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Lecture recordings to support learning: A contested space between students and teachers

Neil P. Morris, Bronwen Swinnerton, Taryn Coop



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Title Page

Title: Lecture recordings to support learning: a contested space between students and teachers

Author names and affiliations: Neil P Morris^a, Bronwen Swinnerton^a, Taryn Coop^a

^aSchool of Education, University of Leeds, Leeds, UK

Corresponding author: Neil P Morris, n.p.morris@leeds.ac.uk

Key findings:

- Students use lecture recordings during term time for learning, and for assessment preparation and examination revision
- Students request more lecture recordings and quicker access to recordings
- Students attendance when lectures are recorded is significantly lower
- Staff have mixed views on the effectiveness of lecture recordings to support learning
- Staff perceptions of the value of lecture recordings change over time

Please state the research question addressed by this paper (200 words):

This research paper addresses the issue of lecture capture, and its perceived value by students and teaching staff. The research question addressed by this paper is 'Do students and teachers have similar perceptions about the value of lecture recordings?'. This question is important because the literature suggests that students and staff have differing views about the value of lecture recordings to support and enhance learning. The study had a number of specific sub-questions:

- In what ways do student and teacher perceptions of lecture capture differ?
- How do students use and perceive lecture recordings, and how does use vary by demographic groups?
- Do teaching staff value lecture recording as a useful tool for student learning?
- Do staff perceptions of lecture recordings change over time?
- Are fears about the impact of lecture capture on attendance well-founded?

Therefore, in this research we have asked students and staff in a single university about their perceptions of the value of lecture capture over an extended period, and also used systems data to support or refute students' and staff views.

Please explain how the research in this paper advances the field (200 words):

Previous research in this area has been mostly small scale, and based on self-reported data. In this research, we have combined large system generated data sets, and repeated cross-sectional data collection, with self-reported data from staff and students, to generate a multi-dimensional data set which addresses these research questions. These data, and the findings of this research, are important to the global higher education sector as it moves towards a more blended learning approach, to offer flexible, inclusive educational opportunities to a diverse set of learners. There is a heated debate about the value of lecture recordings within the global academic community, and much of it focuses on the polarity of views between staff and

students. It is expected that these data will provide strong empirical evidence to inform that debate, by presenting a more nuanced view developed from triangulating perception data with more 'subjective' systems data. The global relevance of this research is indicated by the geographical spread of previous studies on lecture capture, which includes studies in Australia, the US, Canada and across Europe.

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Abstract

Universities, globally, are increasingly offering students a blended learning approach to support their campus-based education, through use of a wide range of educational technologies, tools and systems. Research has demonstrated that blended learning offers at least equivalent learning outcomes for students, and enhances flexibility, inclusivity, engagement and motivation. Many universities across the world (including Australia, the US, Canada, Singapore, Qatar, and across Europe) have adopted lecture capture as a means to support a blended learning approach, and students have strong positive perceptions about the value of lecture recordings to enhance their learning and support their education. However, research shows that teaching staff are generally less positive about the value of lecture capture, believing it to diminish the value of the live lecture experience, reduce learning, and encourage student absenteeism from lectures. In this study, we used mixed methods and repeated cross-sectional data collection to investigate the use and value of lecture recordings from the perspective of students and teaching staff in a large campus-based university, employing a blended learning approach. Our data show that students make significant use of lecture recordings, throughout the academic session, and place great value on recordings for note-taking, more in-depth understanding or clarification, and assessment preparation. As a result, students have high expectations about the availability and quality of recordings. Teaching staff reported a range of reservations about the value of lecture recordings, including its impact on teaching style, and strong concerns about the negative impact of lecture recordings on students learning and attendance. Our data show that over 80% of students attended recorded lectures, but lectures that weren't recorded had significantly higher attendance. In conclusion, our research demonstrates a contested space between staff and students in relation to the use and value of lecture recordings, a contested space that will need to be debated and resolved as universities grow their use of blended learning. This study contributes significantly to this global debate by its use of a wide range of additional data sets to delve further and provide a more nuanced view of this space.

Keywords

Improving classroom teaching;
Pedagogical issues;
Media in education;
Adult learning;
Teaching/learning strategies

1. Introduction

Digital technology is increasingly impacting on learning and teaching processes in the higher education sector, in many countries around the world. Digital technologies are used by students, teachers and education professionals to support learning and teaching, enhance the student experience and for administrative processes. The utilisation of digital technology for learning and teaching is motivated by potential benefits in a number of areas, including: to increase flexibility of learning for students on campus, to enhance the student experience and support student learning, to enable personalisation of learning, to improve access to learning resources for students off campus and students studying at distance (Chang, 2007; Cilesiz, 2015; Gordon, 2014; O'Callaghan, Neumann, Jones, & Creed, 2017; Owston, Lupshenyuk, & Wideman, 2011; Walker, Voce, & Jenkins, 2013), and to cater for growing numbers of students and reductions in government funding (O'Callaghan et al., 2017). There is also growing external pressure on universities to engage with the use of digital technologies to support student education, from stakeholders including employers, government, parents and students themselves (Gorissen, Van Bruggen, & Jochems, 2012; Marshall, 2018; Mayes, Morrison, Mellar, Bullen, & Oliver, 2009). University investments in this area have included the widespread introduction of learning management systems, growth in the number of online, blended and distance courses offered, the use of Massive Open Online Courses (MOOCs), and the introduction in many universities of some form of lecture capture system to record teaching sessions, and to provide facilities for staff to create digital learning resources for use by students outside of the classroom (Danielson, Preast, Bender, & Hassall, 2014).

The value of lecture capture, to staff and students and its potential impact on attendance and learning outcomes is a global higher education issue, indicated by the geographical spread of studies in this area, ranging from Australia (e.g. Chang, 2007; Gosper, Green, McNeill, Phillips, Preston & Woo, 2008), the US (e.g. Bollmeier, Wenger & Forinash, 2010; Cilesiz, 2014; Danielson et al., 2014), Canada (e.g. Brooks, Epp, Logan & Greer, 2011; Owston et al., 2011), to Europe (e.g. two universities in the Netherlands (Gorissen et al., 2012)). Witthaus and Robinson's 2015 literature review refers to many studies including one in Belgium and the Netherlands, and one each in Croatia and Spain, whilst the UK has seen many studies (e.g. Bond & Grussendorf, 2013; Edwards & Clinton, 2018; Elliot & Neal, 2015). There is also a cross border study of three different lecture capture systems in three countries: Israel, Germany and Canada (Barokas, Ketterl, Brooks & Greer, 2010). These research studies are a reflection of the increasing use of lecture capture systems across higher education in many countries. A large number of universities have provided institution-wide lecture capture systems, using either 'home-grown', open source or commercial solutions (Barokas et al., 2018; Cilesiz, 2015; Henderson, 2014; Owston et al., 2011; Zhang, Rui, Crawford, & He, 2005). The functionality of these systems varies widely, from audio-only podcasts published to internal or external digital learning channels, through to fully automated video, audio and screen-capture installations, synchronized with timetable systems and offering automated publication to internal and external channels (McGarr, 2009; Walker et al., 2013). Most commonly, lecture capture solutions are used in specific faculties or disciplines, and some universities make use of multiple systems to capture events. The growth of lecture capture implementations has been explained by a combination of three critical features: (i) it leverages learning benefit from the predominant classroom delivery method (the lecture); (ii) it is relatively invisible to

the lecturer and therefore requires little or no technical training, and (iii) student feedback is overwhelmingly and consistently positive (Morris, Hardy & Hinrichsen, 2009). However, the use of lecture capture systems to support student learning, and the impact on teachers, is a contested subject with many strong views from the academic community about the drawbacks of these tools. Overall, the main problems with lecture capture are perceived to be the impact on lecture attendance, the negative portrayal of the lecture, and the negative impact on students' learning.

1.1 Literature Review

1.1.1 Perceptions of lecture capture

There have been a number of studies describing the benefits of audio and video capture of lectures for student learning. Perceived benefits include flexible learning (anytime, anywhere access to learning materials), multi-modal learning (providing learning resources in multiple formats), deeper learning (ability to evaluate and contextualise learning resources over time), accessibility and practicality (Danielson et al., 2014; Evans, 2008; McKinney, Dyck, & Luber, 2009; Morris, 2012; Owston et al., 2011). Studies have found that students in higher education tend to be very positive about lecture capture, believing that it improves their academic performance, enabling them to catch up on content they missed in class, or to make up for absences (Groen, Quigley & Herry, 2016). Studies have described how students can revisit lectures to better understand challenging content and to clarify lecture notes, for revision and to make up for absence (Chang, 2007; Elliott & Neal, 2015; Groen et al., 2016; Taplin, Kerr & Brown, 2014). Students feel that the ability to pause, rewind and fast forward as they please, provides them with control over their learning (Copley, 2007; Traphagan, Kucsera, & Kishi, 2010), and Elliott and Neal (2015) report that students believe lecture capture helps support independent study. Several studies have also suggested that students have increased satisfaction when lecture capture is available and often state they would like more (Bollmeier et al., 2010; Cramer, Collins, Snider, & Fawcett, 2007; Elliott & Neal, 2015; Jones & Olczak, 2016; Witton, 2016), enjoying the flexibility it provides (Hall & Ivaldi, 2017).

However, academic staff are generally not so positive about lecture capture. Research shows that it can lead to a change in teaching through academics being more self-conscious and changing their behaviour as a result (Bond & Grussendorf, 2013; Taplin et al., 2014), for example, talking to the microphone and repeating materials for the camera (Chang, 2007). In these scenarios, staff are concerned about recordings reducing interactivity between teachers and students, and students and students (Danielson et al., 2014; Freed, Bertram, & McLaughlin, 2014). Chang (2007) suggests that lecture capture is not suitable for all lecturing styles, in particular, where there were 'multiple visual cues ... and where there was a high level of interactivity between academic and students' (Chang, 2007, p.136). Staff are also concerned about the impact of lecture capture on them, as teachers and professionals, citing concerns about the notion of intrusion, impact on spontaneity, students using recordings to parody their lectures on social networking sites, concerns about body image and need for media training (Bond & Grussendorf, 2013). Freed et al. (2014) use the term 'technostress' (borrowed from Craig Brod) to refer to how academics can feel unsettled by the introduction of lecture capture, and some have pointed to the practice of self-censoring of lecturing (Chang, 2007; Elliott & Neal, 2015; Smith & Sodano, 2011). This unease has also been linked to what lecture recording might mean in relation to intellectual property law and copyright policies (Rios-Amaya, Secker & Morrison, 2016). Staff also have concerns about

changes in student behaviour, such as procrastinating about difficult tasks, for example assignments, in favour of easier tasks such as watching lecture videos, and binge studying using lecture capture videos near to exam time (Chai, 2014).

Academic staff also have concerns about the impact of lecture capture on student performance and attainment, although research findings on the impact of lecture capture on students' learning are mixed: some studies show no impact of lecture capture on learning outcomes (Bosshardt & Chiang, 2016; Franklin, Gibson, Samuel, Teeter & Clarkson, 2011; Williams, Aguilar-Roca & O'Dowd, 2016), whilst others show an increase in academic performance (Cortinhas, 2017; Terry, Macy, Clark & Sanders, 2015; Traphagan et al., 2010). Owston et al. (2011) found students who watched more lectures performed less well than those who watched fewer lectures but suggest this may be due to higher achieving students not needing to access so many lectures and lower achieving students lacking confidence, comprehension skills and note taking ability. Jones and Olczak (2016) found that using lecture capture videos for revision was more beneficial to performance than if lectures were watched immediately after the lecture, although any improvements in performance were small. Edwards and Clinton (2018), in their study of both the availability and the usage of lecture capture by students, found that the availability of lecture capture led to a drop in attendance whilst usage (viewing) did not compensate, leading to a generally negative impact of lecture capture on attainment.

