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Exploring Higher Education Students' Perspectives on Factors Affecting Use, Attitudes and Confidence with Learning Technologies[1]

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The use of technology in higher education has become unavoidable. Between the "pivot" to online teaching during the covid-19 pandemic and pressure from universities to integrate technology innovatively within courses, educators are increasingly turning to technology. In turn, all students are expected to engage successfully and rapidly with technology, irrespective of their level or background. It is therefore important to understand students' attitudes and confidence towards technology, and how this drives their use, in order to keep students engaged. This study explores the factors that affect students' use, attitudes and confidence with learning technologies. 11 volunteers from a UK university were interviewed about their experiences with technology. A thematic analysis was carried on the interviews, which found that there are a number of key factors underlying the participants' attitude and confidence with technology. Students strongly considered the purpose and convenience of a technology before choosing whether to accept or reject it. Other factors included familiarity with particular technologies, and the use of an emerging universal iconic language, a new finding from this study. In addition, this study contributes five key recommendations surrounding competence, design and ownership which should be considered when educators are contemplating the use of technology in their higher education classrooms, whether online or face-to-face. It is important to think about these implications and how we as educators use these technologies going forward in a post-pandemic and technology-rich world.

Keywords: technology attitude, technology use, technology confidence, learning technology, higher education

INTRODUCTION

In 2020 the higher education (HE) sector was asked to "pivot" to online teaching and learning due to the covid-19 pandemic. This was combined with the continued pressure from universities for educators to integrate technology innovatively throughout their courses. In turn, all students were expected to engage successfully and rapidly with potentially-new technologies, irrespective of their level or background.

[1] This study was produced from the data of the PhD thesis.

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Even before the covid-19 pandemic, most universities across the UK mentioned technology and its use in their Learning and Teaching Strategies. For example, the University of Bristol promises that "We will continue to invest in successful innovative technology to support learning and teaching." (University of Bristol, 2015), and this is not a unique statement amongst institutions. Most, if not all, institutions mention the use of technology or digital innovations in their Learning and Teaching Strategies. This shows that universities are strongly encouraging widespread embedding of technology across their programmes. This is pushing lecturers to include more and more technology, whether it's using a basic virtual learning environment, in-class voting systems, or going all-out with flipped learning (Jdaitawi, 2019; O'Callaghan et al., 2017; Shelton, 2014). This has several implications. Firstly, this implies that staff are confident, comfortable, and able to educate students using technology, which has been shown to not necessarily be the case (Pierson & Cozart, 2004). Secondly, this push towards digital education may have negative effects for particular groups of students; students with little access to technology, or students who have negative attitudes towards technology, will be disproportionately affected. This increase in technology usage presents challenges in designing learning activities and environments. This is why it is important to determine the factors underlying students' attitudes to technology, and to respond accordingly. To that end, this study explores the factors that affect students' use, attitudes, and confidence with technology in their studies and personal lives.

Context and Review of the Literature

Benefits of Technology in Higher Education

Learning technologies can benefit students in a number of different ways. They can improve their experiences at university, from a pedagogical standpoint and more broadly, for example for welfare issues (Akçayır & Akçayır, 2018; Awidi & Paynter, 2019). Student experience can also be improved through lecturers' choices of technologies, which may include virtual learning environments, videos, and the use of social media (Loughlin, 2017). The use of appropriate learning technologies can increase students' motivation and promote a positive attitude (Al Yakin et al., 2022; Munawaroh et al., 2022) which leads to a more positive learning experience for students. Technology has the potential to remove obstacles to education such as time and proximity limitations, resulting in a more flexible approach that has been capitalised upon over the months of the pandemic and beyond (Markova et al., 2017; P.-C. Sun et al., 2008). O'Neill et al. (2004) suggest that a technological learning environment is particularly useful for part-time students who may be having to balance their studies with jobs, childcare, or erratic schedules. Again, this is particularly relevant thanks to the pandemic, where many parents were attempting to study while homeschooling their children.

