.
- Promoting collaborative learning, with students working together with their peers or their teachers.
- Improving digital literacy and digital equity, promotion of working in digital environments, but also addressing the lack or equal access to digital technology.

The report also highlighted the change in roles that educators would play in the future, from being teachers to being facilitators. They would need to be able to learn to use new technologies and be able to introduce new pedagogical approaches to be able to match the intention of the newly developing learning spaces.

With the introduction of the redesigned lecture theatres at Leeds University, press releases at the time described them as collaborative, digitally enabled learning spaces (Morris, 2016). The theatres were designed to allow for a range of different pedagogies. Primarily aimed at increasing the provision of collaborative teaching, the design still included the option to provide traditional didactic lectures. Even though the furniture in the lecture theatre cannot be moved, the fact that it can be used in a variety of teaching styles would make this an "*Enabling Learning Space*" as described by Elkington and Bligh, as it facilitates a range of different teaching activities (Elkington and Bligh, 2019, p.12). Whilst it is left open to staff to choose how to teach, if staff were to adopt new teaching practices, they would need to develop the skills to do so.

This literature review will examine the changing nature of lectures, lecture theatre design, the skills required by staff to adopt using technology in education, develop their pedagogical practices and the factors that may influence the adoption or otherwise of new practices. Finally, there will be an exploration of how the design of a lecture theatre may impact on the teaching behaviour of staff.

2.1 The changing nature of lectures

Lectures have formed the backbone of large-group university education for many years (Daud et al., 2017). The layout of students in rows facing the front (Figure 1-1) and a podium for the teacher at the front, places the focus squarely on the teacher rather than students.

Student satisfaction with lectures is reported to be low and attendance is falling (Walsh, 2012; Doggrell, 2021). The benefits to students of attending lectures and a positive correlation between attendance and improved examination results have been widely reported (Gatherer and Manning, 1998; Massingham and Herrington, 2006; Newman-Ford et al., 2008; O'Dwyer, 2011; Midle et al., 2016; Demir et al., 2017; Doggrell, 2021). It is important therefore, to both encourage attendance and address the reasons for non-attendance.

This section will examine how and why the nature of lectures within higher education may be changing in response to advancements in technology and a move towards making teaching more student focussed.

2.1.1 Traditional lectures

For this study, the definition of a '*traditional lecture*' will be taken from Freeman et al. (2014) as being a "*continuous exposition by the teacher*." Although this may not be a universally accepted definition, it does align with Bligh (2000) who compared traditional lectures to a speech or sermon, with the teacher placed at the centre and the students as passive recipients.

Traditional lectures have been described by some as an outdated mode of information delivery (Gibbs, 1981; French and Kennedy, 2016; Schwartzstein and Roberts, 2017). Using a questionnaire-based study of health science undergraduates, Bati et al., (2013) found that although 51% of dental students thought the content of the lectures was essential for their learning, only 26% found the lecture format useful and only 23% found them interesting. The reasons for not attending included; boring subjects, boring lecturers, having to work for other subjects, illness, sleeping and generally felt they could learn from the lecture notes without having to attend (Kelly, 2012; Bati et al., 2013; Desalegn et al., 2014; Persky et al., 2014; Petrović and Pale, 2015).

Traditional lectures have also been criticised for being too heavily linked to learning outcomes, rather than preparing students adequately for the real world (Hannafin and Land, 1997). They are though, only one aspect of a student's learning and are usually supplemented by seminars, tutorial and

practical exercises where gained knowledge can be explored further through experiential learning or discussion.

When done badly, traditional lectures have been criticised for encouraging rote learning and not engaging the students in discussion (Pickering and Roberts, 2017). But, despite criticism, lectures can be informative, entertaining and inspiring (French and Kennedy, 2016), as well as creating a social atmosphere for cohorts to meet, have discussions and getting to know the teaching staff in a cost-effective manner (Bligh, 2000).

2.1.2 Active learning and lectures

Psychologists have long debated the process of learning and the conditions in which we learn. Robert Gagné provided several learning concepts, some observed from nature, such as learning by association, learning by trial and error, and conditioned Pavlovian learning, along with more contemporary theories of information processing based upon cognitive load and memory transformation (Gagné, 1985). Building upon this work, Rosenshine (2012) used an evidence-based approach to explore which classroom practices led to improved performance and provided ten principles of instruction shown by research to improve learning. These include activities such as asking questions and checking understanding, guiding student practice and providing the students with scaffolds for difficult tasks. These do not relate to the traditional lecture as described above, but these principles can be applied in the lecture theatre by using planned activities instead of a continuous monologue.

Benwell and Eison (1991) described active learning as students being engaged in activities other than simply receiving information during the lecture. Taking this definition, active learning may include diverse activities such as; asking students to analyse and evaluate the subject material (Beichner, 2014; Park and Choi, 2014), employing a flipped classroom approach (Gilboy et al., 2015) or the use of technology to support engagement and check prior knowledge, as an alternative to the flipped classroom (Pickering and Roberts, 2018). In a large-scale study Hake (1998) found that students taught using interactive-engagement methods had significantly better assessment outcomes than those taught in a traditional or non-interactive manner. Unfortunately, Hake does not really elucidate what interactive engagement was involved, apart from describing activities as being "*heads-on*" or "*hands-on*". One can only make assumptions about what these activities are. A more recent meta-analysis of 225 studies reported that students receiving traditional lectures had lower grades and were 1.5 times

more likely to fail than students whose lectures involved active learning, regardless of class size (Freeman et al., 2014).

It is also not clear whether students want a change in how their lectures are delivered. Whilst active learning may have its benefits (Freeman et al., 2014; McLean et al., 2016; Hunsu et al., 2016; Morton and Colbert-Getz, 2017; Chiu and Cheng, 2017; Akçayır and Akçayır, 2018; Gómez-Tejedor et al., 2020), Reid and Johnston, (1999) warn that students may not be so positive about interactions with each other, and these may be harder to promote in the lecture theatre. There have also been concerns raised that active learning may not benefit all students in the same way, for instance Reinholz et al. (2022) found active learning scenarios in mathematics to produce inequity in favour of male undergraduates.

2.1.3 Socio-cultural theory and the move towards collaborative learning

Despite concerns, overall, the benefits of active learning are clear. One particular aspect of active learning that the lecture theatre has been designed to promote is collaborative learning.

Collaborative learning has been promoted as having potential benefits for student education (Gokhale, 1995; Zheng et al., 2015; Loes and Pascarella, 2017; Loes et al., 2018; Robbins and Hoggan, 2019; Männistö et al., 2020; Scager et al., 2020). The idea that learning is more effective when learning with others has grown out of the early 20th century theories of Piaget, Vygotsky and Dewey (Ruey, 2010).

Collaborative learning has been defined as students working together on tasks in small groups (De Hei et al., 2015) with the teacher acting as guide and facilitator (Robbins and Hoggan, 2019). The benefits of learning collaboratively have been described as not just gaining knowledge, but students also learn how to interact, formulate arguments, negotiate and instil their own understanding more deeply (Gunderson and Moore, 2008). Of relevance to this research project, all of these are essential skills in modern dental work settings and relate directly to the more transferrable outcomes contained in Preparing for Practice (GDC, 2018).

Collaborative learning has its roots in socio-cultural theory (SCT) that has as its central tenet that each individual, learning by themselves can only go so far, and can go further by interacting with others (Lourenço, 2012). Vygotsky proposed that when children are learning new concepts, by initially conversing with others, they begin to develop an inner language or '*private speech*' as they start to internalise knowledge (Lantolf, 1994). Vygotsky developed his

theories around the way the human brain interacts and makes sense with the social and physical world around it through symbolic artefacts such as language, science, numeracy etc., via a process of mediation; that is, the mental faculty to use these artefacts as tools (Lantolf et al., 2015). One aspect of Vygotsky's theory was the potential range that learning can extend to whilst interacting with others, termed the Zone of Proximal Development (ZPD), could be extended by the help of those around them, termed '*more knowledgeable others*' (MKO) (Vygotsky, 1978). The 'others' could be their peers at different stages of development or a teacher or parent. The appropriate support provided to help development was termed scaffolding.

Whilst there are aspects of SCT that could clearly transfer to the lecture theatre environment such as social interaction and scaffolding, the MKO may be more problematic as they may not be paired with more knowledgeable others in their own groupings, or the main MKO, the lecturer may not be able to interact with all groups if there is a large cohort. ZPD has also been criticised for encouraging the learner to be passive and may just repeat the views of others rather than develop their own (Pathan et al., 2018).

Collaborative learning, in general, has been shown to have positive benefits with respect to both outcomes and student satisfaction (Laal and Ghodsi, 2012; Leow and Neo, 2018; Clinton and Wilson, 2019; Scager et al., 2020; Leopold and Smith, 2020).
Rocca et al., (2014), investigated whether students felt there was a benefit to working collaboratively after they introduced a collaborative component to an undergraduate scientific teaching module in Italy. Student feedback gained by questionnaire using Likert scales and open questions showed that the students who partook in collaborative learning felt more prepared for their exams and created a better relationship with their teacher. Whether their grades actually improved was not reported. Some students had difficulty with this style of learning in the beginning, which was alleviated by discourse with their tutors.

Some further benefits of collaborative learning have been claimed to include:

- Socio-emotional benefits of interpersonal relationships
- Developing higher self-esteem
- Developing positive attitudes towards learning
- Benefit to low-achieving students from working with higher achievers
- Greater level of accountability for own learning
  (Gunderson and Moore, 2008)

Robbins and Hoggan, (2019) considered collaborative pedagogies to improve workplace performance and improve employability, a key university metric, due to helping to develop better thinking skills, communication and team-working skills. Jackson et al., (2018) observed that when dental students and dental hygiene / therapy students learned together collaboratively, not only was their problem-solving skills enhanced, but they also developed a more respectful team working ethic.

2.1.4 The use of digital tools to augment learning

One of the key features of the redesigned DLT was the incorporation of digital technology to support and assist learning such as the digital whiteboard, the hub laptops and the ability to share student screens. This can be controlled by the teacher in terms of the projected screens and digital whiteboard or by the students with their shared laptop and connectivity for devices.

The use of digital technologies to enhance learning within the lecture theatre setting has been reported, for example in the creation of Wikis (Zheng et al., 2015), and team-based quizzes using clickers (Egelandsdal and Krumsvik, 2017). Hannafin and Land (1997) gave examples of how technology could be used in the lecture theatre setting, such as navigating online resources, communication between learners and collection of real-world data to make learning more authentic and promote the development of learning cultures. This may also help prepare students for using digital tools in the real world.

One has to apply a note of caution to the positive findings of such studies, as they are possibly being carried out by teachers who perhaps feel quite enthusiastic about whatever innovation they are introducing and that may influence the students and lead to a more successful introduction, than for example say a teacher who was not so well disposed towards technology; would their students have such a positive viewpoint? This was in some way suggested in a systematic review of five randomised controlled trials examining the use of digital collaborative teaching in nursing by Männistö et al., (2020) .They noted that any benefits of using digital tools were dependent upon the engagement of the teacher and the careful preparation of the learning environment and that the teacher needs to have sufficient pedagogical knowledge to select the most appropriate tools and technological competence both to use them and to assist the students (Männistö et al., 2020).

2.1.5 Summary

The above discussion leads to some conclusions; that lecture attendance is beneficial, that students need to see the benefit of attending and that techniques that engage students in lectures can lead to improved behaviours, level of understanding and better grades.

Lecture practices are changing to become more student focused. It has been suggested that engaging students with active learning does not necessarily require a change in the design of the learning space. O'Neill and McMahon (2005) suggested that there were ways of engaging students in traditional lecture theatres by using such tools as buzz groups, quizzes and the creation of mind maps. How these work with students arranged in rows was not made clear, and traditional lecture theatres have been criticised for use in active learning by limiting the ability of the lecturer to engage the students in small group collaboration (Copridge et al., 2021).

2.2 Changing Learning Spaces

Talbert and Mor-Avi (2019) defined a learning space as a formal space where students are timetabled to congregate to undertake educational activities. Traditional learning spaces have been criticised for being too inflexible, having bad acoustics, seating students in a way that is not supportive of modern teaching practices and for putting the teacher at the centre of attention amongst other issues (Papaioannou et al., 2023).

Throughout the 21st century there has been a move towards putting the student at the centre of the learning space (Oblinger, 2005; Jisc, 2006; Temple, 2007; Radcliffe, 2008; Hunley and Schaller, 2009). In 2007, Temple made observations that learning spaces were changing across the university sector to be more welcoming, flexible in response to changing learning activities and incorporating more technology. However, at the time he drew attention to the lack of evidence of improved outcomes, lack of research available regarding the impact of such spaces and therefore little guidance on the cost effectiveness of such reconfigurations (Temple, 2007).

The idea of changing learning spaces to match pedagogy is not new. In their 1976 review, Cannon and Kapelis reported on how lecture benches were forbidding and the layout in lecture theatres restricted movement (Cannon and Kapelis, 1976). They also gave ideas for how seminar rooms could be made more flexible by having tables that could be rearranged to suit the activity, and also how lecture theatres could be modified by the introduction of technology,

desk layout and swivel chairs to allow students to interact with each other in buzz groups, giving feedback and working individually.

Further transferable skills that are developed in active learning spaces have been shown to include collaborative and communication skills in senior medical students (Marchiori & McLean (2022). These are essential skills for the modern world and are particularly highlighted within the undergraduate dental curriculum.

Graetz and Goliber (2002) predicted the demise of traditional lecture spaces and that physical environments must be designed in a way that allows students to interact and be supported by information technology. Yet, they highlighted the importance that the attitudes towards the space of staff and students need to adjust and develop meaningful attachments to the new rooms.

Changes to learning spaces are generally seen as a positive move by both teachers and students (Leijon et al., 2022). It is also concluded that changing learning spaces allows for a change in practice, for example Blom et al. (2022) observed that following the introduction of active learning classrooms, the teachers perceived their lessons to be more active.

Whilst the design of the learning space to facilitate certain teaching practices and pedagogies is important, there is a theory that the learning space itself can promote changes in behaviour. *"Spaces are themselves agents for change. Changed spaces will change practice."* (JISC, 2006, p.30).

2.3 The effect of learning space design on staff behaviour

The notion of a space itself being an active agent towards changes in behaviour and attitudes is well known in architectural circles (Jamieson, 2003).

Observations of the same teachers, in different environments have revealed the impact of the design of the teaching space on teaching behaviour. For example, Whiteside et al. (2010) observed the same teacher, teaching the same subject in two different classrooms; one traditional in layout, the other an active learning classroom, witnessed greater interaction with students, increased mobility and greater use of active learning in the second space. Brooks (2011) observed that with the same teacher and teaching material, but in two different spaces there was a reduction of the teacher talking from 77.4% to 54.5% of the time, whilst pupil discussion increased by 48% in active classrooms compared to traditional. Brooks later concluded that just the space

alone influenced the behaviour of staff which subsequently influenced the behaviour of the students (Brooks, 2012).

In a review of the literature relating to the factors that affect how teachers choose to teach, Savin-Baden et al. (2008) identified the learning space as a key influencer of staff thinking and practice in higher education, along with agency and notions of improvement. They considered teachers' and learners' attitudes in terms of their positive or negative evaluation of their teaching space. When breaking down the psychological impact of learning spaces they considered the spaces in terms of; the attachment to the space, the physical environment (heating and lighting) and the social environment (crowding and noise). With regards to space attachment, they point to the fact that the layout of the traditional lecture theatre with desks in lines facing a central podium expects the students to pay attention in silence, whereas if desks were more scattered without a central podium, the anticipation would suggest that collaboration will take place. This anticipation is a conditioned response and hence when wishing to change how students anticipate how to work, the space needs to alter to encourage that, therefore Universities require spaces that are more versatile that can enable different approaches to teaching if wanted (Jamieson, 2003).

Utilising an observational study, Beery et al. (2013) had expected to find that when teaching staff were provided with a collaborative classroom, more would take up active learning pedagogies. They found no significant change in the behaviour of the staff, and that those teachers who had previously practiced active and collaborative teaching styles did so regardless of the space.

Talbert and Mor-Avi (2019), carried out a literature review on the effects of the learning space on the pedagogical practices and behaviours of staff and were only able to identify a small number of studies in this area, mainly relating to the ability of staff to move around the room more easily and therefore be more able to engage with the students. They identified the effect that learning spaces can have on the behaviours and practices of staff as being an emerging area for research, and that none of the studies they reviewed addressed the cultural changes required by institutions when adopting active learning spaces.

Using interviews and questionnaires of teaching staff using newly redesigned collaborative lecture theatres, Swinnerton (2021) concluded that the change in space alone did not always lead to change in pedagogy and was closely related to the context of the teaching, the teaching matter being delivered and discipline area. Further to this it has been suggested that teacher backgrounds and beliefs can play a significant part in teacher choices, with

the space being more of an enabler, or a hindrance, depending on how it is designed (Haines and Maurice-Takerei, 2019).

Whilst the above studies have shown a change in some staff behaviour and activities that could be attributed to the change in design of the teaching space, more research is required to find out which staff change their pedagogical practices and why do they do that.

2.4 The adoption of new pedagogical teaching practices

If a change in teaching practice is to take place, we need to consider the conditions that must be met to enable change to happen. It follows that if we know and understand the reasons why some staff adopt new pedagogies and some don't, this could inform implementation strategies. By looking at the process of adoption through behavioural change in general and then change of teaching practices and the adoption of technology in teaching more specifically, this section will attempt to explore the factors behind teaching decisions and what factors are important when considering a change in teaching practice.

2.4.1 Adoption

Fullan and Pomfret (1977, p.336) defined '*adoption*' as "*the decision to use an innovation*" and '*implementation*' as the '*actual use*' of said innovation in practice. During this literature review, adoption may sometimes be termed in different sources as 'behavioural intention' or 'acceptance'.

2.4.2 The willingness to change

Weinberger and Shonfeld (2020) looked at the behavioural intention or willingness of student teachers in Israel to introduce collaborative learning into their classes using questionnaires containing both closed and open questions to explore the situation in some depth. They found that whilst the age and gender of the student teacher had no correlation with willingness, the most important factor was previous experience. This was positively correlated with the attitudes and skills necessary to be able to make a change and represented diagrammatically in Figure 2-1. Skills referred to the teacher feeling they had sufficient expertise to practice collaborative learning and was described as a mediator of change.

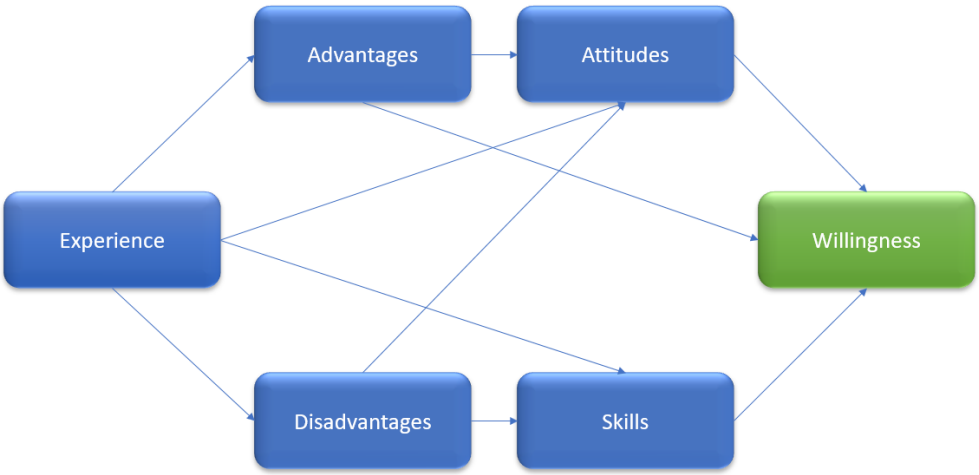

Figure 2-1 - Factors affecting willingness to include collaborative learning in their classes (Weinberger and Shonfeld, 2020)

This model only goes as far as willingness to introduce something new, it does not include any of the factors that facilitate implementation or the external forces that may affect the behaviour of teacher. Implementation as defined by Fullan and Pomfret (1977) as the actual use of an innovation in practice, has been less widely studied. The following sections will look at some further aspects that may be involved in the decision-making process to adopt a new pedagogy.

2.4.3 Teacher cognition, and beliefs

Beliefs, conceptions and teacher cognition are all terms that have been used when trying to describe the qualities and viewpoints of a teacher that guides their attitudes and actions. In very basic terms, two major orientations in teachers' conceptions of what teaching is have been identified; to either transmit information, or to facilitate learning (Kember and Gow, 1994). It could be argued that this is an over-simplification.

Teacher beliefs

Richardson defined a belief as "*a proposition that is accepted as true by the individual holding the belief*." (Richardson, 1996, p.106). However, Pajares (1992) explored beliefs from many different viewpoints and concluded that the term 'belief' is difficult to encapsulate in a singular definition as it covers a wide range of philosophical perspectives. These include shared cultural practices and cognitive principals, social strategies and orientations (Eisenhart et al., 1988).

Teacher beliefs have been described as one of the most important factors to influence teachers when considering how to teach (Richardson, 1996, p.102). Richardson (1996) went on to describe how beliefs are closely linked to experiences, including personal, those developed during teacher training and those formed during subject knowledge construction and can be altered and shaped by them, in a sense they are dynamic.

Teacher beliefs can play a part in not just whether they practice collaborative teaching, but also what type of collaborative teaching approach they choose to use and how effectively it is applied. In a detailed essay on the subject, Cohen postulated that effective application requires not just a motivation but effective training, which can be a reason why some teachers try to use collaboration, but then struggle to control the groups and gain anticipated benefits (Cohen, 1994).

There is some discussion with regards to introducing new teaching practices, whether the introduction should fit in with the existing beliefs of others, or whether the aim should be to change beliefs to embrace the new behaviour. For instance, when interviewing 20 teachers for their views on barriers to technology integration, Ertmer et al. (2012) found a strong correlation between beliefs regarding technology and educational practice. Five of the interviewees stating their own positive attitudes to technology as the strongest enabler to introduce technology, a further nine stated the greatest barrier to change was the negative attitudes and beliefs of others.

Likewise, Fenstermacher (1978) observed that change will most effective when they are compatible with the teachers' existing beliefs.

Eisenhart et al. (1988) found beliefs to be closely related to classroom practices that they are in control of and will be more likely to be responsive to innovations which allow them to maintain that control rather than diktats that are highly prescriptive.

In a mixed-methods study looking at the attitudes of 115 lecturers in higher education across Northern Europe, de Hei et al. (2015) found that the beliefs of the teachers had a strong impact upon the uptake and effectiveness of adopting collaborative learning. They found from a questionnaire that 90% of respondents did incorporate some aspects of collaborative learning into their classes, though it wasn't clear what the teachers considered collaborative learning to be. Of those that didn't use collaboration, the reasons given were frequently lack of perceived benefit and lack of time. Subsequent interviews allowed deeper discussion of why and how collaborative learning was incorporated, as well as problems that had arisen and support required. As far

as teacher beliefs were concerned, areas such as effort expectancy, improved learning and student motivation were found to be reliable predictors of using collaborative learning. Overall, the motivations for moving towards collaborative learning were largely student oriented (De Hei et al., 2015).

Teacher Cognition

Borg (2003) used the term Teacher Cognition as the mental construct that makes up what teachers believe, understand, and think about teaching, and how that relates to what they then put into practice. When considering language, the cognition of language teachers, Borg (2003) identified the factors that had a pivotal effect upon a teacher's beliefs. Shown in Figure 2-2 these included previous experience as a student, their training as a teacher, the context and their classroom practices.

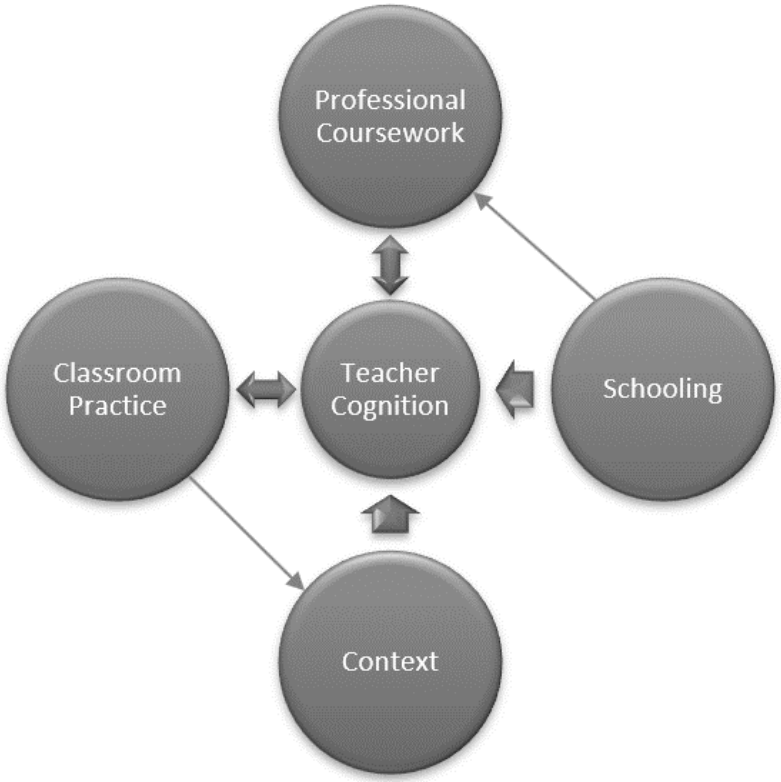

Figure 2-2 - Borg's schematic conceptualisation of teacher cognition in relationship with the events that shape beliefs (Borg, 2003).

Classroom Practice is the pedagogical and classroom management approach taken by the teacher in order to achieve their teaching goals. This may be focussing on student motivation, development of skills, preparing for work, and will be shaped by beliefs about the best way to achieve the aims and the *context* that it is being taught in. Some teachers may be given more agency in their practice than others and therefore classroom practice may not be the sole decision of the teacher. A teacher's personal experiences start

developing while they themselves are at *school;* inspirational teachers, enjoyable lessons are frequently remembered and possibly emulated. Past experiences of working collaboratively, or past attempts at introducing collaborative working cannot be ignored as part of the decision-making process. The effect of teacher training is debated widely. Borg observes that, whilst courses had the ability to change cognitive understanding of the learning process, this doesn't always lead to a change in adopted practices (Borg, 2003).

Changing beliefs

Teacher beliefs are very personal and although they evolve, they are probably the sum of many multiple experiences on top of some fairly deeply held personal beliefs. This can make it very difficult to think that you can change the mind of a teacher with any ease (Kagan, 1992).

Opfer et al. (2011) proposed the concept that for a teacher to change their learning practice, they must change their orientation towards teaching. Their orientation is formed by past experiences, teacher beliefs and practices. They also proposed the idea that once change had been implemented, what is expected of their students also changes. This can both reinforce beliefs but also lead to ever-evolving cyclical change. They showed the interrelation diagrammatically (**Figure 2-3**) and tested the theory with a questionnaire-based survey. Their results showed that both internal and external influences have a moderate effect on their teaching orientation and therefore a moderate effect on their changes in practice. Those changes in practice were iterative and dynamic, confirming a feedback loop effect on teaching practice. They acknowledge that this is just one part of the process regarding change and that the bigger picture is complex.

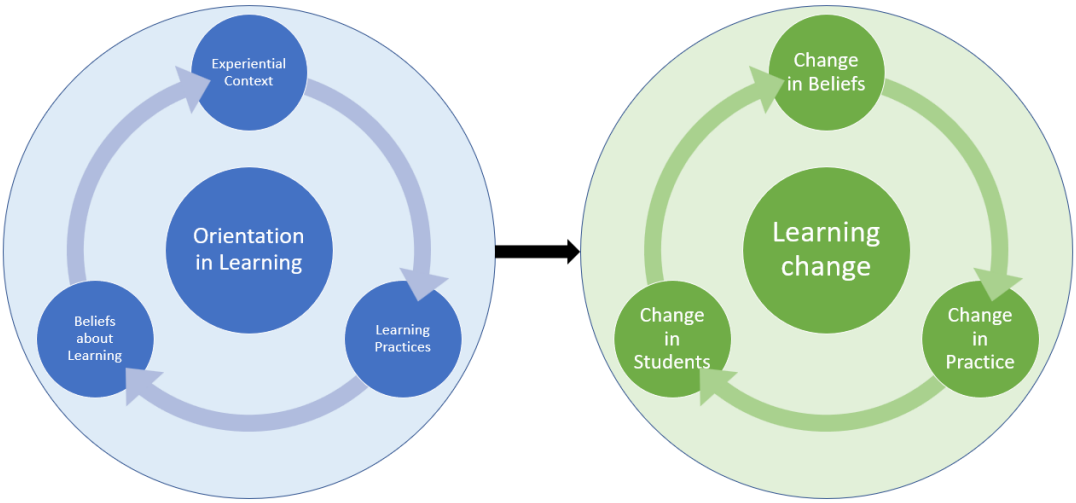

Figure 2-3 - Teacher orientation to learning influence on teaching change. Recreated from Opfer et al. (2011, p.447)

In summary, the understanding the beliefs of teachers is a crucial part of educational research and that understanding can help when considering personal and curricular development. However, teacher beliefs are complex, evolve slowly (Kagan, 1998), are multifactorial in their origin and can be deeply held (Kember, 1997).

2.5 The adoption of technology in teaching

The DLT refurbishment introduced some new technologies that would enable teachers to use a variety of tools to engage the students or to facilitate collaborative learning, but would they use them?

In a recent review of the advantages of integrating digital technologies in education, Haleem et al. (2022) listed numerous benefits including; increased educational opportunities, access to up-to-date learning materials, environmental benefits and a reduction in teacher workload. They also highlighted the benefits of developing communication skills and preparation for the modern world.

To consider the wide range of factors that may lead a member of staff to use technology in teaching, firstly general theories of technology acceptance will be reviewed. This gives an understanding into how new technologies brought into the workplace will be accepted by staff that are asked to use it. Secondly there will be a consideration of the adoption of technology in higher education to support teaching and learning. Several models will be introduced that have been designed to try to explain why and how people become adopters of technology in the workplace. These are useful, not just when considering the adoption of technology in general, but as they consider human factors and

emotions, they can serve as grounding points for adoption of new workplace practices in general.

2.5.1 Technology acceptance in general

The acceptance of technology has been extensively researched and the development of models with which to explore the uptake of technology is evolving as more is understood about behavioural science. Technology Acceptance Models have a long history, reaching back to times when office tasks became more mechanised and computerised, such as the introduction of word processors to replace typewriters and FAX machines to enable new means of communication.

The adoption of technology was observed by Rogers as not happening with all potential users at the same rate, some were quicker than others to start using what was made available (Rogers, 2003). Rogers categorised adopters by the speed with which they started using a technology into 5 categories and ascribed characteristics to them:

1. Innovators – the earliest adopters and willing to take risks, they decrease uncertainty for others by demonstrating effectiveness of the technology.
2. Early Adopters – less likely to take risks than innovators, more certain of effectiveness before adoption, but adopt early to lead the way. These tend to be opinion leaders and well respected in an organisation.
3. Early majority – usually deliberate for some time before feeling certain that they wish to adopt the technology. Followers rather than leaders.
4. Late majority – more sceptical and tend to adopt more out of necessity or due to peer pressure.
5. Laggards – Decisions tend to be located on events of the past rather than looking forwards. Must be absolutely convinced that the technology will work before adopting.

Rogers estimated the percentage within each category to be present within a system (Figure 2-4).

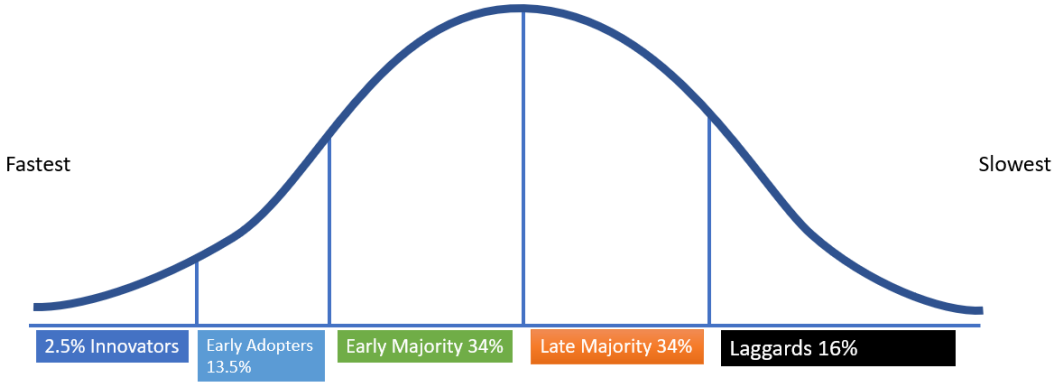

Figure 2-4 - Percentages of each category of adopter, adapted from Rogers (2003, p171)

Whilst this is useful to give an indication of what to expect when introducing innovation, it is more useful for examining uptake of technology at an organisational level than to assess the reasons why individuals adopt technology (Li, 2020).

In order to explore what factors may assist with the adoption process, several technology adoption models have been created. The driver for such research was to reduce wasteful purchases of equipment by exploring the conditions that lead to acceptance and usage (Venkatesh et al., 2003; Venkatesh and Bala, 2008). The technology is not of any value to an organisation if it is not being used.

The Technology Acceptance Models (TAM 1, TAM2 and TAM 3, UTAUT)

The Technology Acceptance Model (TAM), as proposed by Davis, (1986) in its most simplified form is shown in Figure 2-5. The TAM model considers that to accept a new system, the users must perceive it to be useful, and perceive it to be easy enough to use leading to a motivation to use it. Davis labelled the design features of the system as X1, X2 and X3 were explored and evaluated in later versions of TAM.

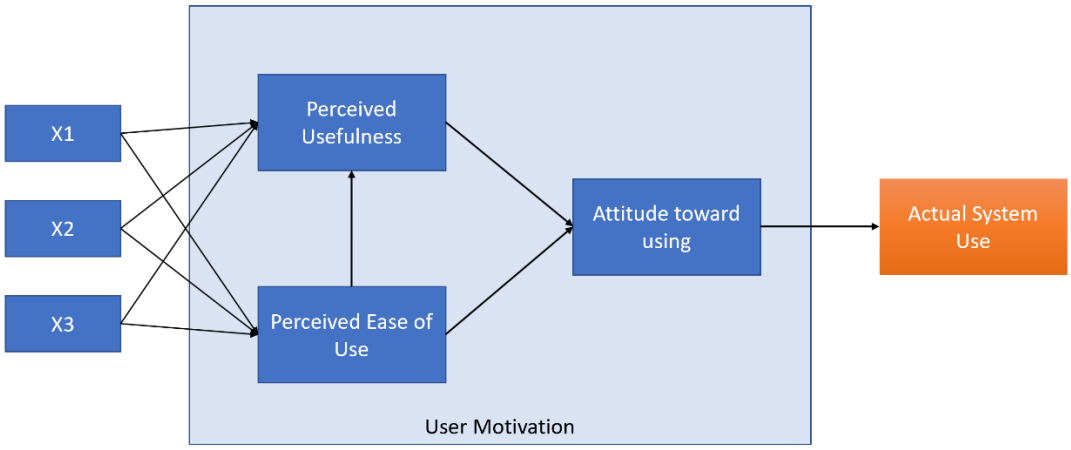

Figure 2-5 - The first iteration of the Technology Acceptance Model (TAM) (Davis, 1986)

Relating this to the Dental Lecture Theatre, this model implies that staff must first be convinced of the usefulness of using technology in teaching, and also that any changes made to their teaching practices will be easy to implement, for both themselves and their students. What is missing here are the factors that lead to both the feeling of usefulness and what would contribute to the perception that change would be easy. What is also missing are the steps that come between having a positive attitude towards using the technology and actual use.

Perceived Usefulness

Davis (1989, p.320) defined perceived ease of use as "*the degree to which a person believes that using a particular system would enhance his or her job performance*." Whilst this is relating to technology, for the current study this could be substituted for collaborative teaching.

Perceived Ease of use

Davis (1989, p.320) defined perceived ease of use as the freedom of effort someone believed it would take to change to a new system. Venkatesh, (2000) explored this idea further and introduced the ideas of *internal and external control*. Control being *"…an individual's perception of the availability of knowledge, resources, and opportunities required to perform the specific behaviour*". He described the notion of ***internal control*** of being those being the knowledge held, or self-sufficiency of the individual to make changes, and ***external control*** as how conducive the environment is to change.

The TAM model went through several iterations until TAM3 (Figure 2-6) which included 'Anchors' and 'Adjustment factors', such as the factors that may lead

to someone feeling comfortable around technology, and how much they enjoy using it (Venkatesh and Bala, 2008). By adding these, the model is becoming very complicated, but that may only reflect the complexities of human nature when a change to the normal routine is suggested.

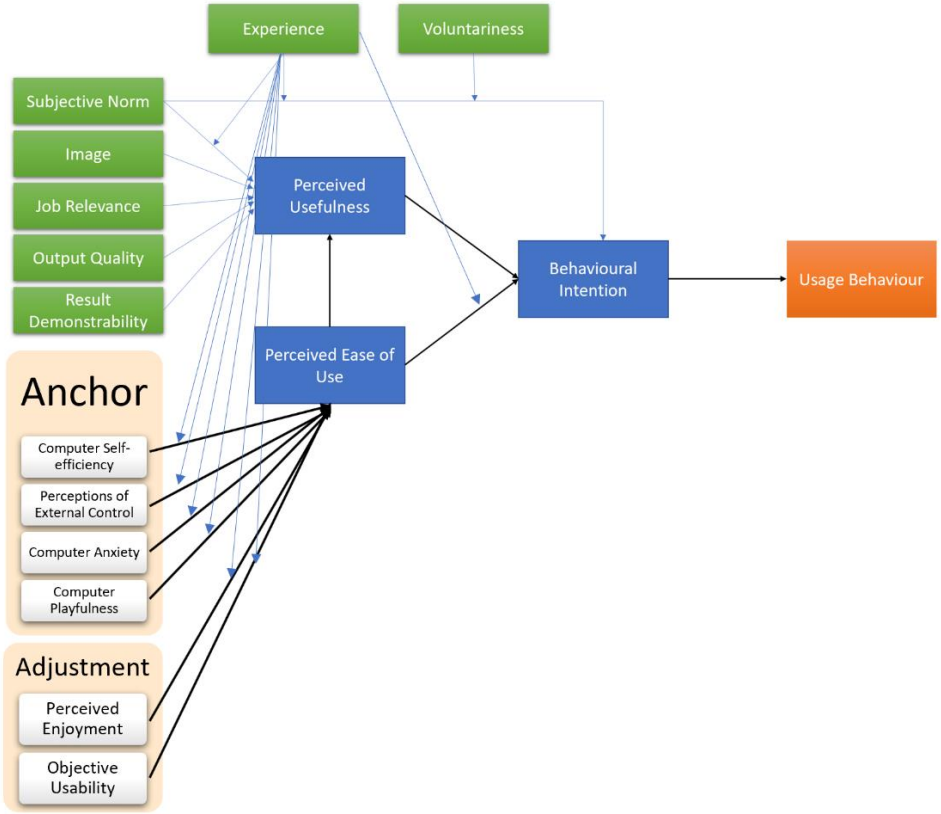

Figure 2-6 - TAM3, which includes the original TAM in blue, TAM2 in green and introduces Anchors and Adjustment factors in light orange adapted from Venkatesh and Bala (2008)

All iterations of the Technology Acceptance Models have at their core the ideas of perceived usefulness and perceived ease of use, the later modifications to the model largely based upon the conditions or factors that may influence these perceptions. Davis (1989) tested those aspects that may make up ‘perceived usefulness’ by getting potential users of technology to answer a series of questions, including whether adoption would make the job easier, save time, improve quality etc. They found that improving the outcomes was a higher motivation than making work easier.

Alongside the technology acceptance models, research was being undertaken regarding the enhanced effectiveness or efficiency improvement that technology could bring to the individual using it. The Test-Technology-Fit (TTF) model (Goodhue and Thompson, 1995) focused more on the success of implementation than the acceptance in the workplace. They reported that the closer the alignment between the technology and the task to be carried out, the greater the effectiveness and better the implementation.

Combining, amongst other factors, these two research streams of acceptance and successful implementation, and including the Theory of Reasoned Action, the Unified Theory of Acceptance and Use of Technology (UTAUT) was developed by Venkatesh et al., (2003). This unified eight previous models but retained the central core of behavioural intention from the TAM models. By introducing moderating factors such as gender and age that were perceived to have an influence on the desire to use technology Figure 2-7, the model has gained wide acceptance. In their evaluation of the new model, Venkatesh et al., (2003) found that the factors they had chosen to include from the eight previous models were successful in predicting 70% of usage behaviour after training and later at 1 month and 6 months following the introduction of a new technology.

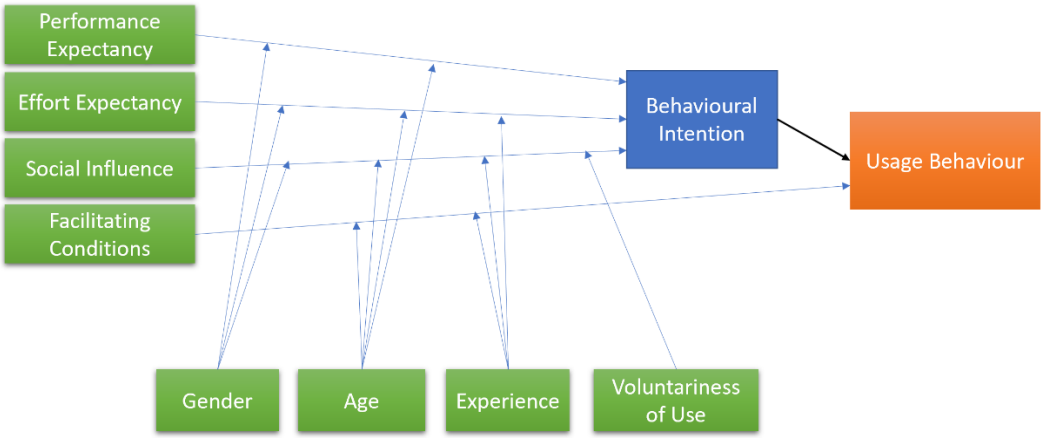

Figure 2-7 - UTAUT model (Venkatesh et al., 2003)

Whilst the UTAUT model along with the TAM models are originally and principally related to the adoption of technological solutions, they provide a good insight into the decision-making process in general. We can look at the factors that are associated with a change in behavioural intention and in turn relate those to the introduction of a new pedagogical solution.

Performance expectancy: Venkatesh et al. (2003) describe performance expectancy as "*the degree to which an individual believes that using the system will him or her to attain gains in job performance*". This had been referred to in earlier literature as "*usefulness*" (Bagozzi et al., 1992). In educational terms, this could relate to an anticipated improvement in such metrics as, assessment performance, professional behaviour and or improved attendance.