Some studies have focused on benefits to different groups of students, for example international students for whom English may not be the first language (Cortinhas, 2017; Groen et al., 2016; Hall & Ivaldi, 2017), and students with disabilities (Hall & Ivaldi, 2017; Leadbeater, Shuttleworth, Couperthwaite, Karl & Nightingale, 2013;), although Cortinhas (2017) did not find any difference in use by students with disabilities, and low achieving students (Owston et al., 2011; Groen et al., 2016). Mark and Vrijmoed (2016) found conversely that lecture capture benefited mid-range achievers rather than high performing or weaker students. Hall and Ivaldi (2017), in their qualitative study, found that lecture capture benefited students with long term illness who may otherwise have dropped out, whilst Wong (2013) found students who were also in employment found them useful (in Jones & Olczak, 2016). Research shows that students for whom English is not their first language and those requiring additional support tend to find recordings more useful, and a review of literature on lecture capture concludes that 'the positives of lecture recordings outweigh the negatives...' (O'Callaghan et al., 2015, p.399). The jury is still out on the impact of lecture capture on attainment, and studies are required which focus on the way different groups of students utilise lecture capture.

Teaching staff do perceive some benefits of lecture capture, particularly for overcoming logistical challenges, supporting learning and for professional development. Chang (2007) suggests that it is of benefit to staff to be able to offer students a repeat of the lecture, and Vajoczki, Watt, Marquis, and Holshausen (2010) support this and suggest it means teachers don't have to clarify points so often. Danielson et al. (2014) although also finding that students were more likely to perceive benefits of lecture capture than were academics, does suggest that one area of benefit to staff was the opportunity lecture capture afforded to review their own performance. This finding is echoed in Joseph-Richard, Jessop, Okafor, Almpanis and Price's study (2018) which shows lecture capture being used by staff for reflective practice and greater self-awareness.

Finally, there is evidence to suggest that technology is used more in some discipline areas more than others. For a number of years the UCISA TEL

(Technology Enhanced Learning) Survey reports have found that Medicine, Nursing and Health, and Management, Accountancy, Finance, Business etc. use technology enhanced learning the most, with Languages and Humanities using it the least (Walker et al., 2013). These disciplinary differences in lecture capture usage may reflect different teaching styles. In terms of level of study, it has also been suggested that introductory-level courses may be more suitable for lecture capture (Nordmann, Calder, Bishop, Irwin & Comber, 2018) as knowledge acquisition benefits from additional exposure (Demetriadis & Pombortsis, 2007).

With research generally indicating academic staff's negative views of lecture capture, centrally developed policies for lecture capture implementation provides insight into key areas of controversy. A review of the lecture capture policies adopted at 35 UK institutions reveals three main approaches to implementation: opt-in, opt-out and customised according to specific institutional needs and demands (Nordmann & McGeorge, 2018). Institution-wide policies generally cover a number of contentious issues: the suitability of teaching activities for recording, the use of lecture capture as a supplement and not replacement of the live lecture, intellectual property laws, and affirmation that lecture capture will not be used to manage teaching performance (Nordmann & McGeorge, 2018).

1.1.2 Impact of lecture capture on lecture attendance

One of the main concerns for academic staff is student attendance, suggesting that the availability of lecture recordings leads to reductions in physical attendance at lectures. Many of the studies exploring lecture capture and attendance have focused on staff perceptions and student self-reporting of attendance rather than analysing attendance data. For example, a majority of the lecturers interviewed in a London School of Economics study (15 of the 23 that mentioned attendance) claimed that the availability of recordings would lead to a drop in attendance (Bond & Grussendorf, 2013). A survey of 34 staff at the University of Colombia found that they perceived attendance to be affected by up to 40.0%, whilst 7.0% of 239 students surveyed reported missing more lectures than previously (Marchand, Pearson & Albon, 2014), and Toppin (2011) found in his study at a US university that of 319 students surveyed, 2.6% stated it led to decreased attendance by them, whilst 11.5% said it led to increased attendance. Of the seven faculty members surveyed, one claimed it led to a decrease in attendance.

There have been studies illustrating no significant reduction in student attendance when lectures are captured; for example, Elliott and Neal (2015), deduced from lecturers perceptions of the impact of lecture capture on attendance for one module, with 700+ students over two years; and Larkin (2010) who measured attendance data of 64 3rd year students over a 13 week period; and Smith & Morris (2014) who measured self-reported attendance by 131 students; and Groen et al. (2016) from self-reported student data of 1,068 students. Franklin et al. (2011) also using students self-reported attendance data, found that for the 94 first year students who responded, none felt the availability of lecture capture affected attendance, whilst of the 91 2nd year students responding, 13 (14.4%) felt it led to a decline in attendance, whilst five (5.5%) claimed it increased their attendance.

There are studies illustrating reductions in lecture attendance for specific student cohorts (Drouin, 2013; Traphagan et al., 2010), and others finding a reduction in attendance when lectures are captured (Edwards & Clinton, 2018; King, Dawson, Rothberg & Batmaz, 2017). A layer of complexity is added when some institutions cite specifically using lecture recordings to discourage or prevent the physical

attendance of students to address limitations of space (Marshall, 2018). However, other studies suggest that lecture capture does not markedly decrease attendance, suggesting that students attend lectures irrespective of the availability of other learning resources. Pursel and Fang's (2012) review of 47 relevant journal articles found 26 mentioned attendance and around 20% of those studies found a decrease in attendance linked to lecture capture. Nordmann and McGeorge's 2018 study, which includes a review of current literature on lecture capture found 'there is no systematic evidence to suggest that access to recordings alone significantly impacts attendance...' (p.2). Their paper suggests that where attendance has seen a decrease a range of other factors are present for example level of study, ability and approaches to learning. Overall, the impact of lecture recordings on students' attendance at lectures is unclear, lacking any large-scale research from attendance data.

1.1.3 Lectures versus active learning

Opinion is divided about the value of the lecture versus 'active learning' teaching sessions. Supporters of the lecture describe the value of didactic delivery during lectures to initiate a 'dialogic relationship' between lecturer and students (Fulford & Mahon, 2018), and criticise the view of transmissive knowledge exchange during a 'traditional lecture' as an inaccurate representation of the interaction between teacher and students during such sessions (Abeysekera & Dawson, 2015), and the learning processes triggered by the lecture (Thaman, Dhillon, Saggarr, Gupta & Kaur, 2013). Others suggest the lecture provides a structure for students and an opportunity for social interaction between students (all in the same place at the same time) (Rennick-Egglestone, 2015), or is portrayed as having benefits associated with listening and interpreting meaning (Webster, 2015). Proponents of active learning cite the strength of the constructivist approach to learning (Bull, 2009; Christie & de Graaff, 2017). Research evidence overwhelmingly demonstrates the value of active learning teaching sessions to improve learning outcomes (Baepler, Walker & Driessen, 2014; Freeman, McDonough, Smith, Okoroafor, Jordt & Wenderoth, 2014; Thai, De Wever & Valcke, 2017), whilst supporters of lectures cite research demonstrating high 'recall and retention' from lecturing (Bjork & Bjork, 2014). Notable amongst these is Freeman et al's. (2014) meta-analysis of over 200 studies exploring student performance in STEM disciplines when experiencing traditional lecturing versus active learning, which found that on average performance increased in active learning contexts and failure was more likely when students were taught using traditional lectures. The study proposed 'abandoning traditional lectures in favour of active learning' (Freeman et al., 2014, p.8410).

These studies have a direct bearing on the lecture capture debate. Proponents of the traditional lecture believe that lecture capture impacts negatively on the delivery of the lecture, student interaction and engagement with the learning materials, and the investment in time and deep thinking to conceptualise and internalise the lecture. Proponents of active learning consider lecture capture as a tool to record the transmissive elements of the teaching session (e.g. introduction, plenary, assessment instructions etc.) and use the tool as such, not allowing it to drive, or alter, the intended pedagogic approach.

1.1.4 Digital technology: the rhetoric versus reality

The portrayal of digital technology as a means of improving educational provision, and as commonplace and 'part of the furniture of university life', leads to any negative aspects of digital technology in higher education being 'problematized in rather unsophisticated ways' (Selwyn, 2016, p.1007), such as Internet 'overuse' and 'addiction', online plagiarism, or 'information overload'. There is however, a more critical view of the role of technology in education. Educational technology has been criticised for its positioning in solutionism (Morozov, 2013), and Selwyn (2013) suggests that digital technology can be as much of a 'problem changer' as a problem solver (Selwyn, 2013). Others argue that there is no 'intrinsic value' in using technology for education which automatically leads to it achieving certain outcomes (Oliver 2011, 2014). Selwyn (2017) further argues that it is important to consider the rhetoric of the potential of digital technology versus the reality, contending that its impact is not binary, good or bad, but much more complex and shaped by the social context in which it is used (Selwyn, 2017), a view supported by Aagaard (2018) and others who suggest that describing digital technology in terms of its affordances, i.e. the potential actions associated with it, does not always provide an accurate portrayal of what 'actually' happens (Littlejohn & Hood, 2018). However, there is empirical research, most notably in Tamim et al's (2011) meta-analysis of 25 meta-studies, which provides evidence that generally the use of technology in the classroom has a small to moderate positive impact on learners' performance versus classrooms where no technology is used (Tamim, Bernard, Borokhovski, Abrami & Schmid, 2011). Other studies have also found positive effects for technology integration, for example, Dziuban et al's (2018) study of blended learning, found that it results in improvement in student success and satisfaction (Dziuban, Graham, Moskal, Norberg, & Sicilia, 2018). It is, however, widely accepted that access to digital technology in education is unequal and impacted by a range of factors including social class, gender, age and race (Helsper & Eynon, 2010). Where learners are able to access online provision, other barriers exist, such as the learners' skills, their ability to engage in meaningful, self-regulated learning (Littlejohn, Hood, Milligan & Mustain, 2016), and the context in which the learning is situated (Littlejohn, Beetham & McGill, 2013). Although Tamim et al's (2011) study does go beyond the rhetoric in its analysis of the impact of technology use on outcomes, one of its limitations is its focus on technology versus no technology without exploration of how such technology was used. Walker et al's (2017) study of the impact of technology using data from UCISA surveys, suggests that pedagogical change is limited (Walker, Jenkins & Voce, 2017). It is important therefore to explore the utilisation of a particular form of digital technology from a range of perspectives, and to explore not only how it is being used but the context, or various contexts, in which it is being utilised.

In this study, we focus on one particular application of digital technology in higher education, and analyse data from multiple sources (staff surveys, student surveys and systems data) over a number of years to explore use of, and attitudes to, an institutional lecture capture and desktop capture system. In particular we focus on the contested space between students and teaching staff about the value of lecture capture to support the student experience and learning. Nordmann and McGeorge (2018) recommend progressing from the binary question of whether or not lecture capture should be implemented, to designing research that provides more context to nuance and deepen our understanding of theory, perceptions and practice. Our literature review shows the various dichotomies in focus in current research on lecture recordings: student attendance when lectures are recorded versus student

attendance when lectures are not recorded; student perceptions versus staff perceptions; supply (lecture recording availability) versus demand (indicated by student usage of recordings); opt-in institutional approaches versus opt-out institutional approaches; and traditional lectures versus active or flipped approaches. It demonstrates that there is abundant evidence on both sides about the benefits and drawbacks of lecture capture for student learning, engagement and delivery of lectures, and it is not uniformly portrayed as a 'good thing'. Drawing on Selwyn's notion that use of and perception of digital technology is related to social context, this study explores the activities and practices associated with lecture capture in one institution and the varying contexts (staff, student, subsets of students) in which they take place, rather than the technology itself to show that this technology is not inherently positive or negative, but its value is related to the context and purpose of lecture capture for the user. This approach furthers our understanding of why the 'space' between students and staff is 'contested'. Furthermore, by using a broad range of different types of data, we are able to moderate the rhetoric to present a more nuanced view of this space.

1.2 Research design and questions

Although we are considering some of the same binaries and tensions teased out in current research, we aim to address the identified gaps in the literature by using a mixed methods approach including multiple data sources, captured over an extended period, to explore the perceptions of staff and students using an institutional lecture capture and desktop capture system, on student experience, learning and teaching delivery.

The overarching research question for this study was 'Do students and teachers have similar perceptions about the value of lecture recordings?'. The study had a number of specific sub-questions:

- In what ways do student and teacher perceptions of lecture capture differ?
- How do students use and perceive lecture recordings, and how does use vary by demographic groups?
- Do teaching staff value lecture recording as a useful tool for student learning?
- Do staff perceptions of lecture recordings change over time?
- Are fears about the impact of lecture capture on attendance well-founded?

