

RESEARCH ARTICLE

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# Staff and student views of lecture capture: a qualitative study



Eleanor J. Dommett<sup>1,2\*</sup>, Benjamin Gardner<sup>1</sup> and Wijnand van Tilburg<sup>1</sup>

\* Correspondence: [Eleanor.dommett@kcl.ac.uk](mailto:dommett@kcl.ac.uk)

<sup>1</sup>Department of Psychology, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London SE1 1UL, UK

<sup>2</sup>Centre for Technology Enhanced Learning, Waterloo Bridge Wing, Franklin-Wilkins Building, 150 Stamford Street, London SE1 9NH, UK

## Abstract

Many universities now use lecture capture. We used focus groups to investigate perceptions of lectures and their capture in staff ( $N = 8$ ) and students ( $N = 17$ ). We found that staff and students held different views of lectures and this impacted on their perceptions of lecture capture. Our findings confirmed a range of previously identified uses of lecture capture and additionally demonstrated its use to model expert behaviour. Furthermore, we report here that students felt lecture capture reduced anxiety, particularly for those with disabilities, indicating that lecture capture may be a useful tool in creating an environment that supports mental wellbeing. Despite this potential value of lecture capture, it was still perceived to have some negative impact on the live lecture; reducing the interaction with students and prevent staff using anecdotes and humour in their teaching, which could reduce the value of the lecture capture.

**Keywords:** Lecture capture, Qualitative study, Student participation

## Introduction

Lectures are commonly used within universities, offering a practical approach to teaching large classes (Behr, 1988). Research shows that students value lectures, reporting that they feel involved in learning and able to engage in independent thinking and problem solving during teaching (Covill, 2011). Furthermore, lectures provide students with an opportunity to see how experts approach tasks (Feldon, 2010), and can help build new knowledge into their existing frameworks (Mallin, 2017) in a way that they may not managed from reading alone (Kirkpatrick, 1990).

In recent years, the recording of live lectures, referred to as lecture capture, has become increasingly common and has already been the focus of considerable research (Deal, 2007; Evans, 2008; McGarr, 2009; Scutter, Stupans, Sawyer, & King, 2010; Traphagan, 2005; Woo et al., 2008). This research consistently shows that students have positive perceptions of lecture capture (Gosper et al., 2008; Heilesen, 2010; McGarr, 2009; O'Callaghan, Neumann, Jones, & Creed, 2017; Pons, Walker, Hollis, & Thomas, 2012; Traphagan, Kucsera, & Kishi, 2010), irrespective of age, gender, enrolment mode or attendance pattern (Gosper et al., 2010). Lecture capture is so highly valued by students that its availability has been shown to improve student satisfaction (Al-Nashash & Gunn, 2013; Brecht & Ogilby, 2008; Bryans Bongey, Cizadlo, & Kalnbach, 2006; Greenberg & Nilssen, 2009; Secker, Bond, & Grussendorf, 2010; Toppin, 2011; Traphagan et al., 2010; Veeramani & Bradley, 2008; Woo et al.,

2008) and influence course choice (Vajoczki, Watt, Marquis, Liao, & Vine, 2011; Watt et al., 2014).

Several studies have shown that use of capture peaks during assessment and revision periods (Brady, Wong, & Newton, 2013; Gosper et al., 2010; Saunders & Hutt, 2015) and investigations into how lecture capture is used show that students use it to review complex material, revisit sections they missed in the live lecture (Gorissen, Van Bruggen, & Jochems, 2012; Gosper et al., 2010; Groen, Quigley, & Herry, 2016; Watt et al., 2014), make more detailed notes (Elliott & Neal, 2016; Gosper et al., 2010; Newton, Tucker, Dawson, & Currie, 2014; Saunders & Hutt, 2015; Watt et al., 2014) and take control over their learning, particularly through self-pacing (Al-Nashash & Gunn, 2013; Gosper et al., 2010; Newton et al., 2014; Watt et al., 2014). Perhaps unsurprisingly, the use of lecture capture appears most beneficial where the student has English as a second language or there is otherwise a difference in first language between the student and lecturer (Gosper et al., 2010; Groen et al., 2016; Revell, 2013; Saunders & Hutt, 2015).