Effort expectancy: Relates to the ease of use or adoption. For the example of a digitally enhanced collaborative teaching space this could relate to the use of technology, but also could be extended to think about the demands of

the pedagogy, such as making changes to normal teaching practice and increased planning. This may relate to students also, for the example of the flipped classroom, not only do the teachers have to prepare material to study in advance, but the students also need to find the time to do it.

Performance and effort expectancy may be interrelated as the greater the anticipated performance improvement, the greater the effort an individual may make in adoption.

Social influence: Relates to the how much the individual thinks that there is an expectation on them to use a new system from people they deem to be important. It also is used to explain how someone may be positively influenced by another's use, especially if they respect that other person's views and opinions. This is very significant, as can be seen in the almost tribal usage of different brands of smartphones (Sierra and Taute, 2019), or current trends for "influencers" on social media who can be paid considerable sums of money to promote a brand (Caruelle, 2023).

Facilitating conditions: Facilitating conditions are the degree to which the organisation and infrastructure support a change from acceptance to implementation. In order to make a change in behaviour, the conditions need to allow that to happen, for instance the time to re-imagine a curriculum, or the technical support to use complex functionality. However, this is very interesting in that in the UTAUT model facilitating conditions are shown before a behavioural intention, rather than the desire to change being followed by being provided with the resources to make that change, and this is the crux of the current study. Does the fact that collaborative learning can be done influence a behavioural intention to do it?

The modifying factors of age, gender etc. may be important. Venkatesh et al., (2003) thought that older users and women may have more difficulty with new complex processes. This viewpoint requires significant challenge. Whilst older studies such as Loyd and Gressard (1984) may have found age to have an effect on anxiety in using computers, they found no such effect of gender. Gilroy and Desai (1986) did find that girls were more anxious than boys about using computers, but both of these studies found that previous computer experience was the most significant factor in computer confidence, and it could be that nearly 40 years ago boys played on computers more than girls leading to more experience rather than there being an inherent gender difference. More recent studies have shown age and gender to have minimal impact, however previous *experience*, according to Weinberger and Shonfeld (2020) would still appear to be a significant factor in the adoption process.

2.5.2 The integration of technology in teaching

Petersen and Gorman (2014) described how some instructors can feel overwhelmed by technology and that students may either feel overwhelmed by it, or conversely irritated that their teacher is not using the technology to its full potential.

As seen previously, Ertmer et al. (2012) found a strong connection between beliefs and the integration of technology, which leads to the challenge observed by Clegg et al (2000) that, whilst an innovative and enthusiastic minority will embrace the technology, a significant number of staff will have neither the training nor skills to use it. This must be only partly true, as the enthusiastic minority were presumably not born with those skills, they must have sought them out, but what leads some to do that, but not others?

The technology acceptance models are useful tools for predicting behaviour when looking at the adoption of technology, but what about adoption of pedagogy, can the same factors be translated for that use?

To attempt to create a model for the adoption of a technology enhanced pedagogy, Gellerstedt et al. (2018), modified the UTAUT model and replaced the modifying factors with a construct they called "*digital living*" rather than age, gender and experience they felt the amount that an individual embraced technology generally would be an important factor. They found that digital living related to both performance and effort expectancy but not with actual use. They used a questionnaire-based study, which could lead to questions regarding how digital living was determined as the questions required self-evaluation and were not always objective and could be interpreted differently by different people. For example, questions such as "Digital technology is an important part of my social life…", and "you could say I am addicted to my smartphone." may relate more to personality traits in how they answer them than how much they embrace technology. Modern technology is also so user friendly that very little ICT knowledge would be required in their operation.

From this (Gellerstedt et al., 2018) concluded that the familiarity and comfort with technology experienced by the teacher was pivotal in the uptake of technology. But to apply it properly and technology and pedagogy must be properly integrated (Fawns, 2022).

2.5.3 TPACK

A well-established model for identifying the knowledge domains required to provide technology-enhanced pedagogical practice is the Technological,

Pedagogical and Content Knowledge (TPACK) framework (Figure 2-8) (Mishra and Koehler, 2006).

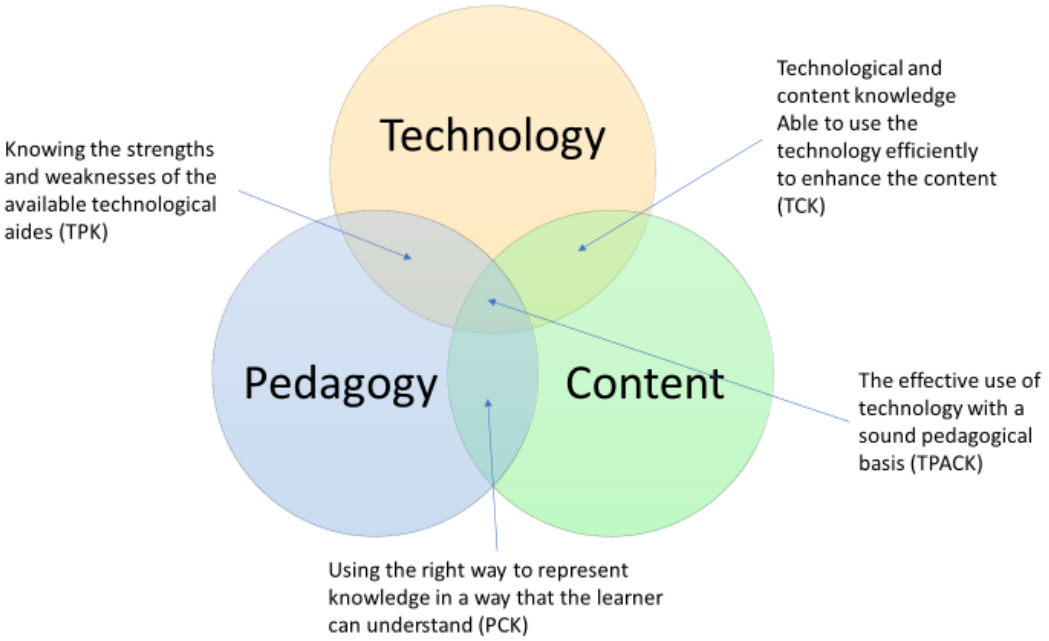

Figure 2-8 - Venn diagram of interrelation between different knowledge types - adapted from Mishra & Koehler (2006)

Building on previous research, principally that of Shulman (1986) into the connections between pedagogical knowledge and content knowledge, Mishra and Koehler (2006) were aware that there was no consideration given to how technology is incorporated into teaching. By introducing Technological Knowledge into the model and looking at how technology may influence and be influenced by the knowledge of the subject area (Content Knowledge) and the knowledge of teaching and learning methods (Pedagogical Knowledge), Mishra and Koehler created a combined framework. This framework could be used to both investigate current practice and help develop teachers into the effective use of technology to support learning and enhance the student experience (Kurt, 2019).

The components of TPACK

The knowledge required to become a teacher could be considered as mainly having an adequacy of content knowledge of their subject area. Typically, the pre-requisite to become a lecturer would be a PhD in the subject area to be taught. In The School of Dentistry at Leeds, the only requirement to become a lecturer in Dentistry is the possession of a dental degree. In school teaching however, there has been a shift towards an emphasis on pedagogical knowledge, sometimes at the expense of content knowledge (Veal and

Makinster, 1999). To try to provide a framework for the development of teachers, the concept of combining pedagogical and content knowledge into a single entity of Pedagogical Content Knowledge (PCK) led to much research into how teachers develop during the 1980s and 1990s. PCK was first described by (Shulman, 1986) but the notion of exactly what components make up PCK show some variation between researchers (Veal and Makinster, 1999) but mainly include the context or “student knowledge” along with content and pedagogical knowledge. Each component of the TPACK model is detailed as:

- Content knowledge (CK)
  Shulman defines content knowledge as the amount, nature and organisation of subject matter in the mind of the teacher, that is required to be taught (Shulman, 1986). This will be very context dependent, for example, the type of knowledge to teach in school may be different from university and will vary considerably between subjects.

- Pedagogical knowledge (PK)
  Pedagogical knowledge encompasses the practices involved in teaching and learning. Along with an understanding of how students learn and construct knowledge as well as classroom management, designing lessons and evaluating the knowledge of the students (Shulman, 1986).

- Pedagogical Content Knowledge (PCK)
  The ability to consider how best to represent, explain, categorise, and assess content knowledge requires a further skill, that of the possession of Pedagogical Content Knowledge (PCK). Shulman (1986) proposed the concept of Pedagogical Content Knowledge as the intersection between subject specific Content Knowledge and Pedagogical Knowledge Shulman later defined PCK as the ability to adapt knowledge for the purpose of education. This would include such matters as what is easy to understand and how to best take a new learner through the stages necessary for them to be able to understand the more difficult concepts. Cochran et al. (1993) described PCK as the factor that differentiates between expert teachers in a subject, and subject experts who aren’t necessarily teachers.
  Pedagogical Content knowledge will vary widely in different disciplines and will be unique to each discipline whether that be languages, science or mathematics (Bauer, 2013).

- Technical Knowledge (TK)
  Technology, in its broadest sense includes the tools we use to achieve a purpose. In teaching, technology changes and evolves with time. From chalk boards to overhead projectors to visualisers and electronic whiteboards, Technological Knowledge (TK) is the set of skills required to be able to utilise the technology. As technology becomes more digitally based there are both hardware and software skills required, as well as an understanding of how information is shared and stored.

- Technological Content Knowledge (TCK)
  TCK is a knowledge of the relationship between technology and the content being taught (Mishra and Koehler, 2006). For example, this technology may include an augmented reality application for learning anatomy, or 3D scanning to aid design. The technology could be applied to different subjects in different ways, and the appropriate use of technology in that field makes up TCK.

- Technological Pedagogical Knowledge (TPK)
  This is the knowledge of what technology can be used to support teaching, what it is capable of and how it may change the way we teach (Mishra and Koehler, 2006). This will include whether the technology is fit for purpose as well as the creation of strategies for its use that are compliant with effective learning and teaching methodologies.

- Technological Pedagogical Content Knowledge (TPCK)
  Mishra and Koehler (2006) state that TPCK goes beyond the scope of each of the knowledge domains it encompasses and forms the backbone of good teaching standards using technology. It includes the knowledge of using technologies and good pedagogical practice to teach content in a constructive way that can help students build on their existing knowledge, by making concepts easier to understand, memorise or self-assess their current levels of understanding.

TPACK has been found to be a useful tool for prediction of integration of technology in teaching. Li et al. (2022) showed CK, PK, TPK and TPACK scores to have a good correlation with teachers experience and level within their institution.

Practical applications of TPACK

TPACK is frequently used in self-evaluation style studies using questionnaires. For example, Bauer (2013) designed a TPACK questionnaire for music teachers in in the United States to ascertain how much each teacher had integrated technology into their classroom. The responses from the questionnaire were evaluated to create a "*TPACK score*". They concluded that for music teachers in the US, TPACK was a promising model for understanding the skills and knowledge that teachers required for successful integration of technology.

Shortcomings of TPACK

Most studies using TPACK, use it quantitatively such as in Bauer's study. Participant's answers rely on self-evaluation with no evidence to back up the claims which raises questions of validity. One TPACK instrument in common usage, developed by Schmidt et al. (2009) has been criticised for being too generalised for specific studies (Fisser et al., 2015). There is also a question about the potential for bias by using it as a questionnaire. For example, to test PCK, one of the questions from Schmidt et al. (2009) is; "*I know how to select effective teaching approaches to guide student thinking and learning in mathematics*". There are many problems with this kind of question, for instance it may get higher scores teachers with self-confidence rather than those with self-doubt regardless of their actual knowledge. This could easily lead to staff with high levels of self-confidence giving themselves high scores on TPACK. This example question is by no means unique, and conditions such as imposter syndrome, which is common in new and pre-service teachers (Brems et al., 1994) could lead to the risk that TPACK questionnaires, relying on self-assessment, lack validity. Self-reporting may lead to other areas where validity is called into question; it is known for instance that females have a lower perception of their digital competencies than males (María Gómez-Trigueros et al., 2021). It is also reported that participants may be unaware of their own knowledge gaps (Willermark, 2018).

There are few examples of TPACK being assessed by interview. A mixed methods study by Harris et al. (2012) attempted to assess TPACK via structured interviews, and whilst they achieved good inter examiner agreement using a rubric to assess interview recordings, there is no evidence that this actually assessed TPACK and there was no attempt to isolate the subcomponents of the TPACK model. Swallow and Olofson (2017) also used semi-structured interviews to assess TPACK. Whilst they considered the TPACK framework was good for specific items being explored, they thought it

too loose for general use. The TPACK model has also been criticised for not being readily verifiable, and having domains which appear as separate entities in the model, but difficult to tell apart in the real world (Kompa, 2018).

2.6 Challenges to implementing changes in teaching practice

In a study, similar to the current one, de Hei et al. (2015) found that whilst the majority of teachers were using some collaborative learning, there was a cohort that were not. They speculated that those teachers did not do so because they had limited knowledge of the theory behind collaborative learning or had difficulty in putting it into practice. To explore the phenomenon, they ran a survey which highlighted eight potential reasons for not adopting collaborative teaching, which included; thoughts that it would be either ineffective, it would be an inefficient use of time, their content was too complex to deliver that way or students would prefer to work independently.

The Novigado Project, a European initiative to assist schools in transitioning to active learning and innovative teaching environments, has recently produced a series of guidelines which outline the benefits of active learning, but also highlighting the challenges faced by stakeholders, teachers and students (Aydos 2021). They split the challenges into three categories; challenges of mindset, toolset and skillset. The toolset related to the suitability of the space for the intended teaching and may not be apt to this study as the DLT is not flexible in its arrangement, however the mindset and skillset are very relevant as we have previously seen in terms of teacher beliefs and technological, pedagogical knowledge.

2.6.1 Challenges to adoption of collaborative teaching

Several reasons for a failure to implement collaborative teaching have been postulated to include; a lack of familiarity, confidence or knowledge of how to make the changes, concern that subject matter may not be fully covered, and concern that students will be unfamiliar with how to learn collaboratively (Panitz, 1997). Murray and Macdonald (1997) found that whilst staff may see their role as motivating and facilitating students to learn, their habits in lectures and seminars were less likely to change if the environment that they were working in did not promote or support such change.

Teachers also need to take into consideration that changes in teaching practice are accompanied by a change in learning practices for students who may be both unfamiliar with the new styles of learning and be suspicious of it(O’Neill and McMahon, 2005). Felder and Brent (1996) explored the

concerns that lecturers had when asked to introduce student-centred learning. Some of those expressed by staff that may demotivate them from making changes in the first place included; spending time on in-class activities reduces the time available to deliver the syllabus; students won't all do the self-directed learning that would be required if didactic delivery is reduced; some students want to be passive learners and may be hostile to change; teams of students are difficult to manage, some won't play an equal part, some might not get on with each other. They concluded that for university teachers, already burdened with pressure for research and a lack of familiarity with new pedagogies, rewriting lesson plans and teaching materials may be considered too time consuming (Felder and Brent, 1996).

There is also the suggestion by Haines and Maurice-Takerei (2019) that less confident staff may prefer to avoid scenarios where they are having to respond to questions and may feel more comfortable delivering a pre-prepared presentation.

2.6.2 Barriers to the uptake of technology

The barriers to uptake of technology in teaching were explored by Georgina and Olson (2008), who found the key issues to include; not being a priority, 'old-school' teachers not wanting to learn new skills, the time required, the difficulty of incorporating technology into pedagogy without departmental support and inadequate training being available. Ertmer et al. (2012) also found lack of technology support, state standards and time to develop new practices as barriers. Haleem et al (2022) highlighted the fact that teachers often lack the motivation, skills and training to adopt technology effectively.

Sang et al. (2009) categorised these barriers to adoption of technology in teaching as being either first order (external barriers) or second order (internal barriers). External barriers being such things as training and support, which were noted that even when these barriers were removed by providing training and support this did not automatically lead to technology integration without the internal barriers of beliefs and attitudes towards the integration of technology being oriented to do so.

2.6.3 Summary

From the previous three sections, it can be seen that, to be able to implement a change in practice effectively, the teacher should possess the belief that change is necessary and have the desire to do so. They must possess the relevant pedagogical and technological knowledge, have appropriate tools and sufficient time and support.

Michael (2006) observed that, even when the benefits of changing teaching practices are evident, change doesn't just happen by itself without active intervention. Encouraging staff to adopt different teaching styles is reportedly very difficult, particularly across a large university department never mind a whole university (Kember, 2009). According to Brown Wright (2011), neither students nor teachers are particularly adept at making a change towards student centred learning. This may be due in part to the fact that university lecturers may become teachers only after developing an expertise in a field other than teaching, lack pedagogical training (Postareff et al., 2007; Aškerc and Kočar, 2015; Biku et al., 2018), and their teaching may be a secondary role to other aspects such as researcher or clinician.

Leijon et al. (2022) identified a key issue, that teachers are not always familiar with how to use new learning spaces, and need support and time to use the space to its full potential. This support could come in the form of formal and informal training, however they found that a dearth of studies in this area, only 6 were available, they were not able to point to a correct way for staff to be supported.

Papaioannou et al. (2023) highlighted hybrid learning spaces as being more demanding for staff to use in terms of operating technology and communicating with the students, to ensure that none feel left out, but also that students do engage with activities and participate with each other. This then places pressure and challenges upon staff. Bligh (2019) made three recommendations for addressing these challenges. Firstly, that staff are actively involved in the redesign of spaces, so that the outcome fits with their desired practices and workloads. Secondly that teachers must start to engage with the students out of classroom learning activities, one example of which would be the flipped classroom approach whereby targeted learning is given as homework to prepare for in-class sessions (Bergmann and Sams, 2014). And finally, that teachers should re-evaluate how they use the time they have with the students in the classrooms, so that these can both complement the students own learning as well as an opportunity to evaluate their learning and understanding.

The following section will look at the role that the institution in promoting, supporting and facilitating change.

2.7 The role of the institution

As Aydos (2021) pointed out, teachers first need to be able to change their mindset regarding new ways of teaching, and then learn how to do it. The role

of the institution is to provide opportunities and the tools for development as well as foster a shared vision that everyone feels part of (Niemi, 2020).

In a review of the available literature on implementation, Fullan and Pomfret (1977) described the change in physical space as the easiest part of the adoption or implementation process, whereas changes in how the space was administered was more complex. They stated that personal changes in behaviour and organisational changes are connected, but organisational change is a huge challenge, with roles needing to be allocated through change management, time allowed for new tasks and staff to adopt new roles to support and monitor the change process.

Such organisational changes were explored by Steel and Andrews (2011) who identified the key aspects of assisting staff to make best use of re-imagined spaces as being:

- **Leadership:** To enable, support and empower teachers to make changes, by sharing a vision for how change should be effected and facilitating teachers to be able to overcome challenges they may face in the change process. For technology-enriched learning spaces, they recommend the involvement of partnerships with colleagues, pedagogical and technological experts to help overcome more specific barriers.
- **Academic Development**: To develop the new skills required.
- **Modify curriculum and assessment:** To reflect the activities that are intended and the type of learning that is being promoted.

In a survey of K-12 teachers in the USA, Snider and Roehl (2007) found that half of teachers thought a prescriptive but well-designed curriculum was the best for student learning, whilst 23% thought that a curriculum that was too prescriptive stifled creativity.

Smylie (2016) emphasised the importance of the role of the school principal in setting goals and expectations for staff as well as allowing freedom to make changes within their own practice. However, the individual teachers must also have a mindset that is open for change, this mindset can be influenced by how effectively they feel they may be able to teach and the confidence they have in their teaching strategies and practice.

Rather than dictating how spaces should be used, leadership has an important role in providing a vision for staff and support through making changes. Frelin and Grannäs (2021) discussed the role of the head of school,

who can introduce change gradually and “nudge” teachers towards making changes, whilst at the same time providing support and time to do so.

In an opinion piece, Oblinger outlined that leaders should be setting the vision for the use of spaces, based upon the determined learning philosophy and vision for the expected student experience (Oblinger, 2005). She goes on to discuss how the move away from a lecture-based pedagogy to a more collaborative style of teaching requires curricular change including a change in how assessments are carried out. The importance of why leaders should be providing a vision for how spaces should be used, and for supporting staff to make the use of new spaces using new pedagogies was witnessed in a survey of primary and secondary schools in New Zealand (Carvalho et al., 2020). Apart from providing a vision, two key areas in which leadership can be major influencers of change is to make necessary training available, and provide support for staff, in terms of the time and resources to make changes, available.

Yang et al. (2023) brought together all of the considerations of the role of the institution into three recommendations. Firstly, to empower the teachers to be innovative and reform their teaching plans, secondly provide resources for making changes and positive examples of how teaching could utilise the facilities for better outcomes. Thirdly provide training and develop competencies to use the ICT and the spaces designed.

2.7.1 Training

From work carried out with medical educators, staff are generally very well trained in their subject matter, therefore their content knowledge will be high, but, using TPACK, they have been shown to be lacking in both pedagogical knowledge and technological knowledge (Youm and Corral, 2019). They recommended that medical teachers are trained adequately in both of these areas if technology enhanced learning is to be adopted more widely. Dental Staff will be no different, with their only requirement to join the teaching team is a dental qualification.

Training may not only affect how teachers teach but can also standardise how different teachers teach across an institution (Biku et al., 2018). Staff training has been shown to have an impact on change, which can lead to staff becoming more supportive of their students (Dexter and Richardson, 2020), and in turn, improvement in the assessment outcomes seen in students (Gibbs and Coffey, 2004). Whilst training would seem to be an important component of change, Clegg et al., (2000) warn that some staff may be

sceptical of training, especially if it is not evidence based and the other pressures on staff make their own teaching development more challenging.

Snider and Roehl (2007) found that some teachers can be sceptical of evidence-based teaching, believing that the most effective way to learn is from experience, despite their actual observations that experiential learning can be unreliable or even misinformed. This scepticism could explain why Georgina and Hosford (2009) found no correlation between faculty training and the integration of technology into teaching. They further found that there was no relationship between number of years teaching and technology use, despite more junior staff reported feeling more proficient with tehnology than senior staff. They did find though that training was most efficient when targetted at a particular task or individual.

Training, however, has been reported to be frequently inadequate (Cohen, 1994). To identify the issues with training, in a study of the implementation of ICT training in a UK university, Clegg et al. (2000), using questionnaires and group discussion sessions, observed several issues when attempting to provide a training course for a diverse group of academic staff. They found that with a wide range of technical abilities for staff prior to the sessions some felt the level of the training was either based too high and others too low, but mainly they observed that although staff could be trained to use educational technology, if they were going to use it, they would have to know when it was best to use it and when it was inappropriate. Simply understanding how to use the technology was not sufficient to be able to embrace it.

Guskey (2002) believes that the majority of staff development occurs in the classroom. In his 1986 paper, he discusses the effectiveness of teacher development and concluded that although training may influence a teacher's actions, a change in belief is a slow and iterative process (Figure 2-9) that is shaped by experiences, reflection and observable changes in outcomes Guskey (1986). He described a continuous development shaped by the success or failure of attempts to instigate change. When changes proved to be unsuccessful, they were abandoned and those that worked lead to either further change or reinforcement of beliefs, cementing practice.

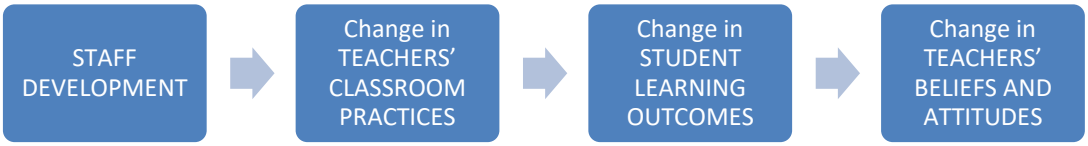

Figure 2-9 - Staff development and changes in teacher beliefs, adapted from Guskey (1986, p. 7)

In Guskey's own words.

> *"…when teachers see that a new program or innovation enhances the learning outcomes of students in their classes; when, for example, they see their students attaining higher levels of achievement, becoming more involved in instruction, or expressing greater confidence in themselves or their ability to learn, then, and perhaps only then, is significant change in their beliefs and attitudes likely to occur."*

Following the introduction of the three redesigned collaborative lecture theatres at the University of Leeds, a report by Clement included several case studies highlighting successful use of the new spaces, but also recommended that there was scope to make even more lectures interactive and collaborative, and in order to achieve this, she suggested that staff training should focus on pedagogy rather than technology (Clement, 2018).

2.7.2 Support

The first order barriers to change previously identified in section 2.6 apart from training, included lack of time to adapt teaching materials and lack of support with technology, but (Georgina and Hosford, 2009) identified many ways in which the institution could support the change process, including:

1. Provision of sufficient time for training
2. Provision of mentors
3. Providing Clear goals for the school and University with respect to what is expected
4. Access to pedagogical and technological support

These are amongst a range of others but seem most relevant to the current situation.

2.8 Summary and gaps in knowledge

It is recognised in the higher education sector that the design of the spaces within which teaching happens can have an impact on learning (Steel and Andrews, 2011; Evans and Kozhevnikova, 2011).

To enable a move towards collaborative learning, teaching spaces are increasingly being altered to facilitate different pedagogies (Educause, 2013). In The University of Leeds, three innovative collaborative learning spaces have been installed to replace three traditional lecture theatres. Since their introduction there are many examples of innovative use of the learning spaces by staff who have embraced them (Clement, 2018) and the literature points towards collaborative teaching spaces being a means of improving the educational experience (Gunderson and Moore, 2008), however for staff used

to traditional didactic teaching there are many challenges to face before change can happen.

The factors that affect the choices made by teachers about how they teach are complex. Savin-Baden et al. (2008) highlighted the importance of the teaching space, whether the space itself motivates change or enables a change that was already desired but not previously possible is not clear.

In order to study teacher adoption of new pedagogies and technologies, there are existing models such as TPACK and UTAUT that could be utilised. Each looks at different areas and some have felt that the two should be combined to get a fuller picture understanding of a phenomenon. For example, when investigating the factors that led teachers to adopt the use of clickers in the classroom, Cheung et al. (2016) realised that the current accepted models for looking at adoption of technology in education did not include the teacher knowledges that may be required. To overcome this, they used both the UTAUT model (Venkatesh et al., 2003) and the TPACK model (Mishra and Koehler, 2006), and were able to look for correlations between the two. They found that teachers with higher TPACK scores were more likely to adopt clickers, and more likely to continue to use clickers in the future, this does not however take into account beliefs.

Kimmons and Hall (2018) considered the usefulness of the existing models, discussing that even if models which are well-known and widely used did not necessarily reflect how useful they were, and that models should reflect the real world. As already shown, there are numerous models that already exist, some of which concentrate mainly on the adoption of technology of individuals, and some on behavioural change, but it is rare to find a model that combines these and also takes into account beliefs and facilitation. Even when combined though, the UTAUT and TPACK models don’t address some of the other key issues in teacher choices such as teacher beliefs and cognition.

The literature review highlights several areas worthy of exploration when considering the impact of introducing a new teaching space to university lecturers:

- The teaching environment - Does the classroom design by itself, by being present change the attitudes of staff?
- Is the space appropriate for genuine collaborative teaching to take place?

- For those staff that wish to change their teaching style, do the barriers they face lie within the familiarity with technology, the knowledge of the pedagogy or whether their subject matter lends itself to such change?
- How would they prefer to be supported though change?
- For those staff that have changed how they teach following the refurbishment, what factors influenced that decision and what benefits do they feel they change has brought for them and their students?

2.9 Research aims

The overall aim of this project is to contribute to the knowledge base about how staff respond to and can be supported through changes in teaching environments. If more is known about the positive and negative implications of redesigning learning spaces, ultimately it will help staff develop the best pedagogical practices and use the facilities provided for the best outcomes for the students.

In order to guide the study, the following research aims have been created:

1. To investigate whether teachers have changed their teaching style depending on the learning space they are in.
2. To find out if they made use of the way the students are arranged and the technology available to them.
3. To understand the motivations of staff towards collaborative learning, including their knowledge of the benefits and potential drawbacks, and how they could envisage it could improve the experience of their students.
4. To explore whether there are factors that are facilitating or inhibiting the opportunity to change, what have they found useful and what assistance do they feel they need.
5. To discover how likely they are to make changes in the future?
6. To discover whether the staff feel adequately prepared for making changes to the way they teach when using a collaborative learning space.
7. To be able to contribute to future change management having a better insight into the levels of support that staff may require to make the transition as smooth as possible.
8. To create and critique a novel framework within which a fully dimensional exploration of teachers attitudes towards technology-enhanced, collaborative learning. To identify the factors that are either positively or negatively associated with change or the desire and ability to change pedagogical practice.

2.9.1 Research Questions

In order to address the gaps in the existing knowledge and to develop a conceptual model the following research questions have been formulated:

1. Have staff changed their lecturing style in response to the changed design of the lecture theatre?
    a. What factors motivated or demotivated staff towards making changes?
    b. What factors helped facilitate change?
    c. What challenges did they face?
2. How can educators be supported following the change of a teaching space?

3 The development of a theoretical framework model to explore the adoption of new pedagogies

Before embarking upon the research itself, the themes to be investigated need to be identified (Brinkmann and Kvale, 2018a). These themes can be used to decide on how the research is carried out and, in the analysis, and discussion of the data.

Several themes have already been identified in the literature review, this section will attempt to draw them out and place them in an ordered hierarchy, related to the decision-making process. This order will be in the form of a novel model that will be used throughout the study.

3.1 The Theory of Reasoned Action (TRA)

As a starting point for the new model, Fishbein & Azjen's 1975 Theory of Reasoned Action (TRA) (Figure 3-1) has been chosen, as this forms the basis for several of the currently available models for adoption of a behaviour such as TAM and UTAUT (Lai, 2017). TRA has been described as a generic model for behaviour prediction (Li, 2020). The TRA states that a change in behaviour arises from an intention to change. This intention is influenced by the factors that affect the attitude of the person and a desire to appear to fit in (normative beliefs).

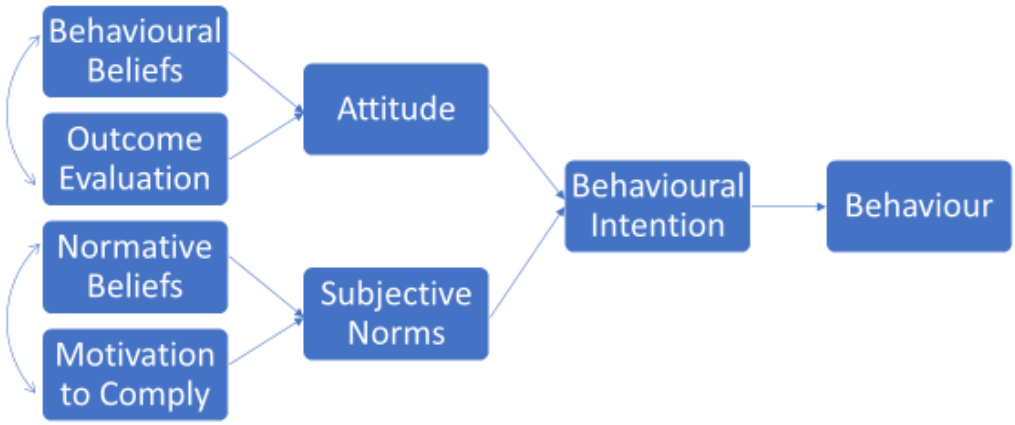

Figure 3-1 - Fishbein and Ajzen's Theory of Reasoned Action (1975) adapted from Lai (2017).

The factors that contribute to the behavioural intention could be considered the 'motivating factors', those factors which either increase or decrease the likelihood of somebody wanting to change their teaching style.

From the TRA and models examined in the previous chapter, this could be simplified to identify that behaviour intention starts with a decision based upon predisposing factors. Shown as a simple pathway in Figure 3-2, these predisposing factors will lead to a decision of whether or not to adopt new behaviour. At this point, someone is deciding whether they would like to make changes to their behaviour or not.

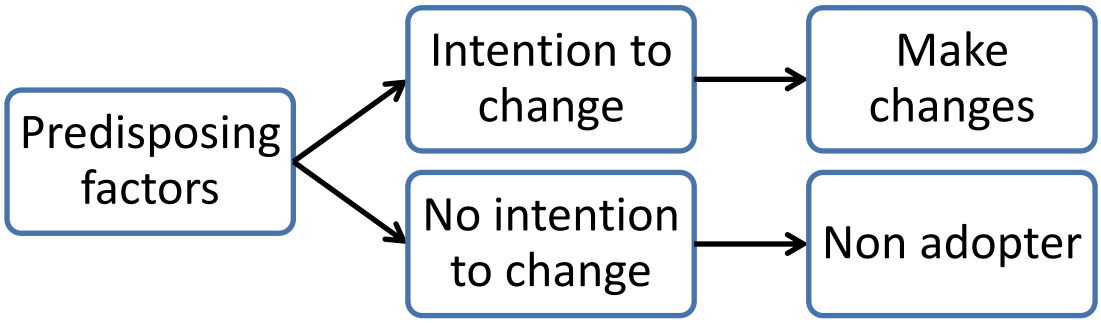

Figure 3-2 - Simplified behavioural decision pathway.

Supposing someone wishes to make a change, the next question is – can they? For example, if someone wanted a new car, they make the decision to get a new car, but then they have to look at what is available in their price range.

Murray and Macdonald (1997) say that teachers often express beliefs and attitudes towards a particular pedagogy, but this is not always followed up by a change in teaching practice. They suggested the mismatch was due to “environmental constraints” such as insufficient support, training and resources. Therefore, a step has been added into the pathway to account for constraints or barriers and shown in Figure 3-3. This takes the behavioural intention from several of the models but adds in the findings from section 2.6 that barriers need to be overcome before change can happen. One of the purposes of the current study therefore is to help fill in the gaps in this model, which are the motivating factors and facilitating conditions that can help staff become actual users of new facilities.

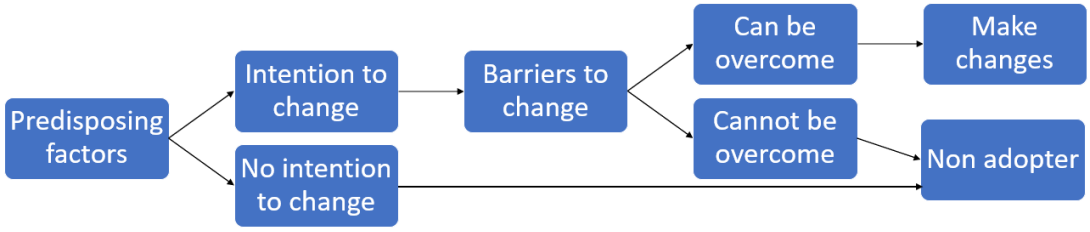

Figure 3-3 - Decision pathway including barriers to change.

This shows that someone may become a non-adopter either if they choose not to adopt, or if they want to adopt but something is preventing them from doing so. It also shows barriers being considered after the decision process, whereas they may well be predicted and influence the decision in the first place.

There are two points on the path where the route taken can be influenced; the decision to make a change or not and the ability to overcome any obstacles to change or not. Taking these ideas into account a modified decision pathway is provided in Figure 3-4.

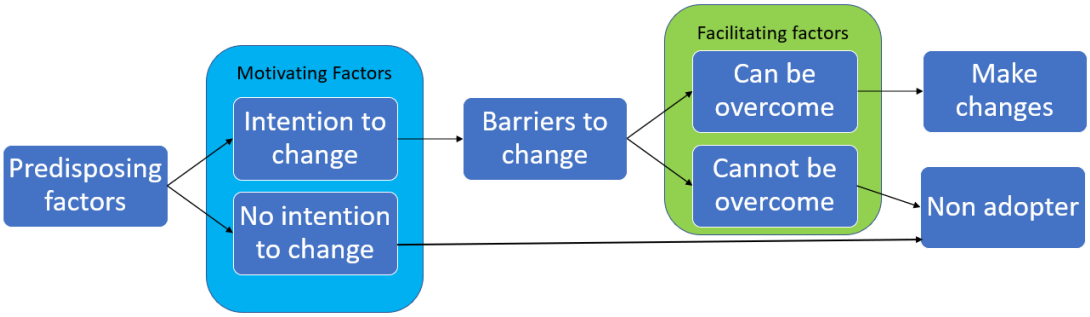

Figure 3-4 - Simplified map of the decision process and conditions required for adoption of new practice.

There are no existing models that include the facilitation that must exist to take someone from having an intention to use, to actual usage behaviour, this seems to be a natural consequence of an intention.

Therefore, the novel model will start with these two basic premises; there must be an intention (Davis, 1989) or motivation to change pedagogical style and there must be the appropriate facilitating conditions (Steel and Andrews, 2011) to be able to do so. The first iteration of the new model (Figure 3-5) reflects these two overarching concepts; that of motivation to change and that of facilitating change.

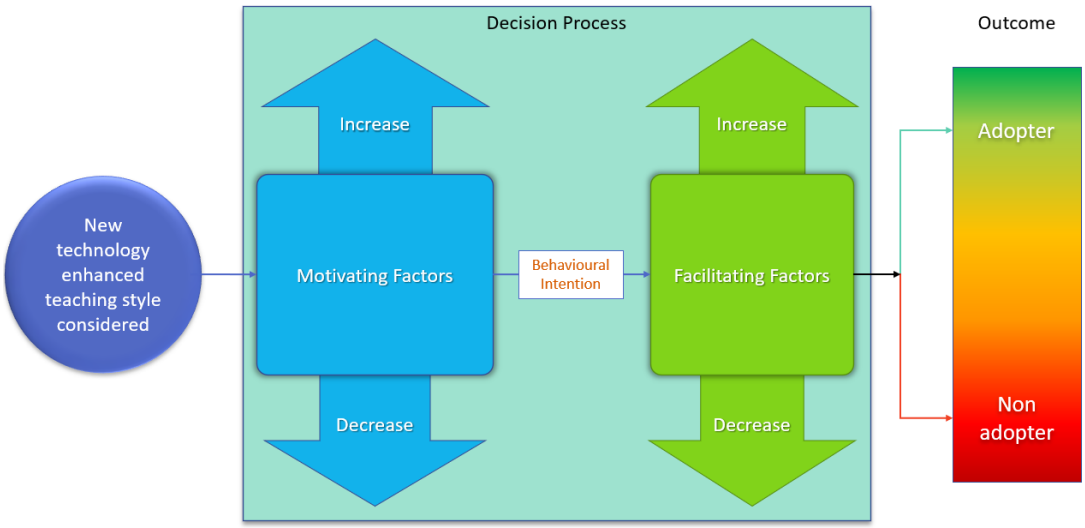

Figure 3-5 - Basic outline of the novel model including motivation, leading to a behavioural intention and enabling factors leading to whether somebody actually makes a change or not.

The outcome is intended to show that adoption of new teaching practices could be on a continuum of small scale to large scale changes in teaching practice.

It is the factors that affect motivation and the factors that enable change that are going to be of interest in this study, and these will be looked at in more detail in the following sections.

3.2 The motivation to change

Motivations that lead to behaviours have been studied for many years and have been reviewed succinctly by Legault (2016). Legault describes motivations as being either intrinsic or extrinsic. Intrinsic motivations are behaviours which give the individual satisfaction or enjoyment in carrying out that behaviour. External motivations, on the other hand, are where there is an outcome achieved by carrying out the behaviour, which itself may be a reward, but not necessarily for the person themselves. For example, if a teacher uses a new teaching method, it may be because they find it easier to do, which would be an internal motivation. It may be that they think the students would enjoy it more, or exam results may improve, which would be external motivations.

From the TAM models described in section 2.5.1, motivation was defined by '*Perceived Usefulness'* the degree to which the potential user feels that their work would be enhanced by adoption (Davis, 1989). Further development of TAM and UTAUT included factors that may influence the perceived usefulness and shown in Table 3-1. It should be noted that some of the

motivations, including social influence and performance expectancy could be classed as internal or external depending on who the user is trying to please.

Table 3-1 - Internal and external motivations included in the TAM and UTAUT models.

	TAM models	UTAUT
Internal Motivations	Subjective Norm Image Job Relevance Experience	Performance Expectancy Social influence
External Motivations	Output Quality Result Demonstrability	

TAM3 included emotional aspects in the form of anchors and adjustments. These are almost exclusively computer related, however, they are connected to the beliefs of the individual and in section 2.4.3 it was discussed how teacher beliefs can shape teaching choices.

Whilst appearing obvious from TRA that beliefs shape attitudes and therefore behaviour (Richardson, 1996), it also reinforces the idea that beliefs can be changed as outcomes become apparent. Of course, there must a belief regarding change in the first place, which may be externally motivated, such as an instruction to do so, observation of successful behaviours in role models, or an internal desire, which will be explored later.

In a review of 13 articles on the subject of beliefs, Kember (1997) made connections between teacher conceptions and teaching practices (Figure 3-6).

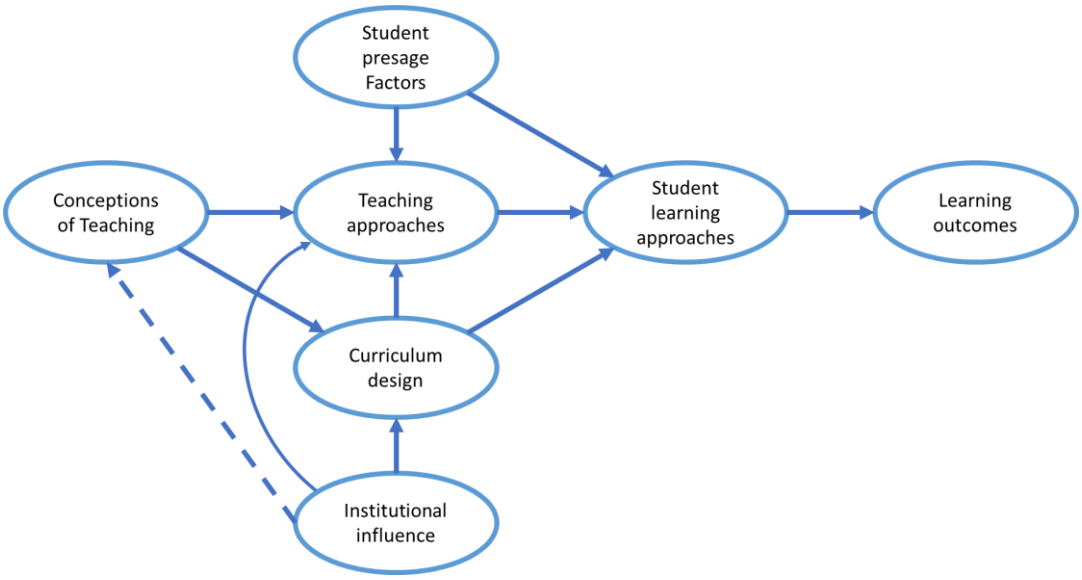

Figure 3-6 - The relationship between teaching conceptions, approaches and learning outcomes adapted from Kember (1997)

From the preceding discussion of motivational factors, the factors most relevant to the introduction of a new teaching space have been taken and added to the new model Figure 3-7, being listed as internal or external motivations.