1.3 The context of the study

A common feature of lecture capture implementations is that staff 'opt-in' and choose whether to engage with the use of lecture capture as part of their teaching practice. A few universities in the UK have implemented 'opt-out' policies, meaning that the normal expectation is for scheduled teaching events to be captured unless the presenter manually prevents the recordings either in advance, during or after the teaching session (Jisc Digital Media, n.d.). Lecture capture was introduced across the site of this study in September 2014, along with an opt-out policy. All of the University's 250 central teaching spaces were equipped with lecture capture functionality, including a physical recording device, microphones (lectern based and ceiling mounted), and where appropriate a video camera. All teaching staff at the University had the opportunity to have their lectures captured on the lecture capture system, and timetabled lectures were automatically captured (unless the presenter opted out).

2. Material and methods

2.1 Study 1: Lecture capture survey – staff perceptions

A staff survey was developed and conducted for the 2014-15 academic year (administered June-July 2015) and again for the 2016-17 academic year (administered November 2017). The survey consisted of 48 questions (and sub-questions) in six sections relating to: personal and professional information; prior experience using technology in a professional context including acceptance and use of technology and prior experience of lecture capture; use of lecture capture, attitudes towards it and intended use in the future; technical issues; feedback from students; and training. This study uses data from selected questions from the survey relating to the impact of lecture capture on teaching style, student learning and attitudes towards it. Only academic staff data are reported.

A draft instrument was tested with a small number of participants, and iterated in response to their feedback in 2014-15. Test users responses are not included in the final data set. Consent was obtained from all survey respondents, and ethical consent for the research was obtained from the University's Research Ethics Committee (LTEDUC-067). A link to the survey was sent to all staff at the University through electronic mail in June 2015. In 2016-17 the survey was shortened to remove the 'technical issues' section and was sent to all teaching staff at the University in November 2017. Consent was obtained from all survey respondents, and ethical consent for the research was obtained from the University's Research Ethics Committee (LTEDUC-090). Staff were allowed four weeks to complete the survey each time.

Responses were organised and grouped as appropriate and numbers (n) and percentages (%) were calculated from the collected data using Microsoft Excel and SPSS. The attitude questions use a 5-point Likert scale Strongly agree, Agree, Neutral, Disagree and Strongly disagree, with the addition of a 'Don't know' option. Where appropriate, responses indicating 'strongly agree' and 'agree' have been collapsed into one variable indicating overall agreement and 'strongly disagree' and 'disagree' collapsed into one variable to indicate overall disagreement. An initial descriptive statistics analysis was conducted to reveal any patterns in the frequencies of responses. A contingency table analysis and chi-square (χ^2) test of association was used to find significant differences between the survey results from each year group. If a chi-square test revealed a statistically significant association ($p < .05$) between the survey response and the year group, Cramer's V was considered for effect size. A post-hoc test was conducted to determine significant differences between the cells in each contingency table that is larger than 2x2, by calculating the adjusted standardised residuals. By convention, an adjusted standardised residual less than -2 suggests that the cell's observed frequency is less than expected, and a residual more than 2 suggests that the cell's observed frequency is greater than expected. High and low proportions indicated by adjusted standardised residuals are interpreted as contributing to the significant differences between the two year groups.

Qualitative data were collected via open-response questions and these responses were coded and thematised inductively into thirteen themes. Staff comments in these themes were compared between years to investigate changes in perceptions to lecture capture over time.

2.2 Study 2: Systems data – attendance data, lecture capture usage data

Large data sets from university systems were obtained to explore the usage of recorded lectures and the possible effect of lecture capture on student attendance.

The analytics for the lecture capture system were accessed to see staff and student users of recorded lectures over four years. Each student username is associated with the number of presentations watched, total views of recorded content (including presentations watched more than once), the number of hours spent watching recorded content, the student's course subject area, and the academic year and month for which the data were relevant. Presentations refer to any teaching session recorded through the lecture capture system and made available to staff and students. This repeated cross-sectional design (Bryman, 2012) allowed analysis of usage over time. Frequencies were calculated to analyse trends in increasing or decreasing views of content over the four years, as well as each month. The number of presentations watched and total views by students were not distributed normally and measures around the median were calculated to compare student usage data over time. The non-parametric Kruskal-Wallis test (χ^2) was used to identify significant differences between the median number of presentations watched, total views and total number of hours for each academic year and each subject area.

The university presentation statistics for the lecture capture system were also accessed for all recorded lectures in both 2014-15 and 2017-18. The data set includes all presentations recorded, the date and time of the recording, the length, the total views it received, and the module code. The module codes were recoded into subject area, year group and stage of study (undergraduate or postgraduate). Also retrieved from University systems data were the attendance data by module for 2014-15 and 2017-18. The data set included all university activities, the date and time of the activity, whether attendance had been formally recorded, the number of students present at the activity, and the activity's module code. This data set was filtered to only include activities that were categorised as lectures and further filtered to only include lectures for which attendance had been recorded. The attendance record for lectures and the analytics for lecture capture were combined, resulting in a data set containing all university lectures for which attendance was formally recorded, the number of students present and the number absent from the lecture, the academic year, date and time of the lecture, the module code, subject area, year group, stage of study, whether or not the lecture had been recorded and uploaded, and the number of views for the recorded lectures. A descriptive statistical analysis was conducted indicating that the attendance data was not normally distributed. Medians were computed for each of 1,000 bootstrapped samples to generate confidence intervals (CI) for the true central value. The non-parametric Mann-Whitney U test (U) was used to identify significant differences between student attendance counts when lectures are recorded and not recorded. To determine whether the percentage of students present is statistically associated with subject area and whether or not a lecture is recorded, a multinomial logistic regression was conducted with the percentage of students present at each lecture grouped into quartiles.

Study 3: Jisc Digital Tracker survey instrument – student data collection

The Student Digital Experience Tracker is a short survey developed by Jisc, to gather data relating to students' expectations and experiences of digital technology (Jisc, 2017). It includes questions relating to access to digital devices, course-related digital activities, institutional-level digital provision and support, and learner skills. An additional question was added to the survey at this institution to collect data relating to student use of lecture capture, in particular how often recorded lectures were made available to students and the reasons student have for watching them. The

tracker was delivered in Online Surveys (formerly Bristol Online Surveys) - an online survey service developed for the UK education sector. The tracker was administered at this university in the first semester of the 2017/18 academic year, and was open to all undergraduate (bachelors) and taught postgraduate (graduate) students from 19 November to 9 December 2017. A full communications campaign was undertaken to attract as many responses as possible. The survey respondents were also entered into a prize draw to win an iPad. Ethical consent for the research was obtained from the University's Research Ethics Committee (LTEDUC-093).

Usable responses were received from 1,734 undergraduate and postgraduate taught students. The data was organised and grouped as appropriate and numbers (n) and percentages (%) were calculated from the collected data using SPSS. Each participant was asked to provide consent and a student ID so that survey responses could be linked to demographic data, such as gender, nationality and course subject area from the University's student information system. Subject areas were grouped as follows: Science, Technology, Engineering and Mathematics (STEM); Business; Arts, Humanities, Social Sciences and Law (Arts and Social Sciences); and Medicine and Health. The survey responses were combined with student demographic data.

An initial descriptive statistics analysis was conducted to reveal any patterns in the frequencies of responses. Next, a contingency table analysis and chi-square test of association was conducted for each survey response with each demographic variable to reveal any significant relationships between the variables. If a chi-square test revealed a statistically significant association ($p < .05$) between two variables, Cramer's V and phi-square were considered for effect size, and post-hoc tests were conducted.

Two open-response questions on this survey elicited a large set of qualitative responses: (i) "To improve your experience of digital teaching and learning ... what one thing should we DO?"; (ii) "To improve your experience of digital teaching and learning ... what one thing should we NOT DO?". These qualitative responses were coded and thematised using an inductive approach into eight overarching themes, noting that some comments contained codes relating to multiple themes.

3. Results

3.1 Total usage of recorded content

Over the 4-year period of the study (2014-15 to 2017-18 inclusive), there were 4.47 million views of recorded content (which includes an individual's multiple views of the same presentation). Of these 82.2% (3,675,871 views) were from logged-in students, with the remainder from staff (2.7%, 121,277 views) and anonymous users viewing externally visible content (15.1%, 674,860 views). Overall, total views of the content increased from year 1 (539,343 views) to year 4 (1,701,388 views). Content views were measured by month, and showed a similar pattern in all 4 years (see Figure 1). On average (over 4 years) during the academic session, views were lowest in September and June, and peaked in January and May (examination periods). During term time (October – December; February – April), median views per month were between 90,000 and 140,000. The remainder of this analysis is based on logged-in student views of the content.

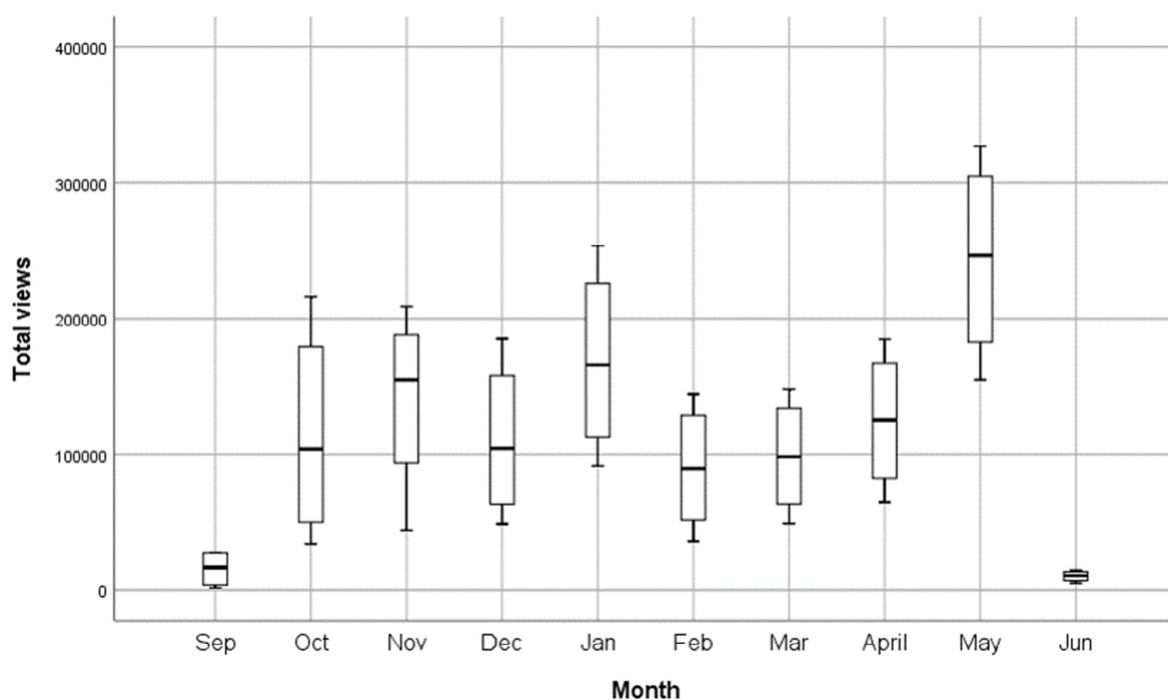


Figure 1. Lecture capture views per month over a 4 year period (2014- 2018)

3.2 Student usage of recorded content

Each academic year, recorded content was viewed by a proportion of the total student population, resulting in an overall count of students watching content for each year. The cumulative total of these annual student equals 89,438 students. (taking into account students being counted in more than one year, this total equals 57,182 unique students over the 4 year period), watching 1,662,438 presentations for a total of 893,977 hours. The proportion of the university's students viewing content at least once increased steadily from 17,133 (50.4%) in year 1 to 27,677 (81.4%) in year 4 (based on a total student population of approximately 34,000, which will have varied slightly per year; exact figures not available). The total number of presentations was calculated by summing the number of presentations watched by each student each year. The median number of presentations watched by students was 10.0 (IQR = 3.0 - 25.0), with the median number of presentations watched per student increasing over the first three years, before plateauing (see Figure 2). The total number of content views was calculated by summing the number of times each student viewed a presentation (including re-watching the same presentation more than once) each year. The median number of views of content per student was 18.0 (IQR = 5.0 - 50.0), with the number of views per student increasing over the first three years and decreasing slightly in the fourth (see Figure 2). Overall, the median amount of time spent viewing content per student was 3h 31m 04s (IQR = 0h 39m 51s - 11h 52m 32s), which increased from year 1-3 and then reduced by almost an hour in year 4 (see Figure 2). The median time each student spent watching content per view was 11m 54s, which also increased from year 1 (12m 05s) to year 3 (12m 35s), and then reduced in year 4 (10m 44s; see Figure 2).