The use of technology can develop students' higher-order level thinking, which may in turn increase the students' chances of being academically successful (J. Lee & Choi, 2017; Zohar & Dori, 2003). Learning technologies can also increase collaboration between students (Zainuddin, 2017); methods of collaboration enabled by technology include: resource- and knowledge-sharing (Al-Emran et al., 2016); resource creation,

such as creating student podcasts (M. J. W. Lee et al., 2008); and simply making communication easier, which in turn allows peer feedback and reflection to arise naturally (J. Lee & Choi, 2017). Technological learning environments are also central to a variety of interactive pedagogies such as blended learning (Dalsgaard & Godsk, 2007), distance learning (Arrosagaray et al., 2019), or flipped learning (Akçayır & Akçayır, 2018). These interactive teaching approaches have been found to have a number of benefits in themselves, including improving attainment (Al-Qahtani & Higgins, 2013; Charles-Ogan & Williams, 2015) and decreasing subject-specific anxieties (Marshall et al., 2017). These interactive pedagogies can help enable students to be active participators in their own learning. Furthermore, the better a student's digital literacy, the more self-directed their learning style is, and this is a reciprocal relationship (Rini et al., 2022). This increase in self-directed and active learning is important, since it encourages reflection, independence, and responsibility, and supports students to take ownership over their own education (Lan, 2018).

Attitudes to Technology

Kukulska-Hulme et al. (2011) found that learners in HE often prefer to use certain technologies for learning, which results in them tending to choose more familiar forms of technology, particularly if they have used them successfully in the past. Experience with a specific technology improves one's attitude towards it (Al-Emran et al., 2016; Samani et al., 2020) and increases their confidence (Hougham et al., 2018). However, it is important to avoid overusing particular technologies, as students who become bored with them become demotivated and tend towards more negative attitudes (Loderer et al., 2020).

Sun et al. (2008) found that students who use technology resources cite ease of use and their own confidence with computers and the Internet to be critical factors in their satisfaction with a course involving technology. This is supported by Staddon (2020a), who found that the factors affecting students' overall attitude to technology were confidence and utility, where utility is defined as how students use the technology. The utility factor is also in agreement with Sun et al. (2016), who suggest that students assess which technology is most suitable for purpose, which in turn affects their attitude towards it.

In addition to technology use increasing students' confidence (Hougham et al., 2018), confidence is perhaps unsurprisingly increased by students possessing higher levels of proficiency (Bartolic et al., 2022). Confidence itself influences students' perceived ease of use of a given technology, as well as their self-efficacy and perseverance (Malureanu et al., 2021). In the COVID-19 lockdown period, the student's living environment (noise, disruption, being around others) was the most impactful factor on their confidence using online learning (Bartolic et al., 2022). This was presumably due to these factors contributing to a feeling of being overwhelmed, rather than any technology-inherent reason, and this is an important point that we can take forward in thinking about the use of technology in higher education.

Students also tend towards technologies they find convenient (Connaway et al., 2011; Mitzner et al., 2010). Time and effort, where effort relates to ease of use, were the

primary types of convenience found by Mitzner at al. (2010). Convenience, however, can also become expected by students. When they are used to their lives being more convenient in one medium, they also expect that convenience to be carried across to other media (Dekimpe et al., 2020). As a result, students tend to avoid technologies that they view as redundant or non-functional (Mitzner et al., 2010). This view can be affected by the lecturer's use or misuse of a technology. Students feel that it is the role of the lecturer to be competent using the technology (Khoo et al., 2010; Maclaren et al., 2017), and where this is not the case, students can feel that the technology is not useful to them, presumably because they haven't seen effective use modelled well.

It is also important to students that educators are able to support students' use of technology (Khoo et al., 2010). Although students tend to prefer to try to troubleshoot problems themselves first, particularly if they are familiar with a piece of technology, they will often turn to educators and friends for support (Khosrowjerdi & Iranshahi, 2011; Liyana & Noorhidawati, 2017).

Attitudes towards the use of technology for learning may depend on an individual's learning preferences, such as whether independent or collaborative study is preferred (Balakrishnan & Gan, 2016), or whether the individual is socially introverted or extroverted (Balakrishnan & Gan, 2016; Orchard & Fullwood, 2010). Introverts tend to prefer online asynchronous communication and developing an online identity, whereas extroverts tend to feel inhibited by online factors and prefer synchronous face-to-face communication (Balakrishnan & Gan, 2016; Orchard & Fullwood, 2010).