Given how and when lecture capture is used, studies have investigated its relationship to academic performance. This research shows that whilst students believe lecture capture positively impacts on performance (Al-Nashash & Gunn, 2013; Groen et al., 2016) studies using actual grades give a mixed picture with some indicating a positive relationship (Bollmeier, Wenger, & Forinash, 2010; Francom, Ryan, & Kariuki, 2011; Griffin, Mitchell, & Thompson, 2009; Harrigan, 1995; McFarlin, 2008; McKinney, Dyck, & Luber, 2009; Vajoczki, Watt, Marquis, & Holshausen, 2010; Wiese & Newton, 2013; Yu, Wang, & Su, 2015) and others reporting little or no relationship between the capture and performance (Abt & Barry, 2007; Brotherton & Abowd, 2004; Edwards & Clinton, 2019; Hadgu, Huynh, & Gopalan, 2016). These mixed findings may arise from differences in the populations sampled because student characteristics are known to influence use of capture. For example, research has shown impact of proficiency in the language in which one is taught (Molnar, 2011; Revell, 2013), gender (Williams, Aguilar-Roca, & O'Dowd, 2016) study year (Nordmann, Calder, Bishop, Irwin, & Comber, 2017), academic ability and learning approach (Brady et al., 2013; Newton & McCunn, 2015; Owston, Lupshenyuk, & Wideman, 2011; Vajoczki et al., 2011) on use of lecture capture. It is also likely that the effect of lecture capture on performance differs when students use it to supplement and substitute for attendance at the live lecture, with stronger students being more likely to supplement attendance (Von Kinsky, Ivins, & Gribble, 2009) and weaker students more likely to substitute (Vajoczki et al., 2011). Substitution may not compensate for the impact of low attendance on performance (Edwards & Clinton, 2019). In addition to the factors already identified, it is possible that the perception and use of lecture capture, and therefore potentially its impact on performance may be determined in part by student views and experiences of lectures in general, which has not been examined alongside lecture capture previously.

In contrast to research with students, there is little research into staff views of lecture capture (Al-Nashash & Gunn, 2013) but what does exist suggests that staff perceive lecture capture more negatively than students (Danielson, Preast, Bender, & Hassall, 2014; O'Callaghan et al., 2017), although many still use it to record their live lectures (Germany, 2012) and evaluate their teaching (Voort, 2013) if it is in use at their institution. For the latter, they report that watching their capture back had a positive impact on their teaching, likely due to altering their pedagogy or improving communication skills (Voort, 2013). Despite this relatively high usage and some positive reflections,

staff tend to cite negative reasons for using capture, notably pressure from students and their university, which may explain the more negative perceptions (O'Callaghan et al., 2017). Additionally, staff are less convinced of an impact on student performance, and therefore fail to see the same potential benefits as students (Chang, 2007).

As well as being less research with staff about lecture capture there is no research considering both staff and students collectively in terms of the various issues identified e.g. impact of lecture capture on learning and details of how the capture is used. Furthermore, much of the research considering lecture capture fails to consider how participants view lectures, meaning it is hard to establish whether different views of lecture capture between staff and students are driven by different views about lectures per se. Lecture capture has been used at our institution since September 2015 and most staff and students now have direct experience of it, making it a sensible time to examine how they feel about lecture capture and what impact, if any, they feel it has had. Improved understanding of how lecture capture is perceived by both staff and students, and the impact it has had will allow us to identify opportunities for optimising effective use of lecture capture. Furthermore, any differences in the views of staff and students may inform the support and guidance provided to these two groups and enable effective communication about capture for and between the two groups. On this basis, we conducted a series of focus groups to answer the following research question 'How do staff and students perceive lectures and lecture capture?'

## **Methods**

### **Research context**

This research took place at a large U.K. university, with nine faculties, located across four different sites. The university offers undergraduate and taught post-graduate programmes utilising lecture capture using the Echo360 platform. Presently, any teaching session labelled as a lecture and taking place in a room with a capacity of 21 or more, is captured unless the staff member chooses to opt-out in advance of the session and approval to do so is granted by a senior member of faculty staff. All three formats of capture (audio only, audio and slides, audio, slides and video) are available and the exact type used depends on the facilities in individual teaching rooms and staff requests. Ethical approval was obtained for this study in advance of the research being conducted from the Institutional Ethical Review Committee (ref: MR 1617 1286).