The reasons for including each are given as follows:

- **Perceived Usefulness –** From TAM3 (Venkatesh and Bala, 2008). TAM3 considered the perceived usefulness to be contributed to be factors such as job relevance, output quality and result demonstrability. The perceived usefulness in this study is a measure of how the design of the teaching space and the possibilities it affords are relevant or inspiring to the teacher.
    - ***Performance expectancy*** – From UTAUT. Will changing teaching style allow them to do their job more easily, how useful would it be to use the tools available.
    - ***Pedagogical Benefits*** – From TPACK. Can the teacher identify any pedagogical benefits from the redesign or how it may be used.
    - ***Experience* and beliefs**– Experience is included from UTAUT and Weinberger and Shonfeld (2020). Previous experience and beliefs have been proposed as significant factors in teaching choices (Haines and Maurice-Takerei, 2019; Weinberger and Shonfeld, 2020). Beliefs were also seen in both the Theory of Reasoned Action (3.1) and in Opfer's work on Teacher orientation (**Figure 2-3**) they have been included with

experience as they are closely related, in that one can influence the other (Richardson, 1996).

- ***Social Influence*** – from UTAUT, teacher conceptions (Kember, 1997) and teacher cognition (Borg, 2003), the factors encompassing the influence that significant others have on decision making. Social influences include the institution (Yang et al., 2023), students and colleagues. Bligh (2019) also pointed to being consulted and involved in the design of teaching spaces would help shape their pedagogical practices.
    - ***Institutional influence*** – from Kember's Teacher Conceptions. What autonomy does the individual have to make changes, are they in anyway encouraged or discouraged from teaching practices. Are there any directives given? This also appears in UTAUT as voluntariness of use. This may have relevance also when considering that external bodies may have some influence on how students are taught with particular reference to the General Dental Council (GDC) who require evidence that learning outcomes have been achieved.
    - **Subjective norms** – from TAM3. How much is the teacher influenced by what they observe as normal use of the lecture theatre by others, are they influenced by others apparent successes or failures (Lai, 2017).
    - ***Student Presage*** – From Kember's Teacher Conceptions. What influence does the student body have, either from direct feedback or module / course evaluation? Do teachers think feel that there are any expectations from the students to make more use of the space? Conversely students may be expecting a style of teaching that they have got used to in other settings.

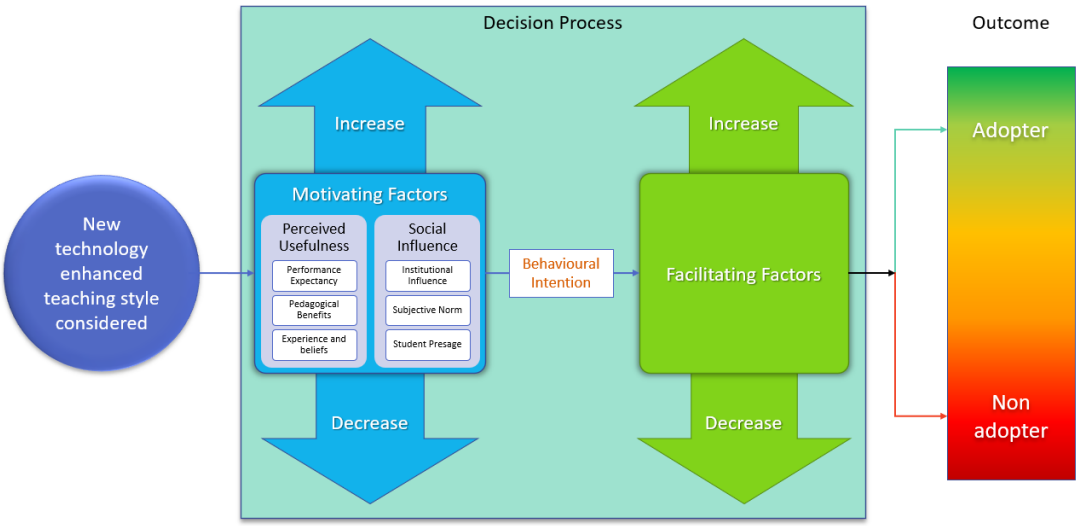

Figure 3-7 – Second iteration new model including further factors regarding motivations.

3.3 Facilitating Factors

Following the idea of internal and external control from Venkatesh (2000) this section is divided into those that relate to the individual and those that relate to the environment.

Facilitating Factors: the factors that may assist in adoption, both under the control of the individual and those provided by the institution.

- ***Perceived ease of use*** – from TAM and UTAUT, the individual assessment of the effort required to adopt a new system. These have been divided into those in the control of the individual (internal control) and those out of the individual's control (environment).
    - **Effort expectancy** – Venkatesh (2000) the perceived self-efficacy of the individual to adopt a system. When putting together the UTAUT model, Venkatesh et al. (2003) combined perceived ease of use, complexity and ease of use from previous models to create a construct they called effort expectancy, which they used to measure the ease with which somebody is able to use a system. When considering the use of new teaching styles, this could be considered as what factors would make the transition easier or harder.
    - ***Pedagogical knowledge –*** From the idea of internal control and from TPACK, does the individual feel they have adequate pedagogical knowledge to adopt a different style of teaching. Li et al. (2022) found PK to be related to seniority and experience in teaching, and a significant factor in ICT integration.

  - ***Technological ability –*** From internal control, how much does the individual believe they are able to use the technology effectively for educational purposes.
- The final section of the model contains those factors that help facilitate using the space for collaborative teaching that are out of the control of the individual and depend upon the institution. Such factors may include how the lessons are timetabled, whether support is made available or whether the design of the curriculum allow for such a style of teaching.

- ***Environment –*** What conditions are provided to help the teacher to make changes to teaching styles.
  - ***Curriculum design*** – from Kember's teacher conceptions (Kember, 1997). Does the curriculum allow for the type of teaching desired, in terms of how it is assessed and whether the teacher can include more sessions for example if wanting to flip the classroom, does the amount of self-study hours allow for the extra work for the students, what other demands are on their time, is there an exam in a different module imminent?
  - ***Training*** – One of the key aspects identified by the literature was training. In order to use the lecture theatre for technology enhanced collaborative teaching sessions both pedagogical training and technological training could improve the perceived ease of use and reduce the amount of time needed to make transitions. Providing technological or pedagogical training was shown by Clement (2018) to be an important factor in successful transitions.
  - ***Institutional Support*** - Not directly from any other model but identified by Georgina and Hosford (2009), Bligh (2019) and Yang et al. (2023) as important. This could include any way the institution could facilitate change, such as promotion of time to make changes, or additional staff ('wingers' as identified by Clement (1996)).

The final version of the proposed model is shown in Figure 3-8.

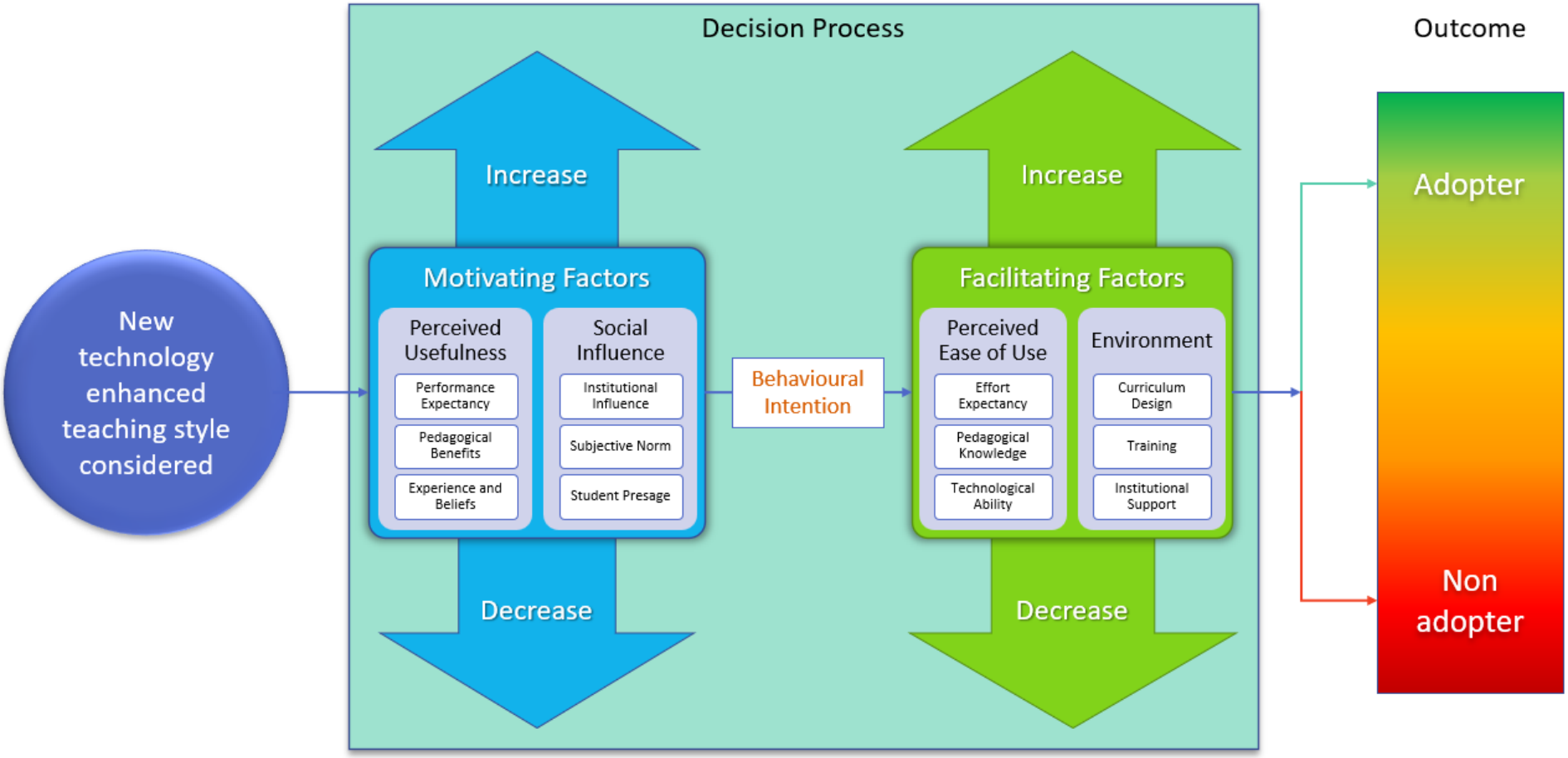

Figure 3-8 – The completed proposed model including motivating and facilitating factors

Any of these factors may have a positive association with adopting change, conversely the same factors may contribute to decreased motivation or deny facilitation. For example, past experiences may be positive or negative, or the availability of tech support may be emancipating, the lack of it may be daunting.

Some factors may have both motivating and facilitating functions, for example pedagogical knowledge (PK) is related to perceived usefulness as they allow the teacher to see the possibilities of what change could bring about, yet Shulman (1986) saw pedagogical knowledge as being connected with the ability to design a lesson and manage students. Therefore, someone with high PK might consider a change in pedagogy as a less significant hurdle than someone with a lower PK.

In the outcome, teachers will be somewhere on a spectrum ranging from very keen adopters to those with no intention to change. It will serve to explore which factors appear to have had impact on reaching that standpoint.

4 Methodology and methods

4.1 Research Design

4.1.1 Assumptions and the research paradigm

The research paradigm is a key aspect to defining the framework that will form the basis for a research project (Mackenzie and Knipe, 2006). The research paradigm has been described as the basic set of beliefs that constitute the world view (Guba and Lincoln, 1994) and consist of; ontology, epistemology and methodology (Assalahi, 2015).

The author is coming to this project from a background in the natural sciences, where the typical research paradigm belongs with positivism. In a positivistic paradigm there is an assumption that experimental testing leads to a discovery of provable truths. When considering teacher choices though, based on and shaped by numerous factors, there is not one truth to find, or a simple equation that can solve a problem. What is aimed for is an interpretation of a situation, using data to guide that interpretation. An interpretivistic paradigm relies on the researcher to construct understanding and explain phenomena by interpreting the actions or discussions with participants. The interpretivist researcher is not separated from the subjects of their study, but actively takes part in the research to construct knowledge together with the participants (Assalahi, 2015). Therefore, this study will be shaped by an interpretivist paradigm.

Ontology and axiology

Ontology describes the nature of what is reality (Guba and Lincoln, 1994). For example, in a positivist paradigm, reality can be found by experimentation, such as the melting point of pure gold. The accuracy of the test can improve the accuracy of the result, but the result is there to be found. Whereas, for example, if we were to ask a person '*why did they chose a particular gold ring in a jewellery shop?*', there are a myriad of possibilities, which may be attempted to be explained through cultural and social experiences. No one reality will exist that could be generalised to all customers in the shop, or even the same customer on different days. This is not to say that to seek such explanation is fruitless.

These preconceived ontological beliefs of the researcher (Guba et al., 1994) shape the theoretical framework for the research project (Mackenzie and Knipe,

2006) and have been described as the lens that the researcher views the world through (Kivunja and Kuyini, 2017).

Hypothetically, there could be an ontological belief in the current study that all staff would wish to change their teaching style because that is the prevailing trend, and that those staff who don't change must be behaving that way because they are facing barriers or impediments to change. Such assumptions guide the design of a choice of research design and questions asked in interviews. In this study, no opinion or action however will be considered in terms of coming from a better or a worse viewpoint. One approach to using the space will not be considered as superior or inferior to any another.

Axiology describes the role of such values and, although values may be consciously or subconsciously held, they should not bias the findings or interpretations of a study. For the sake of clarity, I personally see a role for both traditional lectures and more interactive learning sessions. I have found that trying to change my teaching style has been difficult as I sometimes felt uncomfortable trying out new teaching techniques in case they don't work out. I haven't felt any encouragement or pressure to use the lecture theatre in a different way from anyone, but I do feel that student judgement can be harsh if the lecturer has a poor performance.

4.1.2 Deciding the research methodology

Saunders et al. (2019, p.130) suggested one way of determining the methodology was by thinking about the decision process as layers of an onion, starting with the overall philosophy as the outermost layer, gradually peeling away the layers through theory development, methodological choices down to techniques and procedures. The "onion" has been simplified for ease of reading in Figure 4-1. This chart proved a very useful guide as going down each layer to think about which options best fitted the current study.

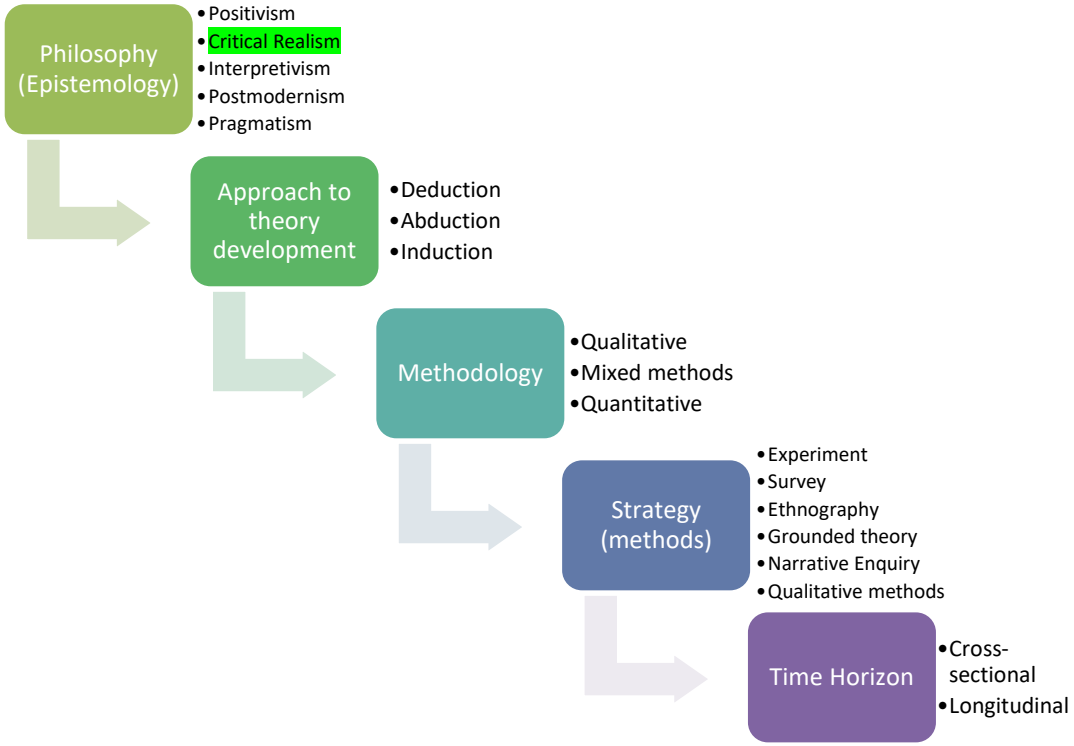

Figure 4-1 - Philosophical approaches to research design adapted from Saunders "research onion" (Saunders et al., 2019)

Epistemology

Epistemology has been described as relating to the nature of knowledge and what makes knowledge acceptable (Saunders et al., 2019). For the current study, starting with an epistemology based in interpretivism, the aim of this research was to attempt to apply meaning with regards to responses given by participants with respect to their thoughts and actions in response to the introduction of the CLT.

Approach

Next came the decision as whether this should be an inductive or a deductive study. The differences between an inductive or a deductive approach are shown in Figure 4-2 and Figure 4-3 (adapted from Burney and Saleem (2008). For an inductive study the starting point is not clear and only after analysis of the findings will the hypothesis become clear.

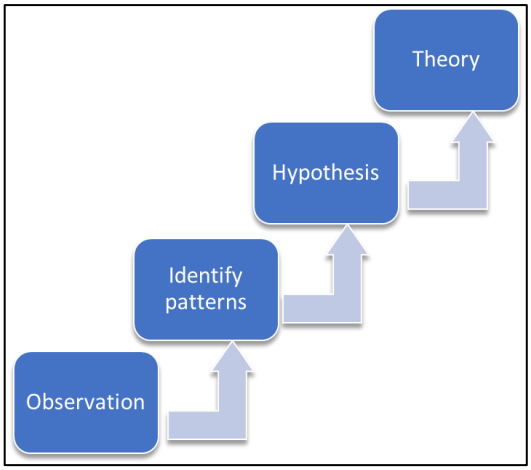

Figure 4-2 - The Inductive approach

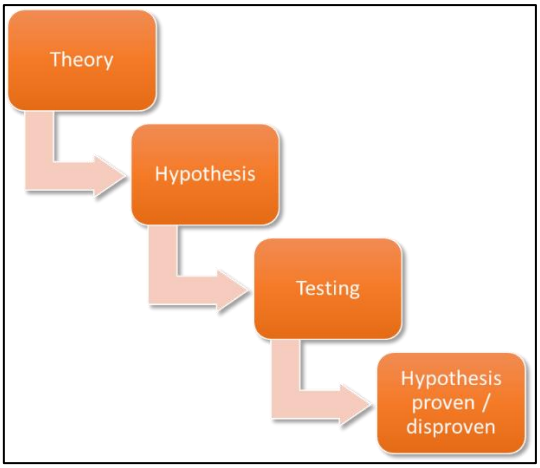

Figure 4-3 - The deductive approach

If taking a deductive approach, the starting point would be the factors identified previously along with a theory of how they will influence the participants and the study would be to test that theory. In the present study, whilst the literature has suggested some factors that may be important, there are very few studies exploring this type of data, so it is important not to miss new or unpredicted findings. The approach therefore was abductive, meaning that some prediction is applied, but the data and connections between the data and actions still must be found.

Methodology

A choice had to be made whether the study would be qualitative, quantitative, or mixed. Following the previous section, qualitative methods may be more suited to a deductive approach, where known factors could be used in a questionnaire to find out what are the most frequently experienced and to ascertain connections between factors. As this study has a largely inductive component, and the purpose is to be able to answer the question 'why' regarding staff choices and behaviours a qualitative approach was chosen. In future the findings of this study may be able to lead to a quantitative or mixed approach, but at the current time, not enough about the issues affecting staff were known.

4.1.3 Qualitative research methods

Qualitative methods have been suggested when wishing to study the experiences of people and where unanticipated findings can be explored (Chai et al., 2021). Qualitative research methods utilise a range of different means of gathering data. For example, questionnaires and observation may inform us of *how* staff are using the lecture theatre but will not tell us *why* they are using it

that way, or what has shaped their decision making to be taking the approach that they do. To answer this, the design needs to allow for an exploration of their thoughts, experiences and reasons behind their decisions. As Brinkmann and Kvale (2018a) put it:

> *"If you want to know how people understand their world and their lives, why not talk with them? … Through conversations we get to know other people, get to learn about their experiences, feelings and hopes and the world they live in."*

Interviews can take several different forms including structured, unstructured, semi-structured and phenomenological. Each has their advantages and disadvantages.

Phenomenological interviewing as described by Guerrero-Castañeda et al. (2017), where the interviewer takes a central focussing event with supplemental questions and attempts to find how the subject existed through that event. Seidman suggested an unstructured three interview strategy with the first interview to gain the individuals background, the second to explore the phenomenological event and the third to reflect upon meaning (Seidman, 2006). All three of these aspects could prove to be important as the background of the teacher, the use of the space and reflecting on how their practice has changed or could improve are very much overarching areas to be explored, however, the nature of such interviews is time consuming, and is better suited to exploring a particular phenomenon and was therefore rejected for this study.

Structured interviews, with a set of questions fixed beforehand for instance could be a good means of generalising the scale of a problem, and would be simpler to analyse than other methods, however, since the questions are fixed in advance, they are not very useful for exploring feelings or deeper meanings as this doesn't allow for following up on interesting comments (Opie, 2004). Constructivist and social psychology research bring into question the value of predetermined questionnaires and structured interviews as being an appropriate method of being able to explore how a subject construes a topic (Tomlinson, 1989). As not all factors relating to staff conceptions, actions and responses can be predicted then this was considered not to be the most useful form of interview at this stage. It may be for a future study to explore the prevalence of findings that are induced at this stage.

Semi-structured interviews are described as using a predetermined set of open-ended questions to ensure that the main topics are covered, with follow up questions to probe further (Adams, 2015). They have the advantage of allowing the interviewer to explore more deeply any areas that could require more explanation or factors not previously considered. They require the

interviewer to be capable and could be affected by the subjective views of the interviewer (Howell, 2013, p.234). Despite this, the semi-structured interview would seem to be the most pragmatic approach to take as the lack of rigidity allows factors as yet unknown to be explored (Opie, 2004) within a structure determined by the conceptual framework. Building on Seidmans approach to the three interviews, Bevan (2014) described using three stages in the interview to fully explore a situation. He suggested the stages were; (1) contextualisation, (2) apprehension of the phenomenon and (3) clarifying the phenomenon. As there is no strict phenomenon here, borrowing from both Seidman's and Bevans theories to create an interview schedule that allows for gaining the background of the teacher, exploring how they teach in the space compared to traditional lecture theatres and reflect upon their practice and what support could be provided for making changes should they wish, using a new model to identify key themes.

A qualitative study using semi-structured interviews was selected to take place with members of teaching staff within the School of Dentistry as the best means of both investigating specific aspects of the behaviours of the staff, but also to allow for exploring areas that may arise in conversation for which predetermined questions have not been prescribed.

Personal values

I have been a member of teaching staff for over 16 years, having spent 10 years as a practicing dentist. I deliver about 15 to 20 lectures per year along with multiple small group and clinical teaching sessions. At the time of beginning this research project I was also acting head of department, however, by the time the interviews were carried out I no longer held this position.

I know all of the interviewees personally and am also as a user of the space. This will bring an insider perspective to the interviews with the participants, which Burgess has described as a purposeful conversation with the co-construction of knowledge through both the emic and etic perspective (Burgess 1984).

4.2 Context

The School of Dentistry is made up of five departments. The Department of Restorative Dentistry is the largest teaching department, with the departments of Oral Surgery and Paediatric Dentistry make up the other departments based around clinical teaching. The two other departments, Oral Biology and Dental

Public Health are largely research based, however they do contribute to teaching and lecturing within the School.

Table 4-1 – Total number of staff and module leads within each department (2022)

Division	Staff Members	Module Leaders
Restorative Dentistry	76	17
Paediatric Dentistry	21	2
Oral Biology	19	6
Dental Public Health	12	5
Oral Surgery	10	3

The number of staff in a division includes teachers, support and technical staff. The actual number of staff with lecturing responsibilities was not available for the whole school, but with regards to Restorative Department it was 47, with 27 of those providing lectures. The Staff profile of the department of restorative dentistry is outlined in Table 4-2. Seniority was defined as; Junior included lecturers and CTFs, or Senior included SCTFs, associate professors and professors. Although there are more male staff compared to female staff and more junior staff compared to senior staff, when considering those with lecturing commitments the numbers are reasonably equal.

Table 4-2 - Staff profile of the Department of Restorative Dentistry as of 2019

	Overall teaching staff numbers (2019)	With lecturing responsibilities	% of lecturers
Junior	32	13	48 %
Senior	15	14	52 %
Female	20	13	48 %
Male	27	14	52 %

4.3 Development of the Interview Schedule

Tomlinson (1989) suggests a hierarchical approach to questions in order to construct meaning to the subjects' thoughts and actions in a scenario. He suggests that questions start quite broad and get progressively narrower by a process of hierarchical focussing. A schedule along these lines of exploring ***whether*** someone has changed their style of teaching, leading into the ***why*** they have done that and then the ***how*** they went about that leading into the

specifics of the techniques that were used. This approach is also commonly used to explore the experiences of patients undergoing health care (Bricki and Green, 2007).

Using the approaches of Seidman (2006) to arrange the interview into three broad sections, past, present and future, and Tomlinson (1989) to explore the situation in a hierarchical way, the potential interview questions were developed (Table 4-3). These have been arranged in this table to align with the research aims, and connections to the motivating and facilitating factors identified when creating the model are shown.

Table 4-3 – Potential Questions to include in the interview with connections to the proposed model.

Contextual:	
Can you tell me about your career and your role as an educator?	Context / Experience
When were you first aware that the lecture theatre was being redesigned?	Context
Research Aim 1: ***To investigate whether teachers have changed their teaching style depending on the learning space they are in.***	
How would you describe your previous experience of lectures either as a student or a teacher	Experience
How useful do you think lectures are as a means of undergraduate education?	Beliefs
Are you aware of how your students respond to the lecture style of teaching?	Student presage
Did the presence of the DLT cause you to think differently about the way you teach	Perceived Usefulness / Ped benefits
Have you changed the way you teach since the introduction of the DLT (or when using DLT compared to traditional spaces?	Outcome
Research Aim 2: ***Do they take advantage of the way the students are arranged and the technology available to them?***	
Tell me about a time you have used (want to use) the lecture theatre in a different way that has been enabled by the design	Narrative
Can you tell me about a time you have used any of the digital technology that was installed into the DLT to engage the students?	Ped benefits
Research Aim 3: ***To understand the motivations of staff towards collaborative learning, including their knowledge of the benefits and potential drawbacks, and how they could envisage it could improve the experience of their students.***	
Do you remember how you felt when the new lecture theatre was announced / found out one was available	Beliefs / Inst Influence / Perf expectancy
What do you think could be the potential advantages of students working collaboratively?	Ped benefits / performance expectancy / beliefs
Do you feel any expectation to use the lecture theatre in a different style from a traditional lecture from the school / students / colleagues?	Inst Influence / subjective norm / student presage
Research Aim 4: ***To explore whether there are factors that are facilitating or inhibiting the opportunity to change, what have they found useful and what assistance do they feel they need?***	

Would you choose the CLT preferentially to a traditional lecture theatre?	Perceived usefulness
Did the introduction of the lecture theatre cause you any anxieties	Perceived ease of use
Do you feel able to choose effective technological solutions to support the teaching you would like to provide?	Perceived ease of use
Did you have a colleague present / would one be available when trying to do a collaborative session	Institutional Support
Have you received any training on how to use the lecture theatre collaboratively?	Pedagogical training
Do you think the curriculum lends itself to collaborative learning?	Curriculum design
How easy would it be to change your teaching materials to include collaborative teaching?	Effort expectancy / Environment
Do you think the students would be able to adapt to that style	Perceived challenges
How confident do you feel using the available digital technologies?	Perceived ease of use
What training have you received specifically on the use of the technology	Training
Is a technologist available while you are teaching?	Institutional Support
Research Aim 5: ***Do discover how likely are they to make changes in the future?***	
Do you have plans to make changes in the future?	Open
Research Aim 6: ***To discover whether the staff feel adequately prepared for making future / further changes to the way they teach when using a collaborative learning space.***	
What barriers would you need to overcome to make changes?	Perceived challenges
What anxieties would you have regarding making changes?	Perceived ease of use / Anxiety
Would there be anything that would help you to make changes	Open
Do you have any other thoughts about the future of lectures, how spaces should be designed, and staff supported?	Open

To create the interview schedule that was used in the study (Appendix E: Interview Schedule) these questions were arranged into 5 sections:

Section 1: Context.

Chai et al., (2021) proposed that following initial contextual questions to set the scene, questions should not be leading and should be open ended. The non-threatening nature of the initial questions that explore demographics can help the interviewee to relax (Ryan et al., 2009).

Section 2: The impact of the CLT on their practice.

Whether the introduction made them think about their practice or what changes they have made and why did they do that.

Section 3: Beliefs regarding collaborative learning.

Exploring past experiences and beliefs about their value of collaborative learning as a pedagogy.

Section 4: Integration of technology.

What technologies available have they used and what challenges have they faced regarding its use.

Section 5: Looking forward.

What plans to they have for how they will deliver lectures in the future and how can they be supported with any changes they wish to make.

Every effort was made to word questions in a way that would not suggest that one style of teaching or changing styles because of the changes to the lecture theatre was either a positive or a negative attribute. Some closed questions have been included to be able to make comparisons between participants at a later stage, but a number of open questions were also included to give the interviewees a chance to speak without constraints as suggested by Raworth et al. (2012).

4.4 Pilot Study

A pilot study was carried out to; test the utility of the questions at eliciting the information required to be able to answer the research questions, and to establish whether the planned process of video interviews with digital recording would work for both interviewer and interviewee.

Initial ethical approval was obtained (section 4.5.1), and a pilot study was carried out by interviewing three lecturers who were not from the School of

Dentistry, however they were familiar with at least one of the three redesigned lecture theatres in the University.

Prior to the interviews, they were sent participant information sheets and consent forms to fill in. The interviews were carried out on Microsoft Teams [Microsoft Corporation, Redmond, Washington, USA]. They gave verbal consent to being recorded at the start of the interview.

The interviews took place in 2020 whilst there was no face-to-face teaching on campus. There was concern that due to the length of time that had passed since using the lecture theatre that recollections may not be as precise.

Findings of the pilot study

Two of the three participants were very enthusiastic about using the collaborative lecture theatres, the third whilst keen on collaborative learning did not see the lecture theatre as the place that should happen.

Suitability of questions – The questions worked well for the two adopters and had to be modified during the interview process for the non-adopter. These changes were recorded and have been reflected in changes subsequently made to the interview schedule.

Recording using the in-built voice recorder worked satisfactorily but the participant's voices were quiet. For future interviews it was decided to place the microphone closer to the computer speaker.

Transcription was generally easy to carry out. If the participant was interrupted or the interviewer gave approving noises this was picked up by the microphone and obscured some words, therefore in the main study the interviewer will remain as quiet as possible during responses and avoid giving approval as that may also influence the answers being given. Giving non-verbal cues of active listening however should be practiced as it encourages the flow of conversation (Gill et al., 2008).

The semi-structured nature of the interview worked well, with the ability to explore some events more deeply and follow up if any key factors had not been mentioned.

A brief analysis of the findings confirmed that for the adopters there were a large number of the suspected motivating factors being picked up which were not present in the non-adopter, and for the three interviews carried out it was apparent that motivation was more important than facilitation, however no conclusions can be drawn from such a small number.

Concerns about the length of time since the interviewees had used the lecture theatre were allayed when all three interviewees spoke fluently about their experiences and had good, focussed recall of their thought and fears at the time.

4.5 Methods

4.5.1 Ethical Considerations

Ethics are essential to both preserve any personal data of the participants but also to preserve the integrity of the study and the reliability of the findings (Gibbs, 2018).

Ethical approval for this project has been sought, and approved (AREA 20-002) under condition that:

- No one from a vulnerable group would take part.
- Participants would give informed consent prior to being interviewed.
- There was no pressure placed upon anyone to take part, and anyone reserved the right to withdraw at any time prior to the interview and within two weeks of the interview taking place could choose for their data not to be included.
- Anonymity was preserved. No participants would be identifiable by name and no names would be stored with the research data. Participants would be coded at the time of acceptance along with only very brief attributes including gender and job position.
- Participants could be identifiable by voice and therefore voice recordings would be deleted once transcription is complete and verified.
- Data would be stored in encrypted folders on a secure university server and deleted within 3 years of the end of the project.

There were no benefits for taking part and no risks involved in the study. There were also no penalties for not taking part or withdrawing from the study.

Gill and Baillie (2018) recommended that for online interviews, consent forms may be emailed to each other and verbally giving consent at the start of the recording should be carried out, which is what was done.

Personal position

The position of the researcher in this project opens some important ethical considerations, including the relationship to the participants and potential biases within the design, analysis and conclusions drawn by the study. Holmes (2020) discussed the benefits of being an insider or an outsider in the research, with

the advantages of the insider including; asking more insightful questions, having a familiarity with the day-to-day issues affecting the participants, being more trusted by the participants, being familiar with the language being used as well as having easier access to the participants both physically and personally. The disadvantages including an unwitting bias, projecting the researcher’s own feelings on the responses given, the participants may assume that the researcher knows what they are talking about even if this isn’t the case, so that they may gloss over areas of importance.

As the interviewer was known to the participants as a senior member of staff a lot of care was taken in the preparation of recruitment materials and in the framing of the questions that this was being carried out in the role of a postgraduate student. The interviewer’s student email address was used in all correspondence and participation was entirely voluntary.

My position with the participants was complex. I have a friendly and respectful relationship with everyone that took part, we are colleagues and friends which helped. I am aware the more junior staff could have subconsciously wanted to say something that put them in a good light, but none did. I stayed neutral throughout the interviews, not giving any idea of approval other than being thankful for their thoughtful responses. I have been a participant in several semi-structured interviews in the past. I always found it useful when it was a colleague and they explained why they were doing it and why my opinions were valuable. I was once interviewed by somebody high up in an organisation, and I felt terrified of saying the wrong things, and so with every question my first thought was "what are they asking this for and what would be the correct answer to give". With colleagues, it has felt much more like a conversation, and we are often let's say critical of the establishment, so maybe we feel more free to say what we really mean to a friend or colleague, knowing they will treat that sensitively than to a stranger with a potentially hidden agenda.

All communications with participants made clear that the study was part of a postgraduate research project with the sole aim of generating data regarding how they personally feel the space has influenced them. At the start of each interview this was reiterated and my position as a student researcher and not as a colleague was the important factor. As participation was voluntary, I would like to think that colleagues participated to help me as a student as well as to share their knowledge and experience. Questioning was carefully and sensitively carried out, respectful of their position and anonymity. During the writing of this thesis names of colleagues and others have been removed to preserve their anonymity also.

4.5.2 Data Collection

Recruitment of participants

There is much variation in how sample sizes should be calculated, with some sources suggesting that interviews should be continued until saturation is reached, meaning, nothing new is being discovered. Numbers ranging from 5 to 25 interviews have been suggested (Beitin, 2012). Ando et al. (2014) reported that all themes and 92.2% of codes were established after 12 interviews. They go on to state that their group was homogenous, which may affect the number of interviews required. It was decided that a total of 15 interviews should be undertaken.

An advertisement to take part in the study (Appendix A: Recruitment advertisement) was sent out via the school' fortnightly newsletter over a period of eight weeks until sufficient volunteers responded. Any staff members expressing an interest were sent further information (Appendix B: Email to participants) and also a participant information sheet (Appendix C: Participant Information Sheet).

Interviews

Due to the COVID-19 Pandemic, all interviews and communication took place electronically using Microsoft Teams [Microsoft Corporation, Redmond, Washington, USA] which had become the preferred communication tool since the start of the pandemic and all staff were familiar with using it.

At the beginning of each interview, the interviewee returned a signed consent form (Appendix D: Consent Form) and were asked again if they were happy to be audio recorded and for anonymised quotes to be used in the write-up, which they all were.

Recordings were carried out via a microphone connected to a second PC running windows voice recorder. The recordings were saved as a compressed file that was moved to a password protected, encrypted folder within the University's One Drive immediately and any local files deleted.

A research journal was kept throughout to record details of each interview. Following the interviews 'field notes' were made including a brief reflection of the process and any key findings that stood out.

A total of 16 colleagues responded to the request for volunteers to take part in the interviews. One was rejected due to having no previous experience of

lecturing or current lecturing duties. All participants attended for interview between February and July 2021.

Following interviews all interviewees were assigned a pseudonym, in a similar way to that described by Van Horne and Murniati (2016). This alias was chosen at random with names chosen in alphabetical order and applied chronologically to the interviews.

A list of interviewees, their level of seniority and length of time for each interview is shown in Table 4-4 along with an indication of whether they were employed as teachers prior to the refurbishment.

Table 4-4 - Overview of interviewees

Interview number	Length of interview (mins)	Male / Female	Interviewee pseudonym	Junior / Senior	Number of years teaching	Worked as a teacher in the school before the
1	40	F	Anya	J	<5	Yes
2	17	F	Bianca	J	5-10	No
3	30	F	Cathy	J	<5	No
4	50	M	Dan	J	<5	No
5	45	M	Edgar	S	11-20	Yes
6	28	F	Faiza	J	11-20	No
7	91	M	Gerry	S	5-10	Yes
8	72	M	Hiro	S	>20	No
9	40	M	Ivan	S	>20	Yes
10	55	M	Jack	S	5-10	Yes
11	55	F	Kara	S	5-10	Yes
12	60	F	Lily	S	>20	Yes
13	30	F	Maria	J	5-10	Yes
14	40	M	Norman	S	>20	Yes
15	45	F	Olivia	S	11-20	Yes

The pseudonyms have not been shared with the participants, though when reading this document, they may be able to identify themselves from the statements made and the broad demographics supplied. The job titles or positions have also not been included as in a small school this could lead to the possibility of being able to identify quite easily by other members of staff.

The length of interviews varied widely from 17 minutes for Bianca who gave very short answers and hadn't had the opportunity to use the new space on her own, and Gerry whose interview lasted 91 minutes and gave very thoughtful and detailed responses requiring more dialogue to further explore concepts that were raised. He was asked once the hour had passed if he was happy to carry on and he replied he was. This may be longer than the one hour that Adams suggests as the maximum length for an interview (Adams, 2015), but most interviews fitted comfortably within that time frame.

Key demographics can be seen in Table 4-5. This table shows that there was a representative mix of male and female, junior and senior staff, the mean time spent teaching was 14.6 years, with a range of 2 to 40 years.

Table 4-5 - Table of key demographics of the interview cohort

Gender	Female	8 (53%)
	Male	7 (47%)
Seniority	Junior	6 (40%)
	Senior	9 (60%)
Number of years teaching	Range	2-40 years
	Mean	14.6 years

During the interviews a tick list of key topics to cover was marked off as topics arose as recommended by Adams (2015). This allowed for the fact that some interviewees would jump off to different topics in an answer that lead the interview into a topic intended to be covered later. Near the end of each interview the tick list was checked and any areas that had been skipped were revisited.

4.5.3 The influence of the Covid-19 Pandemic

Interviews were carried out in the first half of 2021, towards the end of the first 12 months of the Covid-19 pandemic. During that period, face-to-face lectures had been replaced with synchronous and asynchronous online lectures. Face-to-face teaching in clinical and laboratory areas was still in operation, however.

Whilst the impact of the pandemic was not explored explicitly during the interviews, some of the interviewees expressed how it may have had some bearing upon their responses.

4.5.4 Data Analysis

Transcribing

Transcriptions have been described as an interpretation of the data rather than a definitive text version of the spoken word (Arksey and Knight, 1999). All interviews were transcribed by initially playing the interviews into the dictate function of Microsoft Word [Microsoft Corporation, Redmond, Washington, USA]. These rough transcriptions were then manually formatted and corrected by several passes through each interview, until it was felt that the transcription was a faithful, verbatim record of the interview. Pauses, repetitions and thinking aloud sound e.g., ‘errm’ were recorded, but for the sake of ease of reading the findings section quotes from participants may be truncated for ease of reading. Any quotes that could be considered controversial or may embarrass the participant have been avoided. It is important that strong feelings are included but treated sensitively.

Thematic analysis

Qualitative data is typically analysed using a deductive or inductive approach. The choice of approach depends upon whether a predetermined framework is being used, or whether there is no assumption about the findings (Burnard et al., 2008). In this study, both are being carried out. This dual approach of inductive and deductive research has been termed ‘abduction’ (Gibbs, 2012) and creates a challenge in terms of how to approach the data.

Thematic analysis has been described as a tool that can be used both deductively and inductively (Ibrahim, 2012). Braun and Clarke (2006) describe thematic analysis as being a flexible research tool that can produce a rich account of complex data and should be one of the first tools that researchers who are new to qualitative techniques should learn. Put simply, thematic analysis is a way of exploring data by identifying themes and patterns (Gibbs, 2006). These themes could be predetermined, for example those selected to make up the conceptual model previously in this chapter or could arise inductively by just reading the transcripts and identifying important influences and identifying patterns across the whole data set.

In this instance both types of analysis were carried out using NVivo 20 [QSR International, Massachusetts, USA] to record and organise codes. Codes, as

described by Peel (2020) are extracts of the data, in this case interview transcriptions that may contain information pertinent to the research questions. The theoretical analysis was carried out to try to identify positive and negative influences of items included in the conceptual model otherwise known as concept coding (Gibbs, 2012) and the codes were defined prior to the data being explored. At the same time, inductive analysis was carried out using the six-phase process described by Braun & Clarke (2006), the first four of which include;

1. Familiarising with the data – this was done both during the transcription process, by repeatedly listening to the recordings and improving the transcriptions.
2. Generating initial codes – identifying factors which appeared to have some influence over thoughts and actions. These are usually short phrases that summarise the related text (Burnard et al., 2008).
3. Searching for themes – the initial codes were then grouped into themes which had common features, such as “challenges faced” which included codes such as “anxieties” or “student acceptance” that were further subdivided.
4. Reviewing themes – the creation of a thematic map to check relationships for example a map of the theme of challenges is shown in Figure 4-4.