Social media has increasingly become a teaching tool in HE, particularly Twitter, Facebook and discussion boards; these are often thought to be a useful platform for communication or dissemination (Stathopoulou et al., 2019; Tess, 2013). However, nearly half of students have felt that they had had negative experiences on social media (Ricciardelli et al., 2020). Negative experiences can lead to negative attitudes, and therefore students' experiences on social media will affect their attitude towards using it.

Purpose of the Study

Due to an ever-evolving technology landscape, it is important to understand how students adopt particular technologies for learning, and how to keep students engaged with learning-enhancing technology materials and technology-based courses (Kukulska-Hulme et al., 2011; P.-C. Sun et al., 2008). It is also vital that chosen technologies must be an enhancement to learning, not a replacement (O'Neill et al., 2004), meaning that technology should be employed thoughtfully from a basis of good pedagogy, not for the sake of it. Many teachers and tutors adopt learning technologies due to them being in fashion, or there being institutional pressures upon them to do so. Furthermore, all students are expected to engage with the technology, irrespective of their confidence or knowledge level or background. This, unsurprisingly, means that the use of technology is less successful, and that the students are less successful and less satisfied learners as a result (O'Neill et al., 2004).

This paper presents the findings from a qualitative study exploring the factors that affect students' use of learning technologies, as well as their attitudes and confidence with technology and learning technologies. This study is timely since so many educators and

students are being asked to engage with learning technologies in their HE studies due to the covid-19 pandemic. Even following the pandemic, there may be a long-lasting effect on the HE pedagogical landscape, with distance and online learning persevering. To this end, the following research question was posited: What factors affect students' use, attitudes and confidence with learning technologies? The answers to this question will inform a discussion of the implications for the use of learning technologies in today's HE classrooms, and how we as educators use these technologies going forward in a post-pandemic world.

METHOD

This section presents information on the participants in the study, the interview instrument used, the pilot process, how the data was collected, and the data analysis strategies.

Participants

The study was based at a Russell Group university in the North of England. Students who had previously participated in an online survey (n = 161) about their attitudes to technology (Staddon, 2020a) were invited to volunteer for follow-up interviews in 2018. This involved signing up for an individual interview slot using Google Calendar. From the 50 survey participants who initially volunteered to be interviewed, a total of 11 attended an interview. These students were from a range of levels of study, including undergraduate, Masters and PhD, although this information was not explicitly collected. All but one of the students over 40 were undergraduates on the course I taught on. Students who completed the interview were entered into a prize draw for an Amazon voucher. Table 1 shows the demographic profiles of the interview participants, and the pseudonyms (false names) I will use throughout this paper.

Table 1
Participant profiles

Pseudonym	Age group	Discipline	Mode of study
Bill	18-21	Arts and humanities	Full time
Daniel	18-21	Engineering	Full time
Emma	18-21	Arts and humanities	Full time
Harris	22-25	Social sciences	Full time
Chun	22-25	Social sciences	Full time
Sophia	26-30	Social sciences	Full time
Julie	41-50	Arts and humanities	Full time
Anne	41-50	Social sciences	Full time
Aylen	41-50	Engineering	Part time
Gwen	41-50	Social sciences	Full time
Felix	61-70	Arts and humanities	Full time

Instrument

Semi-structured interviews were conducted with volunteer participants. This involved following an interview protocol to guide the interview and generate the same broad areas of conversation with each of the participants, but also allowed space for participants to expand upon their opinions, for both parties to ask follow-up questions, and otherwise enable flexibility (Coiro et al., 2014; Knox & Burkard, 2009).

The interview explored topics including a discussion of participants' use of different technologies, their confidence with and enjoyment of technology for learning and personal use, and their support needs.

Pilot

Pilot interviews were carried out with a small number of students (n = 3) from the target population in order to ensure question clarity and understanding, and also to confirm that the arrangements for arranging and carrying out the interviews were suitable. Several changes were made as the result of this pilot, including reordering some of the questions, and rewording others. Prompts and probes were also explicitly included in the interview schedule, to be used if the participants were having trouble thinking of answers.