### **Participants**

Participant recruitment was via the institution Research Recruitment mailing list, which is sent to all staff and students every 2 weeks, and via the landing page of the institutional virtual learning environment. In both cases, prospective participants were directed to an online survey where they were able to express interest in participating and select their chosen campus location. The final sample consisted of staff ( $N=8$ ) and students ( $N=17$ ) from six different faculties. The staff focus groups were held at three of the four campuses, whilst the student sessions were held at all four. The maximum size of any one focus group was six. All participants confirmed that they were currently giving or receiving lectures, and all

had experience (current or previous) of captured lectures at the institution. They also all provided written informed consent prior to the start of focus groups.

### Procedure

The focus groups for staff and students were held separately and conducted by the same researcher (author ED), who as an academic member of staff has experience using lecture capture to record their lectures over several years and experience researching educational technologies. The focus groups for both staff and students centred around two key discussion topics i) how they felt about lecture capture ii) the impact of capture on the live lecture and student learning. Each focus group was audio recorded, transcribed and analysed using Thematic Analysis procedures (Braun & Clarke, 2006). The six-stage analysis process involved data familiarisation, coding, thematic extraction, and review and naming of themes, before finally completing a narrative analysis (Clarke & Braun, 2013). Qualitative analysis was initially completed by the researcher who conducted the focus groups and then reviewed independently by author BG who has extensive qualitative research experience within psychology. Quotes identified by group (e.g. Staff or Student) are provided as evidence (Mays & Pope, 1995) of findings.

### Results

Two themes emerged, respectively relating to perceptions of (a) the function of lectures and lecture capture, and (b) the use and impact of lecture capture.

#### Perceived functions of lecture capture

Students typically regarded lectures as learning events designed to provide an overview of a topic and core information, and other teaching modes as opportunities for consolidation of the material, or for seeking help or clarification as required:

*“Lectures are there for you to listen and help you with the reading so when you read a text book, it should relate. The tutorials are for you to ask questions and be engaged.”* (Student)

From this perspective, although 16 of the 17 student participants indicated that they regularly attend live lectures, lecture capture was seen as an adequate substitute when attendance was either not possible or not seen to represent an optimal use of time. For example, many students reported non-attendance when working to deadlines or attending clashing, extra-curricular events (*“in the second year we have a lot of vacation scheme interviews during the day and knowing that I’ll just miss one lecture and it’s recorded [helps]”*; Student). Some also saw lecture capture as a more time-efficient and potentially lower-cost form of learning:

*“It would be a pain to have to travel an hour and a half here and an hour and a half back for the sake of a 50-minute lecture, [and] it would cost me £30 in the morning or £20 in the afternoon.”* Student

Yet, most students reportedly used lecture capture not as a substitute for attendance, but rather to supplement their learning from the live lecture. Many used the capture to help them to write notes, or to repeatedly view challenging material. The ability to vary presentation speed when viewing lecture capture was valued in this respect (“*when I’m using the lecture capture I can pause and actually think about what the lecturer is saying*”; Student), particularly where English was not the first language of the student (“*I’m not from an English-speaking country so especially the first year I just wasn’t able to listen to a lecture with that pace [...] I couldn’t understand the lectures without being able to pause them.*”; Student). Lecture capture was thus seen by students to allow greater autonomy over the learning process than does the live event:

*“If they give you extra information and they say this word that you haven’t heard you can pause it, search it, find it out and then add that to your notes, which you can’t really do [live].”* (Student)

Capture was particularly valued for sessions with narratives that elaborate far beyond the material provided on lecture slides:

*“In my place a lot of the stuff they read on the slides, you can read through the slides and get it but then the teacher will explain it or they’ll use like an anecdote, an example that you can’t just generate by reading.”* (Student)

While staff agreed that it could provide a substitute for attendance in sessions that play only a knowledge transfer role, they felt that lecture capture was inadequate for more experiential learning events:

*“If [the lecture is] about me delivering, kind of conveying knowledge then this is an appropriate tool or it could be a helpful tool [...] for the kind of teaching I’m doing right now, for example, the knowing what was said in that hour in that room in the safe space wouldn’t help you because you weren’t there, and if you were there something else would have been said both by yourself and by others.”* (Staff)

Staff also voiced concerns that students use lecture capture as a reductive tool, to gather the information required to meet learning objectives, rather than more deeply engaging with the material:

*“They skip through it, they do a 45-minute lecture in about ten minutes and they [...] get the facts, the factoids out of it and write them down and learn them instead of listening to the discursive bit which is what we’re trying to [teach] and get over.”* (Staff)