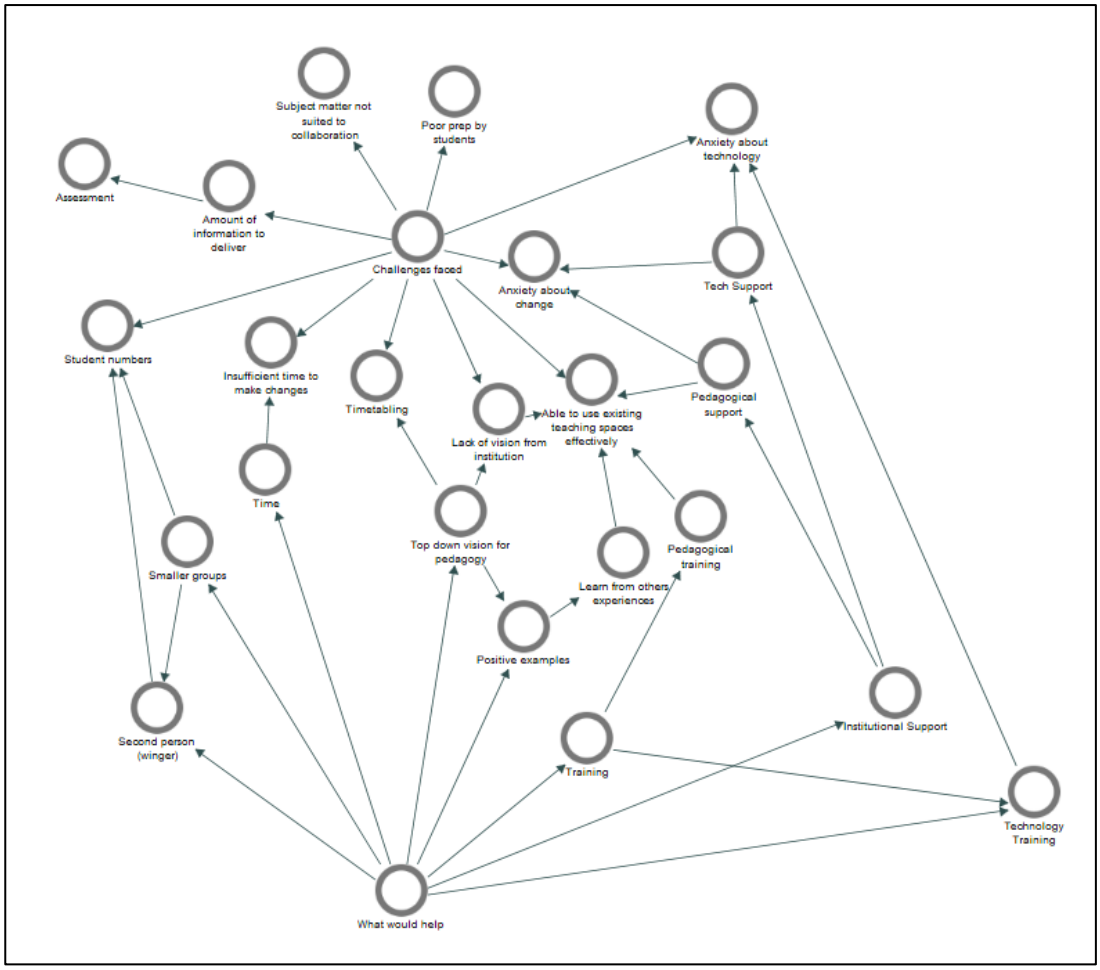

Figure 4-4 – Example thematic map of challenges faced.

In the analysis, the model will be used initially to generate codes to help search for the themes of motivating and facilitating factors. If any common themes are found within the headings in the model then these will be given subcodes. As this study is deductive as well as inductive, should any themes arise that had not been thought of they will be considered within the overarching headings of motivation or facilitation, but if necessary, they could form a whole new theme. Should any new themes appear then transcripts already considered will be re-examined to see if there are any connections that had been missed earlier. This iterative approach to coding will lead to potentially a large amount of data that will need to be filtered in the findings and discussion sections as necessary but will be retained for future work and analysis.

There was also an intention to code against the existing models of UTAUT and TPACK, however analysis of the data gained in the pilot study proved that this was too difficult to carry out without sets of structured questions deliberately aimed at generating this data. Attempting to interpret from the open answers

given and trying to isolate codes such as PK, PCK and TCPK was unreliable and so will not be provided.

There is always the challenge that codes within the data can be interpreted in different ways, for example, pedagogical training could be considered that it was; received and useful, received and not useful, not received and seen as a barrier to not making changes or not received and seen as something desirable. There is the opportunity within analysis software such as the one used to attach sentiments to comments and these will be used later in the analysis to generate “heat maps” of positive and negative sentiments, where something was seen as a motivator or facilitator, or conversely a demotivator or an impediment will be colour coded in responses to try to build a visual picture of what was important to each participant.

4.5.5 Quality and reliability

It is acknowledged that with almost any interview, the interviewer may influence the interviewee and the interview (Howell, 2013, p.235). Given that the interviewer is a colleague of the interviewees, there was the possibility of bias, and the insider view of the interviewer could taint the findings. Transparency by use of verbatim quotes, applied ethical processes and repeated measures within the interviews should confirm the findings to be as objective as they could be with such a study. Spencer et al. (2003) stressed the importance of neutrality and openness to different views of researchers to avoid bias. As a member of the same teaching group and user of the same teaching spaces, the researcher acknowledges their position within this study and consciously made all attempt to avoid any bias.

Neither participant validation nor peer review of the analysis was carried out. Whilst these techniques can provide verification of the data, they may lead to participants wanting to alter their responses or the possibility of two different interpretations of the data, neither of which is verifiable (Burnard et al., 2008). One participant did read a draft of this thesis and although they were able to identify themselves and confirm it to be a fair representation of their position, they were unable to identify anybody else.

5 Findings

5.1 Introduction

This chapter will present the findings of the interviews arranged into sections that cover; staff feelings about the lecture theatre, what impact the redesign has had on their teaching practice and consideration of the factors that may have inspired, facilitated or been barriers to change.

The chapter will begin with an overview of the cohort giving the reader some background information on each participant to gain an appreciation of where each one is on their teaching journey and whether or not they were teaching at Leeds prior to the refurbishment, meaning they can make a direct comparison of before and after. For those that started after, the comparison will be between traditional lecture theatres and the new DLT. Following this there will be mini-biographies of each participant and a summary of their experiences of using the new lecture theatre in their own words. This again is meant to familiarise the reader with the 15 participants and get to know a little of their personalities, which may relate to the decisions they made about using the space.

Section 5.4 will explore the use that was made of the educational technology available, and section 5.5 will be an attempt to categorise the participants by how they have altered their teaching in direct response to the presence of the DLT. The factors behind those decisions will be explored in sections 5.6, 5.7 and 5.8. In these sections, attitudes to change will be discussed followed by an exploration of the factors contained in the model and the relevance of those to the decisions being made.

Sections 5.9 and 5.10 are a look to the future, again using the model as a framework for what factors they think would be useful to support their future lecture provision and whether they envisage making changes to a different style, what could help them with those changes.

5.2 Overview of Cohort

Questions at the start of the interviews regarding the background of the subjects, including; gender, teaching experience, educational qualifications and seniority level are summarised in

Table 5-1.

Table 5-1 - Summary of interviewees

Alias	Junior / Senior	Educational Qualifications	Module Leader?	Number of years teaching	At Leeds prior to refurbishment
Anya	J	Yes	Yes	<5	Yes
Bianca	J	No	Yes	5-10	No
Cathy	J	No	Yes	<5	No
Dan	J	Working towards	Yes	<5	No
Edgar	S	No	No	11-20	No
Faiza	J	No	No	11-20	No
Gerry	S	Yes	Yes	5-10	Yes
Hiro	S	Yes	No	>20	No
Ivan	S	No	Yes	>20	Yes
Jack	S	Yes	Yes	5-10	Yes
Kara	S	Yes	Yes	5-10	Yes
Lily	S	Yes	No	>20	Yes
Maria	J	No	No	5-10	Yes
Norman	S	No	Yes	>20	Yes
Olivia	S	Yes	No	11-20	Yes

5.3 Mini case-studies of the group

This section will present a mini biography of each group member with an outline of their approach to the lecture theatre. These are intended as an introduction to each participant rather than a complete summary of their data.

Anya

Anya had been a teacher for almost 5 years and recently completed a separate educational qualification that included the use of “smart” teaching spaces. Her own experiences as an undergraduate student were that lectures were not an environment in which she felt able to ask questions or where discussion was encouraged. More recent experiences as a student on a postgraduate teaching course (PGCAP) reminded Anya of how stressful it can feel as a student.

Anya's aim with making changes was to try to break down the barrier that she felt between herself and her teachers and to put into practice things she had learned during her educational certificate.

> *"I do have some experience as a student, and I do also have the experience now being on the other side and probably realising the challenges that the tutor would have had back in my days as a student but hoping that what we have available to us now will help break down those barriers to some degree."*

She was anxious about the use of technology and had to think what her "*Plan B*" was in case it failed, though she did feel able to adapt her teaching to the technology available.

Anya felt that the layout of students in small groups was one of the aspects that made her think about how she would use the space.

> *"It doesn't look like your typical lecture theatre, so the dental lecture theatre now is split up into pods where you encourage a group of students to sit together rather than your linear rows of students … you are already thinking, how do I use this space differently to the way that a traditional lecture theatre could be used?"*

Anya says that she changed the way she teaches due to the new space and has made use of the newly available technology to enhance her teaching:

> *"I have changed the way I teach, in the sense that I tried to use the technology available that is not there with the other lecture theatres, and in all honesty, if I was to deliver my lecture in a traditional lecture setup, I think I would struggle".*

Anya started giving the students learning materials to read before lectures, cutting down on the amount of time she needed to spend on didactic delivery.

> *"I am encouraging more scenario-based discussions where I am flipping from one projector to another projector where we're using the laptops that are in the pods so that we can ping up the students' work and we can have a look as a whole group of what Ideas certain groups have put together when they've just discussed a scenario."*

Anya also made use of the digital whiteboard to help explain concepts. Thinking about the planning of each session she combined quizzes and discussions with watching videos to try to avoid the fatigue she suspected could occur with students being more active in the session.

> *"Your lecture is no longer just a standard lecture anymore, it's almost like a lesson where you have to think of 'right the first 10 minutes we're going to do this, the next 10 minutes we're going to do that', factor in, you know, some fatigue that the students might have if you're really involving them in the whole session…"*

She felt that one of the benefits of teaching the way she does is that it allows those students that require more time to process the information the opportunity to do that.

Reflecting on the time it took to prepare her teaching sessions for the new style of delivery, Anya felt that although it was time consuming at first, subsequent delivery was easier as the material was already prepared.

Bianca

Bianca worked mainly in the clinical skills laboratories delivering small group teaching. She didn't take much opportunity for lecture delivery but felt that the redesigned lecture theatre gave more opportunity for interaction, and the increased use of technology was a progressive step, without expressing any ideas about how the technology could enhance learning.

Bianca thought that it would be useful to have some training on the technology perhaps more so than the pedagogical side of things and maybe a second person to change the slides while she was talking. One of the things she wanted to know more about was how the technology could be integrated into her teaching sessions, but wasn't sure how it could be used:

> *"…how you can generate those interactive bits, you know, would be very useful as a starting point, and then that in turn you may lead into looking at new technologies ... getting the information to put in your lecture is probably straightforward and then then you got to, kind of, look at the technology and see how they both, kind of, meet together."*

Cathy

Cathy had been a teacher for two years and had only delivered a small number of lectures. In the new DLT she had only delivered one lecture, but described it as a very traditional, information-delivery style lecture.

She enjoys lectures which are more interactive, and would really like to make her teaching more engaging, which she thought may be helped by using software that she had not yet had training with:

> *"I'd like to think if I ever get another go again it would be interactive and engaging, more relaxed. Social is not the right word, but you know I mean … sharing opinions and observations and stuff like that rather than me just lecturing at them and just giving them a load of information."*

Cathy's first impression was that the space made the whole dynamic of "*I'm the teacher, you're the student, you listen to me*" change to a space that looked like discussions could take place. She imagined the teacher being able to get group chats going with much more opportunity for interaction.

Cathy envisaged that students would be able to "*bounce ideas around*" and even come up with ideas even she hadn't thought of. She also thought that having a more conversational style of learning in the lecture theatre would lead to a more relaxed environment where students can learn better. This may relate back to Cathy's experiences as an undergraduate where she found lectures to be a one-way dialogue of just being "talked at" and weren't very engaging. Instead, she envisages a more relaxed and social space, not focussed on delivering information to pass exams, but to inspire. She felt that if the learning sessions were more fun, students would be more engaged and absorb the information better. Getting quite animated at the expectation of how lectures could be, she imagined how she would have liked lectures to be:

> *"I would like to have a bit more of an interactive teaching session rather than just me talking to them and just giving a load of text. I mean, I can probably talk for Britain to be fair, but … I just want it to be more engaging and using probably different software to try and get that engagement. I don't remember anything like that when we were undergraduates like you can do with these polls and get people's thoughts and opinions and really obtain what people know."*

She envisioned a future when the students would have prepared for her lectures, and she could use polls and discussion to find out the students' thoughts and opinions and be able to gauge what the students understand or need more help with. Unfortunately, due to the pandemic neither the opportunity nor the training had happened.

Dan

Dan had been teaching for less than 5 years when he joined Leeds and was part way through an educational certificate. Like Anya, he also wanted to break away from traditional "*old style*" lecture format, which he remembered as just sitting in rows with other students making discussion difficult. His use of the lecture theatre first involved splitting the session into two halves, delivering material in the first half and promoting discussion in the second, using quizzes and group discussions throughout. He felt that the way he used the DLT meant less need to find smaller rooms for group work. Being quite technically proficient had helped Dan's transition so that he included using two projectors to run quizzes. He prepared learning materials including recorded patient conversations for the students to watch before attending so that they could discuss them when together. He prepared the students for the change in style by introducing them previously to the polling software and also made announcements leading up the live sessions explaining exactly what was expected of the students and to remind them not expect a usual type of lecture.

> *"…from weeks before the lecture I introduced them to the platform that we were going to use, and I sent them an email just to say about two weeks or a week in advance to say "this is not going to be any kind of your usual type of lecture. This is the task that you need to do before hand, I need you to go through these and sort of answer the questions" … we gave them some papers to read as well"*

He felt cautious at first, he didn't know how the students would respond to changes, though he went on to add he shouldn't have been worried as there were no issues. With having no formal technology training, he worried that the technology wouldn't work, and so he only used apps and technologies he was already familiar with. He was further reassured that technical help was readily available if needed. He felt it took more time to prepare interactive sessions, stating that it would have been much easier just to deliver a PowerPoint, though he said it had helped to be able to observe a more experienced member of staff run collaborative sessions in the DLT.

Edgar

Edgar had a history of general dental practice prior to teaching but following gaining a master's degree 10 years ago he had largely provided postgraduate education. During that time, Edgar started some educational training, but didn't finish due to various reasons. Coming to Leeds four years ago he started providing lectures for undergraduates. This was after the refurbishment had occurred though he had taught postgraduate courses at Leeds using the old DLT prior to this and also being a Leeds graduate himself, he remembered the old layout of the lecture theatre. His first impression of the redesigned lecture theatre was positive, thinking it was innovative, he was put off changing his teaching practice largely due to the number of students in each group. He also felt that the students themselves would not want change. Edgar stated that nobody ever informed him of the theory behind the space or why it has been changed. Essentially, he just carried on using the lecture theatre as a traditional lecture theatre:

> *"Effectively all I really use when I go in there is I take my laptop and I plug the HDMI in, so it's not any different from what you might class as an old-school lecture theatre for me."*

Despite not using the lecture theatre differently, Edgar was very keen on collaborative learning in general, though he felt that was better provided in clinical spaces or in labs rather than in lectures. His final cynical comment was that the DLT was really…

> *"…just a lecture theatre, albeit with fancy seats."*

Faiza

Faiza had been teaching for more than 10 years and held a Fellowship of the Higher Education Academy (FHEA), though had no formal teaching qualification. She had been at Leeds for three years and had not had much opportunity to develop her practice in the new lecture theatre, despite being very excited about the possibilities it afforded. She was very keen on group interaction and delivered teaching sessions with students working in small groups in other learning spaces, for instance, in clinics where she saw the benefit of that group interaction.

> *"I do lots of group activity on clinic. When they don't have patients or, you know, during the briefing and debriefing time…. I have seen the peer groups, when they come together, the ideas bounce each other and it just works out amazingly well."*

Since the new DLT was introduced, her lectures now had more interaction, though she wasn't making use of the technology.

Gerry

As a student, Gerry enjoyed some lectures more than others:

> *"I did enjoy lectures. It gave us access to people who were experts in the field and the ones I enjoyed the most were the ones where the lecturer was very passionate about what they delivered and did … which I now know is them breaking it up. Whether they did it naturally or consciously it certainly seemed natural at the time...I experienced a wide range of lecture styles, and some worked for me and some didn't."*

Remembering when he started teaching, using the old-style lecture theatre, he brought in some of the aspects he had enjoyed as a student into his own teaching including breaks and activities.

> *"I started with what information I wanted to get across, but also what really the outcomes of what I would like the students to get out from the sessions and then try to break it up with a range of tools I really like. I got very good support and guidance from a range of colleagues with which I would now refer to sort of more active learning."*

One of Gerry's internal motivators to adapt his lectures was knowing that the students frequently have four hours of lectures back-to-back in a morning. Talking to them it became clear that they weren't really taking any information in during those lectures, so he felt motivated to try to be as engaging as he could be as he describes:

> *"I always do feel an expectation because I've got to try and make a topic engaging, that's my view on it and not necessarily inspirational but engaging so that the students can find it interesting. "*

Gerry's main change came when he realised he could walk around the lecture theatre. Having previously having to use flat floored teaching rooms for his style of teaching, Gerry felt that this could now be done in the lecture theatre. Being very focussed on the pedagogy, having previously gained a teaching qualification, and currently undertaking a doctorate in education, the space was more important to him and had some misgivings regarding the technology.

> *"Yes, I've really focused on space so far, even though the students have technology available to them, I've felt more confident exploring the space and using that to my advantage than the technology per se. I include quizzes, but I've generally got them to write their answer down. I know there's a laptop there, I don't know how familiar they are with using it, and I'm not that familiar, so I've used the fact that they are in different groups to be able to have group discussions."*

In traditional lecture theatres he had felt hampered by not being able to engage students in discussion and had stuck to a more traditional "*quite didactic, scientific sort of lecture*." He is continuing to use visualisers and run quizzes on pen and paper. His main use of new technology was being able to use the desktop microphones, which he found helpful. Although he has made changes, Gerry felt that he was more taking advantage of the facilities to do what he already did more easily, though he felt he had come a long way from "*just reading from the slides*."

The influence of the lecture theatre went beyond that space, having had considerable input into the design and refurbishment of a clinical skills teaching facility, Gerry wanted to incorporate the facility for students to learn together collaboratively, and therefore incorporated pods in the clinical skills design, inspired by the lecture theatre.

Hiro

Hiro has been teaching dentistry for more than 20 years, gaining a teaching certificate in the process. He had been a teacher at Leeds both before and after the redesign but was in another institution when the new DLT opened.

Early in his teaching career Hiro felt limited by the slideshow method of delivery, and after attending courses on gaining engagement and interaction in presentations, he started getting the audience to work in pairs or threes to discuss ideas or situations and then asked the groups to share their ideas with everyone else.

> *"I've really tried to apply small group stuff to large lecture theatres. So, the idea of getting interaction and getting engagement rather than just delivery of information."*

As his teaching practice developed, he found that setting up groups for discussion worked better than just asking general questions to the room.

> *"…I started off asking those questions and I guess early on with my teaching there was just a wall of silence, whereas actually a sort of group having some interactions within the lecture theatre before they had to answer was helpful."*

He enhanced this by starting to use flexible delivery techniques and bringing in polling software to allow the whole group to interact. He also made use of software that students could use to highlight diagrams, which he thought allowed him to discover misconceptions and to address them without someone having to give a wrong answer when asked.

On first sight of the new DLT, he was intrigued by some of the technology such as the whiteboard that enabled him to draw on slides rather than use overhead projections. He found the pods allowed for better pre-defined groups that enabled discussion more than simply turning to their neighbours.

Describing a typical lecture he designed it in discrete chunks, allowing breathing points and sections for recap of information. At several stages he asked students to discuss concepts and previous learning. When asked if he delivered lectures differently because of the extra facilities of the room he felt he didn't and he would try to deliver a similar lecture whatever the space, however the pods did help with group work.

> *"I try and do things because I try to have interactions in lectures, so just because it happened to be in a room that was designed to perhaps facilitate group work, it wouldn't have stopped me trying to get people to discuss and answer questions and work together. So, I don't personally feel that the room itself changed what I was going to do … It was easier in that there were very clearly defined groups of students … So, from a logistical point of view, maybe it was that was easier, I would say."*

Hiro hadn't received any training on how to use the lecture theatre but hoped in the future to adopt a more flipped approach to teaching and learning.

Ivan

Ivan, a senior member of staff has been teaching for many years, with most of that time being at Leeds. Despite not having any educational qualifications he gave multiple lectures each year, however he was mainly engaged in research. Ivan really liked the concept of the design of the lecture theatre, initially thinking it would encourage him to bring about changes to how he taught:

> *"Up front I thought yeah, now is the time to change the way I teach, to put some material out there for them beforehand and just do a Q&A session on it. But I've never really followed that through to extent I would like."*

When asked why he hadn't followed it through he raised several issues including a lack of training and a lack of direction from the University highlighting the benefits of making any changes.

> *"I think it's about training, I just know the basics about to use the place, no one's ever sat down and gone, 'If you want to do that, this is what you need to do' or, you know, 'if you're going to put material out you need to upload it in this format, this far ahead and you know these are the sort of strategies and to engage with them once they're in the room.' So, it's that sort of knowledge gap really."*

Ivan feels comfortable with the teaching style he has been developing over many years. He tries to make it interactive and uses visual aides to engage his audience but feels he could do that the same in any lecture theatre.

With regards to the technology available he feels that he could achieve the same by drawing on PowerPoint slides rather than using the smartboard or asking the students to draw on paper and walking round to look at their drawings would be easier than trying to do the same using the inbuilt laptops.

Jack

Jack joined the University ten years ago, having previously being a dentist in general practice with no prior experience of teaching. Currently a senior staff member, Jack ran several modules. During his ten years of teaching, he undertook the University of Leeds Teaching Award which aimed to develop reflective practice in teaching (University of Leeds, 2016). After his own experiences as a student of sitting on long benches and being "talked at" in lectures, Jack's initial impression was that the design of the lecture theatre would allow him to attempt to be a little more engaging and interactive. Thinking back now, he felt that any changes he made to his teaching weren't necessarily due to the lecture theatre *per se*, but more the way he was developing his teaching practice over the years, reflecting upon what he'd done previously and trying to improve it:

> *"You've either got a slightly questioning mind or an inherent feedback-y type mind where you do something, we do it as clinicians as well, you do something and you're not quite happy with it. Actually, that's probably what it is, I'm never quite happy with what I do and that can be my clinical work, that could be teaching, that could be anything."*

He then relates that to what he saw as the ‘human condition’ of not being able to focus on the positives and maybe dwells on the negatives that could be improved.

> *“I try not to cry about it, but it does mean that every time you do something, maybe it's a positive I don't know, but you focus on the bits that you don't think went well. It's quite hard in human nature to focus on what went well, I think you always focus on the bits that didn't seem so good, and then you always wonder about how to improve things, so I guess that's just the inherent nature of the cycle of teaching.”*

His teaching style included setting questions for mini breakout groups, asking students to draw diagrams and quizzes. He enjoyed discussions with students individually and felt that the layout of the new room allowed him to reach all students, whereas before he couldn’t reach 80% of them.

> *“…already as a teacher, you know maybe, you know, asking questions, having a quiz or things like that, and I think if you were that way inclined you would be almost battling the layout of the traditional lecture theatre, but going ahead with it anyway because you knew that that was the way to go, and that's been easier with the new lecture theatre, you can walk up and down the aisles”*

He also feels that it could be beneficial to some of the more reticent students.

> *“…you get students who, if you roam around a little bit, if you've set a couple of questions or a little task, they'll ask you if you're walking past, whereas they might not have shouted out in front of 80 odd students, you know, so I guess it helps in that respect as well.”*

Jack has “*dabbled with*” some of the technology, such as the laptops and whiteboard but hadn’t reached a conclusion about whether they made any difference compared to what he could achieve without them. He felt the benefit was mainly due to the layout and had taken advantage of having an extended lecture time of two hours to fit in all the activities he wanted to. If timetabled to a traditional lecture theatre he thought he would struggle.

Kara

Kara held a Master of Education (MEd) degree alongside her professional qualifications and described how she used evolving technologies to maximise her time with the students by using their short- and long-term memory to attempt to cement ideas through interaction. She would intersperse didactic presentations with quizzes and case presentations to test application of knowledge. She saw the lecture scenario as being part of a continuum with small group teaching and clinical practice. Whilst not currently using any techniques she would describe as ‘collaborative’ in lectures, she would do so if

that was the vision of the school and received the appropriate training. Her current teaching style has been developed through continuously developing process of finding what worked and what didn't.

Despite intentions to make changes, she found that training and support focussed on how to operate the technology rather than how to develop her own use the space.

> *"… after the initial 'this is the new thing, these are the buttons you press'. It felt like it went really quiet to me… I think there needed to be more support for staff to actually evolve their content, not just operate the equipment".*

The importance of inclusivity in teaching was important to Kara, which also shaped some of her decisions of how to teach.

Lily

Lily had been teaching for more than 10 years and remembered the lecture theatre before and after the refurbishment. One of Lily's key motivations when designing her lectures was to try to make sure that the students who attended got a different experience from those simply choosing to watch a recording.

She said that she had made changes in response to the redesign, by posing questions, getting the students to work in groups and annotate diagrams. She has used the facility to share those annotations with the whole class. She says she found she didn't really need to use the new tools to do those activities and had carried some of these changes over into using other lecture theatres that were not designed for collaborative teaching. Like the others who have adopted a new way of teaching, there were elements of active learning in Lily's lesson plans, which she included as she believed that application of knowledge is important.

> *"…with this kind of teaching, it's application of knowledge rather than imparting knowledge, and if I had my way, we wouldn't be imparting any of that knowledge in lectures. We would be telling them that "these are the things you need to go and read. And once you've read it, we can discuss it." That's much better use of our time and better use of their time."*

Lily raised the concern that giving students too much preparation for a lecture lead to students not attending:

> *"…If we want them to do work before they engage in a teaching exercise, they need to know that, but we need to know what else they're doing, and we can't just issue them work. So, it's safer to pitch up, assuming that they will have done nothing but turn up."*

Her typical lectures now involved posing questions to the groups, frequently this may be a diagram to annotate, which can then be shown on the main projectors and discussed more widely, with groups being able to compare their attempts with each other. The microphones had made wider discussions easier. Lily also used quizzes using proprietary software.

Lily stated that one of the reasons for changing her teaching style was from experiences she had as a postgraduate student:

> *"When I was doing the teaching course actually, and when I went to some of the taught sessions on the PhD, you go to sessions in the rest of the university, in the business school, it was just the style of teaching was just a bit different. It was because you had to prepare for the session, you had debates and they're quite heated sometimes, I kind of like that, you feel really involved in it and you sort of go away being a bit more inspired."*

Unfortunately, the timetabling constraints mean that she hadn't always got the collaborative lecture theatre but had managed to replicate the experience in more traditional layouts using whatever resources are available, though this can mean a lot of running up and down stairs due to the layout not being ideal for her style of teaching.

Maria

Maria has been teaching undergraduate dental students for between 5 and 10 years and hadn't gained any educational qualifications yet.

When asked if the space had allowed her to change her teaching style, she said no, but does take some advantage of the students sitting in pods. She felt she would probably teach in the same way if it was in a traditional lecture theatre or the new lecture theatre, though she thought that the new lecture theatre had moved her more towards a collaborative style of teaching in general. If she got the chance to deliver lectures again after the pandemic, she would like to introduce more group discussions, maybe not for every lecture but as a means of recapping or consolidating a topic. Despite liking the format and the modern feel of the space she felt that without being able to see someone use the space differently, she would feel uncomfortable about making changes.

What Maria described as her largest barrier was the lack of institutional vision.

> *"I feel like, again, it's sort of that vision that's coming generally from the school in terms of what do they want in terms of, if they would want to change a certain way of teaching in terms of lectures styles, is sort of a general vision. Eventually it all kind of filters down into an action, but one that's consistent across, rather than being just an individual that came up with that idea. What you don't know is, am I doing it right? "*

And what would help was having people lead by example:

> *"I think it would be quite useful to lead by example, you know if there is a change and I'm happy to have change it could be done by having an example of that and not just once, maybe kind of slowly introducing that into the department or into the curriculum and kind of one at a time rather than a lot of changes at the time."*

Norman

Norman had been teaching for more than 20 years. Mainly clinical teaching but was significantly involved in postgraduate education. He gave about six lectures a year to the undergraduate dental students. He held a fellowship in dental training, but no other formal educational qualifications. On seeing the lecture theatre his initial thoughts were that he would be able to try something different, but on reflection he didn't think he really had. His style of lecturing was very much based around presentation of clinical cases, which he tried to make interactive by getting small groups of students to discuss aspects of the treatment and then debate with each other. With the pods, he felt there could be a benefit of those small group discussions and felt that they could work together better than being in straight lines. Although he didn't feel he was using it to its full potential, he had used the whiteboard and the microphones, but not used the laptops or lights. He said he would have liked to do things differently:

> *"Certainly, the new lecture theatre has given greater opportunities to run the sort of sessions that I would like to run, and you know if I were to be given a new topic … and we're gonna do this in this new lecture theatre, then I think I would plan it very differently."*

Reflecting on how he had used it he has tended to revert to the same format he has been used to, though he felt more engaged with the students in the new space and saw further potential for customising learning for students that are at different levels.

Olivia

Olivia has extensive experience of teaching as well as pursuing a number of educational qualifications. She holds a PhD in education and is a Senior Fellow of the Higher Education Academy (SFHEA).

On seeing the redesigned space, it was more the layout than the available equipment that stood out. With regards to changes to her teaching style Olivia said she'd been "*a bit more adventurous*." She described her lectures prior to the introduction of the new theatre as mainly just delivering information. She had tried to introduce techniques she learned during her teaching qualifications,

but they generally didn't quite work, so it is hard to say that the new lecture theatre hadn't had more of an impact than she really fells it has had. Following introduction of the new space, she described a typical teaching session now as; providing pre-reading, and either discussing those at the start of the lecture or delivering a PowerPoint based presentation, but constantly referring back to the pre-reading. The layout of the lecture theatre has encouraged Olivia to include more interaction with the students:

> *"I guess the layout encourages you to interact more with the students, to ask them questions during the during the session, to walk around a bit more than you would have done and not feel this barrier that you've got your presenting area that is something separate to the students. "*

Which seems to be quite a departure from her own memories of being in lectures which she earlier described as:

> *"There was no looking up to the lecturer and actually making eye contact."*

She used '*whatever technology was available*' if it helped to make a point or to answer a question, so she would use the electronic whiteboard as it was available in the new room though thinks she didn't really need to. She said sometimes she would start a discussion and then walk around the pods which would not have been impossible in the old lecture theatre.

> *"Sometimes what I'll do is give them a bit of time to have a discussion about something and actually move away from presenting and go and walk around. That's quite nice to do as well... in the old lecture theatre, trying to get them to have an interactive discussion was impossible because they were turning their heads around."*

Olivia based her teaching style more around the subject matter than the layout of the room, choosing a more didactic style for some topics and more discursive for others:

> *"If it's about delivery of information, you've got to do a bit of didactic teaching, but then it's stopping and trying every so often to just check they're understanding … if it's more of a session where it's about exploration of things … that's where you've gotta make it much more interactive … You know, sometimes you don't even use the screen or a PowerPoint, you just have the discussion, it's much more personal."*

This section has provided a brief introduction to each of the participants in the study. The following section will look more specifically at how they used the technology available.

5.4 The use of Educational Technology

One of the novel aspects of the redesigned lecture theatres was the inclusion of technology to support learning and collaboration. Some of this would not normally be found in the traditional style lecture theatres, such as the pod laptops, the microphones and digital smartboard. Nine of the interviewees could recall a technologist being present at the start of lectures in the months immediately after opening. All apart from Bianca, Cathy and Edgar said that they were aware of how to get help should they need it though Kara added cynically "…i*f they are available…"*

Whilst most staff felt confident enough to use the technology that they were familiar with not many were confident with being able to manage a technological issue if it arose apart from trying to reboot the system. Lily rated her confidence at dealing with issues as "*really low*" and similarly Maria said "*I would panic if something goes off* ". Cathy particularly felt this would be an issue:

> *"If one of them says "Oh ****, this is this broken" Or "how do I turn this on?" I haven't the foggiest, so do you know what I mean?"*

Edgar and Gerry felt less concerned about technical issues, as they would revert to a more traditional teaching style should a failure occur, though Edgar also stated that he would only use technology if he saw proof that it was effective, which he hadn't.

For all interviewees the technology available either met or exceeded their needs. Several admitted to not being sure what was available for example, Cathy *presumed the technology was adequate* as she *assumed other people's lectures were successful*, but admitted to not being sure what technology was available. Jack also wasn't sure what was available and suspected there may be plenty that he didn't use but added that he wasn't convinced of the need for it and maybe there was technology for technology's sake. Similarly, Kara thought she may be discussing the technology from a point of ignorance and felt that by not exploring it she may be doing it a disservice.

Most staff had made some attempt to engage with the technology, what they described having used is presented in Table 5-2.

Table 5-2 – Table detailing the technologies available to teaching staff, indicating which ones stated to have been used by the interviewees.

Name	Microphones	Dual Projection	Digital Smartboard	Visualiser	Pod laptops	Overhead lights	Polling apps
Anya		x	x		x		
Bianca							
Cathy							
Dan	x	x					x
Edgar							
Faiza			x				
Gerry	x			x	x	x	
Hiro			x				x
Ivan				x			
Jack		x	x		x		x
Kara							x
Lily	x		x		x		
Maria	x	x					x
Norman	x		x				
Olivia			x				

Neither Bianca, Cathy nor Kara had made use of the technologies available, though Kara used a polling platform quite heavily during her teaching sessions but using the student's own technology to interact.

Dan and Gerry noted that the microphones made it easier for the other students to hear whilst students were talking, it also meant for Gerry he could hear the students better. Gerry was the only one who had tried using the overhead lights but more to try them out, he couldn't think of a reason to use them seamlessly in a session.

Jack held both positive and cynical views about the technology. He had tried the whiteboard to draw a diagram, and used the laptops for students to do

drawings that they could share with the rest of the class but wasn't really convinced of the value of them and felt, looking back, he felt he may have just been doing that as they were a novelty rather than an essential part of the teaching. He also now felt it would have been easier to just ask the students to draw on pieces of paper. He also didn't want to become too reliant on the technology as he couldn't always guarantee he would be timetabled into that space.

Similarly, Lily had tried to use the laptops to get the students to annotate diagrams and then share with the rest of the class, but she felt she wasn't achieving anything that couldn't have been done a different way. She also thought that everyone sharing their work just became boring after a while for all the other groups. She was also wary of asking students to present anything that could have right or wrong answers as that may cause the students to dread being picked in case they were wrong.

Olivia summed up the feelings of several, worrying that she would just be using the technology because it was there, and really wanted to be surer of the pedagogical value.

5.5 Categorising the staff by outcome

This section will use the self-reported statements regarding changes made together with the use of the available technology to categorise the participants by how they have changed their pedagogical approaches in response to the new DLT. This section will also include the heat maps described in the methodology section to visually depict the sentiments of the participants to the various factors in the model.

One of the aims of the project was to explore the amount of change that staff had made in response to having the use of the refurbished lecture theatre. Staff were categorised into three categories:

1. They reported to have been influenced by the space to make changes.
2. They hadn't made pedagogical changes, but the design of the room facilitated current teaching practice and
3. They had made no changes, had not used any features of the space.

Table 5-3 shows the staff placed into these categories. In total, six made changes and nine did not. Of those that hadn't changed, they all expressed a desire to change apart from Edgar and Ivan. Hiro, Gerry and Jack could be considered to be 'innovators' as they had changed from a didactic teaching style to a collaborative one before the lecture theatre was changed.

Table 5-3 – Degree of change following introduction of new space. *= providing collaborative style lectures prior to refurbishment. Names in red indicate that they have no plans to make changes to their teaching style.

Has changed due to design	**Facilitated current style without significant changes**	**Has not changed**
Anya	Faiza	Bianca
Dan	Hiro*	Cathy
Gerry*	Maria	Edgar
Jack*	Norman	Ivan
Lily		Kara
Olivia		

5.5.1 Heat maps

This section gives an alternative way to look at the data by representing visually the views of each of the interviewees. Using the novel model and applying colours to each section to signify whether a positive or negative tone was detected in the interviews, 'heat maps' have been created for each participant (Appendix F: Heat Maps).

Four of these that represent the different degrees of change within staff have been selected for presentation and later discussion; Anya (Figure 5-1), Cathy (Figure 5-2), Edgar (Figure 5-3) and Gerry (Figure 5-4).

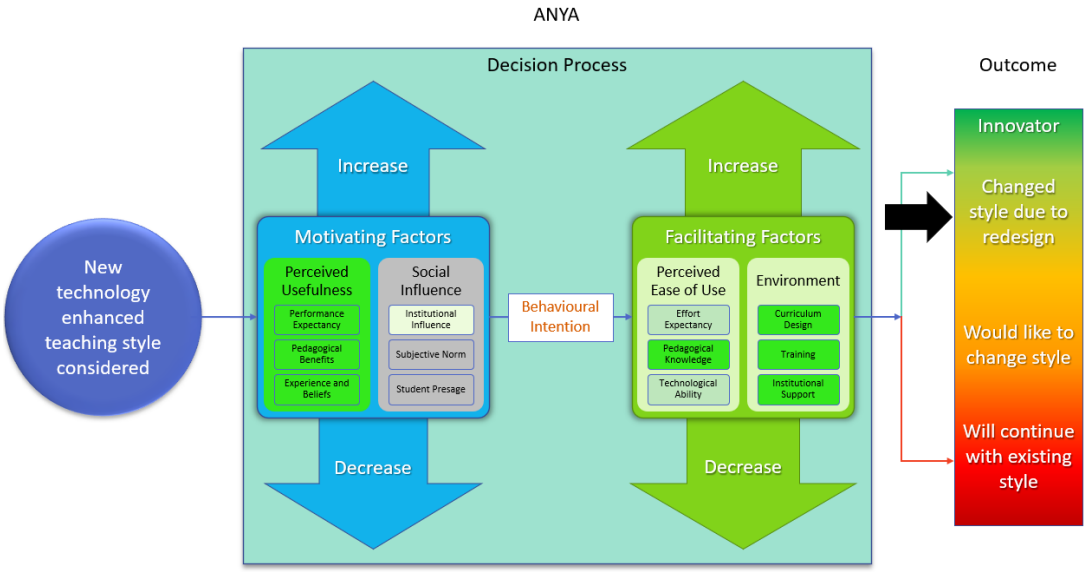

Figure 5-1 - Heat map for Anya

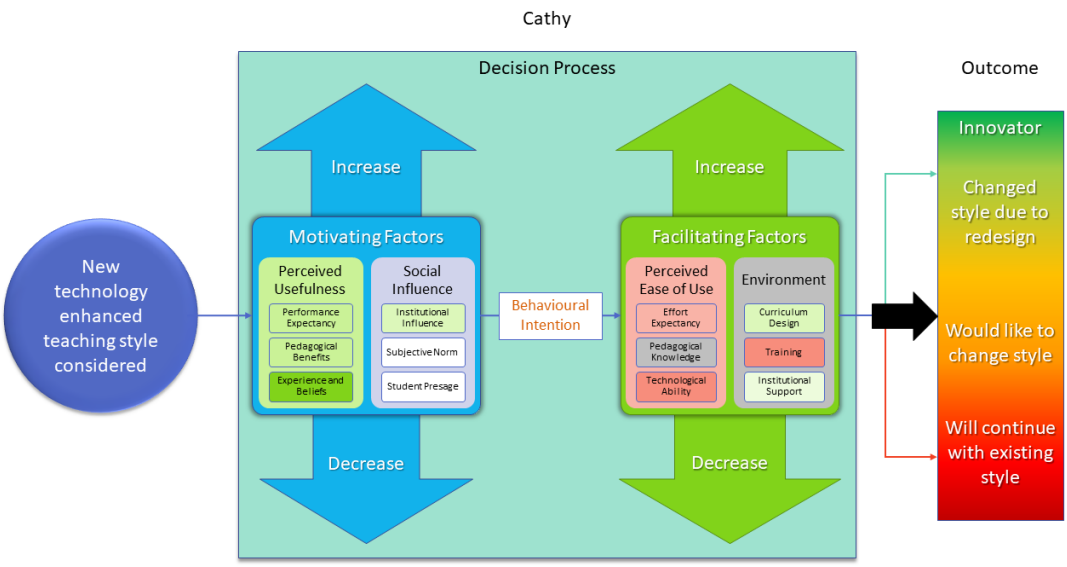

Figure 5-2 - Heat map for Cathy

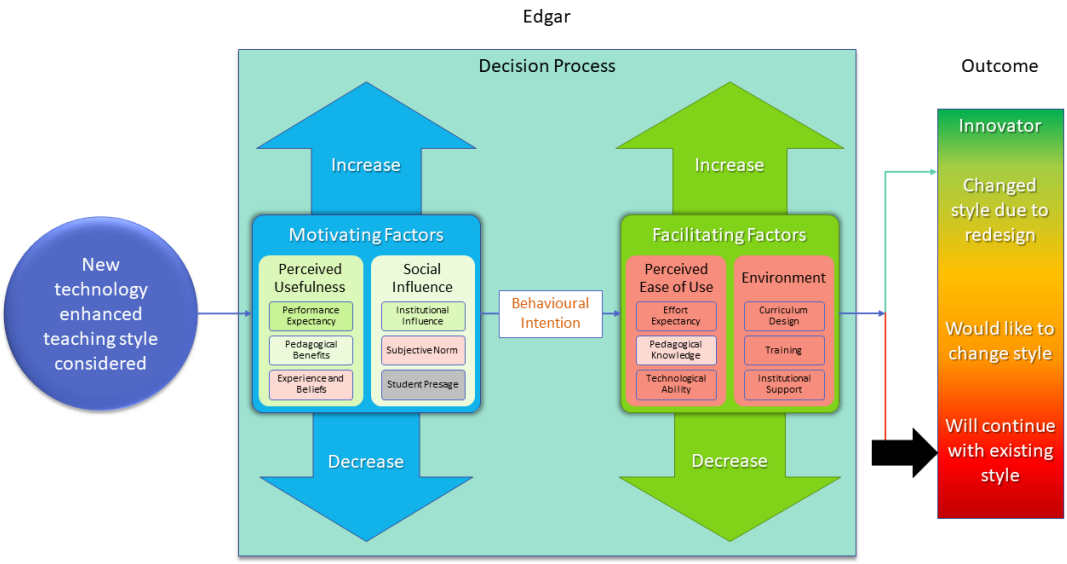

Figure 5-3 - Heat map for Edgar

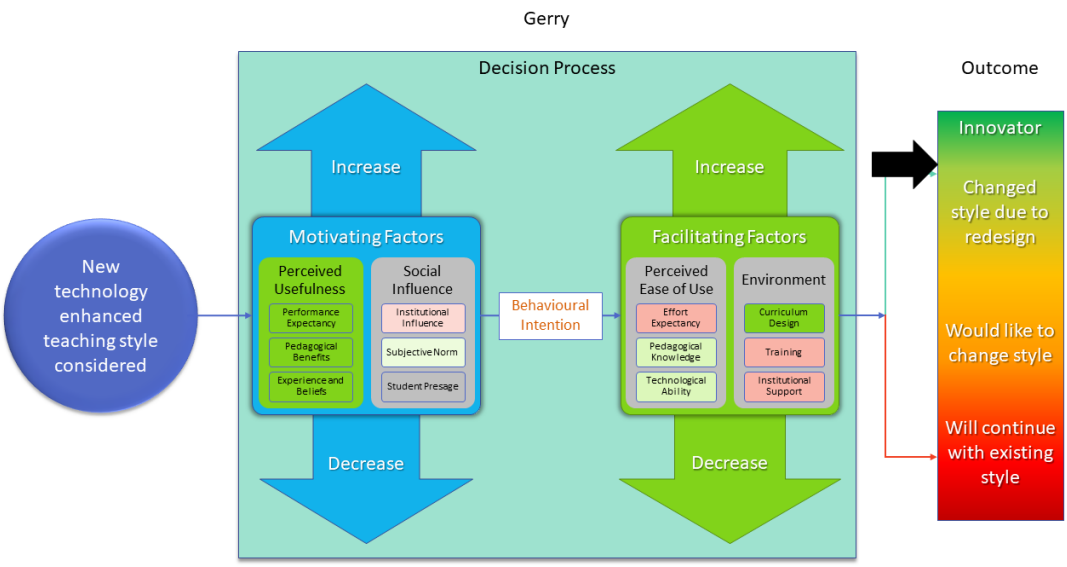

Figure 5-4 - Heat map for Gerry

For each item, the colour was derived from the number of codes or strength of feeling expressed regarding each area. The colours all relate to the uptake of collaborative teaching in lectures rather than provide commentary on the views of the individual. For example, with teacher beliefs, consideration was made of; the value of collaborative teaching in general and whether they thought lectures should be teacher lead or student focused. To illustrate this, Anya (Figure 5-1) felt that introducing collaborative teaching techniques would encourage discussion, and break down barriers between staff and students, and considered lectures to be an opportunity to learn, therefore she was allocated a strong green colour for experience and beliefs. Edgar (Figure 5-3), on the other hand, saw the benefit of collaborative learning, but only outside of the lecture environment, and he only talked about lectures in terms of information transmission, therefore his colour code for experience and beliefs is pale red.