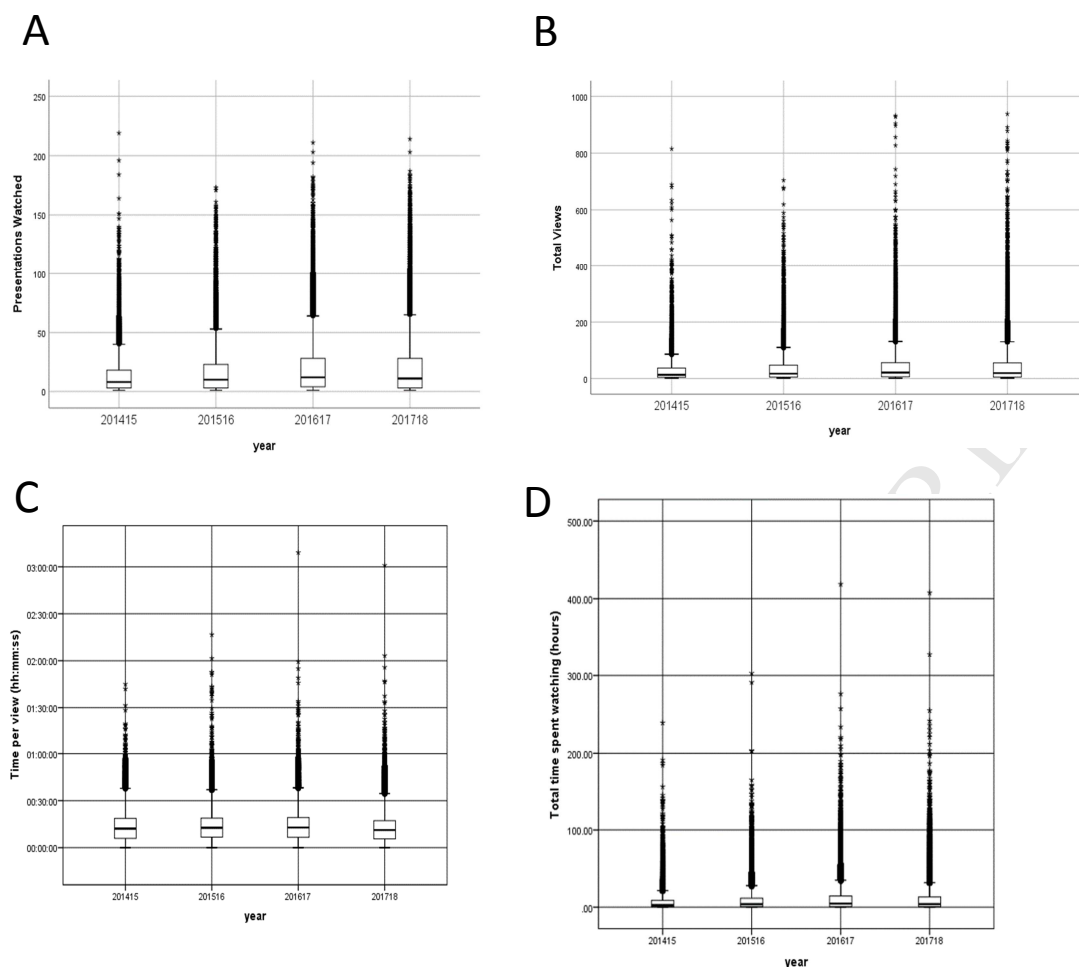


Figure 2. Student views of recorded lectures over 4 year period (2014-2018). A. Number of presentations watched per student each year. B. Number of views per student each year. C. Time spent watching content per view per student each year. D. Total time spent watching content per student each year.

3.2.1 Student usage by subject area

Exploration of views by subject area revealed that STEM students had significantly higher view durations per user (Mdn = 5h 27m 01s, IQR = 1h 12m 12s - 16h 59m 36s; Kruskal-Wallis test $\chi^2(4, n=89438) = 2643.0, p < .001$); and presentations watched per user (Mdn = 15.0, IQR = 6.0 - 35.0; Kruskal-Wallis test $\chi^2(4, n=89438) = 4034.5, p < .001$) than students in other subject areas. However, these results need to be taken in the context of STEM modules having the highest number of lectures and therefore more recorded content available. To explore whether this is the reason for more viewing by STEM students, an analysis of the total number of views and duration of hours of content watched in relation to the number of lectures taking place in each subject area using available data from 2017/18 was conducted. It reveals a significant association between subject area and whether or not a lecture is recorded, with lectures in STEM subjects more likely to be recorded and lectures in Business less likely to be recorded (Chi-square test $\chi^2(4, n=40,947) = 1876.41, p < .001, V = .21$). Usage (i.e. viewing) of recorded content also varied by subject area. Students in STEM subjects who use lecture capture had more views of recorded content per student (Mdn = 27.0, IQR = 9.0 - 72.0), and Arts and Social Sciences had the lowest number of views (Mdn = 13.0, IQR = 4.0 - 36.0).

Similarly, STEM students had significantly higher view durations per user (Mdn = 5h 27m 01s, IQR = 1h 12m 12s - 16h 59m 36s; Kruskal-Wallis test χ^2 (4, n=89,438) = 2643.0, $p < .001$); and presentations watched per user (Mdn = 15.0, IQR = 6.0 - 35.0; Kruskal-Wallis test χ^2 (4, n=89,438) = 4,034.5, $p < .001$) than students in other subject areas. However, results show that the number of views in each subject area are *proportionate* to the number of lectures held within that subject area. For example, 46.8% of lectures captured were in STEM areas, and 47.85% of viewings of lectures were in STEM areas. With the proportions constant, the results concerning usage of recorded content by subject area are not skewed towards the subject area with the most scheduled lectures.

3.2.2 Student views about recorded content usage

Survey data were collected from undergraduate and postgraduate taught students in 2017-18 (n=1,734) about their usage of recorded content. Of these, 78.0% were undergraduates (UG), spread across multiple levels of study (level 1 – 58.8%, level 2 – 19.2%, level 3-5 – 22.0%) and 22.0% were postgraduate (PG) taught students. Within the sample, 61.3% were female and 38.1% male, and the median age was 21 years. Overall, 67.9% of students were from the UK, and the remaining 32.1% were from the EU or other countries (grouped as ‘International’).

Table 1. Proportion of respondents reporting the availability of recorded lectures, organised by study level, fee status, subject area and gender.

Availability of recorded lectures	Always % (n)	Mostly % (n)	Never % (n)
Overall	30.1 (519)	42.4 (732)	6.4 (110)
Undergraduate (UG)	28.7 (386)	44.7 (602)	5.3 (71)
UG (level 1)	35.5 (360)	40.0 (406)	6.4 (6.3)
UG (level 2)	25.8 (86)	45.6 (152)	6.6 (22)
UG (level 3)	19.7 (47)	47.1 (112)	5.0 (12)
UG (level 4)	18 (23)	44.5 (57)	9.4 (12)
Postgraduate (PG)	35.2 (133)	34.4 (130)	10.3 (39)
UK	25.8 (302)	44.4 (520)	7.6 (89)
International	39.2 (217)	38.3 (212)	3.8 (21)
STEM	40.4 (238)	46.3 (273)	2.0 (12)
Business	30.8 (77)	39.2 (98)	5.6 (14)
Arts and Social Sciences	24.7 (147)	36.6 (218)	11.9 (71)
Medicine and Health	16.5 (39)	50.0 (118)	5.5 (13)
Female	29.4 (315)	41.6 (445)	6.9 (74)
Male	31.1 (204)	43.8 (287)	5.5 (36)

Most participants stated that their lectures were recorded and available for viewing on the VLE (see Table 1). This response varied significantly by level with first year students more likely to respond that their lectures were ‘always’ captured and made available compared to students at higher levels (Chi-square test χ^2 (12, n=1,713) = 51.47, $p < .001$, $V = .10$; see Table 1). Responses about the frequency with which lectures were captured and made available was significantly associated with subject area (Chi-square test χ^2 (12, n=1,671) = 147.69, $p < .001$, $V = .17$).

Students in the STEM subject area were more likely to respond that their lectures were 'always' captured and uploaded when compared with students responding from other subject areas, and students in the Arts and Social Sciences were more likely to respond that their lectures were 'never' captured and uploaded.

Table 2. Proportion of respondents reporting their likelihood to use recorded lectures for a variety of purposes, organised by study level, fee status, subject area and gender.

Reasons for using recorded content	Often % (n)	Sometimes % (n)	Never % (n)
Watch recordings to catch up on missed lectures			
Overall	60.7 (1,030)	24.2 (410)	15.1 (256)
Undergraduate (UG)	66.7 (887)	22.6 (301)	10.7 (142)
Postgraduate (PG)	39.1 (143)	29.8 (109)	31.1 (114)
UK	67.5 (778)	19.7 (227)	12.8 (147)
International	46.3 (252)	33.6 (183)	20.0 (109)
STEM	65.6 (384)	24.4 (143)	9.9 (58)
Business	51.2 (126)	32.5 (80)	16.3 (40)
Arts and Social Sciences	57.8 (334)	21.3 (123)	20.9 (121)
Medicine and Health	65.2 (152)	20.2 (47)	14.6 (34)
Female	61.0 (639)	23.5 (246)	15.6 (163)
Male	60.3 (391)	25.3 (164)	14.4 (93)
Note-taking after attending lectures			
Overall	36.9 (628)	39.1 (665)	24.0 (407)
Undergraduate (UG)	36.9 (491)	39.6 (528)	23.5 (313)
Postgraduate (PG)	37.2 (137)	37.2 (137)	25.5 (94)
UK	36.7 (424)	38.5 (445)	24.8 (287)
International	37.5 (204)	40.4 (220)	22.1 (120)
STEM	38.2 (224)	37.3 (219)	24.5 (144)
Business	37.1 (91)	40.4 (99)	22.4 (55)
Arts and Social Sciences	33.9 (197)	39.4 (229)	26.7 (155)
Medicine and Health	44.2 (103)	37.8 (88)	18.0 (42)
Female	39.5 (415)	38.6 (405)	21.9 (230)
Male	32.8 (213)	40.0 (260)	27.2 (177)
Recap on content that may not have been understood after attending a lecture			
Overall	46.2 (787)	38.8 (661)	14.9 (254)
Undergraduate (UG)	47.5 (634)	38.7 (516)	13.8 (184)
Postgraduate (PG)	41.6 (153)	39.4 (145)	19.0 (70)
UK	47.2 (546)	37.5 (434)	15.4 (178)
International	44.3 (241)	41.7 (227)	14.0 (76)
STEM	47.1 (276)	41.6 (244)	11.3 (66)
Business	48.2 (119)	37.7 (93)	14.2 (35)
Arts and Social Sciences	40.4 (235)	39.8 (231)	19.8 (115)
Medicine and Health	56.8 (133)	30.3 (71)	12.8 (30)
Female	47.9 (505)	37.0 (390)	15.1 (159)
Male	43.5 (282)	41.8 (271)	14.7 (95)
Writing assignments			

Overall	40.5 (689)	33.6 (571)	25.9 (441)
Undergraduate (UG)	38.5 (513)	34.9 (465)	26.7 (356)
Postgraduate (PG)	48.0 (176)	28.9 (106)	23.2 (85)
UK	39.4 (456)	32.5 (376)	28.1 (325)
International	42.8 (233)	35.8 (195)	21.3 (116)
STEM	38.7 (227)	35.4 (208)	25.9 (152)
Business	40.2 (99)	36.2 (89)	23.6 (58)
Arts and Social Sciences	43.2 (250)	32.1 (186)	24.7 (143)
Medicine and Health	37.9 (89)	31.5 (74)	30.6 (72)
Female	41.3 (434)	32.8 (345)	26.0 (273)
Male	39.3 (255)	34.8 (226)	25.9 (168)
Revising for examinations			
Overall	52.0 (884)	30.6 (520)	17.4 (296)
Undergraduate (UG)	52.7 (703)	31.7 (423)	15.5 (207)
Postgraduate (PG)	49.3 (181)	26.4 (97)	24.3 (89)
UK	52.8 (611)	29.5 (341)	17.7 (205)
International	50.3 (273)	33.0 (179)	16.8 (91)
STEM	52.7 (309)	33.3 (195)	14.0 (82)
Business	56.5 (139)	30.5 (75)	13.0 (32)
Arts and Social Sciences	50.1 (290)	27.6 (160)	22.3 (129)
Medicine and Health	51.5 (121)	28.9 (68)	19.6 (46)
Female	53.1 (559)	29.1 (306)	17.8 (187)
Male	50.2 (325)	33.0 (214)	16.8 (109)

When asked about the reasons for using recorded content, the vast majority of respondents stated they watch recordings when they have missed a lecture (see Table 2). Undergraduate students were more likely to respond 'often' to watching lecture recordings after missing a lecture than postgraduate students (Chi-square test χ^2 (2, $n=1,696$) = 121.81, $p < .001$, $V = .27$). The frequency with which recorded content was watched when missing a lecture was also significantly associated with subject area (Chi-square test χ^2 (6, $n=1,642$) = 41.45, $p < .001$, $V = .11$), with STEM students most likely to respond 'often' to using lecture recordings in this way (see Table 2). A significantly higher proportion of UK students responded that they watch lectures after having missed a lecture compared with international students (Chi-square test χ^2 (2, $n=1,696$) = 70.02, $p < .001$, $V = .20$; see Table 2).