Some staff also raised a more fundamental concern that lecture capture reinforces students’ perception of lectures as serving *only* an information-transfer function:

*“Do they realise that it’s not the same experience when you watch something at home than when you’re actually there? I mean, it’s a different experience; the lecture’s designed as a live event.”* (Staff)

Others felt that lecture capture suggested, erroneously, that lectures were standalone learning events, rather than recognising their position within a carefully designed and timed narrative thread throughout a module. Staff felt that better-performing students showed greater recognition of the complementary role that lecture capture plays alongside attendance at the live event:

*“If you wanted me to pick out the students that I’m going to expect to do best and most of the time that’s right they are the ones who are there every week who are vocal who say a lot, whether it’s right or wrong, who are there in the seminars who say a lot. They’re the ones who are active, they are not the ones sitting at home watching lecture capture.”* (Staff)

### **Use and impact of lecture capture**

Although some students reported using lecture capture for most lectures, others used it only to review difficult topics (*“For some subjects I knew, I definitely knew I didn’t need to use lecture capture, but for other subjects I heavily relied on lecture capture”*; Student). Some used it throughout the term, and others only during revision periods, to reinforce their learning (*“even if you do make notes in the lecture, sometimes it might be more helpful to have it just repeated again by the lecturer instead of reading your notes”*; Student). As stated above, students with English as a second language seemed to use it more frequently to adjust the pace of the lecture to one they could keep up with. However, they also reported using it to model academic communication skills in English (*“Through lecture capture I am able to see how scientifically the lecturer talks about a certain topic”*; Student). Lecture capture was deemed useful by students and staff alike for facilitating review of previously covered material drawn on later in a programme, though some staff voiced concerns about the implications of students retaining access to old lectures, especially where they felt they had not taught the content adequately, or where the material might have become obsolete:

*“Next year, I’ll teach this differently because I hopefully learnt something between now and next year both in terms of how I teach and the substance matter and the students are a new group and all of this, so this is not reusable and I don’t want this to be held in eternity”* (Staff)

The availability of on-demand lecture recordings was felt by some students to have a positive impact on their wellbeing:

*“I just go for classes and I was a bit stressed out about how I don’t [understand] the class [material] [...] until I discovered lecture capture and I realised, okay, it’s so much more helpful to actually listen and pause.”* (Student)

This positive impact appeared to be felt more for specific students including those with disabilities:

*“With my dyslexia and hearing, knowing that I have the reassurance that it was recorded so if there is a bit where I get confused or I didn’t quite hear the lecturer, I know it’s okay. I don’t have to panic in the lecture.”* (Student)

Although staff could see the added benefit for disabled students (*“We also have a student with a disability in terms of hearing so I think that could be important for that student as well.”*; Staff), some felt that such students could be supported in other ways (*“Looking at the overall impact [...] there might be other ways that things could be made inclusive.”*; Staff).

Most students expected lecture capture to have either a positive impact or no impact on their grades. Any improvement was expected to arise from use of capture to complement other sources of information, particularly when revising:

*“Once you take away [lecture captures] all you have really is some very basic notes that you are able to take during the lecture. [...] All you’ve got is a couple of A4 sheets of notes from the lecture and a text book so, I think, when it comes to revision, it will be useful to be able to look back on those things and I think that will have an impact.”* (Student)

While most students felt that capture had little impact on their engagement in lectures (*“students don’t generally ask questions [in lectures]”*; Student), some felt less able to interact in a captured lecture:

*“If I don’t understand something, if there’s not a recording I will ask a question even if it’s stupid, [but] if it’s on a recording I’m not going to ask that question.”* (Student)

This concern was shared by some staff, who felt capture could introduce inequalities in student engagement:

*“It makes certain kinds of teaching agreements impossible and it affects certain students more than others. I think it would affect their willingness to participate not necessarily in the sense that they wouldn’t ask questions, but they wouldn’t think as adventurously, they wouldn’t put themselves out there ... [in] the way they would if they know this is said now and will be forgotten in twelve hours by everyone present.”* (Staff)

Staff and students alike recognised the potential for capture to impact on lecture material and delivery. Some staff reported that capture could inhibit coverage of controversial material:

*“There’s a part about ethics on the course and I might give anecdotes about something that was a bit dodgy that had happened outside the experiment or something dodgy about another paper that I wanted to highlight, I’d be a bit more reticent to do that with the lecture capturing.”* (Staff)