Grey would indicate whether there were no strong feelings expressed or positive and negative thoughts cancelled each other out. The outer boxes for each set of three factors have been coloured to represent the prevailing sentiment within that section.

This visualisation may therefore be useful when thinking about the issues faced by each person, and for simple comparisons to be made. For example, Cathy was able to appreciate the benefits of making changes, but did not do so. Looking at her heat map, motivation is relatively positive, but facilitation is relatively negative, particularly with regard ease of use, therefore Cathy may benefit from the development of skills and knowledge, rather than encouragement.

In a comparison between Edgar (Figure 5-3) who didn't change and Hiro who did, it would appear that Edgar was not quite as convinced of the benefits and considered change to be hard, in an environment that was not supportive, whereas Gerry (Figure 5-4) saw strong benefit in making changes and was able to overcome any perceived challenges.

In all of them, social influence was a very weak factor, showing that this could be an area for improvement, and also facilitation had greater impact upon outcome than motivation. These will be analysed further in the discussion chapter.

5.6 Attitudes to change

For several participants, the most striking aspect on first seeing the theatre was the aesthetic of the layout. Faiza exclaimed that the layout was beautiful, Anya and Maria felt that the pods gave the space a modern look and feel. Edgar thought the pods gave the appearance of mini seminar groups. Recognising this also, Maria initially thought that the pods would make it easier for students to talk to each other. Whilst Gerry thought the design was "*intriguing*" and wanted to know more about the thinking it. He was already thinking about how to make his lectures more interactive.

Dan expressed an initial surprise at the layout and "*all the stuff that was available*." Being one of the more technologically savvy members of the group, Dan was intrigued by the laptops, microphones and twin projection screens that he hadn't found available in other lecture theatres. Rather than just providing a "*seat to sit on*", he thought the space now provided him the "*tools for students to learn with*".

Cathy was a student at the school prior to refurbishment and can remember the old layout. She thought that the barrier she had experienced as a student, between herself and the lecturer was lowered in the new surroundings and the ability for interaction had removed the hierarchy between student and teacher that she recalled from her student days. That feeling of separation was mirrored by Olivia, who, as a lecturer in the old lecture theatre had felt separated from the students and felt the new layout much more personal.

Bianca, Hiro and Olivia all remarked that the new layout added scope for teaching in a more collaborative way. Hiro hoped that some interactive drawing tools would be available. Olivia thought the layout brought scope for changing delivery, with the whole layout and functionality seeming to be designed for

interaction. Bianca saw the opportunity for discussing patient cases and that the inclusion of technology had been a "*progressive decision*".

Ivan, a very experienced senior member of staff had the initial reaction that the concept of pods and being able to isolate groups was good, though at the same time was sceptical about whether his teaching would benefit from those kinds of activities. Likewise, Norman, another very experienced senior teacher was very impressed by the refurbishment but felt that once the room was full of students there would be challenges.

After first becoming aware of, and seeing the space, some teachers began to develop some thoughts of how they may use it. "*I'm all for change!"* Faiza exclaimed, wanting anything that broke the monotony she had experienced in lectures as a student. Anya also was asking "*how do I use the space differently to the way that a traditional lecture theatre could be used?*"

Like many others Olivia thought the layout lent itself to the potential to bring in interaction, without really knowing how. Jack thought that the technology seemed less important than the layout, being content with the technology that had previously been available, the layout would allow him to move around more. Some of the other teachers noted that the technology could make lectures more interesting and bring them up to date. Bianca saw the technology as "*the way everything is progressing with teaching*", without really thinking about how that could benefit her students. Hiro also saw the interactive drawing tools as something he could use to engage the students, to be able to draw on presentations rather than separately on a whiteboard or overhead projector could be beneficial.

Some of the more experienced teachers expressed scepticism. Lily saw definite benefits of having what was effectively small group teaching within the space, but not with the time allowed and still having to deliver a certain amount of material. For Norman and Edgar, whilst having initially very positive thoughts, when they envisioned the whole year of students being in there, felt that sticking with traditional means of delivery would probably work best. For Kara and Gerry there was potentially a huge pedagogical benefit from changing their teaching, but neither felt that they had been shown how to use it to teach in that way or that they were aware that there was any expectation from the University in making those changes.

Looking at the wider picture, Gerry was aware that staff and students would make changes at different rates, and was concerned about making changes at a faster rate than others:

> *"It, it may well be that the people within our school, we're not even that big a school staff-wise, you know, compared to some others, will be that the speed of change is also about what everybody else can manage".*

Out of the 15 interviewees, Jack was perhaps the only one that didn't have any plans to change initially. Despite being impressed by the layout, he felt he made decisions on how to teach based upon his own reflective practice and would make it work in whatever space he was given, despite the opportunities that different spaces provided, yet he did go on to use technologies that he hadn't used before.

In order to explore the attitudes to change and the reasons behind them the following sections will take an in-depth look at the motivating factors that may have influenced the decisions to make a change and the facilitating factors that may have helped or hindered in the change process.

5.7 Motivating Factors

Motivating factors that had either positive or negative influence over decisions to use the lecture theatre differently were identified and aligned to the subcategories of Perceived Usefulness or Social influence from the model. These are shown hierarchically in Figure 5-5, and the most frequently occurring themes will be expanded upon in the ensuing sections.

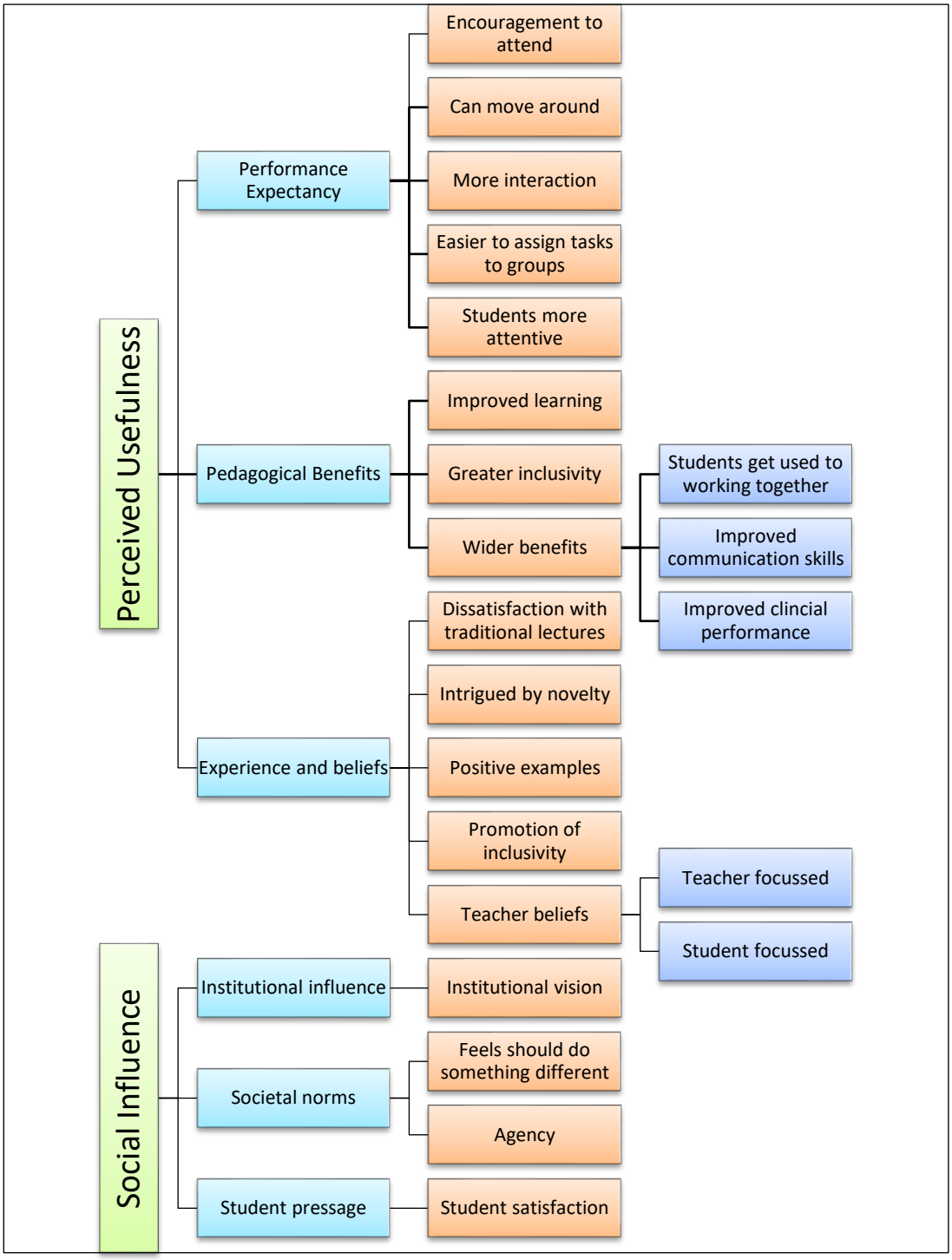

Figure 5-5 - Themes identified associated with motivation to make changes.

5.7.1 Perceived Usefulness

The main benefits of providing a collaborative experience included a perception that student learning would be improved and that the use of collaborative methods would promote inclusivity. Some also mentioned that it would make the task of teaching easier as they would enjoy more interaction with the students as well as being able to move from group to group more easily.

Improved student learning

Eleven out of 15 expressed notions that the new lecture space had the potential to promote improved learning.

Edgar had the opinion that undergraduates would think about their subjects more if they were encouraged to work collaboratively and learn to look up answers to questions rather than rely upon him to tell them everything. In addition, encouraging students to ask more questions which can then be used as springboards to further discussion by throwing those questions back to the students to think about rather than just give them the answers. Having seen this technique working in clinical and clinical skills environments, he felt that being able to find out answers was one of the key features of collaborative learning that could be successful in the lecture theatre, though he bemoaned the number of students in a group being a limiting factor.

> *"If you're an integral part of the discussion, I think you retain the information way better than just listening to somebody spouting at you. I think that's certainly the way to teach if you can get the group down small enough to make that a possibility. But as I say, all of those groups that we did that with at (*previous institution*), the biggest group would have been 12."*

Similarly, Faiza thought that collaborative learning would promote longer term retention and improved understanding. She went on to express a feeling that this would have an additional effect of improving clinical performance:

> *"I think the comprehending and synthesizing information would be better than a regular lecture space when they engage into those formative activities. And I think that it just kind of stays in there probably, you know, in their system more and last longer in long term memory, … I think when they come to clinics … the tendency to remember what they have learned in that kind of space would be better than the conventional lecture space."*

On the other hand, Faiza felt that the 'good' students would want to engage more, but there would be a group of students who preferred being traditionally taught. She thought that both learning preferences should be accommodated as all students need to be brought to the same level of competency as they will be entering a profession and serving the public.

This notion of collaboration leading to improved retention was echoed by Hiro who thought that the synthesis process in bringing ideas together to solve problems was more likely to help retain and maintain information as opposed to just learning a series of facts.

Dan was the only one mentioning research showing that when students are actively involved in their learning, retain information better as it triggers "*deeper*

learning". He also thought that collaborative learning could help students to develop their communication skills.

Gerry and Lily thought that discussions and quizzes during lectures may help identify areas of weakness for the students, rather than finding out nearer to an exam where more work may be required.

Jack expressed the idea that being proactive in lecture theatres is beneficial in terms of retaining information but raised a concern that the level of distraction available to contemporary students, who could while away the time on their phones if not actively engaged with the lecture, could be avoided by setting little tasks and being able to walk around the lecture theatre. Jack saw collaborative working as being more suitable for more senior students as the course transitions from learning facts in the earlier years to applying that knowledge in later years. He points out that dentistry unlike a subject like maths has more possible answers to a problem and more opportunity for discussion. He sees the benefits of working collaboratively in his lab, where more nervous students can be reassured by taking collective decisions and has a very positive view of the benefits of working together:

> *"I think they achieve more as a whole than they would as an individual…I suspect the write up the output of that is better than it would have been had they had to do the whole experiment themselves."*

Jack is also slightly wary of how groups will work together when there are different personalities involved:

> *"It's the whole group dynamic thing, where there's generally people who feel they're doing more, and generally people who, well, the people never complain that they feel they're doing less…it's probably, for the high achievers, a cause for angst working in groups, because they then, you know, carry the can, they feel like they're doing a lot more of the work."*

Inclusivity

Cathy felt that the more relaxed atmosphere that could be created by having group discussions may encourage students who may not normally interact to come forwards, and that they may…

> *"…feel more comfortable to approach me and be like... "I don't understand that". And then we can have a further chat about it. So, I just hope it would just improve a student's experience at the end of the day, so they're not thinking this is a boring stressful lecture."*

For Jack the ability to walk around and interact with each group meant that no one was being left out, as in the past if he set activities, he was only able to chat with those at the end of the aisles.

Hiro thought there was potentially a better chance that for students to have the opportunity to speak rather than feeling excluded, but if they wanted it, there was still an element of anonymity within a group.

Kara noted that since the introduction of the lecture theatre, she had noticed a more collegiate attitude developing between the students, which was having a benefit to the more insecure students:

> *"…there's also a kind of collegiate aspect which, uh, particularly in the hygiene & therapy programs was both heart-warming and astounding to watch how those who are more secure really brought others with them. And, I mean I have no doubt that in in certain groups those individuals who were more anxious or just less secure in the knowledge achieved so much more because of the support of their peers."*

Maria noticed thought that student involvement was now more equal. In old style lecture theatres, she would tend to talk to and ask questions of those at the front or in her eye line, meaning the ones at the sides and the back were less involved. She thought that students fell into a spectrum of personalities regarding confidence:

> *"There are the ones that are, well, kind of outspoken, they want to get their ideas out there… but there are others, not necessarily that they don't know, they just don't have that sort of personality. But when you put them all in one group and everyone has equal opportunity to participate or ask, I feel, like, it makes it more equal and I feel it's beneficial for them in the short term and also kind of long term because … you won't change their personality, but maybe in terms of education they would get more out of it."*

Anya described the student base in dentistry as being very varied, and felt that if materials were given in advance, in the case of a flipped learning approach, it would allow those students who prefer to learn in different ways or digest information at different speeds the time to do so prior to the lecture.

Dan thought that use of the microphones may help quieter students have a voice, and for shy students being able to discuss their understanding with colleagues sitting next to them rather than speak out in front of everyone to ask the teacher could be less stressful. He also thought that if students ask other students, they may get something put in a different way that may be more easily understood, than asking the lecturer to explain something again.

Teacher beliefs

Teacher beliefs were gained by looking for aspects of teaching practices that were student or teacher lead, as well as examining thoughts provided about the value and problems with lectures. All apart from Edgar and Ivan focussed on

student learning, whilst those two focussed on being able to deliver information. This may not be their entrenched positions, but delivery was more strongly emphasised than lectures being for student learning. For example, when discussing whether Edgar had considered using the space as he thought it was intended to be used, he replied:

> *"When you've got an hour or 40 minutes, or whatever it is, to deliver a lecture to 90 students, that space doesn't work."*

Norman expressed a similar sentiment:

> *"I think it's this idea, again I come back to the numbers, you know, when you stand in front of 100 students and you've got 45 minutes to deliver a topic, there's a limit to what you can do. "*

Though he did go on to say that maybe he should "throw out" his conceptions of teaching and just turn up with a small amount of teaching material that could be developed in the session.

Previous experience

Most remembered traditional lectures as being quite a negative experience, though both Gerry and Norman thought that depended greatly upon the lecturer. Gerry remembered positively those lecturers that were both passionate about their subject, but also had the ability to break up the subject matter into manageable chunks. Preferring to learn from lecture notes than from books, the ability that lectures offered to give him access to subject experts was very valuable. Norman also had some fond memories, he felt that although the purpose of his lectures was to provide valuable signposts for what to learn, even a traditional lecture, with an inspirational teacher could be an outstanding experience. Not all of his experiences were positive though, or even the norm. He lamented that he had been on many occasions been subjected to "*death by PowerPoint*."

Generally, they remember their lecture experience as students as being a largely passive experience. Most recalled frantically writing notes with very little interaction with the lecturers. Olivia summed up the experience:

> *"In first and second year you went in, you had your pad of paper … as soon as the lecturer started speaking your head's down, trying or make notes. There was no looking up to the lecturer and actually making eye contact. It was very much an exercise of let's just try and get down all the all the notes that I can."*

Cathy described the lecture experience as being stressful, like others she described a feeling of being 'talked at', rather than feeling included. Jack

described how the use of slide projectors and the dimmed lighting meant that it was quite difficult to make notes.

> *"So, a traditional lecture was like, the lecturer would come in, we'd all hush down. Often the lights would go down a little bit, especially in the old days when the slide projector was on. You couldn't see much actually to write anyway, and they would talk for 45 minutes to an hour, and you'd attempt to listen."*

Dan complained that if a lecturer did try to involve the students, the layout made it hard to speak to anyone other than was sitting next to you and being unable to hear what people further away were saying.

The group were also asked about their experiences of delivering lectures prior to the refurbishment or using traditional style lecture theatres and similar themes started to appear regarding a lack of engagement with the students, Anya even describing the experience as 'cold' with a 'barrier' between lecturer and students. For Dan, traditional lectures were just for transmission of information, not for learning, with no ability to check what the students understood.

In all, twelve of the participants had some negative memories of lectures when they were students, five could remember some positive aspects of lectures. The ones that changed their teaching style most were also the ones with the most vivid recollection of negative experiences.

Table 5-4 shows the same information for the current study. Training has also been included. Age was not directly asked due to there being no evidence that age has an effect, and also in order to further anonymise the group. Number of years teaching may not be related closely to age as staff within the school begin teaching at different points within their career.

Table 5-4 - Some potential correlations between factors related to experience and degree of change.

Degree of change	name	Gender	Present before the refurbishment	Formal Educational qualifications	Junior or Senior	Years of teaching experience	Received pedagogical training	Received technological training	Positive experience of collaborative learning/teaching
Has changed	Anya	F	Y	Y	J	<5	Y	Y	N
	Dan	M	N	Y	J	<5	N	N	Y
	Gerry	M	Y	Y	S	5-10	N	Y	Y
	Jack	M	Y	Y	S	5-10	N	Y	Y
	Lily	F	Y	Y	S	>20	Y	Y	Y
	Olivia	F	Y	Y	S	11-20	Y	Y	Y
Facilitated current style	Faiza	F	N	N	J	11-20	N	Y	Y
	Hiro	M	N	Y	S	>20	N	N	Y
	Maria	F	Y	N	J	5-10	N	N	N
	Norman	M	Y	N	S	>20	N	Y	N
No changes	Bianca	F	N	N	J	5-10	N	N	Y
	Cathy	F	N	N	J	<5	N	N	Y
	Edgar	M	N	N	S	11-20	N	N	Y
	Kara	F	Y	Y	S	5-10	N	Y	Y
	Ivan	M	Y	N	S	>20	N	N	N

Whilst the numbers are small, the table highlights a few areas that are worthy of further investigation:

- Gender had no effect on degree of change, with all groups equally split between male and female.
- All of the staff that had adopted collaborative or active teaching styles held a separate educational qualification, only one of the staff that did not make changes did not, Kara however was using collaborative techniques in other settings and active teaching methods in lectures.
- Being present before the redesign, level of seniority or years of teaching had no effect.

- Only those in the changed group had received pedagogical training, the innovators, Gerry, Hiro and Jack received no pedagogical training.
- Technological training was possibly associated with change.

Experience and beliefs would appear to be closely linked to change. With the data for experience and beliefs isolated from the heat maps, it can be seen in Table 5-5 that there was a correlation between positive experiences and beliefs with providing collaborative teaching.

Table 5-5 - Table of experience and beliefs findings isolated from individual heat maps.

Has changed due to layout	Facilitated current style without making changes	Has not changed
Anya	Faiza	Bianca
Dan	Hiro	Cathy
Gerry	Maria	Edgar
Jack	Norman	Ivan
Lily		Kara
Olivia		

5.7.2 Social Influence

Subjective norms

From speaking to the teachers, they weren't aware of what others were doing in a meaningful way, though some had helped other members of staff or had been helped themselves when learning how to use the space. Jack, Kara and Lily, were typical in that they said that they simply didn't know what other staff were doing or whether others had changed how they teach. Kara suspected that there were some staff using the space differently and described them as 'early adopters', though she didn't think that was the majority of staff.

Gerry and Jack thought that the way the students responded gave a clue as to what other staff were doing. Gerry always asked the students what they had been doing in previous lectures, but they always just looked blankly back at him with some very vague notions of what they had sat through. Likewise, Jack felt

that a lack of student expectation on him to teach in a novel way was probably a reflection of his suspicion that not many staff had in fact changed from traditional lectures:

> *"I think if everybody else was lecturing in a completely novel way in some sort of hologram bubble, then yes, they they'd probably complain about me or something, but I have a strong suspicion that many people are using that lecture theatre in the way that they used to lecture, It's just a slightly more comfortable environment."*

Student Expectations

Not many of the interviewees had really considered what students actually thought of the usefulness of lectures. Jack's feeling was that they probably didn't particular like or enjoy them or gain much benefit:

> *"Students learn in different ways, some of them like to do that face to face, some of them prefer to read a book or whatever. I think. It partly also depends on what you mean by a lecture. If you mean you know an hour of talking at people, probably very few students actually benefit hugely from that, and probably, if you ask them, they they'd say they don't benefit hugely from that."*

He had gained this view from chatting with final year students in his clinical group. He admits his view may not be balanced as in those informal chats people just tend to complain rather than discuss anything they enjoyed.

Kara put herself into the students' position, remembering what lectures were like for her. She also thought that whilst Lecture Capture, which is the inclusion of technology to record lectures for later viewing, could help for those students having difficulty keeping up. It doubles their workload as they have to attend the lecture and then have to work from the recorded lecture later:

> *"It depends on the lecture model, but your traditional didactic, I think they turn up and turn off, uh, from some of them it will be like I was, which was just complete overwhelmed where you just can't keep up, and it's the lecture capture after that's the big way that you learn from that, so it's double the workload for the students."*

Lily points to lecture attendance being "patchy" as maybe an indication of the value they place on lectures. When asked if she thought the students had any expectations on how staff use the space she responded:

> *"I think maybe they did when they first came in. I'm not sure. I don't know what my colleagues are doing, so I don't know whether I'm an exception, or, you know, in the middle or just the norm? No, I don't really know."*

Despite Dan receiving very positive feedback from his students, who found the use of collaborative techniques to be more engaging and enjoyable, there was

no report that students had been requesting this from other teachers, in fact staff had very divergent views on whether students would actually want to make that change. Edgar's feeling was that students come to university expecting to be given the information in lectures in a quite traditional way;

> *"I think the problem is that they're so used to it. And I suppose another gap in my knowledge is how they are taught at school, but they seem to sit in the lecture style where there's a teacher giving them information, there seems to be a huge expectation for it to be like that. So, I think changing from that will be very difficult."*

A perceived lack of institutional vision

Gerry saw the lack of student expectation as part of the wider lack of pedagogical steer from the school regarding lectures. He believes that if lecturers haven't been facilitated to make changes, then student expectations won't change.

> *"I don't feel I'm an outlier in terms of 'everybody else is using the technology and therefore mine are standing out differently.' I always do feel an expectation because I've got to try and make a topic engaging, that's my view on it and not necessarily inspirational but engaging so that so that the students who can, I find it interesting. But I'm not sure they know how the lecture theatre can be used and how you can learn in that space. "*

Even though he had tried to make lectures more engaging, he complained that the students still had the mindset that they attended lectures to get the handout or the slides. Without there being a vision from the school that both lecturers and students can adopt then he felt a futility to trying to change his teaching.

Jack didn't feel obliged to change how he taught and commented on the lack of direction given by the school when the lecture theatre first reopened:

> *"… the lecture theatre appeared, there wasn't, you know, a huge amount of … there may have been some fanfare to it, but there wasn't a huge amount of, you know, 'let's all go and rewrite how we teach and here's some time allocated to do it', and so on. Nobody seems to come into your lectures in particular or anything."*

Some saw the lack of direction from the school as failure to inspire. Maria saw the fact that the school had no set way of teaching as a barrier to making greater changes. She felt that if she was to try something new, she'd rather not do that on her own, saying "there needs be a vision" whether that was across a module or across a year, she would like more consistency. She also felt that such changes maybe should start with a completely new cohort of students rather than change 'mid-stream' in order to be more consistent and more equal.

Kara also picked up this notion of consistency in approach to teaching. She felt that a consistent pedagogical approach by the school or university would inform her own approach. She felt ready to adapt how she teaches to different situations but wanted always to be operating in a way that was informed by the University's vision.

Lily felt that the modular structure in dentistry did not allow her to have an overview of what had been taught before and what came after. She also felt that the students didn't get adequate time for preparation for such collaborative sessions that would involve pre-reading or prior preparation. This was not within her gift as a lecturer to provide. Similarly, Hiro felt that if he had been able to run a series of lectures rather than isolated ones, he could start to introduce a variety of different approaches in a holistic way. Knowing what had been done previously and what was to come in a module, rather than the constraint of being given a single "lecture slot" and a discrete topic could lead to more consistency in his approach with them.

Agency

All staff report they feel able to make their own decisions. They felt, no direct pressure from student, school or module leads to teach in any particular way. As Cathy said, "I've not known anyone dictate how you should or shouldn't do it." Despite having the freedom to choose, she also felt that maybe staff should all get together to bounce ideas off each other, but was resigned to the fact that that was unlikely to happen.

Although Hiro felt no expectation to teach in a particular way, he did sometimes feel constrained by not being given the option of teaching a subject in a way other than lectures, for instance he felt that some of his lecture topics may be better delivered as a tutorial or a practical, but without being the module lead he was resigned to the fact that he had to deliver it as a lecture.

Ivan and Kara both feeling no pressure to change, appreciated that fact that they could continue to deliver lectures as they always had. Olivia saw the fact that staff have the freedom to develop their own style as a positive aspect of the school's approach to education:

> *"…over the years, even times before the we had this new setup we actually had, I felt quite free to do what I think is appropriate, and I think that's great for the development of staff and of teaching actually, yeah."*

5.8 Facilitating factors

The second part of the adoption process is having the right conditions to be able to make any changes that the staff member has been motivated to do.

The themes that arose during the interviews regarding the perceived ease of use, or what challenges the staff think may be creating difficulties when making changes have been arranged hierarchically in Figure 5-6.

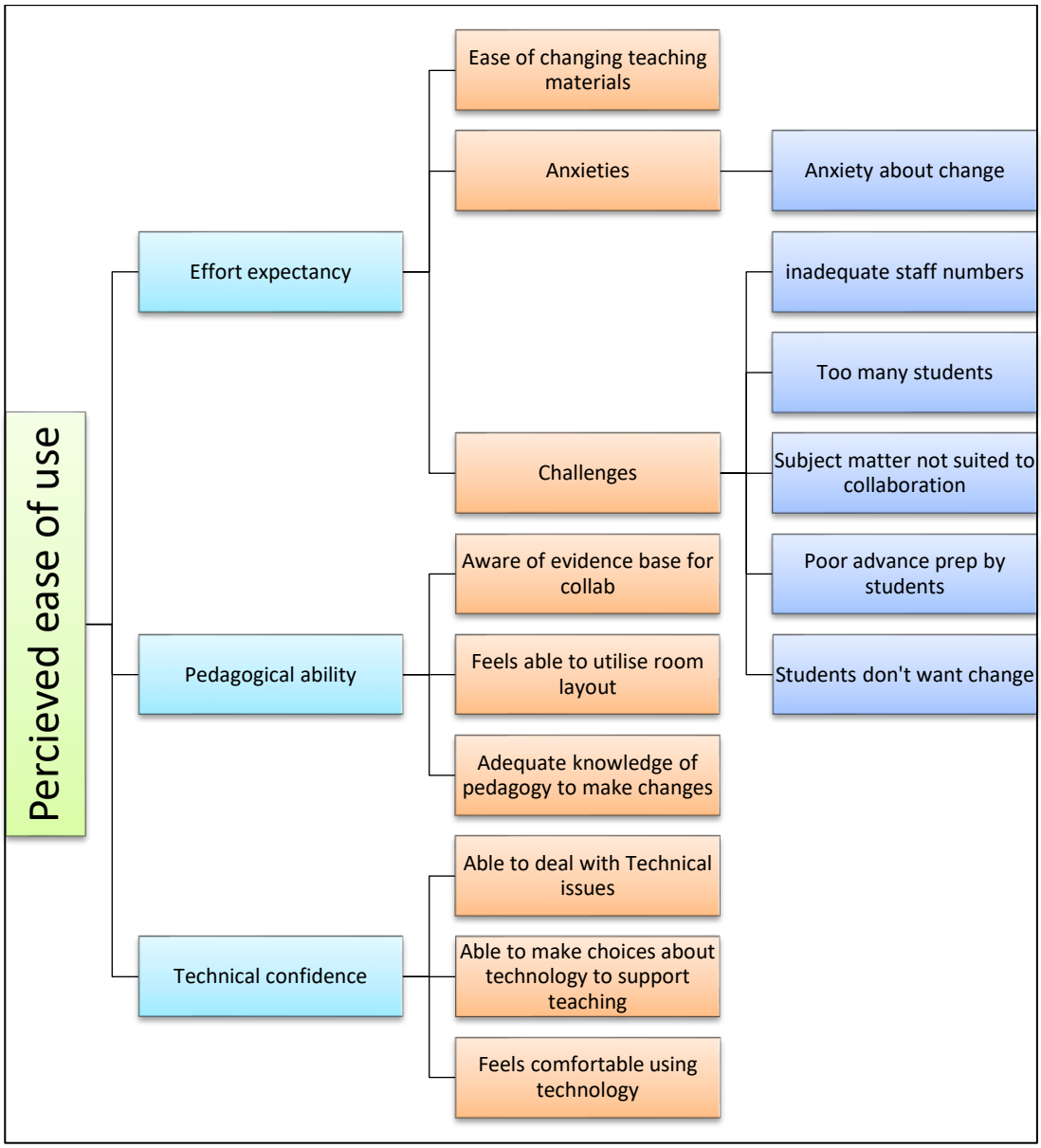

Figure 5-6 - Themes arising regarding the perceived ease or difficulty of making the change to a collaborative style.

5.8.1 Effort Expectancy

Having considered the motivations towards making changes interviewees were asked about factors that may have facilitated or hindered making changes.

Table 5-6 shows the most reported challenges and barriers ranked in order of how frequently they were raised and by how many staff.

Table 5-6 - Frequency of challenges and barriers raised by staff to making changes to the way they teach.

Challenge / barrier	frequency
Lack of pedagogical training	14
Anxiety about using technology	11
Inadequate technological training	11
Student acceptance	9
Anxiety about change	7
Insufficient preparation time to make changes	7
Too many students to engage with them all	7
Not in control of how sessions are timetabled	5
Students would not do prep work / prefer traditional means	5
The amount of information to be delivered in the time allotted	4
Inadequate technical support	3
Lack of awareness of the vision of school regarding change	3
Whether the students would be adequately prepared for assessments	3
Having the right skills to create a collaborative lesson	1
More staff intensive with tight staff numbers	1
Not aware of evidence of improved outcomes	1
Subject matter does not lend itself to discussion	1

The following sections explore the most frequent challenges in more detail.

Anxieties

Jack, Edgar, Hiro and Norman, all experienced lecturers said they would feel very little anxiety about changing, but for the remainder, some degree of anxiety

about making changes existed and they stated that those anxieties influenced their subsequent approach.

Maria in particular felt that she didn't know what was being expected of the staff, she had already planned her lectures for the months coming and was worried about changing the slides to something different. The technical aspects concerned Lily, with the portent that upon changing her teaching, she would be let down by the technology and have to wait for help while the students muttered. Cathy felt very unprepared for using the space, but felt that, in time and with training that worry would disappear.

Despite feeling comfortable with using technology, several members of staff reported anxieties regarding relying on technology in their teaching plan in case something went wrong. Anya, for example, described the anxiety she felt at the start of each teaching session:

> *"I do feel comfortable, but I must admit that the beginning of the session you do have that slight anxiety that technology is going to let you down, and if it does let you down, what is your back up, you know, if a lot of your session is based on that collaborative learning and all of a sudden the iPads don't work or the laptops don't work, or, you know, you've setup a quiz, so there is that little bit of an anxiety at the beginning of the session…"*

For Gerry, the anxieties about the technology not working were not a major concern, feeling confident enough in his abilities to make a joke of it and bring the students along with him if he had to change plans:

> *"I would explain to them 'I'm gonna try this different way, if you come on this other journey with me, let's see if it works, tell me at the end if you thought it was any good.'"*

His main anxiety was not feeling confident about choosing the correct technology for the purpose or what is 'best practice' when using technology:

> *"Anxiety comes from…I guess, using it appropriately so it actually adds something rather than getting in the way of what I'm trying to do. And then, also, the bit that I'm still not sure about is; Why have we got all that kit? Why that Kit, why that specially, and not how to use it, it's how best to use it."*

Ivan, Kara, Lily and Maria all expressed some real anxieties about using the technology. Lily worried most about the effect failure may have on the students:

> *"…you know, you go to press a button and your activity is designed only to be given in that way, and then nothing happens. And then you have those awful 20 minutes when the lecturer just sits there muttering to themselves, and the students are getting bored."*

Olivia mentioned the possibility of some “scary moments” if she couldn’t remember how something worked, but that was only to begin with, with time her confidence increased.

Numbers of students

Whilst the benefits of collaborative learning were widely expressed, the case for providing collaborative teaching to 100 students in a one-hour lecture was less enthusiastically supported.

Around half of the interviewees commented on the high number of students in each lecture being a considerable challenge to using the space in a collaborative way.

Edgar highlighted two issues with the numbers of students. He felt that trying to carry out, what he felt would be similar to small group teaching, would take too long with too many groups to attend to. He also felt that for students having to speak up or present their work in front of 90 others would be very intimidating:

> *“The problem that we have here is that there are 90 students and just doing that is impossible. … You don't want the students to be intimidated and have to present their work to 90 of their colleagues… I think we're limited for time… a comfortable number is, say 10 to 12 people and that means doing it 8 or 9 times over within the class size that we've got.”*

For Ivan too, the numbers of students were a real barrier, particularly if he wanted to have a good consistency in the student experience:

> *“You can’t ask 90 odd people the questions, because you get an hour, you wouldn’t be having any chat in that time, you’d be checking what they know, making sure it’s consistent across the cohort, you just couldn’t do it with a class that size.”*

Jack too was conscious of issue that the numbers raised for the sake of inclusivity, worrying that any time spent discussing a topic with one pod would leave the others out:

> *“…even if you've got like a nice lecture theatre like ours, you've still got 87 or 60 or whatever students, if it's full, and you really want a kind of an in-depth to-and-fro conversation with a table, you know, quite often you can talk for half an hour with that table, but that means you can't go to the next table, and when you're doing that, you're very much not in the room for everybody else.”*

Norman felt that the numbers would have to mean a radical departure to his normal teaching, though he didn’t state whether he felt that would be a benefit or a barrier:

> *“I think it's this idea, again I come back to the numbers, you know, when you stand in front of 100 students and you've got 45 minutes to deliver a topic,*

> *there's a limit to what you can do. Yeah, you could be radical and just say 'OK. I'm just going to use 2 examples I'm going to base the whole lecture on these two examples' and maybe that's what I should do."*

Norman also made the comment that he felt it was easier to make his lectures more student-focussed when teaching postgraduates, he felt that the undergraduate curriculum required him to deliver a certain amount of information in the time.

Perceived lack of Student Acceptance

There was a general feeling that students seemed to expect or prefer the traditional lecture format, with handouts of all of the slides. To his surprise Gerry found that some students refer to areas of knowledge by which slide they were on. He recalled a conversation he had on clinic with some students:

> *"I asked the student 'when do you get taught about this?' whatever technique it was I think it was endodontics and they said they found highlights on Slide 42 of Mr. ****'s presentation, and I thought they were joking. I said 'Haha, good one that, yeah, yeah, excellent!' and the student asked another one, 'It is slide 42, isn't it?' or whatever the slide number was, and I was amazed, I said, 'do you memorize slides?' 'Oh yeah'"*

Lily had concerns that asking students to do some preparatory work prior to a lecture they may be overburdened at certain times of the year, and with tasks that maybe the lecturer is unaware of. This could lead to some students choosing not to attend the lectures for fear of being seen to be unprepared.

> *"I'm aware of a couple of colleagues who were sending out information in advance of a lecture to students and asking them to read this, this, and this because they're going to cover some parts from it in the lecture, which is all fine, but the students were absolutely freaking out because they had an exam which this member of staff had known nothing about and they decided on mass that they wouldn't go to the lecture…"*

Comparing dental students to other students across the University, Lily suspected that the dental students were more heavily timetabled, had more structured days and less time to prepare. And whilst there may be some students who did do the preparation, we needed to be mindful of the ones that were unable to. She concludes that there shouldn't be a wholesale change to a flipped style of learning, as that may lead to students not attending.

Not enough time to adapt materials.

Almost half of the interviewees commented on the extra time required to adapt teaching materials. Anya, Dan and Maria discussed that it's not just a simple case of adding in an interactive session, but that those would need to be

planned, pre-reading materials would need to be prepared which all takes time that is a commodity that most of the respondents felt short of.

Anya described the extra time she required to use the lecture theatre collaboratively:

> *"It's definitely time consuming … once you have the material ready then the following or the subsequent sessions that you deliver is easier to do, but the first or second time that I had to put that particular lecture together it did require quite a bit of time of thinking about the lesson plan, because your lecture is no longer just a standard lecture anymore it's almost like a lesson where you have to think of 'right the first 10 minutes we're going to do this the next 10 minutes we're going to do that'."*

Kara was worried that, without support, she would have to learn how best to make those changes through trial and error, would require too much time. She felt that support, particularly early in the process, would have been a great benefit. Ivan felt that given enough time he could have made a transition to a new way of teaching, but was concerned that without that, he would not be able to achieve the quality he would like to, he therefore decided not to make changes:

> *"The day job is so time consuming, but you end up finding it's a week before your lectures due… It could all be enhanced by using gadgets and the technology in there, but I just haven't got time to prepare that material in that way."*

Faiza too felt despondent about a lack of time to improve her teaching and also doesn't feel there is time withing the programme to introduce further activities without significant curriculum changes:

> *"I think it's the challenges of timetabling and the program structure. We don't have time for that, so unless the program is changed and rethought and given a specific time for those kind of activities, I don't think we can come up with any solutions as of now."*

The issue of assessments

When describing what normally happened at the end of his lectures, Ivan mentioned that some students come to the teacher's podium and want to know more about the topic. Some students ask questions to try to fill gaps missing in their notes, but some ask, "is that going to be on the exam?" and it felt to him like all the students wanted was to get the slides and memorise them in order to pass an exam.

Cathy wanted to try to enthuse the students more than just to pass exams. She would ideally see lectures as a chance to make a subject enjoyable, but she

was aware of a general feeling that students attend lectures, to get handouts in order to pass exams. Several interviewees brought up the issue of students' attitudes towards assessment as being one of the influences for how they teach. Jack mentioned that students frequently asked, "do we need to know this for the exam?" Yet he and others saw the aim of teaching was to prepare the students to face not just exams, but to improve the clinical decision making that they will have to face as independent dental practitioners in the future.