Overall, a lower proportion of respondents reported watching lecture recordings to write detailed notes after attending lectures, with around a quarter reporting 'never' using lecture recordings for this purpose (see Table 2). This was significantly associated with gender, with a larger proportion of males reporting 'never' using lecture recordings for detailed note-taking, than females (Chi-square test χ^2 (2, $n=1,700$) = 9.93, $p < .01$, $V = .08$). Note-taking as a reason for watching recorded content was not significantly associated with level of study, nationality or subject area.

A high proportion of respondents reported watching lecture recordings to recap on content that may not have been understood after attending a lecture; this did not vary significantly by gender or nationality, but was significantly higher in undergraduate students, compared to postgraduate students (Chi-square test χ^2 (2, $n=1,702$) = 7.53, $p < .05$, $V = .07$; see Table 2). Also, students from Medicine and Health were significantly more likely to respond 'often' to watching recorded content

to recap after lectures than students from other subject areas (Chi-square test χ^2 (6, $n=1,648$) = 31.22, $p < .001$, $V = .10$).

Around three quarters of participants reported watching recorded lectures 'often' for help when writing assignments. The response was significantly associated with level of study and revealed that postgraduate students were more likely to use lecture capture 'often' for help when writing assignments than undergraduate students (Chi-square test χ^2 (2, $n=1,701$) = 10.86, $p < .01$, $V = .08$; see Table 2).

A high proportion of participants reported watching recorded content for help when revising for exams (see Table 2). This did not vary between gender or nationality, but there was a significant difference between undergraduate and postgraduate students (Chi-square test χ^2 (2, $n=1,700$) = 15.86, $p < .001$, $V = .10$). Differences in behaviour were also significantly associated with subject area (Chi-square test χ^2 (6, $n=1,646$) = 19.68, $p < .01$, $V = .08$), as participants from the Arts and Social Sciences were more likely to not watch recorded content to revise for exams.

3.3 Student views about lecture capture

Student views about lecture capture were gathered in an institutional survey about digital education, which included two open ended questions about what the university should do to improve students experience of digital learning and teaching: 'what one thing should we do?' and 'what one thing should we not do?'. There were 1,425 responses to the 'do' question, and 991 to the 'not do' question; of these 211 (159 'do', 52 'not do') comments related to lecture capture. Responses were coded and thematised inductively into the following eight overarching themes: lecture capture ($n=128$), quality of recordings ($n=42$), availability of recordings ($n=28$), recording download ($n=5$), recording titles ($n=5$), pedagogical approaches ($n=5$), accessibility ($n=4$) and use of video vs audio for recordings ($n=3$), noting that some comments contained codes relating to multiple themes.

3.3.1 Lecture recordings

The majority of respondents' comments related to the recording of lectures: 86 comments in the 'what should we do?' question and 42 comments in the 'what should we not do?' question. Overall, these comments suggested that the university should record more (and in lots of cases, all) lectures, with only one comment suggesting that the university should not record lectures. Whilst the majority of respondents provided brief, direct, responses, such as "record all lectures" or "all lectures should be recorded", some respondents provided a rationale for the request for more lecture recording. These reasons included use for note taking, understanding, exam revision, support for international students, support for disabled students and recording of whiteboard contents:

"Ensure that all lectures university wide are lecture captured - university has the facilities and I truly believe it helps you to learn better (how can anyone note take effectively for a solid hour)."

"Capture more lectures and make them available online (useful for foreign or disabled students)."

"Ensure all lectures are recorded because only one of my lectures are and it would be very helpful if they were all."

“None of my lectures are online, I would like to have them online since it can help a lot to be able to listen to what the teacher says multiple times.”

Some respondents were strongly insistent about the university providing these recordings, using phrases such as ‘force’, ‘compulsory’ and ‘opt-out’, and were aware of staff resistance and the counter-arguments from staff about potential absence from lectures:

“Recording lectures and then putting them on the VLE should be compulsory for every school within the university.”

“Force all lecturers to use lecture capture and put up any notes used in lectures up within 2 hours of the lecture (note I don’t miss lectures but this would be useful to access straight away when going over my notes rather than having to wait 2-5 days or longer to do this)”

“Have more recorded lectures ... they are useful for revision, not for bunking off classes.”

What should we not do? “Allow lecturers to opt out of lecture capture, this one of the best tools the uni has which many universities do not.”

“Ensure all lectures are captured, some staff seem to dislike using it and often ‘accidentally’ turn it off.”

One respondent commented “record lectures” in response to the ‘what should we not do?’ question; this represented the only reference to students requesting a reduction in lecture capture recording.

3.3.2 Quality of lecture recordings

A large proportion of the respondents’ comments about lecture capture related to the technical quality of the recordings (n=42). These comments were mainly focussed around sound quality and staff use of microphones, and the quality of recordings of whiteboard content, including in disciplines where there is extensive use of whiteboards (e.g. maths):

“Have lecturers wear their microphone on their attire. Sometimes they move around the room which affects the sound recording in lecture captures.”

What should we not do? “Continue to allow lectures not to wear microphones, for recorded lectures, if they wander away from the desk microphone you can find that you can’t hear what they say on the recordings.”

“Fix lecture recording so that is only looks at the white board and is always in focus.”

“Improve the quality of lecture capture so we can see what is written on the board (maths student).”

“Improve the quality of lecture capture. After being off for family reasons and having to catch up on lectures online, the video is not very clear.”

3.3.3 Availability of lecture recordings

A number of comments (n=28) related to the time between recording of the lecture and the availability of the recording within the VLE. Respondents requested that recordings be made available more quickly, with some suggesting this activity should be ‘prioritised’, and others concerned about the need to catch up with lectures:

“Ensure each lecture capture is uploaded as a priority once the lecture has finished.”

“Get lecturers to upload their lectures ASAP.”

“Upload lectures online quicker - takes too long.”

What should we not do? *“Wait a few days before putting lectures online, as I forget what lectures I need to catch up on before I can watch them.”*

What should we not do? *“Take >2 days to upload lecture recordings.”*

3.3.4 Other themes

The remaining comments fell into five themes, as follows: recording download (n=5), recording titles (n=5), pedagogical approaches (n=5), accessibility (n=4) and use of video vs audio for recordings (n=3). Whilst the majority of these were direct requests, such as *“give recordings meaningful titles”*, *“allow recording download”* or *“put subtitles on lectures capture”* some contained a suggestion to improve learning and teaching:

“Flip the classroom - if most lectures are recorded and change little from year-to-year, why can't students watch the lecture beforehand and use the time in class to broaden their understanding with the lecturer.”

“Do video tutorials of certain questions (e.g. maths question tutorial of a certain way to approach the question) as this would really help us to visualise it instead of just seeing words on a screen.”

“Record seminars not just lectures. Would be useful for revision near exams as not possible to write notes for everything said in seminars.”

“Record the class with image would be better for us to review the class rather than just sound and PPT slides.”

3.4 Staff views about lecture capture

Survey data about staff perceptions of lecture capture were collected in the 2014-15 academic session and again in the 2016-17 session, to provide a view of changes in staff perceptions over time. The 2014-15 survey was completed by 250 academic members of staff and the 2016-17 survey by 222.

3.4.1 Impact of lecture capture on teaching style

In 2014-15, 26.4% (n=66) of academic staff indicated that lecture capture had resulted in changes in their teaching style, whilst the majority of staff responded that it had not impacted on their teaching style (57.2%, n=143). 16.4% of respondents (n=41) did not use lecture capture in 2014-15. In 2016-17, the proportion of staff who indicated that lecture capture had resulted in changes to their teaching style was very similar at 27.5% (n=61), with the majority responding that it had not impacted on their teaching style increasing slightly (61.3%, n=136), as the proportion not using lecture capture reduced (11.3%, n=21).

Of the respondents who indicated that their teaching style had changed as a result of lecture capture, a number of scenarios were explored to understand this perception in greater detail (see Table 3). In 2014-15, a large proportion of respondents indicated that their interactions with students during teaching sessions had decreased as a result of lecture capture. This perception changed significantly in the 2016-17 survey, where the majority of respondents reported that their interaction with students had increased or stayed the same as before lecture capture (Chi-square test $\chi^2(2, n=126) = 10.48, p < .01, V = .29$). Participants in both surveys believed the following factors had also impacted on their teaching style: spontaneous behaviour during teaching session decreased; care with words used increased; care with speed of delivery increased; use of copyrighted material decreased (there were no significant differences between 2014-15 and 2016-17).

Table 3. Staff perceptions about the impact of lecture capture on their teaching style and practices.

	Decreased % (n)	Same as before lecture capture % (n)	Increased % (n)
Use of copyrighted material during lectures			
2014-15	37.9 (25)	60.6 (40)	1.5 (1)
2016-17	36.1 (22)	62.3 (38)	1.6 (1)
Interaction with students during teaching sessions			
2014-15	42.4 (28)	48.5 (32)	9.1 (6)
2016-17	18.3 (11)	58.3 (35)	23.3 (14)
Spontaneous behaviour during teaching sessions			
2014-15	57.6 (38)	39.4 (26)	3.0 (2)
2016-17	50.8 (31)	37.7 (23)	11.5 (7)
Care with words used during teaching sessions			
2014-15	4.5 (3)	36.4 (24)	59.1 (39)
2016-17	1.6 (1)	36.1 (22)	62.3 (38)
Care with speed of delivery			
2014-15	6.1 (4)	68.2 (45)	25.8 (17)
2016-17	3.3 (2)	54.1 (33)	42.6 (26)

3.4.2 Staff perceptions of lecture capture for student learning

Staff were asked to rate their views about a number of commonly cited positive and negative perceptions of lecture capture for student learning. In 2014-15,

respondents agreed that lecture capture encourages students to concentrate more in teaching sessions; this decreased significantly in 2016-17 (Chi-square test χ^2 (5, $n=472$) = 12.98, $p < .05$, $V = .17$). However, respondents overwhelmingly agreed that lecture capture enables students to review content that they missed during the lecture, although this view was significantly reduced in 2016-17 (Chi-square test χ^2 (5, $n=472$) = 23.41, $p < .001$, $V = .22$). Respondents had mixed views about whether lecture capture encourages superficial learning: in 2014-15, 35.3% ($n=72$) agreed with this, whilst in 2016-7 fewer staff agreed (see Table 4). This divergence in views between years was significantly different (Chi-square test χ^2 (5, $n=426$) = 11.87, $p < .05$, $V = .17$). On the contentious issue of the impact of lecture capture on attendance at lectures, the majority of respondents agreed that lecture capture encourages poor attendance at lectures, and this view grew significantly over time (Chi-square test χ^2 (5, $n=426$) = 16.52, $p < .01$, $V = .20$).

Table 4. Staff perceptions about the impact of lecture capture on students learning.