Others were concerned that lecture capture would offer a permanent record of any errors or ambiguities within the spoken narrative, which could be misleading or misinterpreted:

*“When we’re talking for two hours, we’re meant to make mistakes and I’m not just [talking about] controversial things. [They are] treating us as documenters.”* (Staff)

Indeed, one student reported observing *“lecturers who want to tell an anecdote ... [so] they turn the lecture capture off”* (Student). Students understood concerns about controversial topics, but questioned whether something could be *“agreeable to people sitting in the lecture [yet not] agreeable to authority or whoever may find that on their lecture capture”* (Student), especially since the students felt that the lecture capture and lecture were aimed at the exact same audience:

*“[Pausing the lecture capture] is weird ... since the lecture capture is for the students, why wouldn’t [the lecturer] say [what they were going to say]?”* (Student)

## Discussion

The current study aimed to better understand how staff and students perceive lectures and lecture capture. The inclusion of perceptions of lectures, alongside lecture capture was deemed necessary because studies to date have not considered the two together, even though perceptions of lecture capture are likely to be influenced by perceptions of lectures. This premise was supported in the current study because it was clear that when students and staff shared their perceptions on lecture capture, they could not do so without sharing their views on lectures as well. In doing so it became apparent that the two groups share quite different views about the purpose of lectures, with students tending to see them as an opportunity to gain information with little active engagement on their behalf, whilst staff cautioned against seeing the lecture in this way. This information in itself is of value. Indeed, it may be helpful to ensure that any discussions around lecture capture acknowledge the purpose of lectures, as agreed by a programme or institution. In our own experience, whilst no two lectures will be the same, there may be characteristics which differentiate lectures from, for example, seminars, which are not communicated to students, meaning expectations of the event upon which the recording is based, are not explicit.

These different views of lectures also seemed to underpin different approaches to using lecture capture. For example, staff were very clear that it was not an ideal substitution for attendance, whilst students tended to feel that it was, in line with a significant body of research suggesting attendance drops when lecture capture is introduced (Bryans Bongey et al., 2006; Copley, 2007; Deal, 2007; Edwards & Clinton, 2019; Harley et al., 2003; Traphagan et al., 2010). Although most students in the focus groups stated that they normally attended their lectures, varied reasons were given for missing them, including other academic (e.g. assessment deadline) or academic-related (e.g. placement interview) reasons. These findings are in keeping with previous research which shows that attendance is likely to be impacted by several factors including academic and employment responsibilities may make it harder for them to attend (Cooke et al., 2012; Newton et al., 2014). Interestingly, the cost of travel was also raised with the students intimating a cost-benefit analysis depending on how much teaching they had and travel time and cost. This has not been identified in previous research and may reflect the central London location of the university where the research was conducted. However, this may also relate to wider changes in Higher Education, which has seen increases in the cost of university study and student populations becoming more diverse

(O'Callaghan et al., 2017). Based on these findings it is important for both staff and students to recognise that where lectures are missed, there may be no single, avoidable reason for this. Moreover, it is helpful to recognise that whilst some students may use capture to substitute for attendance, others will be using it to supplement attendance.

Despite recognising that lecture capture can substitute for attendance, most students in the current study described how they used lecture capture to supplement learning from live lectures. The uses reported confirmed previous research, notably using it to make detailed notes (Elliott & Neal, 2016; Gosper et al., 2010; Newton et al., 2014; Saunders & Hutt, 2015; Watt et al., 2014) and reviewing difficult material (Gorissen et al., 2012; Gosper et al., 2010; Groen et al., 2016; Watt et al., 2014). They also reported that the pace-adjustment allowed them to set the pace of their learning, something that has been raised previously (Al-Nashash & Gunn, 2013; Gosper et al., 2010; Newton et al., 2014; Watt et al., 2014). Pace setting was especially important for students without English as a first language, but this group also reported using lecture capture to help them model discipline-specific communication in English. This use has not been identified previously, although modelling behaviour is a recognised feature of live lectures (Feldon, 2010). The range of approaches used by students could inform future guidance made available to them, for example, adjusting pace was valued by students in the current study and previous work, suggesting it is a useful function. Therefore, ensuring students know how to adjust pace may be one step towards encouraging effective use of lecture capture. It is also possible that by communicating the diverse approaches students take to using capture to staff members, there will be a reduction in those that believe students only use capture to extract specific factoids, which contravenes typical staff beliefs about the value of lectures.