Hiro mentioned that exams in dentistry tended to cover a broad range of topics rather, than any topic in depth. He felt that although questions won't go into much depth, it doesn't mean he avoids delving deeper into subjects in lectures, though there can be speculation regarding whether all lecturers just teach enough to pass the exams or are like Hiro. Gerry notes that students just seem to want the slides from his presentations, even if he prepares a handout with all pertinent information on, he still gets emails asking for the actual slides. He asks, why do they feel we're going to ask them exam questions from specific slides? From this, Gerry feels there is not an expectation from the students for the staff to change what they do.

Lily also addressed the same point. She pointed to the fact that as a school the staff had become conditioned to only asking exam questions which have been covered on a slide handout. Thinking back over the years she said…

> *"It became a requirement that if you couldn't evidence a slide which had a bullet point on it, then you couldn't ask it in an exam. We were actually getting to the stage where in assessment panels, people would go and check that a slide with that particular piece of information had been put up in front of the students."*

Lily felt that this affected how she taught and would put her off just being able to discuss a topic, she felt she had to include everything on the slides that might come up in an exam, and lectures just became purely content exchange. In her words there was a "joint Project", students expected everything to be on the slides, staff wouldn't ask questions about anything that wasn't. Lily wasn't happy about that but accepted it as the reality of the situation.

Likewise, Kara felt similarly despondent about the notion of delivery for exams, but accepted it on the grounds of the amount of information that dental students need to know:

> *"So, I think, you know, transmission, acquisition, whatever you want to call it, content delivery, has its place for dentistry because the stuff you've just got to know, but what I wouldn't want to see is that we go from transmission to assessment, and there's none of those building blocks in between. "*

Which may be one of the reasons she stated earlier that students tend to “turn up and turn off.”

Jack is also aware of different students having different approaches to assessment:

> *“I think there are some students who would still want to be learning by being fed the facts, so that they can revise. I think there may be quite a few who worry that they had a great afternoon chatting about some cases, but they don't really have any structured notes that mean they can go away and revise and write an exam. So, yeah, I guess there might be an element of resistance to that.”*

He goes on to describe how he manages this, by having some very prescriptive handouts, that the students can use to revise with, but have a more collaborative session where they use those notes to apply that knowledge to clinical cases. Edgar felt that this application of knowledge during a collaborative learning session, with students having to speak in front of their contemporaries would in fact be great preparation for clinical oral examinations in the future.

Amount of information to deliver.

Non-changers Bianca, Edgar, Faiza and Norman all thought that trying to change how the material was delivered within a one-hour time slot didn’t allow any opportunity to add activities such as group discussions, and still be able to deliver the amount of information they thought they needed to deliver. Faiza hoped that appropriate training could have led to her becoming more efficient with her time. For Norman the restriction was the undergraduate curriculum as he felt quite comfortable letting postgraduate students lead his teaching sessions with them. Those that were able to adopt a new style tended to get around the problem by inventing their own means of delivery such as Anya’s use of pre-reading for the students and preparation of scenarios to discuss. Anya, though, had received training on how to use the space collaboratively and had completed an educational qualification, something the four mentioned previously had not.

5.8.2 Environment

The themes that arose when discussing the environment within which they are expected to work, are grouped into the headings determined by the model and shown hierarchically in Figure 5-7.

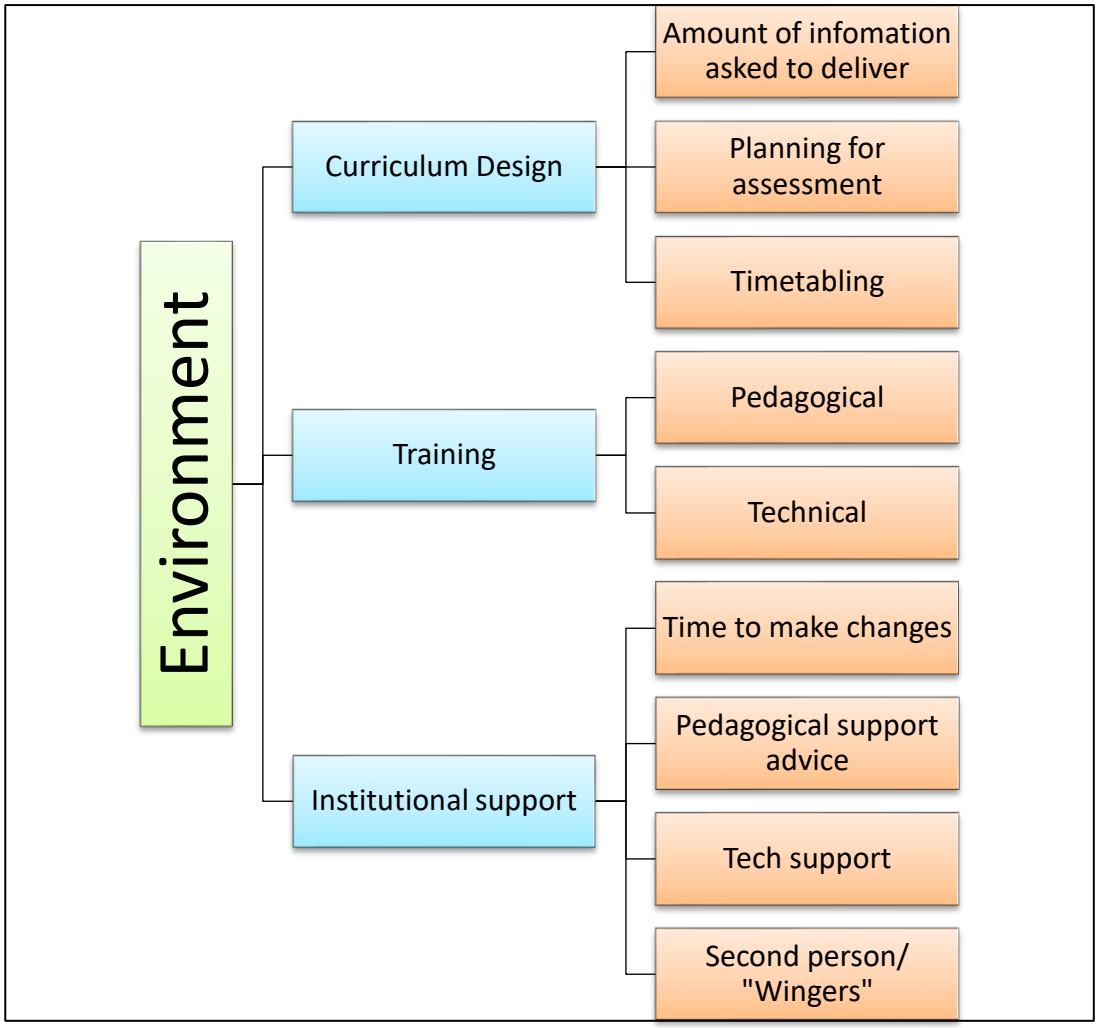

Figure 5-7 - Themes that arose regarding the environment. Clement (2018) described wingers as classroom assistants to support the leader of the session.

5.8.3 Curriculum Design

The interviewees were asked whether it was appropriate to introduce collaborative learning into dental curriculum as it currently stood. Kara's view of collaborative learning was that it was a core competency, a basic necessity for the programme and professional practice. When asked if the dental curriculum currently lends itself to a collaborative approach, her opinion was that the teaching provided was not joined up enough to allow a collaborative approach to learning:

> *"In all honesty no, it feels quite nebulous and disconnected and I see that in the impact on students' prior learning that they as a rule, aren't making those connections, they're not pulling their prior knowledge through. They're completing that exam for that module, and then it's done. That to me suggest that the whole curriculum isn't collaborative. "*

There seemed to be two ways in which the overarching institutions, whether that be the Dental School or the wider University, may have influenced or motivated staff to make changes, one being through lecture timetabling and the other being just the fact that the lecture theatre had been changed: There is no evidence that anyone had been asked to teach differently, however the influence from higher up may have been felt more indirectly; “They must have done it for a reason” was Edgar’s opinion.

Lily explained that prior to the refurbishment, the dental school had always taken priority over other schools when booking the room. It is the only lecture theatre on site, which is convenient as dental students have onsite timetabled activities for most of the day on most days, so travelling across campus could lead someone to be late for clinics or laboratory sessions. Anya, Gerry and Lily, all of whom changed their teaching style, mentioned the fact that they had heard that there were timetabling constraints placed on the new lecture theatre. Anya had heard that unless it was being used it in a collaborative way, priority would be given to other schools and the school would lose its first call over booking dental lectures. While she stated that this didn’t force her to change teaching style, it may have subconsciously affected her choices. Gerry described the fact that he thought it could only be booked for collaborative teaching was the only pressure he had felt to make a change. Lily was worried that unless the teachers used it in the way it was intended the dental staff would lose their priority over bookings and have to lecture in inferior lecture theatres, which felt like an obligation at the time. She goes on to state that she wasn’t sure that her worries were founded as she had delivered lectures in there that in fact were very traditional in nature with no adverse consequences.

5.8.4 Perceived lack of appropriate training

All fifteen mentioned insufficient training, either in the pedagogy of teaching in a collaborative lecture theatre, or in the use of the technology as a significant challenge or barrier to using the space differently or more effectively.

Olivia explained that prior to the opening of the lecture theatre, some training events were scheduled for staff to attend voluntarily. As some staff started after the introduction, we cannot assume that this training was received by all and may not have been available to part-time staff. The training was met with a mixed reception.

Olivia described the training as very good. She described how they sat in the pods and interacted with the trainer, there was some theory, but training seemed mainly to consist of being shown how to operate the equipment.

> *"So, when the lecture theatre was first opened, there were a series of training sessions where we got to use the equipment and so on, and it was very good I remember. It's just at the time was having the headspace to kind of take it all in. Everybody is under pressure constantly for all the things that we have to do and, you know, I wish I had a bit of head space just to think about it."*

Although Olivia felt that the training had been useful, with many other things going on at the time she didn't really get the time to digest it, and still feels even now several years later that she could develop her practice more. A summary of training reportedly received is shown in Table 5-7.

Table 5-7 - Table showing reported training received on both how to use the technology and how to use the space collaboratively.

Name	Training in using the space to teach collaboratively	Training in how to operate the technology
Anya	Yes	Yes
Bianca	No	No
Cathy	No	No
Dan	No	No
Edgar	No	No
Faiza	Yes	Yes
Gerry	No	Yes
Hiro	No	No
Ivan	No	No
Jack	No	Yes
Kara	No	Yes
Lily	Yes	Yes
Maria	No	No
Norman	No	Yes
Olivia	Yes	Yes

Anya was undertaking an educational certificate course at the time of the introduction, which included an introduction to "smart" lecture theatres. The training she described mainly covered how to utilise the technology, but she says that she took advantage of the knowledge of her teachers on the course.

Lily explained that although there hadn't been any pedagogical training within the Dental School, she had attended a training session where lecturers from the School of Music were describing how they were using their lecture theatre collaboratively and how modules had been converted to a flipped format. She recalled thinking that they had an advantage with their modules being more discrete entities, whereas in Dentistry they were different to other parts of the University in terms of them being a collection of different topics under a banner.

For the staff that weren't there at the time of the introduction; Bianca, Cathy, Dan, Edgar, Faiza and Hiro, no formal training was made available. Dan says he had to work out for himself how everything worked, and Cathy had a brief introduction from a colleague but that consisted of just to how to turn on and off some of the technology.

Of the staff who were present at the time of opening, Maria stated she'd received no training at all. Gerry, Ivan, Jack, Kara, and Norman say that training just involved how to operate some of the technical aspects of the room rather than how to develop their pedagogy to use it in a collaborative way.

As Jack described the training he had received, there was nothing regarding the pedagogy, overall, it was very brief:

> *"No, so not in a definitely nothing in a more pedagogical or kind of empirical way, you know, the only thing that I vaguely remember is, as I say, a tech saying, you know, "you put the USB in here."*

For Kara, the lack of pedagogical training was a big issue in terms of adopting a different style of practice:

> *"The only training I've received was on the operational side. Like 'If you want to speak to a specific booth, press this button, if you want to show a particular whiteboard from a particular booth, press this button'. But no training on actually what that would look like. What I wanted was the ability to say 'this is what I do, and this is what I'm aiming to achieve. '"*

Gerry also felt that the lack of training on the pedagogical aspects of collaborative teaching was an impediment to change. When asked if any of the training he received involved pedagogy he answered:

> *"No, not in a way of… 'Here's example A, of how you can go through each student group's laptops for example, and they can show you their screen.' Not; 'how best to do that? Why you would do it? What that's providing? The other students are looking at it, why is that helpful for them?' … I Say that little bit bluntly… but as a lecturer, somebody who lectures in our Dental School lecture theatre, then no, I'm not aware of that, and that again, is another barrier, isn't it?"*

Despite expressing frustrations with the lack of pedagogical training, all three used the space in a student-centred way.

Edgar was left a little exasperated by the lack of training or to find out why the lecture theatre had been changed. He had received no guidance on the theory or reason why changing could be of benefit:

> *"Clearly the lecture Theatre is designed to try and deliver teaching in a different way, otherwise why would you do it like that. Nobody's ever come to me and said, 'the theory behind this', or 'the pedagogy is' … 'why we're doing it this way is…" It would be useful to tell lecturers why it's been done, and I've never really been shown."*

He goes on to say that as a dentist first, and an educator second, more guidance and training would have been helpful. In fact, the need or desire for more training into how the space could be used to improve their pedagogical approach to teaching was raised by all but one interviewee.

Ivan felt that receiving pedagogical training was more important than technological training. As a more mature member of staff, he would like to receive a reminder on the pedagogy as it had been a long time since doing his post graduate certificate in education, he thought that probably the more junior staff going through teaching for the FHEA were receiving that kind of training.

> *"I'm sure the pedagogy's taught, I think it's then with that knowledge how you then apply in that lecture theatre setting with that technology to get the best out of it… it may well be that you know the more mature people need to have that reminder about the pedagogical approach to what we're trying to do."*

Bianca and Cathy felt that more training in the technology side would be most helpful. As Bianca explained she wanted more basic training:

> *"…how you can generate those interactive bits you know would be very useful as a starting point, and then that in turn you may lead onto looking at new technologies and new options for the things."*

When asked if it was more the technology side than the pedagogical side she would like training in, she responded that it was;

> *"Yeah, I think so. I think you know, learning getting the information to put in your lecture is probably straightforward and then then you got to kind of look at the technology and see how they both kind of meet together."*

Student Training

Nobody had any recollection of whether the students had been taught how to work collaboratively or how to use the technology.

Kara had the opinion that students were quite casual in their approach to lectures, not always turning up and then not particularly engaging with it when they are there. She then made an interesting observation that students maybe hadn't been supported in their transition to a new way of learning:

> *"Just like I wasn't supported to do anything more than press different buttons in the new lecture theatre, the students maybe haven't had that similar support of, 'How am I supposed to learn differently in this situation?' … students haven't had that supported transition into a new way of learning, so no other students have expected anything different other than it looks nicer and they can't all fit in now. "*

5.8.5 Adequacy of technical support

The availability of support seemed to be very important to several of the teachers. Ivan, Jack, Lily, Norman and Maria all recall there would be someone there at the start of each lecture to make sure everything is working, though their role was not always clear as described by Maria:

> *"it was right at the beginning, in first few months really, there would be a person, when I came into the lecture theatre and just say "are you happy with how things work?" and I looked at the computer, it was on, the light was on and then it was that basically, like a very quick interaction. It was a bit bizarre because we didn't know what was their role. Was it like an IT support? Was it technical support? Was it support that you know could show us what to do with the actual facilities? I wasn't sure, but I assumed it was technical support."*

Bianca thought that knowing where to get assistance would allow her to embrace some of the technology which up until now she felt she could only manage issues by rebooting. Gerry was happy with the level of technical support provided, knowing who to ring or to sort out a log-in problem, but felt what he really wanted was models of best practice and help tailoring that to his students. Kara also felt that having a learning technologist would have made her feel more confident.

Olivia had quite positive interactions with technical support and had used them on a couple of occasions, though she would normally tend to go into the lecture theatre early if possible, just to set everything up and make sure it was all working. She found it useful to "have a play with things" prior to the students turning up.

5.9 What future changes would they like to make?

This section asks the participants to think about the future. During the interview phase of the project we were still in Covid restrictions and the return to live

lectures was being debated as something that may not happen. This was acknowledged when asking the questions and they were asked to think about, what was at this stage a hypothetical future where lectures had returned, whether they would like to make changes and what would help them to do that. This gives the interesting opportunity to triangulate earlier questions regarding barriers and impediments to see if what they think would help address those issues.

5.9.1 Thinking about lectures going forwards

The group were asked if they were to provide live lectures in the future, after the pandemic had passed whether they would like to make any changes to the way they currently use the space and what support they think would be most helpful to make such changes.

Most staff had some desires to do things differently, but there was also some doubt raised about whether lectures would return in the format seen previously. Lily, Norman and Maria all felt that there were better ways of delivering didactic lectures, having learned from the pandemic to utilise online formats and keep a degree of blended learning in place, be that online discussions or recorded lectures. They did, however, feel that the time students are timetabled in larger groups would be better used for discussions at various stages through a topic or for symposia, in which a number of speakers can talk and hold Q&A sessions. This was similar to Edgar’s thoughts about the future. Edgar referred back to a previous experience he had had with two lecturers holding a “revision” session for final year students using the new lecture theatre and felt that was the ideal model for using the space but warned against “freestyling” for all sessions and this shouldn’t be the means by which students gain their knowledge initially.

Dan didn’t say he would do anything differently in his lectures but felt that attendance at live lectures should be made compulsory, but that students should be allowed to choose whether attend in person or to join online to be more inclusive. Gerry worried that the school would not have learned lessons from the past and going back to live lectures without staff development and the time to make changes would risk that it would remain an underutilised space.

Kara was reluctant to go back to lectures as a form of education, having developed web resources and feels it important that students are able to work at their own speed, but did admit there may be some activities that could work well with the whole year group, but would need support to set those up.

Olivia had a sombre view of the future of lectures, stating that her values of education hadn't changed and felt the method of delivery were not so important as the aims, but like some of the others felt the future would be a hybrid of didactic learning online with some live sessions more occasionally to allow for interactive learning, but wasn't sure whether that would be better in large groups or smaller tutorial groups.

5.9.2 What would they do differently?

There wasn't a great deal of radical thinking about significant future changes, and this may be related to the fact that at the time of asking no lectures were being delivered and there was, at the time, not talk that live lectures would return. Of those that did wish to make changes, they were thinking hypothetically about what they may do given the opportunity.

Reflecting on her experiences of making some significant changes to her teaching, Anya felt that maybe the amount of interaction and activities she had tried to squeeze into an hour's lecture slot could have left the students feeling fatigued, thinking that maybe if she focussed on one or two aspects of interactivity:

> *"I think at the beginning I was so excited to have all these different technologies… I'd try and build as many as I can within the lecture…you'd have discussions and you'd have quizzes and you know you put the scenarios on the board and then you'd draw something on the smart board, and whereas I think going forward I would probably only focus on one or two… That's probably what I would change".*

Cathy would like to use the opportunity to make her lectures more interactive and engaging, and trying to provide the relaxed, social atmosphere that she feels would help students to enjoy the subject, but she felt she would need a lot of support to reach this point:

> *"Personally, it would be the probably the technology / education side for me. I'd like to know more about what works, what doesn't work in terms of delivery of teaching, from people's experiences, and then the technology side, because I don't really know about what's in that lecture Theatre. What can I use and? What's compatible with it and stuff".*

She added that it was the technological side of things that gave her the most concern.

> *"I would be anxious if I was not confident about what was in terms of the technologies, and it goes wrong. That would make me anxious 'cause I'd be like, what do I do now? Who do I talk to? You're in that room on your own, aren't you? And you can't just run out and leave 80 odd students in there."*

5.10 What would help to make changes?

Lastly, the staff were asked what would have helped them the most or what they felt would be most helpful to them in using the space going forward. Several suggestions were made, and these have been summarised in Table 5-8.

Table 5-8 - The factors that staff thought would have been helpful to them in making changes.

What would help	How many staff requested this
Learning from others	11
More training	6
Having a top-down vision	5
More time to make changes	3
Having a second person present	2
Having smaller student groups	2
Knowing the evidence base for making any changes	1

Figure 5-8 shows the connections identified between what were considered barriers and what staff thought would be helpful. Arrows are used to show connections and for most barriers there is an arrow coming from the “what would help” area that would address the issue. There are a few items however for which no solution was requested, including how the students prepare for lectures, subject matter not being suited to collaborative teaching methods and the amount of information needed to be delivered for assessment.

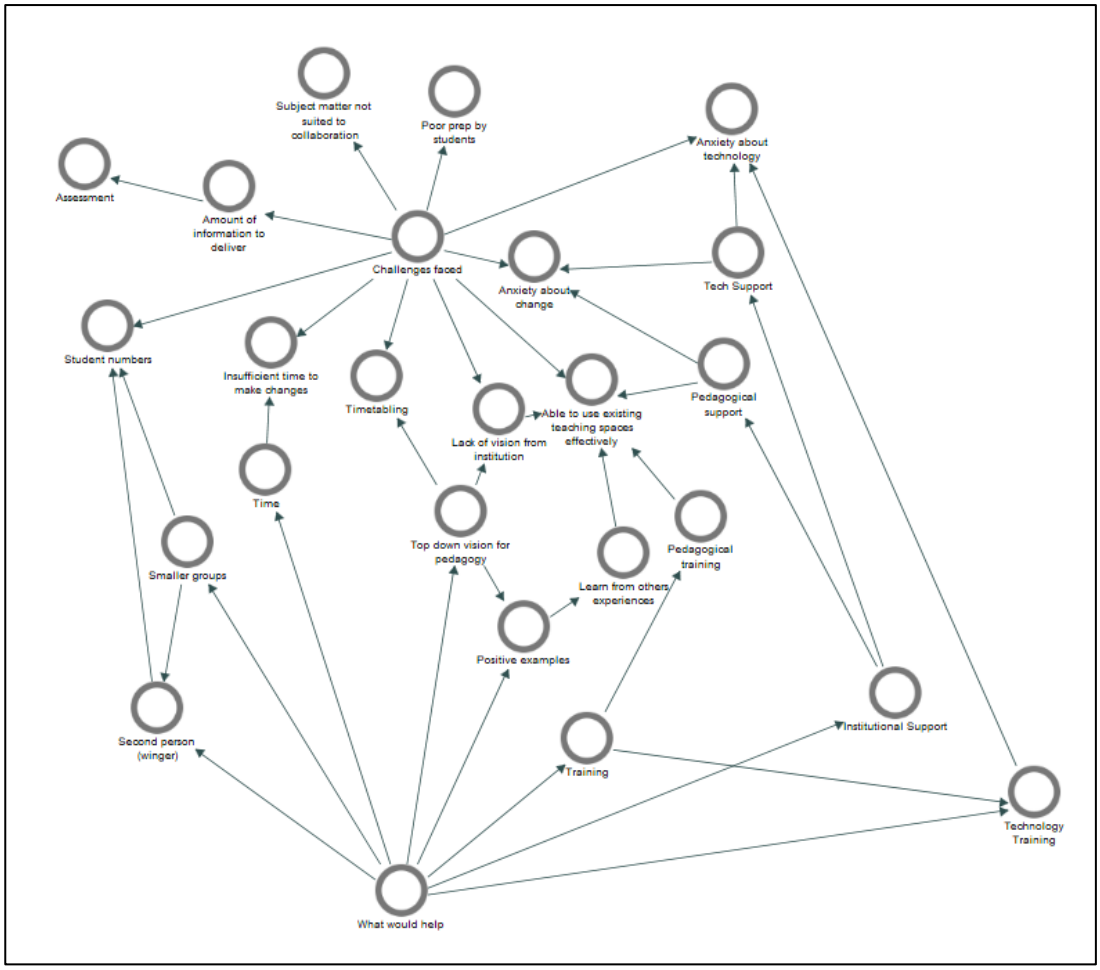

Figure 5-8 – Example thematic map of challenges faced.

Learning from others

Whether through staff discussion groups, seeing people in action or having "champions" to promote how the space could be used, most thought that learning from other people's experiences would be beneficial.

Cathy wanted to hear from more experienced teachers, so they could share with her what had worked well. Dan also thought that asking more experienced staff or the opportunity to see someone in action may be beneficial. Like Hiro, he also thought a resource of videos would be helpful. Dan also that an online discussion space could be utilised for staff to help each other.

Gerry, Hiro and jack felt they would benefit from having someone sit in on their lectures who could offer quite specific advice on how they could do things differently, though Hiro pointed out that this could be time consuming for staff and suggested drop-in workshops:

> *"…you could go along and say, 'this is my lecture that I normally give, how could I use the lecture Theatre to enhance this?' "*

He also suggested having a set of examples showing “this was a simple lecture beforehand, and this is sort of a way to do some worked examples”. He also suggested that ideas be shared on video platforms such as YouTube. Gerry wasn’t so sure that watching recorded lectures would be so useful as he wouldn’t be able to see how the teacher was using the space physically and how the students were responding. He thought that expertise within the school could be captured, but that he also saw a drive towards more active learning as being a national issue and further collaboration with other dental schools could be useful.

Kara and Olivia also wanted more targeted, specific advice. Kara’s request revealed that there were some fundamental issues blocking her from moving forward with changing her teaching:

> *“I'd like to have someone with secure skills where I could go and say ‘this is my aim, this is the activity I'd like to run, can you help me plan it? What do I need to consider in the room? How my best using the space? Which technologies would be best to actually, you know, collate this? Do I share the document electronically? Do I give it on pieces of paper?’ You know, I need someone to help me through those stages of first-time application.”*

Ivan and Olivia thought that “early adopters” would have a large part to play in driving change. Norman agreed, having witnessed how “champions” can raise the bar, giving an example of how PowerPoint has been developed by a champion within the department:

> *“I watch others lectures and I see many examples of xxx’s influence there that really bring the lectures to life. So, you need somebody within the school who's a champion to say, “I'm not just delivering this curriculum, I'm developing it in a certain way”.*

Top-down vision

When asked if Olivia thought those champions would be all that was required to drive change, or would a more top-down approach work better she felt both had their part to play:

> *“I think it's a bit of both, isn't it? I think there are those early adopters who will drive change upwards and then and then there are some lecturing staff who struggle and that's where a bit of top-downness is needed to help encourage us. I think if the university had a set of values or principles of ways of working and that sort of thing, I think that would be very useful”.*

Maria talked about a vision from the top that could filter down to the rest of the school that could bring consistency in approach rather than just doing her own thing. She didn’t see that as necessarily dictatorial, but some guidance on direction:

> *"Absolutely yes, and it might not necessarily filter to the very fine details from the top, but it starts somewhere at the top and then definitely filters down."*

Hiro felt that one of the main reasons why staff weren't able to make changes was due to the way modules are organised, and that as a lecturer he felt constrained to a certain style of delivery as he's given a lecture title and asked to deliver discrete lectures, whereas if he was given a topic to manage over a number of sessions, that would allow for a greater diversity of approaches and allow for sessions in the lecture theatre that were more discursive and less information laden as he would be able to know that the knowledge was being delivered elsewhere.

Norman felt that a top-down approach wouldn't work without cheerleaders and champions driving change forward. He thought there should be more direction and more investment into how the space is used:

> *"I don't think Joe Bloggs can go in that lecture theatre and suddenly with that number of people make the sessions really interactive without some real guidance. I think there's potential, but I think it will only come if there is a real thrust from the university or from our school to say that we need to use this space in a better way."*

Olivia really summed up the situation, that the vision required from the University is essential:

> *"I think if the university had a set of values or principles of ways of working and that sort of thing, I think that's very useful."*

She was worried that too much interference could have a detrimental effect however and a fine balance needs to be:

> *"I don't think it's useful when it's sort of dictated and saying, 'you have to use this this piece of equipment' or 'you have to do it in this particular way'. I think you've got to leave that up to professional judgement of the teaching staff, but a set of values, like … 'Students should have active learning', 'students should be engaged in their learning', that's really important and that drives things I think, but it also gives a bit of scope for innovation and flexibility."*

5.11 Summary

Whilst all staff felt the introduction of the redesigned DLT was significant, not all changed how they taught despite nearly all having initial intentions to do so. The key motivational factors for change included dissatisfaction with traditional lectures and a desire to improve student learning through collaboration. Major barriers to change included not having time, not knowing how to change existing lectures and not being aware of reasons to do so. Others saw the

number of students in the lecture theatre making collaborative learning prohibitive.

The institution seemed to have no expectation on staff to change, but also many felt the institution had not helped by them, by making no changes to the curriculum, examinations or changes to how lectures were to be timetabled, with lecturers receiving the same one-hour slot times that they had for delivering didactically.

All appreciated the agency to teach in whatever style they wanted, but most would have appreciated more guidance on how the space was expected to be used. None seemed to be aware of how others were using it, and there seemed to be no unified school approach to using the space.

Most staff felt a degree of anxiety about bringing in new teaching styles, either in case it wasn't effective, the students didn't want it, or the technology failed, and they were left helpless. To address the anxieties, improved training, time to make changes and an institutional vision along with fewer students in each session were the most requested forms of assistance that staff would have liked. There was also a desire for "champions" to promote how the space could be used most effectively, and this would be a more favourable means towards promoting change than edicts coming down from above.

Motivations were more related to the internal factors, with staff tending to teach in a way that they thought would be most beneficial for the students. Likewise, facilitation tended to be more hinging on internal factors and changes were made despite the system rather than with the help of it.

Three of the cohort had already moved towards collaborative teaching styles prior to the refurbishment, raising the question of what was different about them? This will be explored later, but Jack summed up quite nicely the phenomenon in question:

> *"If you were that way inclined you would be, you know, almost battling the layout of the traditional lecture theatre, but going ahead with it anyway because you knew that that was the way to go."*

6 Discussion

This study used semi-structure interviews to investigate the impact of the introduction of a collaborative lecture theatre on teaching within The School of Dentistry. Specifically, the aims included; whether staff had changed their teaching style in response to the new space and an exploration of their motivations for doing that or not. It also focused on the barriers they faced, and what had helped them to make changes.

The research questions were:

1. Have staff changed their lecturing style in response to the changed design of the lecture theatre?
    a. What factors motivated or demotivated staff towards making changes?
    b. What factors helped facilitate change?
    c. What challenges did they face?
2. How can educators be supported following the change of a teaching space?

To try to answer these research questions a novel framework, to identify key areas to explore during the interviews, was created from previous work looking at change and adoption of new working and teaching practices. This framework helped to design the study, create an interview schedule and interpret the results.

Fifteen members of teaching staff at The School of Dentistry at Leeds University volunteered to be interviewed, representing a wide range of seniority and experience. The findings show that the aims of the study were met in terms of finding out whether they had changed their teaching styles and identified the factors that influenced both the motivation to change and the ability to do so.

The interview format gave the opportunity to interact with the participants in order to gain a deeper understanding and to clarify responses, neither of which would be available through quantitative studies nor a more rigid interview approach. It was important though, to develop trust during the interview through an empathetic approach and active listening (Salmons, 2012). Being a colleague in a similar position to the interviewees gave a unique insight into the responses, and trust could be evidenced by the number of interviewees that were quite critical of the school, the university or the level of support that they had received. By occasionally summarising the conversation back to the interviewee, the opportunity to correct any misinterpretations was provided.

Thematic analysis was chosen as a logical approach to take for an exploratory study collecting a large amount of data. Some of the criticisms of this approach have included a lack of consistency and a lack of clear guidelines on how to apply the approach (Nowell et al., 2017) however, using the novel model as a starting point, consistent themes arose quite naturally, and sub themes fitted neatly into the predetermined categories.

The literature review identified a range of factors that could affect either the motivation to make changes or the facilitation to make a change or both.

6.1 Summary of Key findings

Generally, the staff had positive views with regards to the refurbishment and all considered making changes. Six of the fifteen went on to make definite changes to their teaching style in response to the new space, whilst the remainder either hoped to make changes or had decided not to. Lack of training, time available to make changes and an institutional vision were the most frequently expressed concerns or barriers to changing from a didactic lecturing style.

One of the key aims of this study was to find out whether the introduction of the lecture theatre alone led to changes in the thoughts and behaviour of dental lecturers. In agreement with other studies such as Whiteside et al. (2009), all staff reported positive feelings towards the space. Even those that had not made any changes to how they teach expressed a preference to teach in that room, which is different to Clement's findings in the same University that only 23.4% would prefer all their lectures to be in a collaborative lecture theatre and 32.5% would prefer a traditional lecture theatre (Clement, 2018, p.32). It is not clear why there was this difference, especially as the lecture theatres had been designed to accommodate both traditional teaching methods and student-centred learning.

All staff reported that they preferred teaching in the new DLT, in line with Leijon et al. (2022) who witnessed a general positive attitude towards new teaching spaces amongst staff, and that the space had caused them to think about how they provided teaching. Six had changed how they teach, whilst nine reportedly made no changes or just very slight modifications to take advantage of the layout. It should be said though, that the innovators had changed teaching style prior to its introduction and only four others had significantly changed how they teach in response to the introduction of the space. It is not known whether they would have changed anyway.

To summarise the most important findings:

1. All staff felt positively towards how the lecture theatre was designed. Advantages included the potential for improved learning, greater inclusivity and facilitation of discussion.
2. Six reported that they had changed their teaching style following introduction of the space and that the space itself was a factor in making that change. Nine had not made changes and three of those had no intention to.
3. Motivational factors included; an improved experience for the students, including improved inclusivity, the teacher being able to speak with smaller groups of students more easily and an anticipation that working collaboratively would lead to improved understanding.
4. Those who made changes were inspired by the layout of the students more than the incorporation of the technology.
5. Anxieties related to feelings of possessing inadequate pedagogical skills to make changes and poor student acceptance. The technology was also a cause of anxiety, with only four making use of the pod laptops and seven trying the digital smartboard, with no one reporting continued use.
6. Facilitation to change was considered to include; having a top-down vision for how the space should be used, time available to make changes, champions to set a positive example and training and pedagogical support being available individually.
7. Challenges faced:

- Training was largely felt to be inadequate or non-existent. With some staff feeling that technology training would help them introduce collaborative teaching and others wanting more pedagogical training.
- No coherent vision for how the DLT should be used within the school was evident to the interviewees, nor were they aware of how other staff were using the space.
- The design of the curriculum with lecturers having little consistency with groups of students, lectures being delivered to 100 students in predefined one hour lecture slots, and being asked to deliver large amounts of material driven by assessment were all prohibitive to change.

8. Despite all of the barriers and lack of institutional vision, three “innovators” had started using collaborative techniques prior to the

redesign of the DLT based upon their own conceptions of what constituted good teaching practice.

From these there are several interesting points worthy of discussion. For the purposes of this chapter the following will be explored in more detail; the influence that the space itself had on staff behaviour, the role that the institution can play with particular reference to the institutional vision and provision of training, and finally the relevance of the technology.

6.1.1 Categorising the staff

This proved to be more difficult than anticipated. At the outset the intention was to try to categorise the staff on a continuous scale from “adopter”, if they had changed teaching style to a digitally enhanced collaborative style, to “non-adopter” if they had made no changes. In reality it was difficult to ascertain if changes were actual changes to teaching practice or just reports that they had used what was available in the space. It was decided that they would only be reported as having changed if they actually described how they had carried out a teaching activity that involved using some of the features of the DLT and was different to what they had done before. No one had gone through wholesale changes of, for example, using a flipped approach to all of their teaching or purely discussion-based sessions. The changers had all incorporated some elements of both of these or introduced active learning elements explicitly because of the design of the space.

Those who had changed style could be described by Rogers as *early adopter*s in his Diffusion of innovations theory (Rogers, 2003). This would fit as they displayed “favourable attitudes toward new ideas” and possessed the skills and resources to do so. Making up 40% of the total of interviewees, the early adopters are higher than the 14% suggested by Rogers though with such small numbers, comparisons are not statistically valid. However, it may indicate a greater willingness to adopt new teaching styles than could be predicted.

Rogers described those that did not adopt technology as “laggards”. Whilst the term is not particularly flattering and will not be used to describe staff in this study, he described laggards as having traditional values, who make decisions based upon what they have done previously and are suspicious of innovation, which described Ivan and Edgar quite well. Ivan talked about being in his comfort zone and not being aware of any evidence for making changes to his style, which chimed with Van Horne and Murniati (2016, p.90), who described a sceptical professor, requiring more information before changing what they do. Edgar saw the redesigned space as a traditional lecture theatre with “fancy

seating” and whilst both saw the advantages of collaborative learning and indeed used that as a technique in other environments, they did not see the lecture theatre as the best place for that to occur. The term Laggard was not felt to be the correct term for maintaining this viewpoint as there was no expectation upon them to change, and they held a fully valid and worthy position as explained by the participants. The term “content with current style” was considered more suitable. Edgar and Norman, both very experienced and senior teachers, thought that the number of students was prohibitive to individual discussions or working with groups, whilst a winger or second member of staff may have helped, it may not have made that much difference, as reported in schools with classes of only thirty, teachers can feel they don’t get enough time to spend with each student, and would value another teacher to help out (Fletcher et al., 2023). The fact that dental students are timetabled in groups of 100 would mean considerable curriculum and timetabling changes would need to happen for these and similar staff to feel comfortable.

Bianca, Cathy, Faiza and Maria could be described as the *early majority* as they were willing to adopt, but are waiting for something else to happen first, be that more opportunities or more training. There was no late majority in the group, maybe as there was no evidence of peer pressure, no necessity to adopt and still comparatively early days in the adoption process.

These findings could relate to the challenges of mindset and skillset which were described by Aydos (2021) with the adopters having both the necessary attitude and skills to make changes, whereas the ones that didn’t change did not possess either or both of those. While this is an interesting comparison, the real question is *why* did some possess those and not others, and what influence did the new space have on mindset.

It was hard to categorise Kara and Hiro, whilst they possess some of the characteristics of the innovators (Rogers, 1995), they did not innovate further or adopt any of the newer technologies they were presented with or change their teaching style.

6.2 The influence of the redesigned space on the motivation to make changes.

With regards to motivation, the key factors that emerged from the interviews included a desire to improve the student experience by introducing a more collaborative style of learning. This was described by the interviewees as potentially benefitting the students in two different ways; either that a

collaborative lecture could lead to improved knowledge acquisition gained through active learning or that the student would find the lecture more enjoyable, by being more interactive or more inclusive. Eleven interviewees mentioned either one or both of these.

Many studies have looked at how active learning spaces can improve the experience. Improved learning outcomes from using active learning spaces has been widely reported (Freeman et al., 2014; Nishigawa et al., 2017; Morton and Colbert-Getz, 2017; Akçayır and Akçayır, 2018; Gómez-Tejedor et al., 2020), as well as the development of social interdependence (Johnson and Johnson, 2009). No staff offered evidence to support their standpoint, either being aware of literature or evidence from teaching they had provided. Only Dan said he was aware that there was literature to support improved learning with collaborative teaching but didn't cite any. This is important, as not being aware of evidence could be a significant factor in failing to adopt the new teaching style. Van Horne and Murniati (2016) showed that heads of department were less likely to promote active learning if evidence of improvement wasn't provided. In this study Ivan stated it has one of the really important factors that had led to him to not make any changes, though he admitted to not having looked for evidence. This is an important point going forwards, as dentists are very much guided by evidence in their clinical practice decision making (Gudray and Walmsley, 2016) and it may be that the school needs to think about providing more evidence-based development when it comes to education as well as dentistry.

Another interesting finding was the envisaged promotion of inclusivity. Studies of collaborative learning spaces tend to focus on teaching, student preferences and outcomes, however the ability of a space to promote inclusivity by a variety of benefits fits neatly with the University of Leeds core values of; ***collaboration, compassion, inclusivity*** and ***integrity*** (University of Leeds, 2015), despite not being promoted for that reason when introduced. Whilst the promotion of inclusivity seemed to be more of a speculative benefit, collaborative learning has been reported to promote the conditions for inclusivity (Zubiri-Esnaola et al., 2020).

Petersen and Gorman (2014) recommended arranging the students in groups deliberately to not allow students to hide. Gerry said he had thought about doing this, particularly when he ran a three-hour session, but felt it better to leave students to find their own groups that they felt comfortable with and to allow the shyer ones to feel more comfortable being with who they know. All other staff were happy to let the students choose their own groups and nobody expressed any concerns about students hiding. The reason for not arranging

the students could be, as described previously, that the interactions staff had with students appeared to be on an irregular basis and as such will not have got to know the students as well as if they saw them for the same sessions every week.

With the microphones making it easier to hear and the arrangement being more conducive to discussion than sitting in rows, many of the interviewees thought that the new space had improved the experience of students in terms of being easier to communicate. This is in agreement with the findings of Kariippanon et al. (2018) who found that both the physical layout of flexible learning spaces and the activities that they allowed were reported by staff and students as leading to an improvement in wellbeing.

Improving the student experience does not relate directly to any of the available models. The closest it approximates to is Performance Expectancy component of UTAUT as described by Venkatesh et al. (2003), who found it to be the strongest predictor of an intention to adopt change. Performance expectancy in the original UTAUT model though largely relates to the experience of the user and whether the use of new technology would improve how they do their work. This ‘user’ viewpoint was only highlighted by a small number, where the layout helped the ability to organise and run interactive sessions more easily. They mentioned that they found it easier to navigate around the room to talk to individual groups, rather than, as Jack described, previously only being able to talk with those on the end of rows, or Gerry’s light-hearted comment about trying to sidle along a row of students “like a crab”, but this did not appear to be a motivator for changing to a collaborative style, more a motivator to choose that lecture theatre if you want to use a collaborative teaching style. Although students were not included in this study, it was the perception that students would find it easier to talk to each other when arranged in pods and would not have to turn their heads around so much or be limited to discussing only with the ones they were right next to.

Does the design of the space initiate change or is it a reflection of already changing habits? Mulcahy et al. (2015) discussed the difference between the realist perspective that the space shapes the people within it, and the relationalist perspective that teaching practices and the design of spaces evolve together through an iterative process. They concluded that the space and the user are so interlinked that it would be too simplistic to state that you can change a space and expect that to lead to a change in behaviour.

Beery et al. (2013) assumed that the preferences and beliefs of the teachers was the most important factor regarding change, and the main effect of the

collaborative classroom was to improve the efficiency of such teaching sessions. Their findings are in some part supported in the current study and could be used to explain the behaviour of those that had already introduced some aspects of collaborative learning pedagogy such as, Hiro and Jack. In Jack's words:

> *"I think you were either trying to do things despite the lecture theatre already as a teacher… if you were that way inclined you would be almost battling the layout of the traditional lecture theatre, but going ahead with it anyway because you knew that that was the way to go."*

This would go some way to support Mulcahy's relationalist perspective, in that the innovators were already making changes and the space both reflected what they were doing and enabled further development of that journey. However, and unlike Beery's study, some of the cohort said that they had made changes based solely upon the influence of the introduction of the space, which would point more towards a realist perspective. What cannot be known is whether these adopters were already inclined towards change.