Data Collection

Interviews were held on an individual basis in private meeting rooms within the university, in order of participants' availability according to their sign-up slots. The interviews were recorded with a digital dictaphone for high fidelity. I chose not to make notes in addition to the dictaphone recording in order to focus on the conversation with the participants. I did not stop the dictaphone at any point until the interview was complete.

At the beginning of each interview, I explained the purpose of the study, asked the participant to read the information sheet, and sign a consent form. The interviews ranged from approximately 22 to 56 minutes in duration, and I did not curtail the natural length of the interview at any point.

Table 2 shows the data collection process in order.

Table 2
Data collection process

Stage	Method
Pilot	Students expressed interest in volunteering for interviews from the pilot questionnaire from previous study (Staddon, 2020a).
	3 students responded and volunteered to be interviewed by signing up for an interview slot in Google Calendar.
	3 students were interviewed using the semi-structured interview protocol. Interviews were recorded by dictaphone to check for functionality. Students were also asked whether any questions were unclear or felt uncomfortable.
Participant recruitment	Students expressed interest in volunteering for interviews from the questionnaire from previous study (Staddon, 2020a).
	50 students were emailed invitations to participate along with an information sheet.
	11 students responded and volunteered to be interviewed by signing up for an interview slot in Google Calendar.
Interview process	Student volunteers were asked to attend an individual interview on the university campus, and directions were given.
	A reminder was sent the day before the interview.
	Students signed a consent form and were given a copy, along with a paper copy of the information sheet they had received by email.
	A semi-structured interview was done with each participant and recorded using a dictaphone.
	Participants were thanked and a prize draw was carried out for the students who wished to be entered. The prize was successfully sent.

Data Analysis

I used a thematic analysis (Braun & Clarke, 2006) in order to maintain a rich and complex view of the data while remaining flexible (Clarke & Braun, 2017). The goal of thematic analysis is to identify themes and patterns in the data, and to interpret these. I used an inductive thematic analysis, which is a data-driven approach where the codes and themes have been generated from the data without an existing coding framework (Braun & Clarke, 2006). A semantic level of analysis was adopted, focussing on the rich details of what the participants said and interpreting and explaining any patterns (Maguire & Delahunt, 2017).

Thematic analysis has six steps, proposed by Braun and Clarke (2006):

1. Familiarisation
2. Coding
3. Identification of themes
4. Reviewing themes
5. Defining themes
6. Reporting

Since I conducted all interviews, I initially familiarised myself with the data as it was generated (step one). After the interviews were completed, I transcribed them from the audio files, which resulted in further detailed familiarisation with the data. After transcribing the interviews, but before conducting the analysis, I anonymised the transcripts using pseudonyms.

For step two of the thematic analysis, I coded the data using NVivo. Many of the extracts fit several different codes, and I coded them under all of the potential codes. After an initial round of coding, I went back over all of the transcripts again with my full list of codes, and coded any items that I had missed the first time. In qualitative research, instead of sample size, the idea of saturation is often used. Code saturation is where analysis shows that no new codes are being generated (Saunders et al., 2018). Saturation is a continuum rather than an endpoint, which means that we should be aiming for 'enough' rather than 'all' (Saunders et al., 2018). For the identification of broad themes, code saturation (as opposed to meaning saturation which may need higher numbers of interviews) is sufficient (Hennink et al., 2017). In this study, code saturation was found after nine interviews, with the previous five interviews only adding four additional codes. The codes were then checked for discrete meaning. Codes that explored the same meaning or were redundant were merged (Nowell et al., 2017), resulting in a final set of 79 different codes.

After reading through the codes and the extracts within, ten themes were identified by grouping the codes (step three). The themes were then reviewed (step four) in a two-step process: the first of which was to review themes at the coded extract level; and the second of which was to consider the themes in relation to the whole dataset (Braun & Clarke, 2006). Several of the initially-identified themes were deemed to be subthemes, resulting in five themes overall, of which one had six subthemes. These were then named (step five). The final step (six) of the thematic analysis is to report the findings, which is the purpose of this paper.

FINDINGS

This section explores the results from the thematic analysis, grouping the themes with others that link strongly. Subsections are included for each of these groups of themes and subthemes.

Five themes were generated from the thematic analysis, of which one had six subthemes. Table 3 shows the themes and their constituent codes. All participants mentioned each theme and subtheme at least once.