	2014-15 % Agree (<i>n</i>)	2016-17 % Agree (<i>n</i>)	Significance level (Chi- square test)
Lecture capture encourages students to concentrate more in teaching sessions	24.4 (61)	15.8 (35)	$p < .05$
Lecture capture enables students to review content missed during lectures	84.8 (212)	70.3 (156)	$p < .001$
Lecture capture encourages superficial learning	35.3 (72)	24.3 (54)	$p < .05$
Lecture capture encourages poor attendance at lectures	45.1 (92)	53.6 (119)	$p < .01$

3.4.3 Staff views about lecture recording

Staff respondents to the surveys were asked to provide written comments about their views of lecture capture: a total of 417 comments were received, of these 24 were not relevant and were excluded, leaving a sample of 393 comments (196 in 2014-15, 197 in 2016-17) for analysis. Comments were coded and thematised inductively into the following thirteen themes: attendance ($n=55$), audience ($n=5$), delivery ($n=50$), equipment ($n=19$), experience ($n=53$), interaction ($n=43$), learning ($n=101$), learning materials ($n=4$), note-taking ($n=18$), pedagogy ($n=28$), physical ($n=11$), reflection ($n=6$) and time management ($n=6$). Staff comments in these themes were compared between years to investigate changes in perceptions to lecture capture over time.

3.4.3.1 Impact of lecture capture on the in-room experience

Analysis showed that staff were concerned that the recording of lectures impacts detrimentally on the 'live experience' of delivering a lecture, suggesting that spontaneity, performance, ad-libbing, use of anecdotes, movement in the physical space and humour are all reduced. Staff described being 'more robotic', 'less innovative' and 'more transmissive' as a result of lecture capture. These views were expressed as negative aspects of lecture capture in the 2014-15 survey:

“Lecture capture has made lectures a less spontaneous and enjoyable experience. Lectures have become a forum where I am less inclined to engage in interesting ideas or in a discursive manner in cooperation with a live audience, and much more concerned with how things might be taken out of context at a later date.” (2014-15)

“Lecture capture reinforces some of the worst pedagogical aspects of the modern lecture, increasing focus on delivery of material and transmission of material from PowerPoint slides, rather than provoking students to think. It's education as consumption, which is sad.” (2014-15)

“Less humour, less flexibility (i.e. I am much more likely to stick to the predefined slide contents).” (2014-15)

“Impact on student learning through impact on lecturer (less spontaneity, more caution, and less relaxed in presentation, which makes for a less engaging lecture); the same applies for students (i.e. hesitation to participate/speak up).” (2014-15)

In the 2016-17 survey, staff made a similar number of comments related to delivery (n=23, compared to n=26 in 2014-15), but there were some positive views about how lecture capture can support lecture delivery. Whilst the majority of comments related to how lecture capture inhibits spontaneity and the live experience, there were new comments about how lecture capture had allowed lecturers to ‘add pointers’, ‘talk more quickly’, ‘think around a topic’ and be ‘more spontaneous’ as a result of knowing students will have access to a recording of the session.

“Now I can rely on students having access to lectures, I am freed to ‘think around’ a topic... so while I provide a handout as a guide, I am able to extemporise more freely.” (2016-17)

“Knowing that the content will be available to review allows me to add pointers to revision and information, on slides or in speech, that will be significant anchors; it also means that I am less anxious to ensure that everything is clear straight away, since studies show that retention is low from once-only lecture attendance anyway; it is the reviewing that will bed things down.” (2016-17)

“Mostly the combination of lecture and desktop capture allows me to use the teaching time more spontaneously.” (2016-17)

“I engage in more breakout activities during lectures. I also talk more quickly and repeat less.” (2016-17)

Staff also expressed views about the impact of lecture capture on their use of the physical space and the equipment in the room. In 2014-15, there were eight comments about how lecture capture (specifically the microphones and camera angle) had restricted movement; in 2016-17 there were only three comments of this nature:

“Moving about less due to the limited angle of the camera in the lecture theatre I used. Also, I was conscious that this camera did not capture the O/H projector slides I used and this affected my performance at times.” (2014-15)

“It assumes that we talk at the front, while I tend to move around the room - and doesn't always pick up everything in terms of audio recording.” (2016-17)

As above, staff linked the physical restriction to use of the microphone. Some staff suggested this impacted on their delivery and voice projection, but some comments indicated that staff had changed their behaviour during delivery to offer a lecture more likely to be recorded at high quality:

“Forced use of microphone in class affected my delivery - I tended to project less, which I think was a negative thing.” (2014-15)

“Prior to lecture capture, I would not use a lapel microphone, but relied on voice projection. In truth, I prefer still not to use the lapel microphone, because I think knowing that I have to project my voice makes me speak more clearly. When you can hear your own voice amplified, there is a natural tendency to speak more quietly, and less clearly. However, I use the lapel mic now, so that my voice is properly recorded.” (2016-17)

Staff also expressed views about how lecture capture impacts their use of in-room equipment, such as document cameras, whiteboards etc. Largely, these comments described behaviours and changes in teaching practice aimed at improving the quality of the recording, but which were perceived by some staff to reduce the quality of the in-room experience, although they could also improve the experience for students in the room:

“More conscious to write on doc cam rather than white board so material can be captured in rooms without cameras - but I don't find this as easy for student engagement as you tend to be looking down at the doc camera.” (2014-15)

“I cannot use the white board anymore, nor can I use a laser pointer.” (2016-17)

“Write bigger as not all cameras can capture small writing on board.” (2016-17)

Staff made a large number of comments about the impact of lecture capture on interactions between teachers and students, and students and students, during teaching sessions. In both years, the majority of staff comments related to the perception that interaction with students had reduced as a result of lecture capture (including particularly some sub-groups of students), but some staff described no changes in interaction:

“For interactive lectures, then it has a strong potential to discourage less confident students from contributing openly to the group.” (2014-15)

“Students are reluctant to ask questions if its being recorded.” (2016-17)

"It may affect students' confidence in asking questions - this is not particularly my experience and did not notice a huge difference between this year and last." (2014-15)

However, there were also comments from staff in both years that showed there was considered use of the lecture capture system and its functionality to maintain and encourage student interaction, activities and discussion, although this was sometimes perceived to impact negatively on delivery:

"I stop the recording to create spaces of discussion. It is a way to signpost different stages in the class." (2014-15)

"I do a lot of short interactive discussions and remembering to switch lecture capture on/off is slightly detrimental to flow." (2016-17)

"No reduction of interaction because I do not use lecture capture in highly interactive sessions." (2016-17)

"Students may be reluctant to answer questions but in that case I simply pause recording to allow discussion." (2016-17)

"Increased student interaction - using lecture capture to summarise key aspects of the session." (2014-15)

In both years' survey, staff expressed concerns about the impact of lecture capture on students' note-taking during teaching sessions. Staff were concerned that students were not taking sufficient notes, or learning the skills of note-taking, as a result of a recording being available, making clear links between note-taking and student learning:

"I think there is a risk of students not taking sufficient notes or paying sufficient attention in class thinking they can review the subject later on using the lecture capture on line." (2016-17)

"Taking notes by hand enhance learning in my opinion because students to pay attention and edit the information as they do it." (2014-15)

"Learning to listen and to take notes is a key skill for students." (2016-17)

However, other staff (particularly in 2016-17), expressed opposing views, suggesting that lecture capture had allowed students to concentrate more on understanding lectures, once freed from the need to take detailed notes in real-time:

"Some do not take as many notes during the lecture and instead concentration on the delivery of the lecture (and take notes afterwards using lecture capture)." (2016-17)

"Students can focus on understanding, rather than trying to take a full set of notes." (2016-17)

3.4.3.2 Impact of lecture capture on student learning

The majority of staff comments in both years of the survey were coded into the theme of 'learning'. The vast majority of these comments related to a perception that lecture capture was negatively impacting on students' learning; due to the large number of comments in this theme, they were further coded into sub-themes, as follows: (a) impact on independent thought; (b) regurgitation of lecture material in examination answers; (c) reduction in extra reading; (d) lack of improvement in marks; (e) rushed use of recordings for revision; (f) impact on listening and understanding during lectures; (g) increase in superficial learning. An over-arching theme within these comments was the role of the lecture in the learning process, and the impact that lecture capture has on this – many staff comments referred to the lecture as the 'jumping off point to further reading', and were concerned that lecture capture had resulted in less engagement with extra reading or independent research, resulting in the comments about 'superficial learning'. Staff were also concerned about students' poor time management skills as a result of lecture capture. Also, many comments linked this to the way that students prepared for examinations as a result of lecture capture, suggesting that revision had become a 'Netflix style' activity of binge-watching recordings prior to examinations.

"Lecture capture discourages independent thought." (2014-15)

"Lecture capture reinforces the perception that lectures are simply about transmitting information to students, and they think that as it has been 'captured' for them they can access it whenever they want, which saves them the effort of actually internalising it or thinking about it." (2014-15)

"I am concerned that use of lecture capture will encourage superficial learning in order to pass assessments rather than anything 'deeper'." (2014-15)

"Some students will note specific phrases used by a lecturer to parrot in assessment, rather than completing their own research." (2016-17)

"Access to captured lectures creates a parallel to Netflix in that students do not catchup on lectures during the semester, but rather binge watch lectures immediately before the exam. Thus, captured lectures perpetuate superficial learning." (2016-17)

"It seems good for revision, although the danger is that students over-rely on the lecture as an authoritative statement rather than a source of stimulus for research-led learning." (2016-17)

A number of comments related to the perception from staff that lecture capture had not resulted in improvements in marks, or indeed produced reductions in performance, thus questioning its value. These perceptions were anecdotal or derived from local analysis:

"Marks for work in which lecture capture has been used have not significantly changed compared with marks before. The outcome of the process has therefore not been beneficial to the students in terms of the marks they gain." (2014-15)

"We have evidence that shows, students don't come to lectures and don't engage with the lecture capture material until immediately prior to exams. There is no positive effect on mean module score." (2014-15)

"....This was evidenced by a 12% drop in performance on an MCQ section of the exam (despite the questions being the same or similar to last year) and a smaller, but noticeable drop in quality (i.e. depth of understanding) of their exam essays." (2014-15)

Further comments related to the impact of recordings on students with differing abilities within courses. There were mixed views from staff about whether 'weaker' or 'better' students were able to derive more value from lecture recordings, suggesting that further evidence is needed in this area:

"Lecture capture seems to benefit the 10 or 15% of highly engaged students in our modules who use it as an extra study device, but still come to class. However, the negative impacts upon the larger numbers of students in the middle and at the lower end of the grade scale far outweigh the benefits for those who use it as another study tool (poor attendance, lack of attention, lack of engagement)." (2016-17)

"it very much boosts the tail end of the cohort or those that struggle the most, and is used relatively less by the top end (I tend to check this by going through the usage stats)." (2016-17)

"Overall, I feel (I have no proof for this) that the lecture capture system increases the divide between weak and good students." (2016-17)

Despite the consistently negative perceptions from staff about the impact of lecture capture on students' learning, there were also large numbers of comments about the value it has for students with disabilities, learning difficulties and students whose first language is not English. Some staff also note the value of recordings to allow students to 'catch-up' following periods of absence. However, a number of staff comments framed these responses in a way that assumed that only these groups of students could derive any value from lecture recordings:

"I think most students ignore lecture capture, but it is vital for those with specific learning differences and those who miss class." (2016-17)

"It is a very useful resource for students with disabilities and SpLDs; for students for whom English is not a first language (the majority of my PGT students). However, I am not convinced that it enhances focus and concentration in lectures, nor that students do return to LC as a learning resource at a later date (since it is time consuming)." (2016-17)

"If students are ill, it's very positive to be able to still expect them to get up-to-speed, without this involving a long meeting with me." (2014-15)

"It is very useful for PG students whose English is poor. I have no idea why lecture capture is appropriate for native English speaking undergraduates." (2014-15)

"Lecture capture helps to level the playing field for students with disabilities or caring responsibilities which reduce their ability to attend lectures." (2016-17)

3.4.3.3 Impact of lecture capture on attendance

A large number of staff comments in both surveys related to students' attendance at lectures as a result of lecture capture. The vast majority of these comments demonstrated the widely held staff view that lecture capture results in reduced attendance, and encourages lack of engagement with academic study;

"They just don't turn up to lectures any more with attendance below 10% on occasion - this never happened before lecture capture!!" (2014-15)

"I've had the poorest lecture attendance from my 2nd year class this year since I first started lecturing 9 years ago. Of course it could be coincidence...." (2014-15)

The majority of staff comments in the 2016-17 survey were of a similar nature in relation to a reduction in attendance as a result of lecture recordings (although there were fewer comments about attendance than in the previous survey), but there were some contradictory views presented:

"I have not noticed anything irregular in terms of attendance to lectures or how students have worked towards exams." (2016-17)

"Attendance has not been affected." (2016-17)

3.4.3.4 Impact of lecture capture on pedagogical approaches

Whilst the predominant view from staff about lecture capture was negative, there were a number of comments relating to how staff perceived lecture capture (and desktop recording facilities) positively, particularly in relation to changing pedagogical approaches, reconsidering the notion of the lecture, and use of flipped learning. Whilst there were some examples of this in the 2014-15 survey, the majority were expressed in 2016-17:

"deeper learning through use of virtual lecture snippets that create extra time for interactive tasks in lectures." (2016-17)

"Mostly the combination of lecture and desktop capture allows me to use the teaching time more spontaneously. What might have been a boring "broadcast" lecture is given online via desktop capture, with time to go over the particular problems students had, and case studies, in the face to face time." (2016-17)

"I have always tried to flip the classroom, but having the system in place has reinforced my confidence." (2016-17)

"mainly just thinking differently about the point of lectures." (2016-17)

“Lecture capture tools open up new ways of teaching. The benefits are not so much in having the lectures recorded, but being able to create new learning resources to aid teaching.” (2016-17)

However, these changes have not been universally welcomed by staff colleagues:

“There is at least one module that I know of that has been taught using a bastardised “flipped classroom” approach, whereby the lecturer releases the lectures from the previous year and then attends the lectures to answer questions without a structure to that session. The student pass the exams, but do not seem to learn much based on our interactions with them later. Indeed, they actually rely on previous modules for guidance in that area when they need to apply those skills. Hence there is a danger that lecture capture will encourage lazy, ill-informed pedagogy among staff.” (2016-17)

3.4.3.5 Staff professional development

A small number of comments in both years of the survey related to how staff have valued the availability of recordings to be able to review their own teaching (and that of colleagues), and their delivery and teaching style, and reflect on this for future teaching activities:

“The most useful side effect has been that I can see how long I spent on different sections and activities, which helps planning for future years and self-reflective practice.” (2016-17)

“I use lecture capture as a way to evaluate how I present my body and express myself in lecture settings. This allows me to adjust some elements of my behavior.” (2014-15)

3.5 Lecture capture and attendance

The university has an attendance monitoring policy, which states that attendance is monitored across all years, by taking a paper register in a lecture, for the purposes of student support, well-being and reporting. The policy states that ‘The attendance of all taught students must be monitored by the parent school at least weekly throughout each semester.’ ([reference to be supplied after review], 2015, p.1.) This applies to both undergraduate and postgraduate taught students but not research students. In reality this means that some schools monitor the minimum required whilst others monitor attendance more regularly. The attendance data is also used to satisfy Home Office requirements to report international students who fail to complete registration or who are excluded due to absence. Attendance data is also used to meet the professional/statutory body requirements for certain programmes of study.

Table 5. Number and median attendance for lectures captured and those not captured by group, 2014-15 and 2017-18

	2014-15			2017-18		
	Median % attendance (N)		Sig	Median % attendance (N)		Sig
	when lecture captured	when lecture not captured		when lecture captured	when lecture not captured	
Overall	84.6 (6246)	86.1 (9876)	p<.001	81.0 (7402)	85.7 (4669)	p<.001
UG	82.4 (4501)	84.2 (6914)	p<.001	77.8 (5523)	82.1 (3269)	p<.001
PG	92.9 (1302)	91.3 (2751)	p<.001	91.2 (1599)	93.3 (1250)	p<.001
STEM	85.0 (1851)	85.8 (1698)	p<.05	78.4 (2888)	84.6 (732)	p<.001
Business	82.9 (531)	87.9 (1123)	p<.001	82.0 (318)	84.0 (545)	Not sig
Arts and Social Sciences	82.5 (3039)	85.7 (6602)	p<.001	81.0 (3247)	84.8 (2617)	p<.001
Medicine and Health	91.7 (825)	91.2 (453)	Not sig	87.5 (949)	89.4 (775)	p<.001
Year 1	83.3 (1662)	83.9 (1965)	Not sig	80.5 (1909)	80.0 (1043)	Not sig
Year 2	81.6 (1519)	83.3 (3026)	p<.001	75.6 (1943)	82.4 (1254)	p<.001
Year 3	81.3 (1320)	85.0 (1923)	p<.001	75.0 (1604)	83.3 (907)	p<.001

Shaded indicates that attendance is higher when lecture is captured

N/A – not available

In 2014-15, 16,122 lectures held across the university had attendance recorded into the university's system. This represents 31.8% of the total of 50,685 lectures which took place across the university. The median percentage of students present at each lecture where attendance was recorded was 85.7% (IQR = 75.0% - 93.3%). Of the 16,122 lectures for which attendance counts exist, 38.7% (n=6,246) were recorded. An analysis of the data suggests that attendance may be affected by whether or not a lecture is recorded. The median percentage of students present when the lecture was captured was 84.6% (IQR = 75.0 – 92.8%) and 86.1% (IQR = 76.2% - 93.8%) when the lecture was not captured. Medians were computed for each of 1000 bootstrapped samples. The resulting 95% CI for the median percentage of students present when the lecture was captured was 84.2% to 84.8% and 85.7% to 86.5% when the lecture was not captured. A Mann-Whitney U test indicated that the percentage of students present at a lecture was significantly higher when it was not captured (Mdn = 86.1%) than when it was captured (Mdn = 84.6%), (U = 28698791.5, p<.001; see Figure 3).

When attendance and lecture capture was explored by academic stage (undergraduate/postgraduate), discipline and year group, in most sub groups attendance was higher when the lecture was not captured, and most of these differences were significant (see Table 5). However, this was not the case for postgraduates, or for the discipline of Medicine and Health, where attendance was higher when the lecture was captured (but not significantly, see Table 5). The largest difference in attendance by discipline when lectures were captured versus when they

were not was in Business, and the difference for year groups increased as the year increased. Year 1 shows a difference but was not significant, and this difference increased through year 2 to year 3, both of which were significant (see Table 5).

The same analysis was conducted for 2017-18, during which 12,071 lectures held across the university had attendance recorded into the university's system, which represents 23.5% of the 51,342 lectures which took place. The decrease in the number/proportion of lectures for which attendance was recorded from 2014-15 to 2017-18 was a result of a change in the attendance recording system. Due to the large size of the samples, this difference does not affect the rigour of the statistical analysis. Of the 12,071 lectures for which attendance counts exist, 61.3% (n=7,402) were recorded. The median percentage of students present when the lecture was captured was 81.0% (IQR = 66.7% - 91.1%) and 85.7% (IQR = 73.1% - 94.2%) when the lecture was not captured. Medians were computed for each of 1000 bootstrapped samples. The resulting 95% CI for the median percentage of students present when the lecture was captured was 80.5% to 81.5% and 85.0% to 86.2% when the lecture was not captured. A Mann-Whitney U test indicated that the percentage of students present at a lecture was significantly higher when it was not captured (Mdn = 85.7%) than when it was captured (Mdn = 81.0%), ($U = 14580045.5$, $p < .001$, see Figure 3).

When attendance and lecture capture was explored by sub group, attendance was higher when lectures were not captured for most sub groups, and most of these differences were significant (see Table 5). However, this was not the case for Year 1, where attendance was higher when lectures were captured, although this difference was not significant (see Table 5). Attendance was lower for captured lectures for other year groups and this difference increases through year 2 to year 3, both of which were significant (see Table 5). Attendance was higher at all non-captured lectures in all disciplines.

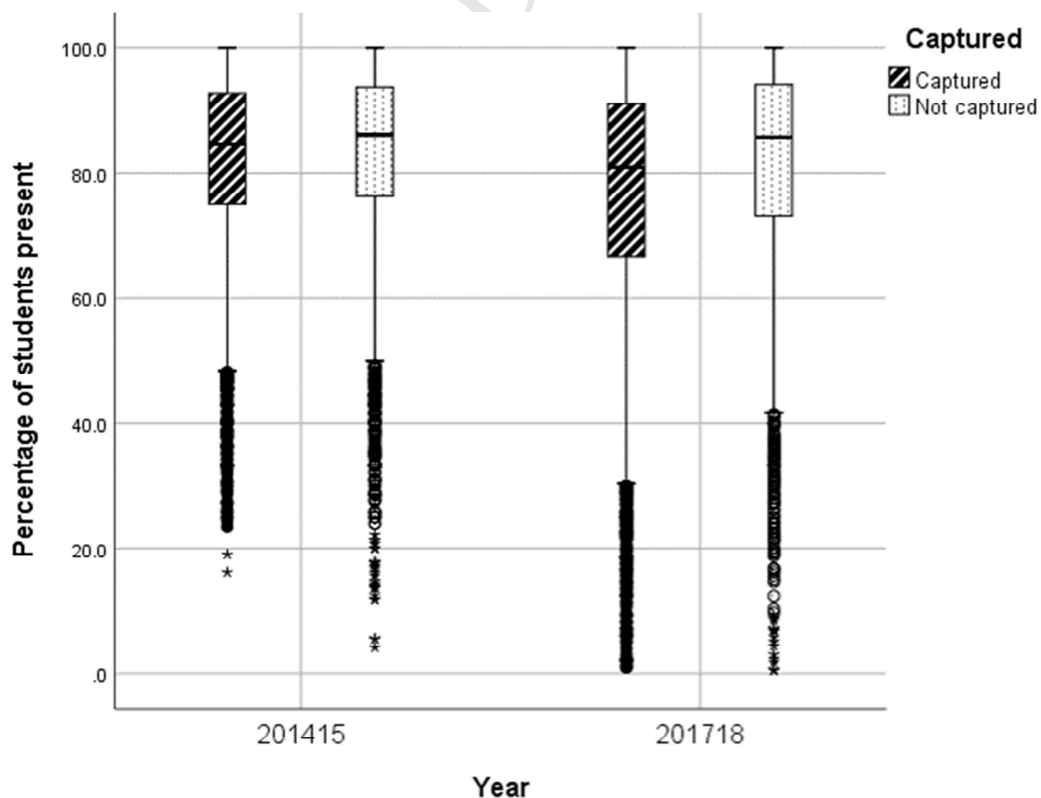


Figure 3. Percentage of students present in lectures that are captured versus not captured (2014/15 and 2017/18).

ACCEPTED MANUSCRIPT

4. Discussion

This paper reports an in-depth view of staff and student perceptions, student use, and impact on attendance, of lecture recordings in a large institution, using multiple data sources over extended time periods. In answer to the overarching research question the data show that the majority of staff and students have differing perceptions regarding the value of lecture capture. Put simply, the staff were largely negative about the value of lecture capture, citing its impact on teaching approach, interaction, student concentration, the development of note-taking skills and attendance. In contrast, the majority of students surveyed valued the flexibility and access to lecture content after the lecture has taken place that lecture capture affords and called for all lectures to be captured, for the recordings to be made available sooner, and for the quality of audio and video to be improved. Many studies across the globe have reported similar findings (e.g. Groen et al., 2016; Bond & Grussendorf, 2013; Danielson et al., 2014; Elliott & Neal, 2015).

However, this study has supplemented the survey data focusing on perceptions of lecture capture with students self-reported reasons for using lecture capture, and large university systems data sets relating to lecture capture usage by students, attendance at lectures captured vs. those not captured and student demographic data, making this study novel in its ability to triangulate these data with 'perceptions'. The data also adds two additional dimensions, exploring staff perceptions over time and exploring students' use of lecture capture by group.

Quantitative data from this study show that around a quarter of staff believed that lecture capture had resulted in a change in their teaching style, becoming more transmissive, less spontaneous, less likely to engage students and more cautious about what they say, in line with previous studies (Bond & Grussendorf, 2013; Taplin et al., 2014; Chang, 2007), and our research demonstrates that this belief is consistent over a sustained period at the site of this research. Staff strongly perceived that lecture capture reduces students' concentration and interaction in class, and that attendance is reduced. Our findings, over a sustained period, are similar to Bond & Grussendorf's (2013) findings that the recording of a lecture changes the lecture in three ways; the reduction in attendance changes the atmosphere, its recording devalues it as a live performance and thirdly the performer changes their behaviour due to being conscious of being recorded.

Qualitative data from this study also show that staff have long-standing and on-going concerns about the impact of lecture capture on students' learning, believing that students are failing to read beyond the lecture, engaging in superficial learning, and demonstrating reduced note-taking skills.