To date we are not aware of any research linking lecture capture to student anxiety. The present study found that students felt the lecture capture reduced their feelings of being "stressed out" when they could not understand something in the live lecture. This appeared to be even more important for students with disabilities who may struggle to keep up in the lecture itself. The safety net of lecture capture appeared to be important to students. Staff also recognised that lecture capture could support inclusive learning although this is perhaps unsurprising given that many institutions give this as a reason for implementing it (Phillips, 2005). Another area of positive impact for students was on performance. As with previous studies (Al-Nashash & Gunn, 2013; Groen et al., 2016), students in the current study believed that lecture capture could improve their performance, because they have the opportunity to go back and revisit the capture during revision.

In terms of impact on the live event, some students believed that lecture capture did not impact on their likelihood of asking questions because this was unlikely anyway. Others did feel that it put them off slightly. The latter view was shared by staff. The staff opinion here is at odds with previous research showing staff did not believe lecture capture impacted participation and interaction (Voort, 2013). However, this is likely to depend on what level of interaction individual staff expect and invite during lectures. Given there are several different styles of lecturing reported in the literature (Behr, 1988), it is likely that variation in impact will exist. One approach to supporting effective use of capture in this regard may be to remind staff that the capture can be paused for question and answer sections of the lecture, thus allowing the core content students value to be captured but reducing inhibition around asking questions. Previous work with staff has shown that lecture capture can impact on teaching style (Voort, 2013), however, in

the present study we have found that lecture capture can also impact on content, with both staff and students noting that more controversial points or anecdotes are normally only given once the capture is paused. Given that the use of anecdotes and humour have been found to be extremely effective in Higher Education teaching (Atkins & Brown, 2002; Torok, McMorris, & Lin, 2004), avoiding recording of these elements is unfortunate.

In summary, the current study demonstrated that the views of staff and students about lectures cannot easily be separated from their views of lecture capture. Indeed, the view held by students that lectures are an opportunity to receive transmitted knowledge from staff appeared to underpin the differences in opinion on how capture could be used. This study confirmed previous findings that students use lecture capture in a range of ways to supplement and substitute attendance at live lectures. However, building on previous research, we found that lecture capture can be used to model expert behaviour and that a wide range of factors including financial cost impacting on attendance and therefore how capture is used. Additionally, we discovered that lecture capture offers a way for students to reduce anxiety about learning in live lectures, especially for those with disabilities. This reduction in anxiety is extremely important given student mental health is an increasing focus of concern in the literature, the media and universities in general (Hughes, Panjawni, Tulcidas, & Byrom, 2018) with the latest data from the England and Wales showing increases in students experiencing problems with anxiety and stress and an increase in the number of students in taking their own lives (Office of National Statistics, 2016). The present study therefore indicates that lecture capture may be a useful tool in creating an environment that supports mental wellbeing. Despite this potential value of lecture capture, it was still perceived to have some negative impact on the live lecture. For example, staff, and to a lesser extent students, felt that the presence of capture reduced the likelihood of students asking questions. In addition, we found for the first time that both staff and students feel the content of sessions is altered by the presence of lecture capture, particularly where anecdotes are used, with staff reluctant to have these captured. It is unclear how to overcome this issue and it will no doubt be impacted by how 'open' captured lectures are, but given the values of this content, consideration should be given to how to overcome this.

It is important to note that there are limitations to the current study. Most notably, the sample size for the staff focus group was low, around half that for the student group. Additionally, not all faculties were represented in the focus groups for either staff or students and it is therefore possible that some discipline specific views may not have been revealed in the present study. Research to date on lecture capture has not identified any discipline specific differences in key perceptions, although, as noted in the introduction, there is very limited research with staff at present. Therefore, it is possible that improved representation, at least in the staff sample, could result in different findings. Finally, as alluded above, the central London location of the university under study may have impacted on the discussion around attendance given the considerable time and cost of travel in the city. Therefore, this finding in particular may be less generalisable than others presented.

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### Authors' contributions

ED designed the study and led data collection and analysis. BG and WvT assisted in data analysis. All authors contributed to the writing of the manuscript and read and approved the final version.

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This research was funded by IT Services at the host institution. They were not involved in the design, implementation, analysis or interpretation of the study.

### Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

### Competing interests

The authors declare that they have no competing interests.

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