Table 3
Thematic analysis results: themes, and substituent codes of each theme

Theme	Subtheme	Codes	Coverage (%)
Familiarity		Addiction, casual mention of non-normal tech, exposure, knowing lots of tech, familiarity	7.9%
Age		How younger people use tech, how older people use tech	6.5%
Knowledge		Changes over time, depth of knowledge, programming and behind the scenes, technology learning	5.6%
Interaction		Communication, feedback, group learning, how you look to others, learning from others, lecturers' use, replaces face-to-face, support	8.9%
Motivation	Confidence	Confidence, easy, frustration, learning on own, not scared, understanding, worry	9.5%
	Purpose	Communication, disability, subject, feedback, fit for purpose, workplace, lecturers' use, makes life easier, necessity, practical use, replaces face-to-face, usefulness, verification	8.7%
	Convenience	Convenient, flexibility, learning style, speed	5.0%
	Barriers	Access, avoid, cost, cybercrime, distraction, doing the right thing, fear, fragility, gender, incompatibility, reliability, support, tired of using tech, too pervasive, trust	4.6%
	Enjoyment	Challenging self, desire to learn, enjoy tech, enjoyment changed, exciting, interest, novelty	8.2%
	Design	Complexity, customisable, formatting, interactivity, intuitive, keeping updated, overload, quality, standardisation	6.0%

Each subtheme of motivation fits with other themes, so I have grouped them as such for discussion. This paper will focus on the themes and discussions about the factors that underlay students' use, attitudes and confidence towards learning technologies. Age, although identified as its own theme, is a broad concept that intersects other themes, and therefore has been incorporated as such rather than being an explicit section.

From the percentage coverage in Table 3, it is clear that the themes of Confidence, Interaction, and Purpose were most frequently discussed in the interviews. It is worth noting this may not indicate their relative importance or strength as factors, but simply it may be that these are the most natural technology-related topics for discussion amongst undergraduates. Thematic analysis doesn't presume to order factors by importance.

Familiarity, Knowledge and Design

Most participants expressed strong opinions that familiarity with technology was an important part of their confidence and attitude towards it. Participants stated they were more confident with the technologies they were used to, and when they were asked to

use unfamiliar technologies or brands, their confidence would decrease dramatically. Some participants viewed early exposure to technology, such as growing up with it or using it as a child, as increasing their confidence.

Daniel mentioned that using a wide range of technologies allowed him to learn a universal language that exists across most modern technology:

Daniel: A lot of things are designed so this button is shaped like it's supposed to be doing that, with websites people are using similar themes […] I see a piece of technology and I just feel as if I know how to use it. […]

Interviewer: So you think that it's kind of this consistency across all the platforms, that there is this shared language?

Daniel: Yeah, yeah. And it's the language that I can speak. So, even if I find a new word or phrase in the language, I'll still understand what it means.

The emergence of a universal iconic language across technologies means that Daniel also mentioned that he'd "hardly ever had to learn software from scratch". Once a person has the knowledge of the "shared language", it can be applied across numerous other technologies, allowing students to access new software and technologies more easily. Confidence with new technologies therefore increases when students have familiar scaffolds on which to hang new knowledge, and knowing how to navigate a layout is one of these potential scaffolds. Most participants at some point in their interview described a button or a function that fit into the universal iconic language as described by Daniel.

Formatting and layout were mentioned by several participants as factors in whether they choose a technology. Daniel preferred the layout on mobile phone apps to websites because:

The software's a lot better designed, the layout is a lot easier to understand, it's a lot more compact on a phone, cause the point is to try and get everything on a small screen, with few buttons. (Daniel)

He also said that simple layouts are more likely to plug into the shared language of technology, automatically making them easier to navigate and understand, and therefore increasing familiarity.

In addition to simple, well-designed layouts, resources can be viewed as easier to navigate when they have instructions, and where processes are broken down into small steps system so that the user doesn't get overloaded. An addition, or perhaps alternative, to this is to use the standardised format of the shared language. Students often find these standardised layouts intuitive – although in which direction the causality lies is unknown. Standardised or intuitive formats enable students to minimise the number of new concepts they have to learn in order to engage with new technologies, and results in an overall simpler experience.