In this study, the change in space definitely appeared to be a significant factor in staff starting to think about their practice. Whether they changed because of the space is not known, but some felt obliged to use the space differently because it had been designed that way and some felt inspired to re-examine how they teach, so it could be concluded that yes, the change in space alone can, for the right staff, initiate change.

An interesting note that had not previously been reported was the impact that the introduction of the space had outside of the lecture theatre, with wider ranging influences such as Lily explaining how it changed how she used other lecture theatres and Gerry describing the influence of the pod arrangement on his redesign of a clinical skills classroom.

For those who decided to continue with their familiar way of teaching there were some very thoughtful reasons for not adopting a change. Change is a difficult process to go through, as explained by Burridge (2014), when a teacher is routinised within a familiar pedagogy, change can be a threat with the insecurity of unknown outcomes or reception by the students, as described by Ivan, who thought that change could be effected relatively easy and there could be advantages to making changes, he felt he had a style that he was comfortable with and didn't want to leave the security of that. For all of the non-changers, it was a conscious, active decision to use the space in a way that they felt was the best use of the time they had and deliver their teaching in a way that they believed was in the students' best interests. Since the introduction of the

redesigned lecture theatre, the timetabling of lecture slots didn't change to accommodate for a different delivery method, so it is easy to see that for some lecturers to just use their hour as they see best.

Whether there is a gender difference in the uptake of collaborative teaching is not so widely researched and less is known. Weinberger and Shonfeld (2020) explored the factors that led trainee teachers to adopt collaborative teaching practice that age and gender had no effect. It is not clear whether there was a difference in the current study as there are roughly equal numbers of males and females in both the group than changed and those that haven't. It is interesting however that all three of the innovators were male. What motivated them to change practice without any external influences is a key question, though the answer is hard to deduce. Apart from being male and senior, all had educational qualifications. All three described their practice as developing out of self-experimentation, learning from courses and a desire to provide what they considered the best experience. Averill and Major (2020) examined the motivations of innovators and found the same, that they were motivated by pedagogical and personal drivers and were not motivated by institutional policies or social influence. Their heat maps in (Appendix F: Heat Maps) would bear this to be true.

Haines and Maurice-Takerei (2019) had raised the possibility that less confident staff may prefer to stay with pre-prepared material rather than face questions unrehearsed, and this may help understand why the staff that have given the fewest lectures such as Bianca and Cathy could have avoided making changes, but does not go any way towards understanding the three who expressed no intention to make changes, all three talked about the benefit of discussion in other settings, particularly post-graduate teaching.

6.3 The role of the Institution in motivation and facilitation of change

The role of the institution seems to be a critical factor in the success of implementation. Looking at the issues raised by those that made changes and the barriers reported by those that didn't, including timetabling issues, assessments, training, time allowances and the number of students, all of these relate back to how the institution could support staff during adoption.

Georgina and Hosford (2009) listed training and the goals of the organisation as being key factors in staff adoption success, and these were both highlighted by this study as important factors.

As previously discussed regarding the Novigado project (Aydos 2021), the mindset and skillset of the teachers regarding innovations in learning spaces are crucial factors. Whilst individuals may have their own thoughts and come with different abilities, previous research has shown that the institution can have a great influence in terms of providing a vision or framework to for staff to work within and strive towards, as well as providing the support to gain the necessary skills.

6.3.1 Institutional vision

One of the greatest issues that was brought up was the lack of vision from higher up to provide direction for teaching within the school. All commented on the need for, or lack of, training provided and some cited being shown how to use the space was a significant factor in why they made changes, others cited lack of training as a major reason why the hadn't.

No staff reported being involved in the redesign of the DLT and most reported only being aware of it once it had arrived or when they arrived. According to Bligh (2019) being involved in the planning stages may have helped them to feel more involved, that the shaping of the space is intimately connected to the shaping of their teaching. The feeling of a lack of institutional vision or direction was remarkable. Several indicated that this would have been a key factor in trying to use the space differently. For example, when asked what would help staff to make changes and the space be better used, Norman stated;

> *"I think there's potential, but I think it will only come if there is a real thrust from the university or from our school to say that we need to use this space in a better way."*

Maria and Gerry thought that if the institution had provided a vision, it would trickle down to staff leading to greater adoption of change. This absence of any pressure or direction from the organisation was a key observation made by nearly all teachers in the study.

Kara was concerned that making changes unilaterally could result in a different experience for her students. She took the absence of feedback from students that other teachers had changed how they taught as confirmation to continue what she was doing, so as not to be out of line. Many staff also suggested that being able to observe somebody else in practice or having champions to lead the way was a key factor that would keep everybody on the same page and help them to make changes. What they are describing and what the technology acceptance models call "subjective norms", May and Finch (2009) termed "normalisation". They describe the processes through which normalisation takes

place through social integration and organised structure making it clear who has what responsibility with collective reflection and monitoring. Mulcahy et al. (2015) describe how staff working together and forming pedagogical change networks led to a growing confidence in using contemporary learning spaces, the more robust the social network, the more comfortable staff felt. What can be clear in the School of Dentistry is that these frameworks were not in place and all interviewees described their own actions without reference to working with others to make changes or having any expectation upon them to act in a particular way. Whether this matters is debatable. Smylie (2016) found that organisational influence had very little effect in practice, and that, when left to their own devices, teachers would teach in a style based upon their own attitudes and beliefs regardless. This somewhat supports Olivia's view that it would have been useful for the University to have a set of values that staff could work within, but should not dictate the teaching style, and leave how to teach in individual situations up to the teacher's own professional judgement. Whether the presence of an organisational vision would have had an effect is debatable.

All staff felt able to make their own choices about how they taught, and autonomy has been shown to be important (Eisenhart et al., 1988; Snider and Roehl, 2007). Most appreciated the freedom to teach how they pleased but it left some complaining of a lack of guidance. Clement (2018) described the autonomy given to staff during the introduction of the lecture theatres was important, and this seems to be borne out. Where some took advantage of this freedom this provided teaching in a way that they wanted to, others took it as a reason not to do anything.

As Fullan and Pomfret (1977) had previously discussed, the change in the space is the easy part. All of those that did make changes did so very much on their own and not in collaboration with others, in fact there seemed to be no collaboration or discussion between any of the teachers about how they would utilise the space. Nobody mentioned talking to each other regarding pedagogical approaches, the only interaction had been with some staff showing newer starters how to functionally operate the lecture theatre. According to May's Normalisation Process Theory (May, 2006), practices that become embedded within an institution don't just require *cognitive participation* and engagement of the individual actors, but also *collective action* such that all actors invest in a collective effort to implement a practice, and *reflexive monitoring* such that a collective reflection on the implementation and development of practices that eventually become embedded (May and Finch, 2009).

Although the physical space had changed, staff felt that the organisation had not. Leaving participants such as Gerry to complain that:

> *"It's not being championed by anybody in particular and I would say that as individual lectures, and I might be an outlier… there is little oversight and there isn't a clear steer on pedagogy in terms of lectures or facilitating a change in terms of the student expectation".*

In this study there was a difference of opinion regarding whether changes should come from the top of the institution down, or from the bottom up. Maria, a more junior member of staff thought that change should "absolutely" come from the top, whereas Norman, with many years of experience proclaimed that a top-down approach "never works" and a group of interested individuals should champion change. Olivia, another senior member of staff had the balanced view that early adopters should be driving change, but leadership from the top could help those who were struggling.

Although staff appreciated the range of pedagogies that the space could allow and no one felt that how the lecture theatre was designed hampered their teaching styles, many did not seem aware of what the reason for it changing was. One of the ways to make staff feel more on board with a project such as the design of the lecture theatre could have been to have them involved in the design stage (Gislason, 2010; van Merriënboer et al., 2017). This helps them to become part of a shared vision (Niemi, 2020). All of the interviewees were asked when they first became aware of the lecture theatre, for the ones that were at Leeds prior to the refurbishment it was clear that none were involved in the design or decision-making process.

Another way the institution could assist the staff would be to provide positive examples and champions of the space. This was requested by many of the participants. Van Horne and Murniati (2016) reported that some departmental heads were not promoting change as they hadn't been provided with evidence that outcomes are improved, despite teachers claiming that they were giving the students a better experience which was well received. Some department heads in their study had the opinion that teachers will "teach the way they learned to teach" (Van Horne and Murniati, 2016, p.83), and so trying to bring in change is pointless. They also thought that students would be resistant to change due to the increased amount of work they would need to do in preparation, a point which Maria also made after talking to students and seeing that they felt overburdened.

At Leeds University there is currently an encouragement towards introducing "*authentic assessment*" (University of Leeds, 2021). It could be argued that

working on problems collaboratively rather than listening to a lecture pontification is more authentic and that assessments based upon the collaborative style of working would reflect how they have learned, and how they will operate in the majority of workplaces, indeed the dental curriculum sets teamworking as a central tenet (General Dental Council, 2008).

6.3.2 The provision of training

Despite all of the staff having initial intentions to make changes, not all of them did so for various reasons. One of the key themes that arose was the adequacy or otherwise of the training they received. Table 5-7 showed that only four had received training on how the lecture theatre could be used to provide different pedagogies. Whilst eight had received training on the use of the technology, they all complained that this was just how to operate it rather than how to use it to support teaching. Murray and Macdonald (1997) suggested the mismatch between intention and practice was possibly due to environmental factors, such as a lack of training and support, which may well be the case here. This is not unusual, Youm and Corral (2019) found that technological knowledge and pedagogical knowledge was frequently lacking in medical educators, and training should be the focus of the institution.

Table 5-4 shows that technology training may not be the significant factor in how the space was used that many of the interviewees thought it was. Faiza, Bianca and Cathy all stated that they would be able to provide collaborative teaching if they had been trained to use the software to do it. Staff in all outcome groups had received technology training, but this did not correlate with actual use of technology, though it is interesting to note that the three who had received pedagogical training were all in the group that had made changes. This would support Clement (2018) who recommended pedagogical rather than technical training in the future roll out of such lecture theatres.

Many complained that when considering changing teaching modality, they were restrained by the same hour-long lecture slots and deliver the same material. Non-changers Bianca, Edgar, Faiza and Norman all thought that trying to change how the material is delivered within the time allowed didn’t allow opportunities for any activities such as group discussions, though Faiza did hope that appropriate training could have led to her becoming more efficient with her time. For Norman the restriction was the undergraduate curriculum as he felt quite comfortable letting postgraduate students lead his teaching sessions with them. Those that were able to adopt a new style tended to get around the problem by inventing their own means of delivery such as Anya’s

use of pre-reading for the students and preparation of scenarios to discuss. Anya mentioned she had received training on how to use the space collaboratively and had completed an educational qualification, something the four mentioned previously had not.

Educational qualifications

What is striking from Table 5-4 is the correlation with how the DLT is being used and holding an educational qualification. This could both relate to the level of knowledge of those participants or the motivation towards pedagogical change.

The work of Li et al. (2022) relating educational qualifications to TPACK scores and finding a direct correlation could go some way to explain this in terms of skills and knowledge to introduce technology, however very little difference was seen in the technology usage of those with and without educational qualifications.

Borg's assertion was that professional coursework had an influence on teacher cognition Borg (2003), therefore influencing what the teacher believes and understands about what teaching should be. It also confirms the assertion of Kember (1997) that a teacher's conceptions of teaching directly influence their teaching approaches. The fact that those receiving technological training as part of their induction to the lecture theatre was not related to change, whereas those with educational qualifications were more likely to change supports the conjecture of Shumar et al. (2023) that brief workshops such as those provided by the university are ineffective, whereas longer term courses such as the PGCAP and the building of communities of practice are what make more significant differences.

Long term pedagogical training along with one-to-one tuition of using the teaching space would therefore appear to be the most important factors in the use of the new DLT by staff for collaborative teaching. However, when it comes to the use of technology this may not be the simple solution it appears to be. As shown by Xie et al. (2023) that training was good at changing the perception of external barriers to change but had little effect on internal barriers.

6.4 The relevance of the technology

6.4.1 Technology usage

When asked about the potential and observed benefits of the redesigned lecture theatre, all expressed approval of the layout and the fact that students can discuss and learn in a group. Apart from Dan, there was very little mention

of the technological being an advantage. No interviewees were aware of any pressure from students to use the technology or to teach in a different way, though some did feel a little overwhelmed. Most used technologies that they were already familiar with and ignored the rest.

Use of technology varied from simply projecting slide presentations, to using the digital whiteboard, pod laptops and polling apps. The majority thought that they weren't really aware of what the technology could do for them or the students and went on to ignore anything beyond what they would find in a standard lecture theatre. This may be a missed opportunity due an unfamiliarity with how technology can enhance learning or could indicate that teachers didn't really need technology to achieve their purpose in the lecture theatre of information delivery.

When a range of technologies is available, Petersen and Gorman (2014) recommend deciding at the outset what technologies to use, inform the students and practice with them before hand, a routine that Olivia described as going into the lecture theatre prior to delivering a lecture to make sure everything was working as expected, which reduced some of the anxiety for her, but was not described by anyone other than Anya.

Several interviewees stated that they weren't really aware of what technologies were available, or how they could enhance teaching. The use of the available technology amongst this cohort was significantly less than that observed by Clement, (2018) who interviewed staff members that had used three different collaborative lecture theatres across the same University. The differences between this study and that of Clement, could be explained by how staff were selected for the study. Unlike the current study where there were no selection criteria, other than that the staff had used the lecture theatre, it is not clear how Clement selected staff members for interview, but as the purpose of her interviews was to create case studies on how the lecture theatres were being used, it could be that Clement selected only from the pool of staff members that had chosen to teach using the features available in the collaborative lecture theatres.

Bianca, Cathy and Edgar had not used any of the technologies other than a basic computer presentation. All three started after the date of introduction and although Cathy had received some training on operating the technology, she did not feel the presentations she gave lent themselves to a collaborative style. Edgar stated he would have to see the evidence that it would improve what he currently did before considering any changes.

Anxieties regarding technology included worries that they wouldn't be able to deal with problems if the technology failed and not knowing how to use technology in a pedagogically sound manner. Some remembered that there had been a technologist available to help at the start of session and although they should have been reassured by that, several said that they didn't know why he was there or what his purpose was. This indicates that none had been told what his purpose was, which goes back to institutional decision and preparation during the introduction to the room.

Despite being described as "*lecture theatre 2.0*" and "*collaborative, digitally-enabled learning spaces*" (Morris, 2016), in reality, the only technologies that were unique to the new lecture theatres, and would have required some training to use were the student laptops being connected to the main screens and the digital whiteboard. For the remainder, the charging points, microphones and lights above each pod that could be turned on and off no real training was required. The point made by several interviewees was that although they were shown how to use these, they were not educated in how using the whiteboard or laptops could enhance the students learning, and it was more pedagogical training that they desired not technical. Georgina and Olson (2008) provide the opinion, supported by Buckenmeyer (2008), that technology alone, without training will do nothing to improve the pedagogy, and that the tools should not just be made available, but properly integrated. They also point out that universities often set up the technological infrastructure without involving the academic staff, leading to a lack of ownership, which does seem to be the case at Leeds. Clegg et al. (2000) blamed the lack of integration of technology into teaching on the lack of formal training, with academic staff mainly used to only using technology in research. Whilst this view was formed over 20 years ago, the perception of a lack of training in the use of technology for pedagogical purposes in the current study was stark.

6.4.2 Technology training

When asked about anxieties in using the space, lack of training in using the technology was a common thread. Whilst nine out of the fifteen say they had received some training in how to use the technology, only Anya, Lily and Olivia state that they had received some training regarding how to use it to support learning. Of the others, it was only functional training, such as how to turn it on. Kara described her training as being "*focussed on button pressing*". Clement, (2018) made the same observation, with one of her interviewees saying "*I can press all these buttons, but I'm not sure how I can make my lecture better by doing that*." Her recommendations included that staff training should "*focus on*

pedagogy rather than technology." Such scepticism of training was also observed by Clegg et al. (2000) Who also pointed out that training needs to be provided regularly as technologies develop, but also staff need to be provided with the time to do it.

The three interviewees that had received training on how to integrate the technology to support collaborative teaching; Anya, Lily and Olivia proved not to be the most avid users of technology available, though all three had used the new technologies such the digital smartboard. Anya and Lily had also utilised the use of pod laptops, whereas most without training had not. All three were also keen on using the space collaboratively but didn't want to just use the technology for the sake of using it and none had a desire to introduce any other technologies not already available.

Five of the interviewees said they were using polling apps, which must have been something they brought in themselves as there were no polling apps provided or training in how to incorporate such technology and therefore must have developed their technological and pedagogical knowledge from other means. This would tend to agree with other findings that technology training makes little difference to behaviour, and it is more likely to be associated with teachers' technological knowledge and educational beliefs (Hermans et al., 2008; Tondeur et al., 2008; Tondeur et al., 2016).

It is probably true that if they were inclined to use technology, they probably would have done so. Training would probably only make a marginal difference to usage, Norton et al. (2005) concluded that training may be beneficial, but evidence points towards it having little or no effect on teaching behaviour.

6.4.3 Gender differences

Studies have pointed to the fact that gender plays no part in teaching choices and practices including (Donche and Van Petegem, 2011). Whether gender played a part in the decision to use technology is a hotly discussed topic. Some authors have found that women had a lower predisposition towards technology than men (María Gómez-Trigueros et al., 2021), whereas others have found that the evidence is equivocal (Goswami and Dutta, 2016). Most agree however that the difference is mainly one of self-perception rather than ability (Hargattai, 2003).

The findings in this study didn't see any difference in computer usage between genders in the numbers admitting to having an anxiety regarding the use of technology or any significant differences in actual usage (Table 5-2). Gender is included as a modifying factor in UTAUT (Venkatesh et al., 2003) and it is

possible that at the time this was developed there was more concern about the gender divide (Cooper, 2006) than there is today. This is possibly due to ubiquitous nature of technology in modern life.

6.5 Reflection on the framework model

This section will reflect on the effectiveness of the proposed model as a predictor of behaviour, and any modifications recommended for future research.

6.5.1 How effective was the model at predicting behaviour.

This is going to be a very subjective opinion as this was not a quantitative study and no statistical significance can be drawn.

This section will examine how well the model was at predicting behaviour and whether there should be any changes based upon the findings.

For example, using the heat maps we could look at the participants and guess from Jack's (Figure 6-1) that he is more likely to be an adopter and from Maria's (Figure 6-2) that she probably isn't.

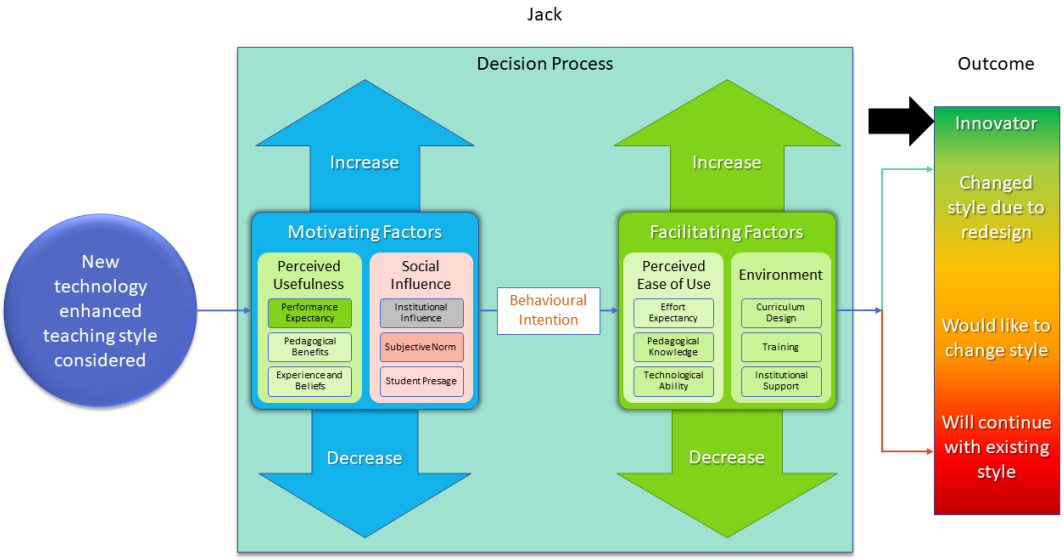

Figure 6-1 - Heat map for Jack

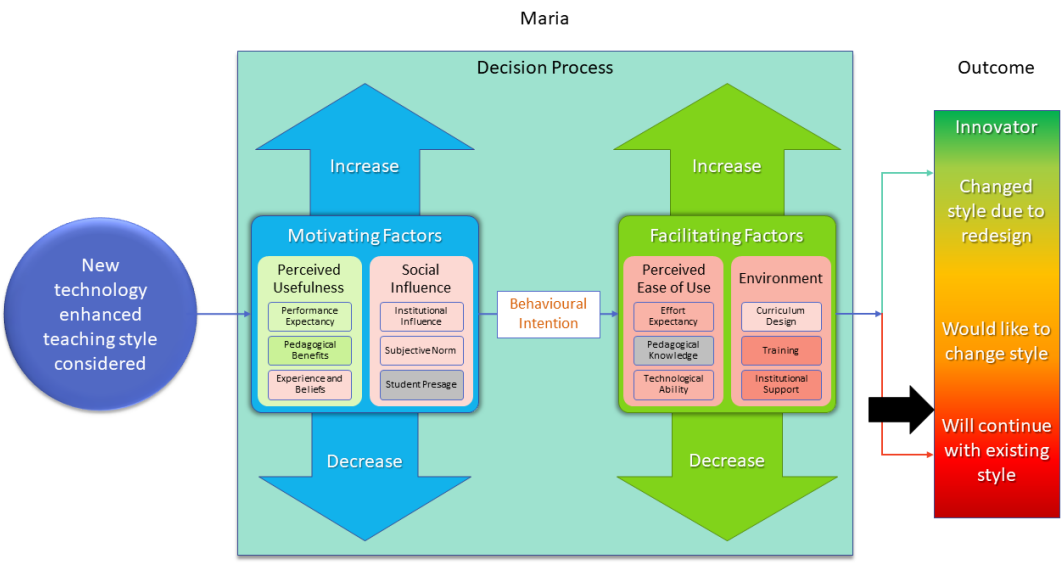

Figure 6-2 - Heat map for Maria

We know from earlier discussion that innovators such as Jack are less likely to be affected by social influence and other than that section, he is green for everything else. What may be of more value is to look at Maria's heat map to look to see where the issues were, the majority of red areas are in the perceived ease of use and the environment sections. She also is slightly negative regarding social influence, but then so was Jack.

In her interview, Maria described the most significant barrier to change as being a lack of institutional vision, and what would help the most was seeing leaders lead by example. This doesn't really come across in the heat map. This could mean that the heatmap is not accurate at reflecting the situation, but it could also be that, through interview, other factors were picked up that were not so obvious from the answers to those two questions and would have been missed in a questionnaire. For instance, she appears to consider change to be difficult, she worries about her technical abilities and maybe just doesn't believe that collaborative lectures are the best way of teaching. It could in fact be that she is using the lack of leadership to disguise or excuse these other issues.

From this point of view the model was very effective at identifying the areas for exploration when designing the interview schedule and identifying which areas to discuss.

6.5.2 Critique of the factors included framework.

It was suggested that the final version of the model was shown in Figure 3-8, with motivation leading to a decision and facilitating factors leading to adoption.

Looking at each of the factors included in the model in turn we can evaluate how relevant they were to the study.

Performance expectancy

Performance expectancy was applied to how the staff member felt that change could improve their teaching or make their teaching easier. Anya, Dan, Gerry, Jack, Lily and Olivia all strongly felt that the space would improve their teaching, and all went on to make changes.

Pedagogical benefits

With eleven out of 15 citing improved student experience or improved inclusivity this is a key factor. Whilst nobody thought that adopting a collaborative teaching style would have a negative effect on outcomes, some did feel that it may lead to a work overload for the students. Anya, Dan, Gerry Jack and Kara, Lily Olivia all showed the strongest attitudes towards outcomes and apart from Kara all were adopters of new teaching styles. Kara saw the benefits of the space but preferred to use collaborative styles when she taught the students in smaller groups.

Experience and beliefs

Bianca, Edgar, Ivan, and Maria, all non-adopters had negative experiences or expressed opinions that teaching should be teacher focussed. As experience and beliefs were combined for the purpose of the model, it would seem more pragmatic to have them as separate categories, as Anya showed, it is possible to have negative experiences but still hold very positive beliefs about the benefits of student-centred learning.

Both Hiro and Jack, two of the innovators and Kara described almost exactly what Guskey (1986) described as the iterative process of change, keeping what works and rejecting what doesn’t.

Institutional influence

This didn’t seem to have much impact, but the lack of vision from the institution was repeatedly highlighted as a shortcoming. Despite this, the ones that wanted to change did do so, but it was cited, particularly by Kara that without a vision and homogeneity of teaching approaches she was less inclined to make changes.

Subjective norms

Like institutional influence, nearly all could not say that others were leading the way or indeed whether other teachers had changed style, but nobody stated this as a reason not to make changes.

Student presage

This was grey on almost every heat map, indicating that it was not mentioned particularly as a factor. For Kara and Jack, it was a negative aspect as they both thought that students wouldn't want to change, despite this Jack went on to make changes and Kara didn't.

Effort expectancy

This was negative for nine of the interviewees, with only five thinking change would be relatively easy, despite this, two of those didn't go on to change. This could fit into both motivation and facilitation as both Edgar and Norman considered the challenges provided by the number of students to be too much to even consider collaboration in the lecture theatre.

Pedagogical knowledge

This possibly had the closest correlation with change in this study, as all those who changed had further educational qualifications, and all those who didn't make changes apart from Kara didn't. This may relate to motivation as well as facilitation, as was shown in the section on first impressions, those such as Anya were already thinking about what she could do with the space the moment she saw it.

Technological ability

The technology ability of the interviewees as expressed by their self-reported ability to choose correct software and to deal with technological issues showed a good correlation with whether they had changed. Except for Kara, the ones that didn't make changes, all expressed concerns with the use of technology. Experience also seemed to be significant, with the more experienced teachers reporting that they could fall back on more traditional teaching methods should there be a technological failure, whereas the less experienced staff expressed that technology failure could lead to the inability to teach.

Curriculum design

Whilst this was raised as a perceived barrier and an area for improvement, there didn't appear to be a clear correlation between those that thought that

curriculum lent itself towards making changes and those that actually made changes. It would appear that changes were made regardless of the design of the curriculum. Hiro, however, did state that he would have made more radical changes if he could have been more in control of how the students were timetabled and sessions planned within the modules.

Training

Some correlation was seen, with Anya, Lily and Olivia all receiving training on using the space collaboratively and all going on to do so. Faiza also said she received training, but other constraints had led to her not making changes. Pedagogical training seems much more important than technical and for this reason they should be considered as separate factors.

Institutional support

Despite being cited in the literature as a factor, this seemed to have little correlation here and is probably covered more effectively under other headings.

6.5.3 Final version of the model

The initial version of the model was useful for bringing together the factors that are involved or potentially involved in the change of pedagogy process. This was the first time this has been done so completely. However, thinking towards the future and the usefulness of this project to policy makers and line managers thinking of such changes the model, as it stands, does not guide such a person through the process involved in change, taking into account what we now know about the factors that were explored and the fact that long lasting change needs positive reinforcement as well as motivation.

The model therefore has been redesigned (Figure 6-3) to include the decision process that was hypothesised in Figure 3-4 and includes a feedback loop.

The model is a little closer to that presented by Opfer et al. (2011) (**Figure 2-3**) which included a change in orientation leading to a change in practice. This model only included beliefs and experience in the orientation section. By incorporating features from UTAUT and TPACK the new model is much more comprehensive. Opfer’s model does though highlight the fact that change is iterative and depends on feedback, such that a change in beliefs, leads to a change in practice which leads to a change in the students, which then feeds back to beliefs. From the current study, that feedback can be positive, for example Dan was encouraged to do more following good feedback from the

students, or it could be negative for example Jack, who did make significant changes, said he tried things and wasn’t sure if they worked and therefore stopped using them.

The new design of the model takes the journey of an individual user being presented with the opportunity to change teaching style. Keeping the idea of motivation and facilitation from the first version of the model, the factors have been slimmed down to those that were proven to be important by this study, either from what factors had motivated the staff to change or what they said would be important to motivate them in the future. Similarly with facilitating factors, the ones described in the previous section as being less important have been removed.

Overarching the motivating and facilitating factors, two aspects have been chosen as being so important for both motivation and facilitation that they are given special consideration. They are pedagogical knowledge, gained from educational training and experience.

The outcome has also been changed from being either adopter or non-adopter to now reflect that change is a continuous process and that implementation is the ultimate goal. There may be further factors that influence the change from adoption to implementation as discussed at length by Fullan & Pomfret (1977) but in this version of the model the positive reinforcement of the feedback loop is included as the most important of those factors identified by the literature review and backed up by this study.

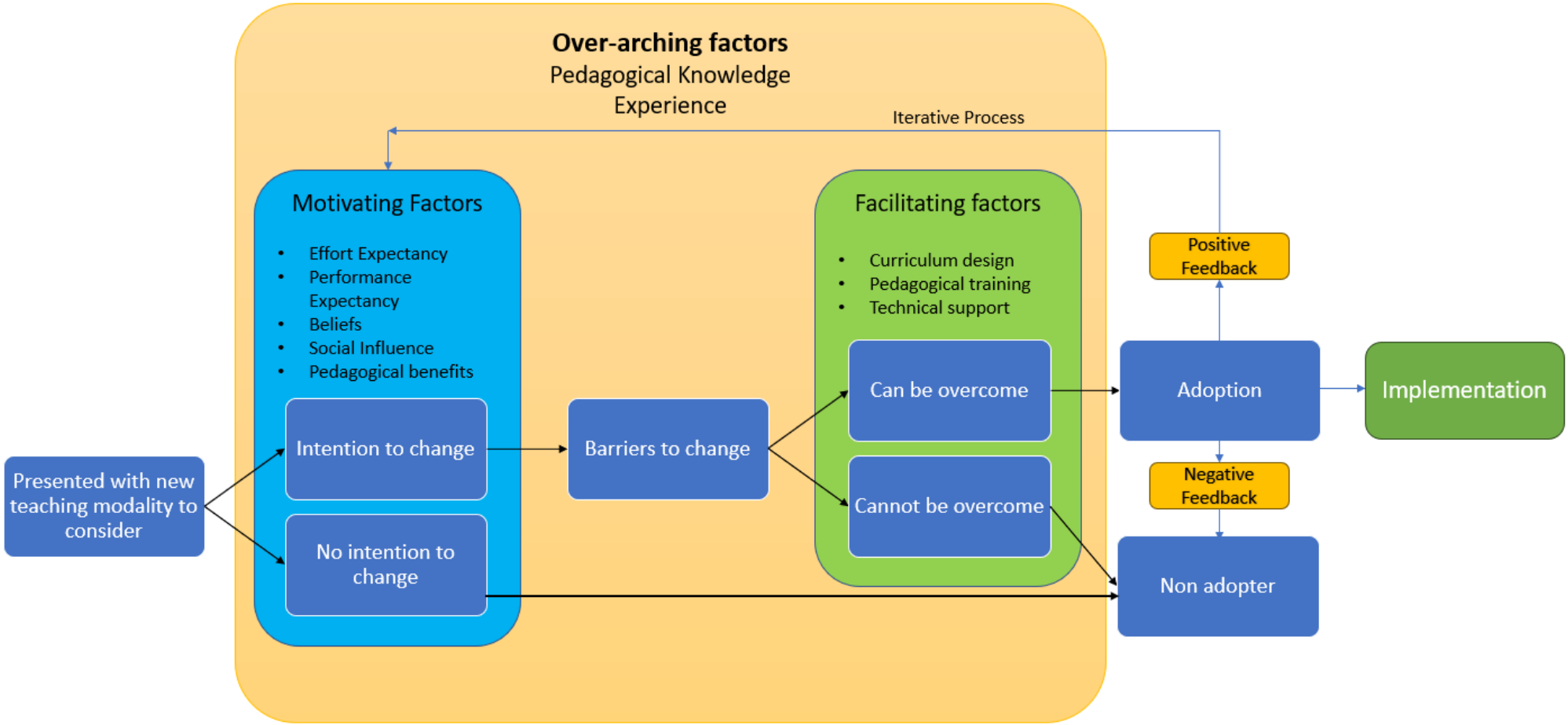

Figure 6-3 - Hypothetical revised model based upon the findings.

The intention of the model is that it could be used by leaders and policy makers for the development of staff when considering changes in learning spaces.

6.6 Recommendations for Practice

As previously identified, due to a lack of available literature in the area, Leijon et al. (2022) were unable to provide guidance on how teachers should best be supported through transformations of teaching spaces. Some have tried to do this, for example, having studied the implementation at two universities, Thanaraj and Williams (2016) created some recommendations for the introduction of technology enhanced learning initiatives suggesting that different approaches should be taken with different organisations. They recommended the use of champions and allowing innovations to “bubble up” through an organisation, by which they meant that academics should learn through experimentation, but within a prescribed quality framework. They also recommended that training should not just be about how to use the technology, but how it can be used to enhance the pedagogical approach, giving the example of the introduction of lecture capture, which could be introduced to improve reflective learning rather than just being introduced with no pedagogical guidance. They also state that universities should be mindful of the fact that staff are starting from different places and have different rates of development.

From the discussion and the development of the model the following recommendations can be suggested:

- Staff should be free to make their own choices about how they teach.
- Changes in workspaces should be accompanied by clear guidance on how the space is expected to be used.
- Where novel teaching methods are encouraged, the following should accompany the introduction:
    - Evidence based education on the benefits of making changes.
    - Pedagogical training and support available at an individual level.
    - Technical support available at the point of use
- Teaching and module teams should work together to plan their approach to future teaching.
- Any changes should be accompanied by necessary changes to timetabling to allow for an appropriate amount of time and a suitable number of students for the session.

- Assessments should be adjusted to reflect the method of teaching.
- Positive examples of how change could benefit the teachers should be available.
- Students should receive detailed updates about why changes are happening so that they can prepare and expect them.
- Gaining educational qualifications should be encouraged of all teachers.
- Staff should be given dedicated time to make necessary changes and be able to plan well in advance.

6.7 Limitations of the study

Whilst the study explores one situation with a small group of staff in one school, the findings of the study should be applicable many situations where pedagogical change is being considered. There were some limitations however, mainly due to the constraints of the potential cohort size and the effect of the Covid-19 pandemic on face-to-face teaching at the time the data was being collected.

Firstly, the cohort was relatively small. Even though 15 staff is a reasonable number for the purpose of interviews, that is only enough to expose the issues, it is not enough to explore the scale of those issues.

The cohort are from one school and 14 of the 15 were from one department within that school. It could be that these are unique issues to that department. We have already seen that lecturers in dentistry don’t need to have any qualifications other than a license to practice dentistry and many go into teaching after some years as clinicians. This may lead to a limit on the generalisability of the findings and recommendations.

The effort to avoid direct questions, that could imply to the interviewee that a certain behaviour had been expected, or leading interviewees to say what they thought the interviewer wanted to hear, made interpretation more difficult, but was deemed to be important due to the power balance between interviewer and some of the participants.

Teacher beliefs is potentially an area that was underreported. Beliefs are notoriously difficult to ascertain and study, and no direct questions about beliefs were included. This left the researcher to try to construct beliefs from a variety of answers given. Richardson warned against trying to construct beliefs from teacher behaviour or from trying to make interpretations from

the technical knowledge, or technical pedagogical knowledge displayed by teachers in interviews of this is frequently misleading (Richardson, 1996).

Without a second methodology such as observation or questionnaire there was no way to triangulate the responses, and what staff claimed need to be accepted at face value.

The Covid-19 pandemic had a significant impact upon the study. Firstly, it caused all interviews to have to be undertaken on-line, which has been suggested as being inferior to face-to-face interviews in terms of building a rapport and sometimes lacking detail (Curasi, 2001). However, during the pandemic staff became very familiar with online meetings and research evidence is generally of the opinion that online interviews can be effective (Deakin and Wakefield, 2014; Lobe et al., 2020; Carter et al., 2021).

A greater impact of the Covid-19 pandemic though was the fact that at the time of undertaking the interviews nobody had used the DLT for 18 months to two years. Despite the interviewees being able to talk fluently about the space, this break in time had meant that several of the interviewees, particularly the newer staff had not really had much opportunity to develop their teaching practice within the room, and whilst they could discuss their feelings, desires and concerns they had little experience of actually making changes to be able to consider. There was also talk in the school that there may never be a move back to face-to-face lectures, which may have been at the back of some people's minds.

6.8 Summary

According to Buckenmeyer (2008), change should start with the teacher and not the technology. A lack of training, either in pedagogical practice or use of the technology was the most commonly stated reason for not using the space effectively or differently. The less experienced staff such as Cathy and Bianca, put more importance on how their lack of confidence about which technologies to choose and worry about if something when wrong was one of their most significant barriers to change. In contrast to this, more senior teaching staff were either amibivalent about the technology or felt confident enough in their own abilities to be able to carry on in the event of failure, though all participants thought more training would have been helpful.

Overall, the presence of the technology was more of a potential deterrent to making changes than seen as a useful adjunct that enhanced teaching. As Stoltzfus and Libarkin (2016, p1) concluded:

> *"…institutions can modify existing classrooms to enhance student engagement without incorporating expensive technology."*

The introduction of a new working area has a significant impact upon the staff that work in that area. It caused all staff to think about their teaching practice and some to change what they did, though there was no compulsion upon them to do so.

Staff that made changes did so to benefit the students in terms of either to help their understanding or to make the experience of lectures more enjoyable. Memories of traditional lectures and experiences shaped beliefs about teaching and delivery methods.

Considerable thought and planning are needed to take place prior to the introduction of a new teaching area, with consideration given to training and support, but most of all a feeling of ownership for the staff must be engendered. The vision for the use of the space should be communicated, but staff should be allowed to make their own choices about how they teach. Those choices are formed by multiple factors including the limitations of their own development and skills but also the needs of the students.

Technology was indicated as being an important feature of the space, which led some to be anxious that they could not use the room properly if they were not using the technology and they were not using the technology because they hadn't received adequate training.

More experienced staff used which aspects of the technology they felt would be useful and ignored the rest.

Lack of training was cited as a key reason for not making changes, however the evidence shows and the ones who did change confirmed that training may not be as important as was imagined, however, if provided training should concentrate on pedagogy and be individual where possible.

The novel model proved to be an effective tool to assist in the development and design of this study. By combining factors available from existing technology acceptance models with aspects of teacher beliefs and facilitation of change the model proved to be comprehensive and relatively successful when considering the individual needs of each teacher as well as the needs of the cohort in general.

Further research is required to test and develop the model further using a wider cohort.

7 Conclusions

To use the often-misquoted phrase from the movie The Field of Dreams; “If you build it, they will come”. Yet, whilst evidence exists that a change in teaching space can influence the behaviour of staff and students (Whiteside et al., 2010; Brooks, 2012), there has been little research into understanding the choices that teachers make and why some teachers may find change more difficult than others. A more accurate, but less snappy analogy from this study would be; “If you build it, some will come, the rest need support.”

The reasons for why a teacher chooses to teach in any particular style are complex, and this will impact upon any desire or requirements for teachers to change that style. In this study there was no explicit requirement to do so, but some staff felt that there was an implicit desire for them to change by the fact that the investment in the space had been made.

For change to occur staff must be motivated to change and secondly must be facilitated through the change. Motivation can be internally driven from a range of experiences and beliefs or may be externally driven by pressure from students or institutions. Facilitation should include training, support and importantly time afforded to do so. Pedagogical training should be given alongside technical training.

Current models used for researching staff teaching choices and teaching behaviour fail to be comprehensive. Realising the shortcomings of existing models, some researchers have tried combining UTAUT with TPACK (Cheung et al., 2016; Gellerstedt et al., 2018), however the use of questionnaires in these studies is of limited value in establishing the understanding behind teacher choices. The current work explored teaching choices more deeply and the development of a novel model that incorporates the knowledge and adoption theories along with those factors known to affect teacher beliefs and cognition.

The knowledge gained by a deeper understanding of teacher choices could help inform practice when further teaching space developments are considered. For example, the Covid-19 pandemic has had a profound impact upon the way we teach. Teachers were given very short notice, sent home with a laptop and in a short space of time were asked to make wholesale changes to their normal practice. This was not without support, but with more knowledge of how changing circumstances affect teachers maybe more personalised and targeted support could be envisaged.

The room changed, but nothing else in the curriculum changed, with lectures continuing to be delivered in existing one-hour slots and lecturers often having no other input within the modules for those students, there is little incentive to deliver teaching in anything other than a didactic fashion, albeit with attempts to make the lectures more interactive and learning in that one-hour session more active.

The presence of the room caused all staff to reflect on their teaching practice, and for those that already wanted to do change from the traditional lecture model it was an impetus to make that change. Despite seeing possibilities afforded by the space, several made no changes to how the taught in the lecture theatre citing several reasons why they would not change including now wanting to leave their comfort zone, not wanting to overload the students with further work and not having the time to make such changes.

The lack of direction from the school and University was seen as both non-constraining, but also a cause of concern that students may get a wide variety of different, disparate teaching methods.

Training was mentioned by many as a factor in not being able to make the most of the room. Training mainly consisted of technical instruction and very few received pedagogical training. Even those that had received a basic instruction felt they would benefit from observation of innovative staff members and the presence of champions to help with the vision of how a lecture could be delivered.

Technology was not the major factor that it was expected to be. Those that hadn’t made changes blamed a lack of training, whereas those that had made changes had changed mainly their pedagogy and very little change in how they used technology.

The novel model reflects the two aspects of making changes well. Dividing the model into motivation and facilitation covered the wide range of issues felt by staff. If the institutions did want change to happen and the space to be used differently, the model would be a good starting point to the factors needing to be considered to encourage and enable more staff to make changes. Perceived usefulness appears to be the strongest motivational factor, and this was strongly associated with the pedagogical knowledge gained from educational qualifications. Facilitating factors were believed or perceived to be the means to overcoming barriers, but staff that made changes did so despite the level of facilitation not because of it.

The fact that the university did not directly express an expectation for staff to make changes has meant that only those staff that felt comfortable with making changes have done so, and those that didn't, felt no pressure to do so. As the move towards active learning approaches also requires more preparatory work of students, it could be argued that the fact that fewer than half of the staff moving towards this style of teaching has spared the students from a potential overload of work if all teaching had moved that way. Therefore, in the final reckoning of the situation, it could be that the way the lecture theatre was introduced ultimately led the best outcome for staff and students.

Most of the interviewees shared a common experience of poorly delivered traditional lectures from their student days, which are becoming more and more outmoded as teaching and learning becomes more student focussed and interactive. This however did not always lead to change.

Contribution to the field of research regarding the introduction of innovative learning spaces

The promotion of modern teaching practices requires multiple aspects of change within the higher education setting. From the infrastructure to support flexibility in teaching styles to the preparation of the staff to allow those changes not just to happen, but to become embedded in the ethos of the institution.