At the same time, quantitative data from this study demonstrate that there is strong student demand for, and usage of recorded lectures, over a sustained period of time. Students have significant engagement with content, both for examination revision and during term-time. Students cite a range of reasons for using lecture capture, including note-taking, deeper understanding, revision, as well as for catching up on missed teaching. There is also a demand for consistency across the university: for all lectures in all their subjects to be captured and uploaded, and in some cases for changes in teaching approach.

Utilising the breadth of data sources in this study enables the study to progress beyond these polarised, binary views of lecture capture being good or bad. Three-quarters of students report using lecture capture for additional note-taking and 85% for recapping on content, which although is self-reported, suggests a strong engagement with the content and an attention to note-taking. Indeed, some staff

reported increased concentration in class due to the opportunity to write more detailed notes later that lecture capture provides. Staff also have concerns about the impact of lecture capture on interaction in teaching sessions. However, the proportion of staff reporting a decrease in interactions has reduced between the two surveys, from 42.4% to 18.3% and staff reporting an increase in interactions with students has risen from 9.1% to 23.3%. Staff reported lecture capture being used predominantly by students at exam time as one respondent called it to 'binge watch' lectures. Although the systems data reveal that lecture capture viewing is at its highest around exam time, it is accessed by significant numbers of students across the whole academic year. In general, staff firmly believe that lecture recording reduces students' learning, for the majority of students, conceding only that it may be beneficial for disabled students and students for whom English is not their first language. Whilst students of all demographic categories claimed to use lecture recordings to support their learning, staff believe that only international students use, and derive value from recordings, contrary to our data showing that all categories and levels of students use lecture recordings, and perceive them to have value.

We noted significant variance in usage and reasons for watching content by student demographic group, which highlights the nuanced digital experiences of students at the same institution. These experiences with lecture capture are intertwined with i) individual lecturer's adoption of the practice (and thus availability of recorded content) and ii) the needs and preferences of the individual learner in terms of when, for how long and why recorded content is watched.

STEM students spent more time watching recorded content, for longer durations than students from other subject areas, and a higher proportion cite missing lectures as a reason for 'often' watching recorded content. Medicine and health students were more likely to watch recorded content to recap after a lecture and Arts and Social Sciences students showed the lowest number of views of recorded content and make up the highest proportion of students relaying experiences of lectures not being captured and recorded, not accessing content after missing a lecture and not using recorded content for exam revision. Less usage of technology enhanced learning in Arts and Social Sciences aligns with previous reports (Walker et al., 2013). Behaviours differed according to educational level too, with more undergraduates accessing recorded content when missing a lecture, to recap or to revise and more postgraduates accessing recorded content for help when writing assignments. More first year students in particular responded that all their lectures were recorded and made available on the VLE, perhaps linked to introductory level of the content as suggested in research (Nordmann et al., 2018). Finally, there is also evidence of variance in behaviour according to nationality, with UK students seemingly more dependent on lecture capture when missing lectures and international students more dependent on watching recorded content for help when writing assignments – linking to the argument made in previous studies that international students may benefit differently from watching recorded content (Cortinhas, 2017; Groen et al., 2016; Hall & Ivaldi, 2017).

Many staff claimed that lecture capture impacts negatively on attendance and this view has grown over time. Our data suggest that staff fears are founded to some extent. In terms of attendance at lectures, analysis of our large data set showed a statistically significant reduction in attendance for recorded lectures in 2014-15 and in 2017-18. When analysed by sub group the data show that in 2014-15 this affected Business lectures the most but by 2017-18 it affected STEM subjects more than other disciplines. In both periods of data collection it affected the later year groups

more. Although over 80% of students attended lectures that were recorded, the difference between the percentage of students present in a recorded lecture and in a lecture that wasn't recorded in each is marginal in context, but statistically significant in the analysis. The drop in attendance is negligible in comparison to the number of lectures accessed, which suggests that students reporting that they didn't only watch lectures when they had missed a lecture and for revision purposes is convincing. However, the gap between students present in recorded lectures and non-recorded lectures is greater in 2017-18 than in 2014-15, suggesting that, if the trend continues, recorded lectures may result in lower attendance in the future. These data are significant given the large data set and multi-year analysis, and will fuel the on-going debate about the impact of lecture capture on students' engagement with lectures.

4.1 Implications for practice

There is clearly a contested space between students and teaching staff about the value of lecture recordings for student learning, which supports Selwyn's notion that use of digital technology is complex and is shaped by the social context in which it is used (Selwyn, 2017), and in our research, by the context of the person using it: staff or student. Whilst there is little rigorous evidence about the impact of lecture recordings on student attainment either way, our data show many staff are sceptical about its value and feel it is undermining the teaching and learning experience of lectures. Overall, the majority of staff appeared resistant to consider alternatives to the traditional lecture, believing that in-room technologies such as lecture capture, microphones, document cameras etc., interfere with the lecture process, devalue the lecture and reduce the learning opportunities for students. Students, however, seem to value these approaches, both for the quality of recorded content but also to allow engagement with the content during the live experience. Some staff did not seem to consider that use of these tools could enhance the students' experience in the room, only thinking of the audience watching the recording after the event. As the need for providing a more inclusive classroom experience grows, teachers may need to consider the role of in-room technologies to support the learning experience of all students. There is evidence of a growing population of academic staff who are engaged in reconsidering their approach to teaching and learning as a result of technologies such as lecture capture and desktop capture. These staff are embracing the opportunities provided by technology to change their pedagogical approach, and use class time differently, as active learning sessions, to enhance student interaction and engagement.

Lecture capture appears to have had unintended consequences in terms of staff delivery of lectures. Previous research demonstrates that students value active learning teaching sessions, where they are engaged in interaction, problem-solving and discussion with their teachers (Freeman et al., 2014). If this active learning is lost as a result of staff changing their delivery style due to lecture capture, students may be more likely to be disengaged during the session, and more likely to miss lectures. Previous research on students' self-regulated learning habits suggests that students with a high level of self-regulation and engagement with their learning will make choices about how to use their available time to best advantage, and may consider engagement with lecture recordings a more effective use of time (Littlejohn et al., 2016). As our data shows, students report high levels of engagement with recordings for note taking, and system data shows they view recordings around 10 – 14 minutes per view. If the live lecture loses interactivity, discussion and intellectual

richness, students may perceive that they are able to gain equivalent value from a recorded lecture, in reduced time.

It is not difficult to see why students have a positive attitude towards lecture capture. It allows them to have flexibility of when and what to attend, and it may well be that those lectures that are captured are those that sometimes get missed because they do have the option to be viewed later. Increasingly students have other pressures on their time, paid work and their own and parental pressure to achieve high grades and exercising this type of choice may be a result of these competing priorities. There are also those students who miss some lectures, fully intending to watch them later, but for whatever reason, fail to do so and catch up at exam time, a strategy that staff feel lecture capture encourages. These may also be reasons why we have seen more of a drop off in attendance in years 2 and 3, as the workload and pressure increases. It may also be due to students exercising choice around attendance at the lectures they believe bring value versus those they don't. One can also see why staff may have a largely negative view of lecture capture for such reasons but also due to all those reasons stated about the consequences of being filmed (Bond & Grussendorf, 2013). This might explain why some lectures are becoming more transmissive – it feels safer to carry out a didactic lecture when being filmed than to try out innovative, more active approaches to teaching. Such fears can be helped to be overcome through additional training and reassurances about surveillance.

The space between students and staff in terms of digital technology is likely to continue being contested as different technological systems and devices continue to be introduced, as the groups are responding with different priorities in mind: students want flexibility and choice to underpin how they learn and staff want flexibility in their professionalism – in terms of their teaching styles, pedagogical considerations and choice to opt-out of lecture capture. On an institutional and practice-based level, this research prompts questions on how universities are to facilitate flexibility for both groups, moving beyond the dichotomy that pits students and staff against each other. With students' experiences of captured lectures varying across subject area, level and nationality, the student body's common emphasis is on quality recordings being uploaded sooner rather than later. Once available, their time spent and reasons for watching content varies, showing that students want the flexibility and choice – as facilitated by digital technology usage in higher education. On the other hand, staff seem to be emphasising the same need for flexibility and choice when it comes to the use of institution-wide digital technology in their teaching roles, with some of the resulting behaviours contradicting what students may associate with flexibility and choice in their learning. Although the systems analysis shows that the number of lectures being captured and uploaded has increased over the last four years, indicating increased staff adoption, the qualitative analysis of staff's free text responses to the survey brings up issues around digital technology decreasing their flexibility and choice (spontaneity during lectures, navigation of the physical space, interaction) as professionals and experts in their teaching roles. Flexibility and choice manifests differently in the acceptance, adoption and usage of digital technology of different stakeholder groups, where students experience an increase through the lecture capture system, and some staff feel a decrease. This study points to the value of going beyond the rhetoric of positive and negative views of lecture capture to an understanding of why these polarised views exist and how lecture capture might be better integrated into a range of teaching approaches.

Overall, our research suggests that universities may need to consider their teaching approach when using lecture capture, and become more open to use of the tools to provide content flexibly for student use before and after teaching sessions, consider the use of technology as supporting an inclusive teaching approach and adapt teaching sessions to deliver less content and engage students in more interaction. Furthermore, it may be beneficial for staff to discuss their pedagogic rationale with students, when lecture recording is not in place, and support them with skills to use recordings to maximum effect. These interventions may help to reduce the contested space currently apparent between students and teaching staff, in relation to the use of and value of lecture recordings.

4.2 Limitations and further research

We recognise that the sample of staff who engaged with our research is relatively low, but it represents around 11% of the academic staff population at the university. We also recognise that the staff who responded to the lecture capture survey may have been those with stronger negative views than the wider academic community, which may have skewed our findings. We believe that our student data set, and the large scale of the systems data explored in this study, offers generalisable data which can be confidently interpreted. Whilst our study has provided detailed insight into student and staff perceptions of lecture capture, and demonstrated the usage of the system and its impact on attendance, we have not provided any research on the impact of lecture capture on learning outcomes. This appears to be the missing piece in the puzzle, which needs to be addressed urgently on a large-scale with authoritative data collection, analysis and reporting. Although there are studies demonstrating both positive and negative impacts of lecture capture on students' learning outcomes, these are generally not well controlled, large-scale or appropriately analysed, and don't reveal trends, patterns or differences due to demographic variables.

5. Conclusion

The debate about lecturing versus active learning, and the use of recording systems to capture teaching content is clearly complex and contested. It is fundamental to the process of teaching and learning in the majority of universities, and involves the whole academic community and the whole student population. However, the arguments on both sides tend to be over-simplified, suggesting that one solution is better than another in all situations. This ignores the complexity of learning and teaching, in relation to the needs of the learners, the desired learning outcomes, the pedagogical approach, the physical and virtual spaces available, the technological tools available and the digital literacy of the staff and students. Each of these factors varies by discipline and level, and will often vary within a single course or degree programme. Such variability means there is rarely, if ever, a single 'one size fits all' approach to learning and teaching, and increases the importance of staff understanding the curriculum design and pedagogical approaches which will help their diverse cohort of learners to meet their learning needs; in our digital age, this requires staff to have a strong understanding of educational technology, including its affordances and drawbacks.

With such high student demand for use of lecture capture, it is ever more important for teaching staff to explain their pedagogic rationale to their students, and to explain the importance of note-taking, understanding and extra reading as key aspects of the learning experience. For staff, there needs to be an acceptance that

educational technologies are not going away, and that they need to design inclusive curricula and pedagogical approaches, which include use of tools such as lecture capture, and use these where pedagogically appropriate to cater for their students' needs. In many cases, learning and teaching will take place through class time involving a mixture of didactic delivery (lecturing) and active learning (participation, interaction, collaboration), and education technologies such as lecture capture will be valuable to record the didactic parts (for later use by students), whereas other technologies such as voting tools, collaborative writing tools, web resources etc. will be valuable for the active learning parts. In this scenario, curriculum design, digital literacy, space configuration and technology can work together to help learners to achieve their learning outcomes.

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Key findings:

- Students use lecture recordings during term time for learning, and for assessment preparation and examination revision
- Students request more lecture recordings and quicker access to recordings
- Students attendance when lectures are recorded is significantly lower
- Staff have mixed views on the effectiveness of lecture recordings to support learning
- Staff perceptions of the value of lecture recordings change over time