This study has brought together several theories of change and adoption to explore the complex set of beliefs, attitudes, knowledge and skills that teachers use when considering how they will deliver their teaching. This is a critically under-researched area, with much more focus being made regarding the student experience than the effect on staff. It is crucial that staff feel that they know what is required of them and also that they have the resources and support to deliver the best pedagogical practices.

All too frequently, research in this area focusses on the innovators, keen to showcase what is possible. By the use of in-depth interviews of a range of staff with a wide range of attitudes towards changing pedagogies, this project had a unique opportunity to capture the thoughts, concerns and expectations of ordinary teachers, with normal lives, backgrounds and past experiences, who want to provide the best possible learning events for their students.

I believe that this study has two major contributions to make to further research in this area. Firstly, the methodology, whilst being nothing new,

showed the value of insider research, and how that can be carried out sympathetically, without undue bias and explore attitudes and perceptions to a depth that is not attainable from other methodologies.

Secondly, but carefully considering a range of models and concepts of change and adoption, followed by reflection on the study as a whole, a novel model has been created that can act as a framework both for future research and also by those planning change within their areas to predict and plan for necessary motivation and support for that change to be a success.

Whilst the new model requires further work and evaluation it has great potential. With the first iteration focussing on the factors behind decision making and subsequent actions, the second version was much more process-led. Taking the journey of an individual through the change process, should that be the desired outcome, and to elucidate what factors are important to consider on the way. Whilst this was originally intended to focus on the pedagogical choices of using a new teaching space it could be equally applicable to many different aspects of change within a large organisation, such as a change of curriculum or the introduction of a new module.

Personal reflections

My vision in setting out to do this project was initially to identify the barriers to change, so that staff within my team could be assisted to overcome the hurdles they faced. The model was intended to be a tool that could be used by senior staff such as myself to assist colleagues to be able to make those changes by identifying what their barriers were. The heat maps seem to do this very well, but this assumes that change is the end goal, which really was not clear. The perceived lack of institutional vision was seen by some as an excuse to continue with their traditional style of teaching and by others as a lack of something they could focus on and strive for. Was there really a lack of institutional vision though, the DLT had been redesigned at great expense and much publicity was made around the introduction.

This was the first qualitative study that I have undertaken. At first the methods used were quite different to my previous experiences of lab-based quantitative research, though seeing the value of interview data has changed my whole approach to future plans. Nearly all of the stages of carrying out this study were challenging for me to get to grips with at first and took much soul searching, late nights and nearly giving up on several occasions. From developing a theoretical framework to analysing the data

there was a learning curve that made each step feel like the first step to climbing an insurmountable object.

What is at the heart of this project though, is something that it turns out I have done all of my working life. As a trainee dentist, I remember a quote passed on to me by one of my teachers, he said "*if you want to find out what is wrong with your patient, listen to them and they will tell you.*" Looking back on this now, I realise that I have been carrying out semi-structured interviews for years, I just never called it that, but the best consultations with patients are the ones where you listen, without interruption, and let them tell you what their symptoms are, and just as importantly, how is it affecting them. This is done with the briefest of hints to guide the consultation and ensure that all salient points are covered. This was perhaps a subconscious guide to me when carrying out the interviews, but the richness of the data obtained stands testament to the process.

8 List of References

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Appendix A: Recruitment advertisement

Participants needed for a study looking at the impact of changes to teaching / learning spaces

Just over three years ago I began on an EdD program in the School of Education. As part of the program, I am carrying out a project to explore the impact of the introduction of a collaborative lecture theatre in 2016. Obviously since then a lot has changed and we are no longer using the lecture theatre for that purpose, however we will be back there one day, and the current situation has highlighted how important it is to understand more about the impact of changes in the workplace.

Who are we looking to recruit?

Anybody who provides clinical lectures / teaching within The School of Dentistry.

What are we studying?

We are studying how staff are impacted by imposed changes upon the spaces they use for teaching, with particular reference to the collaborative Dental Lecture Theatre introduced in 2016.

Why participate?

Your views and experiences how staff are impacted by changes in their workplace could lead to a better understanding of how the introduction of innovations to the workplace impact upon staff and the type of support that may assist in such changes.

What will I have to do?

You will be asked to take part in a 1 to 1 interview on Microsoft Teams. This should take between 30 and 60 minutes and will be recorded, all information will be subsequently anonymised.

How do I find out more about the study?

If you are interested in taking part in the study or would like any further information, please contact the lead researcher:

Paul Franklin: edu2pf@leeds.ac.uk Tel: 0113 3435675).
Ethics approval: AREA 20-002 (8th September 2020).

Appendix B: Email to participants

Dear Colleague,

As part of my EdD programme, I am carrying out a research project into the decisions staff make when preparing for a lecture. You have been identified as being a clinical teacher within School of Dentistry. By virtue of this role, you would be a valuable participant in a research study exploring how the pedagogical decisions of teaching staff have been impacted by the introduction of the collaborative lecture theatre.

What is the purpose of this study?

Staff choose different teaching approaches for many reasons and frequently the traditional lecture format can be the most effective way of delivering information to large groups of students, however there may be times when a student-centred approach to learning is selected. There may be many factors on what choices staff make when coming to such a decision, yet little is known of the factors that staff take into account when choosing. The introduction of the collaborative lecture theatre in the School of Dentistry in 2016 allowed for a greater variety of teaching styles to be used. Currently little is known about how the introduction of such a teaching space impacts upon how staff choose to use it.

Whilst currently we are not using the lecture theatres in a normal way, the project will be retrospective in nature, reflecting on choices made over the past few years, and also thinking forward to when the students return to teaching as normal

Research Aims

My aim with the study is to gather views from a variety of staff in order to discover more about the factors that influence teaching decisions, with particular emphasis upon the impact of the introduction of the collaborative lecture theatre. Once those views are aggregated, this could lead to a better understanding of the positive and negative implications of having innovations such as the collaborative lecture theatre imposed upon teaching staff

What would I have to do?

The study will take the form of a 1 to 1 interview taking place via Microsoft Teams. This will be audio recorded, and all data anonymised so that no individual could be identified from any subsequent reports

Whilst I am a senior colleague within the department of Restorative Dentistry, this project solely relates to my current position as a postgraduate student within the School of Education.

If you are interested in participating in this study please read the participant information form attached and contact the researcher (Paul Franklin) via email to express your interest.

Many thanks

Paul

T: 01133435675

E: edu2pf@leeds.ac.uk

Appendix C: Participant Information Sheet

School of Education

UNIVERSITY OF LEEDS

Participant Information Sheet

The title of the research project

How University Teachers are impacted by the design of their teaching space: A narrative enquiry into staff attitudes regarding the introduction of a collaborative learning space

Invitation

You are being invited to take part in a research project looking at the use of the collaborative lecture theatre within the School of Dentistry. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Ask if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of the project?

Didactic lectures have formed the backbone of undergraduate education for many years, and for many reasons, the traditional lecture format can be an effective means of transmitting information to a large group of students. There may be occasions however, that staff may wish to use a collaborative, student-centred approach to teaching.
In 2016, two schools plus a central teaching space within the University of Leeds were chosen to have their lecture theatres upgraded from a traditional format to one in which the students are arranged into pods with central consoles and an increased array of technology that can be used to support the student while learning.
As part of my EdD program I wish to explore whether the introduction of the collaborative lecture theatre has changed how staff approach the way they teach, compared to using a traditional lecture theatre. This does not imply that there is any particular way to best use the lecture theatre, as different teaching material may require different or indeed have a variety of ways in which teachers think it is best presented, and that range of views is very important.
The overall aim of this project is to contribute to the knowledge base about how staff respond to a changing environment so that ultimately the student experience can be improved if more is known about the positive and negative implications of imposing a newly designed teaching space.

My research aims are:

- To find out more about staff experiences of using the collaborative lecture theatre
- To find out how staff see the future of dental education in light of the changing nature of learning spaces

Why have I been chosen?

All teaching staff within The School of Dentistry that provide clinical lectures as part of their role have been invited to take part

Project title	*Document type*	*Version #*	*Date*
How University Teachers are impacted by the design of their teaching space: A narrative enquiry into staff attitudes regarding the introduction of a collaborative learning space	Participant Information	2	18/8/20

Do I have to take part?

This is completely voluntary. It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep (and be asked to sign a consent form) and you can still withdraw at any time up to one month following the interview. You do not have to give a reason.

What do I have to do?

Data will be collected by a 1-1 interview held between the researcher and yourself using Microsoft Teams. The data produced will be coded for common themes and processed by the researcher.
It is anticipated that each interview will take up to 60 minutes and will be conducted via online meeting at an agreed time convenient to both parties. The interviews will take place between February and July 2021. Interviews will be audio-recorded, transcribed and coded for thematic analysis.

Will I be recorded, and how will the recorded media be used?

In view of the current Coronavirus pandemic, interviews will take place via video link on Teams. An audio recording will be made using audio software on a University Owned laptop, not using inbuilt recorders within Teams. Video recordings will not be made.
The audio recordings will be uploaded to a secure One Drive folder and deleted from the laptop immediately after the interview has taken place.
Following one month the recordings will be transcribed and summarised for trends and key themes that arise.

What are the possible disadvantages and risks of taking part?

The main disadvantage is the commitment to completing 60 minute interview.

What are the possible benefits of taking part?

While there is no direct advantage by taking part, you would be contributing to the knowledge base in the area of undergraduate education. There is little available information about how changes such as the installing of a completely redesigned lecture theatre has upon the staff that are required to use it. It is hoped that the study will identify areas of success as well as areas that were challenging and can inform the University about possible lines of support that may be required should such changes be made in future works. Ultimately, the support of staff through change will have a positive impact upon the students and a knock on positive benefit to the school and University.

Use, dissemination and storage of research data

The principal purpose of the study is as part of a research project leading to the degree of Doctor of Education (EdD). Whilst the knowledge gained my be useful for informing decision makers for future developments, the data is fully anonymised and aggregated. Further dissemination through University publication or peer reviewed journal may be made using fully anonymised data

What will happen to my personal information?

The project is the final part of my educational qualification and as such my role is to gather data for use in my thesis.

In accordance with the University of Leeds Information management Guidance (2019) interview data will be treated as confidential. Direct quotations may be used to support the researcher's dissertation and subsequent publications in educational journals but anonymity will be preserved. Audio recordings will be deleted as soon as possible from the computer used to record the interview. Thereafter, all recordings, transcribed data and reports will be stored anonymously on the University's One Drive in an encrypted folder. No personal data will be published, no one would be able to be identified from the report or any publications that this may lead to, and no responses will be considered in terms of individual staff development or support.

What type of information will be sought from me and why is the collection of this information relevant for achieving the research project's objectives?

I will be seeking your views on how the introduction of the collaborative lecture theatre has impacted upon your experiences as a lecturer explore staff feelings about the potential benefits and challenges that such an introduction brings with it.

Who is organising/ funding the research?

There is no funding for the project. The project is being carried out by Paul franklin who is a Senior Clinical teaching Fellow within the School of Dentistry as well as being a part-time postgraduate student within the School of education at the University of Leeds. The research project is part of my role as a student within the School of Dentistry and not related to my role in The School of Dentistry.

Contact for further information

Project supervisor details:

Professor Neil Morris, School of Education, The University of Leeds.
N.p.morris@leeds.ac.uk

If you agree to take part, would like more information or have any questions or concerns about the study please contact:

Paul Franklin
Part-time PGR student
School of Education
University of Leeds
01133435675
edu2pf@leeds.ac.uk

Finally …

Thank you for taking the time to read this leaflet, you will be given a copy for your records and a copy of your signed consent form.

School of Education

UNIVERSITY OF LEEDS

Paul Franklin

Paul Franklin

18/8/20

Project title	Document type	Version #	Date
How University Teachers are impacted by the design of their teaching space: A narrative enquiry into staff attitudes regarding the introduction of a collaborative learning space	Participant Information	2	18/8/20

Appendix D: Consent Form

School of Education, University of Leeds

UNIVERSITY OF LEEDS

Consent to take part in "How University Teachers are impacted by the design of their teaching space: A narrative enquiry into staff attitudes regarding the introduction of a collaborative learning space"	Add your initials next to the statement if you agree
I confirm that I have read and understand the information sheet dated 31/7/20 explaining the above research project and I have had the opportunity to ask questions about the project.	
I understand that my participation is voluntary and that I am free to withdraw at any time up to one month following the interview without giving any reason and without there being any negative consequences. In addition, should I not wish to answer any particular question or questions, I am free to decline. If you change you mind, contact Paul Franklin – edu2pf@leeds.ac.uk. Your recordings and any transcriptions will be deleted with immediate effect.	
I understand that members of the research team may have access to my anonymised responses. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report or reports that result from the research. I understand that my responses will be kept strictly confidential.	
I understand that the data collected from me may be stored and used in relevant future research in an anonymised form.	
I understand that relevant sections of the data collected during the study, may be looked at by individuals from the University of Leeds or from regulatory authorities where it is relevant to my taking part in this research.	
I agree to take part in the above research project and will inform the lead researcher should my contact details change.	
I agree that the interview will be audio recorded	

Name of participant	
Participant's signature	
Date	
Name of lead researcher	Paul Franklin
Signature	
Date*	

*To be signed and dated in the presence of the participant.
Once this has been signed by all parties the participant should receive a copy of the signed and dated participant consent form, the letter/ pre-written script/ information sheet and any other written information provided to the participants. A copy of the signed and dated consent form should be kept with the project's main documents which must be kept in a secure location.

Project title : How University Teachers are impacted by the design of their teaching space: A narrative enquiry into staff attitudes regarding the introduction of a collaborative learning space	*Document type Participant consent form*	*Version 1*	*31/7/20*

Appendix E: Interview Schedule

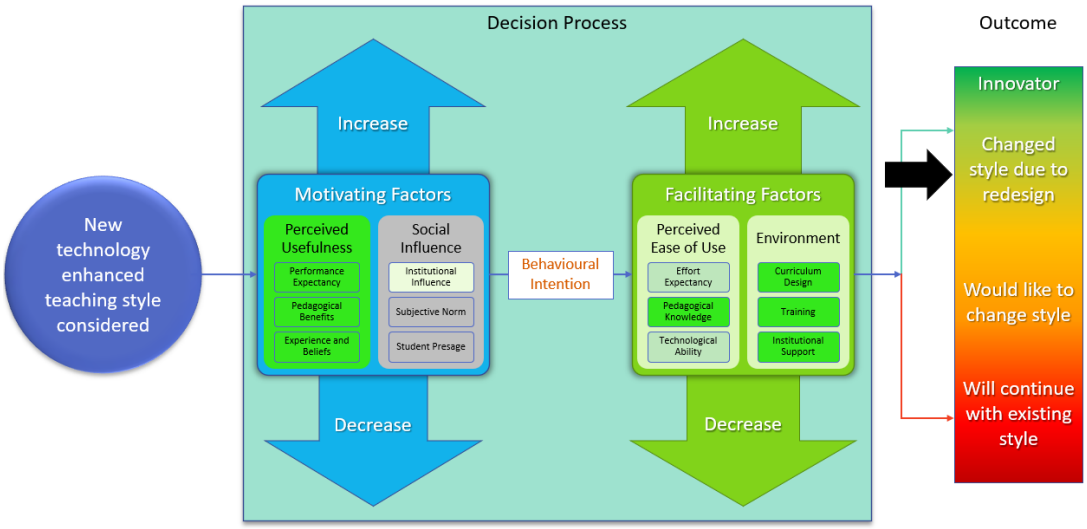
Context
Can you tell me about your career and your role as an educator?
• How many years of teaching? / How many lectures per year?
• Have you gained any educational qualifications?
• What is your position at the school?
• Were you already a teacher at the time of the introduction of the redesigned DLT
How would you describe your previous experience of lectures either as a student or a teacher
Introduction of CLT
When were you first aware that the lecture theatre was being redesigned?
Does the presence of the DLT cause you to think differently about the way you teach
Did the introduction of the lecture theatre cause you any anxieties
Do you remember how you felt when the new lecture theatre was announced / found out one was available
Do you think it has allowed you to teach in a different way
Have you changed the way you teach since the introduction of the DLT (or when using DLT compared to traditional spaces?
Tell me about a time you have used (want to use) the lecture theatre in a different way that has been enabled by the design
Did you have a colleague present / would one be available when trying to do a collaborative session
Do you feel any expectation to use the lecture theatre in a different style from a traditional lecture from the school / students / colleagues?
Would you choose the CLT preferentially to a traditional lecture theatre?
Collaborative Learning
Have you used any teaching techniques that involve students collaborating with each other?
What do you think could be the potential advantages of students working collaboratively?
Have you received any training on how to use the lecture theatre collaboratively?
Have you tried collaborative learning in the past or experienced as a student – was it successful/not
Do you think the curriculum lends itself to collaborative learning?
How easy would it be to change your teaching materials to include collaborative teaching?
Do you think the students would be able to adapt to that style
Technology
Can you tell me about a time you have used any of the digital technology that was installed into the DLT to engage the students?
How confident do you feel using the available digital technologies?
Do you feel confident to manage technical issues that may arise?
What training have you received specifically on the use of the technology
Do you feel able to choose effective technological solutions to support the teaching you would like to provide?
Is a technologist available while you are teaching?
Does the technology available meet all of your needs
Going Forward
How useful do you think lectures are as a means of undergraduate education?
Are you aware of how your students respond to the lecture style of teaching?
Do you have plans to make changes in the future?

What barriers would you need to overcome to make changes?
What anxieties would you have regarding making changes?
Would there be anything that would help you to make changes
Do you have any other thoughts about the future of lectures, how spaces should be designed, and staff supported?

Appendix F: Heat Maps

The following diagrams provide in summary form the items from the provisional model and whether they have had a positive or negative impact upon the person.

ANYA



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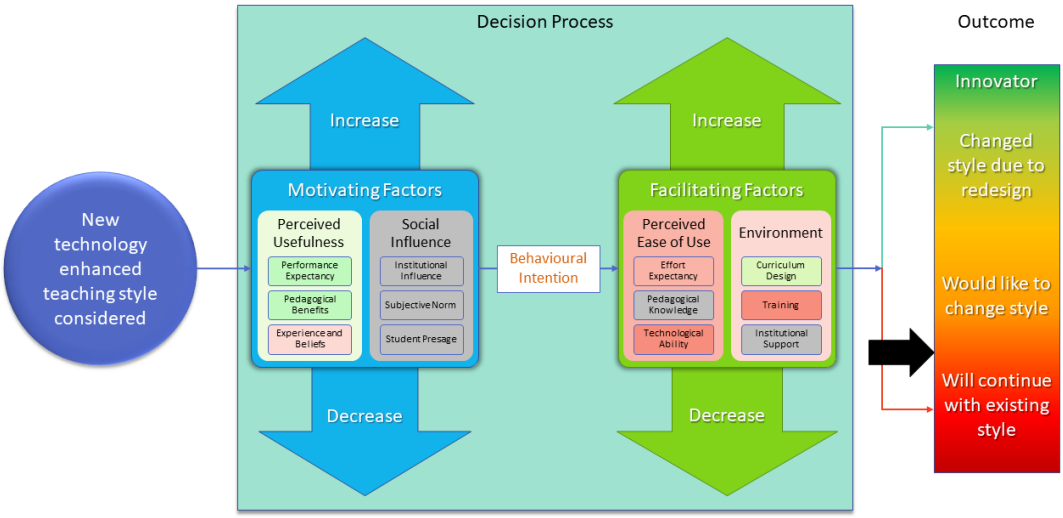

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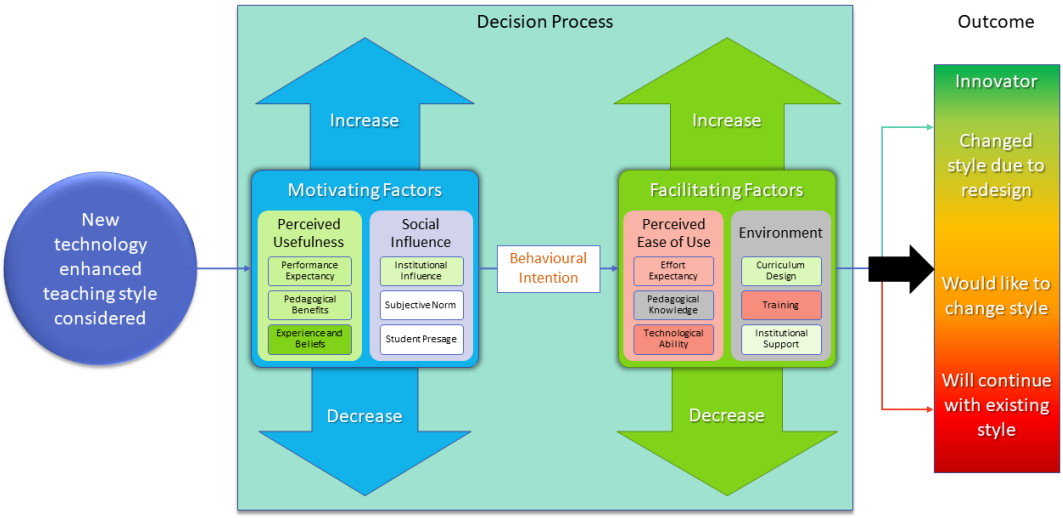

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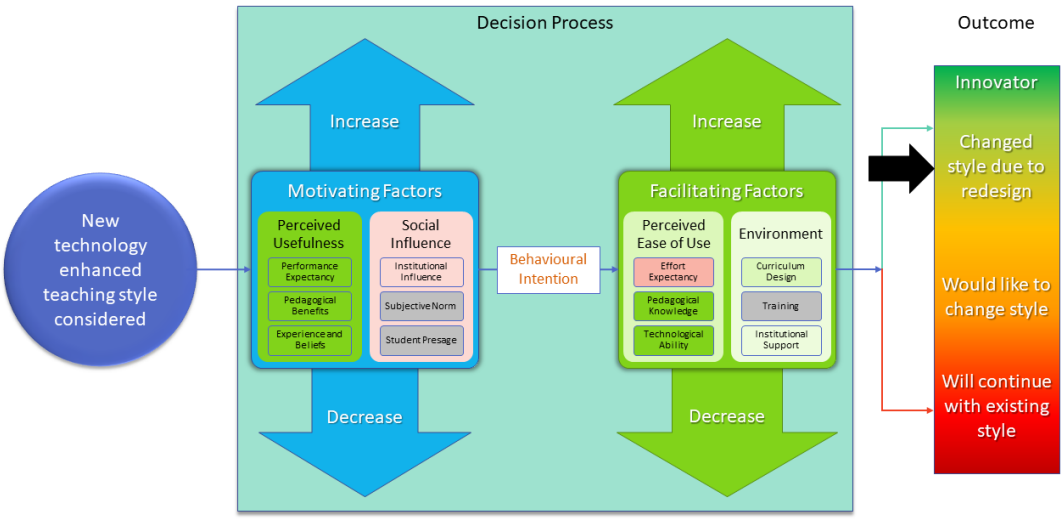

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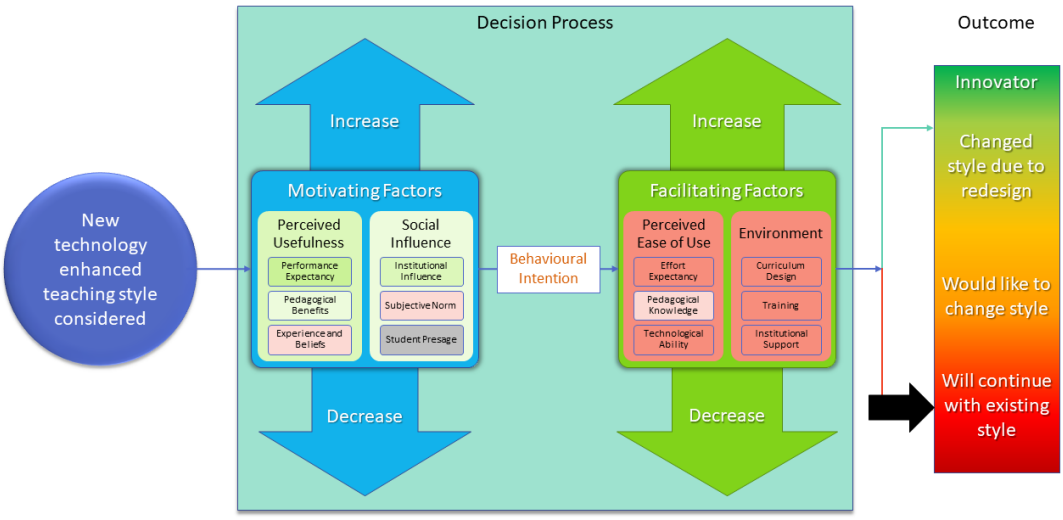

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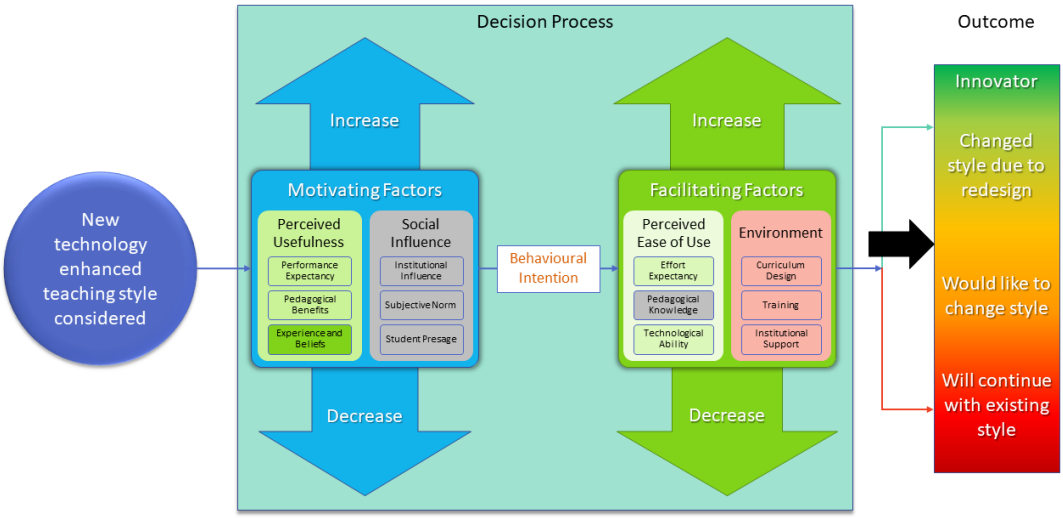

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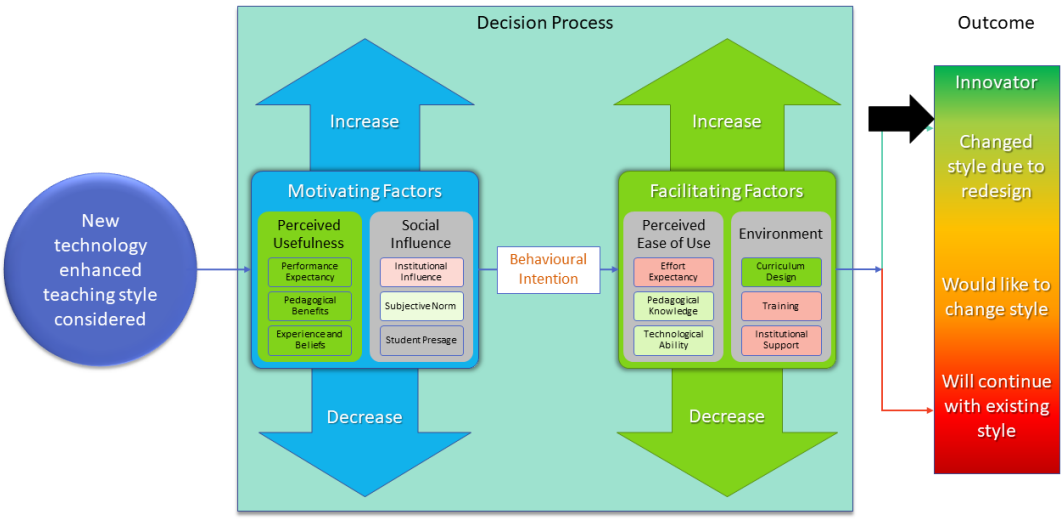

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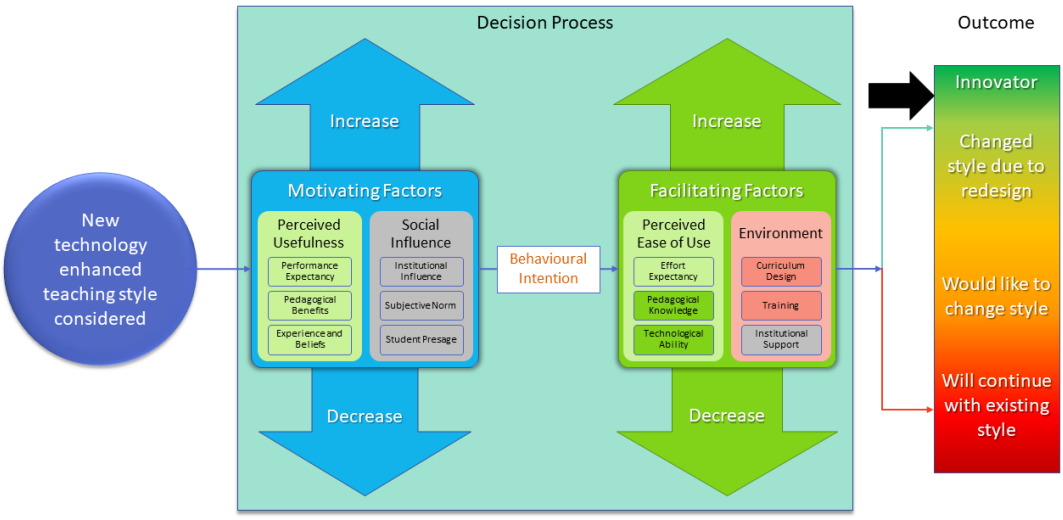

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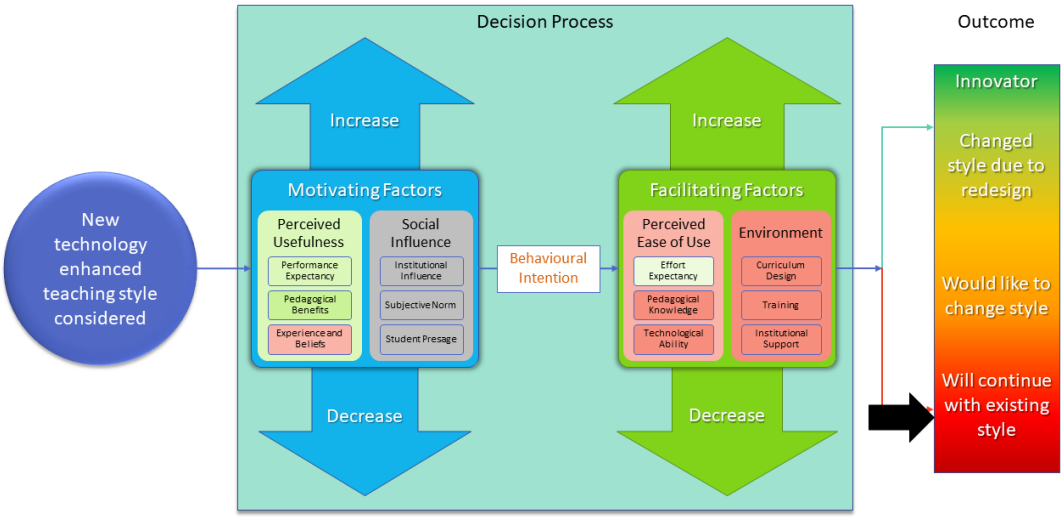

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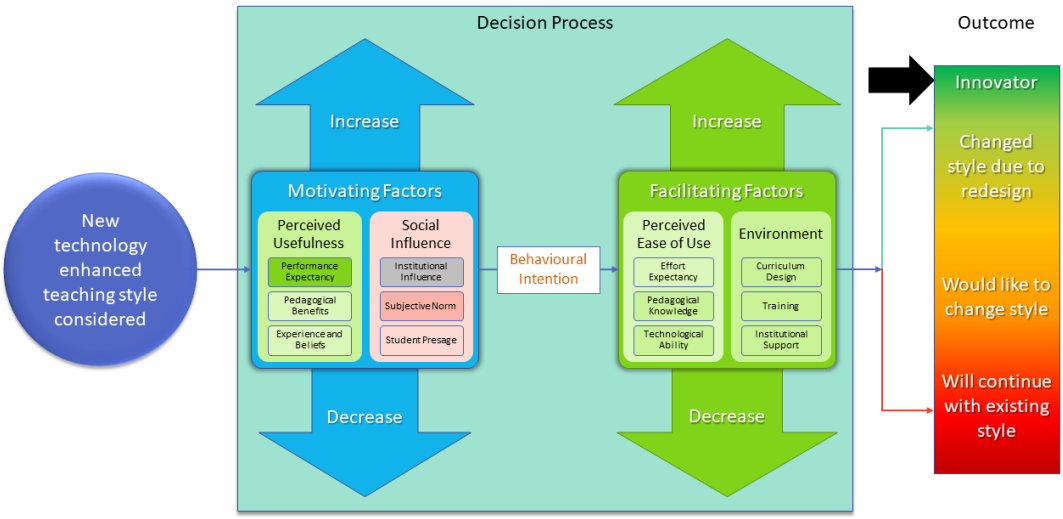

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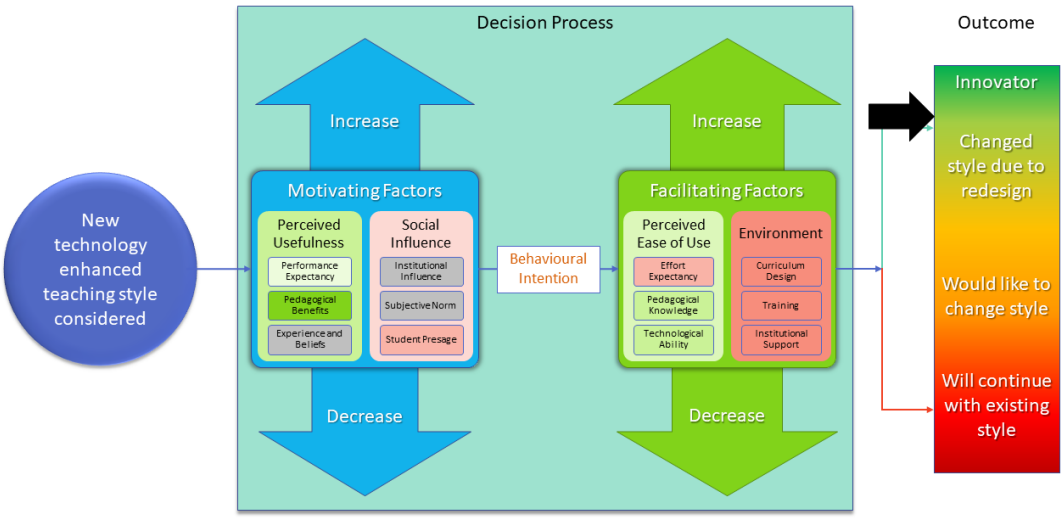

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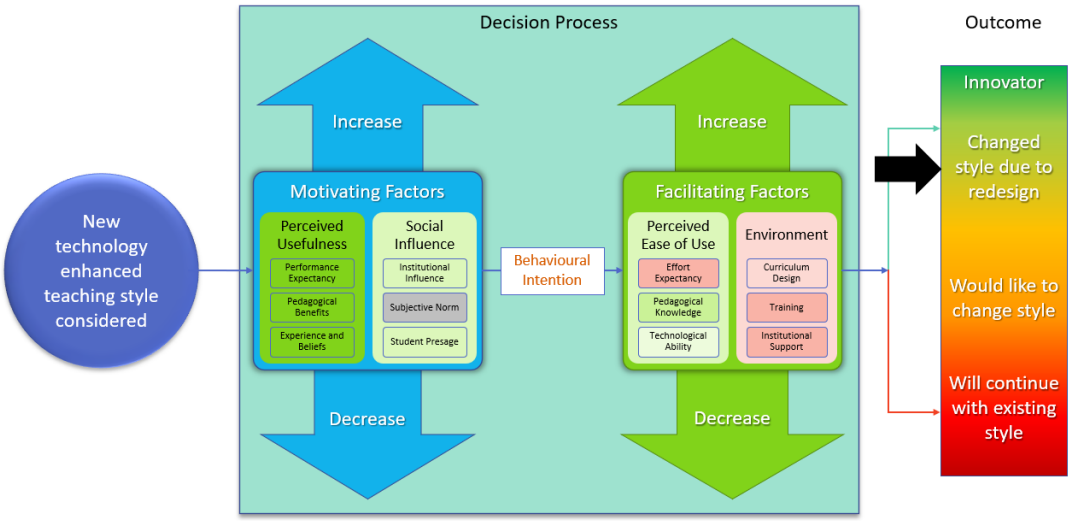

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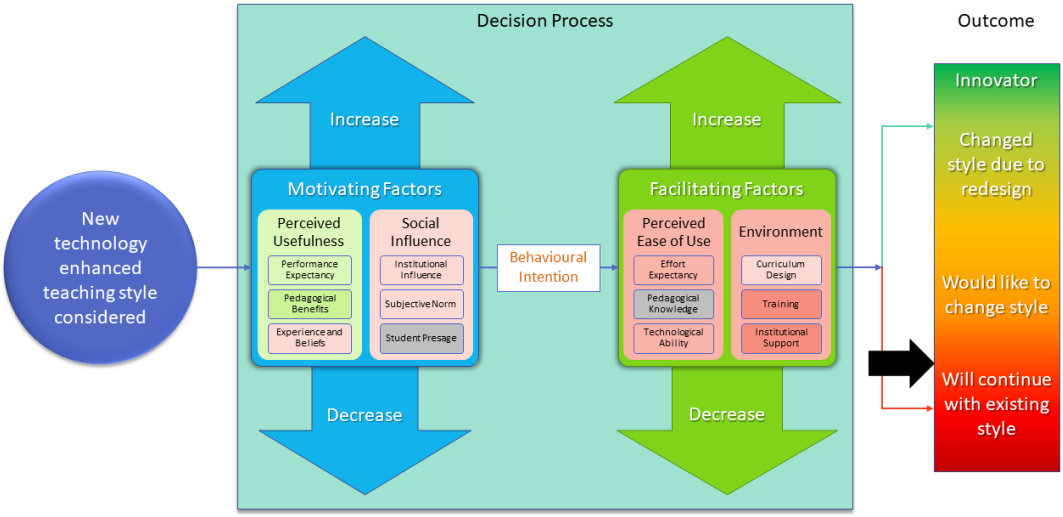

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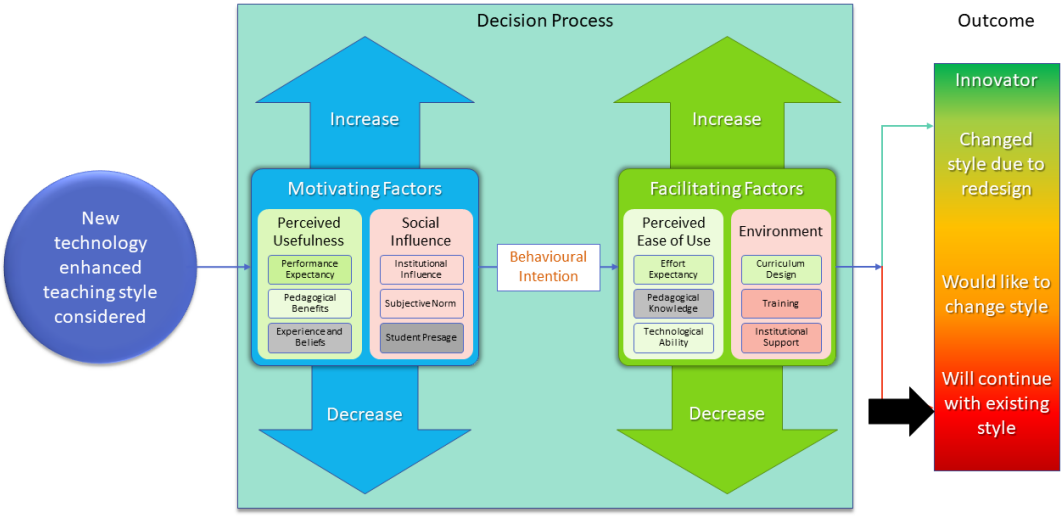
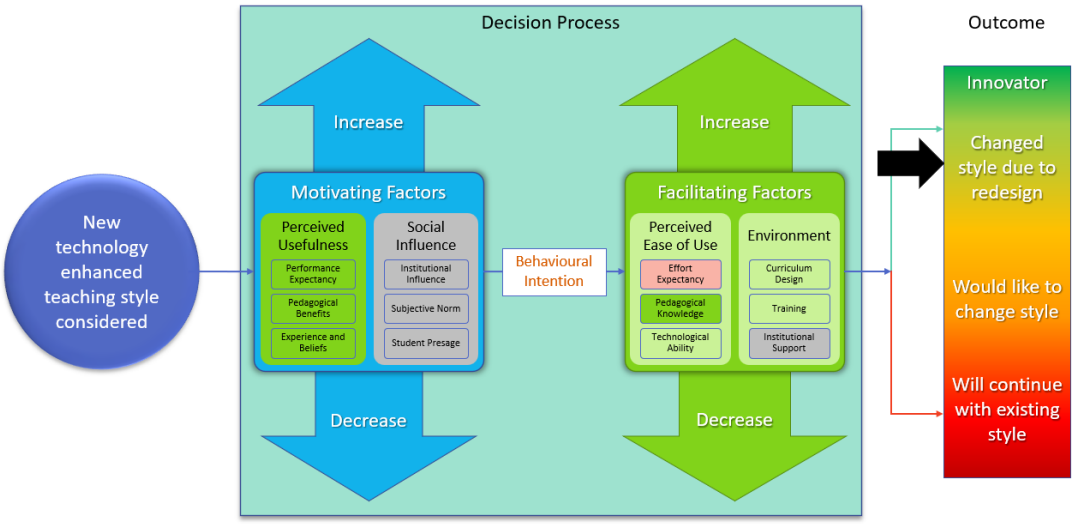


Olivia


Decision Process
Outcome
Increase
Increase
New technology enhanced teaching style considered
Motivating Factors
Perceived Usefulness
Performance Expectancy
Pedagogical Benefits
Experience and Beliefs
Social Influence
Institutional Influence
Subjective Norm
Student Presage
Behavioural Intention
Facilitating Factors
Perceived Ease of Use
Effort Expectancy
Pedagogical Knowledge
Technological Ability
Environment
Curriculum Design
Training
Institutional Support
Decrease
Decrease
Innovator
Changed style due to redesign
Would like to change style
Will continue with existing style