Other design factors that students mentioned they wanted include well-paced materials, the inclusion of videos, questions on those videos, and an activity so that they can apply

their knowledge. The most important factor, however, is that students want the design of their learning materials and platforms to be good quality; they are frustrated by poor design. Therefore the design of a platform, the design of the technology, and the quality of the learning resource itself are all considerations when we create or implement learning materials for students.

Interaction, Purpose and Convenience

The purpose of technology was something that arose frequently in conversations with participants, and seemed to be something that they considered before choosing to use technology.

In general, participants felt that technology should be used only when it makes their lives easier or more convenient in some way, and therefore participants often chose to use technology when they thought it was useful. Multiple participants considered pen-and-paper analogue solutions to be more helpful in some circumstances, such as when reading longer pieces of writing for their course. There is therefore a balance to be struck between choosing technology or low-tech solutions, depending on which makes one's life or studies easier.

The ability of technology to replace face-to-face interaction was one of the main purposes that students chose technology. Technology replacing face-to-face communication is often talked about in the media at the moment, with particular recent focus on replacements due to the COVID-19 pandemic (Neate, 2020; Wootton, 2020). During the interviews conducted for this study, participants expressed that face-to-face replacement is both a good and bad thing. Aylen said that during her studies, she liked that using technology gave her flexibility by replacing face-to-face sessions. This seems to go beyond blended learning into alternative lecture formats:

I think that flexibility is really important. Especially for a lot of students today who are working because they are worried about their debt, they can't always get there at two o'clock, or they've parents to look after, or they've got people who are ill. […] We shouldn't be sat here insisting that students attend lectures, taking compulsory lectures and registers. I think that's just wrong. It's my choice. If I'm paying £9000, it's my choice whether I go to that lecture or not, And I should be able to get an online video, and I'll make my own time up when I have to. (Aylen)

Sophia, in contrast, labels herself as "a traditional kind of learner" who "enjoyed going to lectures, having the interaction with other people and with the professor". She finds it "a pity" that undergraduates have so much online learning as she likes being in class. In complete contrast with Aylen, she says "if you're paying tuition, I think interactions with human beings is at least fifty percent need to be there". One solution to address this difference of opinions may be lecture capture, which provides face-to-face opportunities for those who attend, but that are also recorded for students who require or want flexibility to access later.

A lot of the choices of technology are for practical reasons, with ten out of the eleven participants stating that practical considerations are a big reason why they are inclined towards specific technologies. One of the practical reasons was communication, with

many participants using technologies such as mobile phones and social media as alternatives to face-to-face relationship maintenance:

I have a Facebook account which is mostly for running and things like that rather than, I use it a bit for friendship. (Gwen)

Other practical reasons may be using technology such as mobile devices to help with day-to-day life, such as learning English vocabulary (Chun) or note making:

My phone's for texting my children, and that's about it. It's not for playing games. I use it for doing memo taking, when I'll suddenly think, "Ah, I must remember to do that tomorrow", so it's handy for stuff like that, but no, it's not entertainment at all. (Aylen)

Most participants mentioned that they liked that technology allowed convenient and flexible access, whether to learning materials, tech support, or personal activities such as television and shopping. Speed and efficiency are important to many participants, and they mentioned that fast access is an aspect of technology that they find both useful and enjoyable.

Confidence and Enjoyment

In the interview, students were asked to rate themselves on a scale of one to ten for how confident they felt with technology, and how confident they felt when learning about technology. No participant rated themselves lower than five out of ten for either of the confidence questions. Interestingly, younger participants felt more confident using technology than they did learning about technology, whereas older students tended to score themselves as more confident learning about technology than using it. This may suggest a possibility that older students may be more confident than younger students when faced with new technologies, whereas the younger students rely on current knowledge they hold about technology. Confidence therefore links with the familiarity theme, and most participants suggested they were more confident with the technologies they use most. In fact, Anne explicitly says, "exposure makes you more confident, doesn't it".

Participants were also asked whether they enjoyed using technology for learning, and also whether they enjoyed using technology more generally. Ten out of 11 participants enjoyed using technology for learning, and nine participants enjoyed using technology generally. Participants gave several reasons as to why they enjoyed or did not enjoy technology. For example, Harris said that his excitement about using technology is different depending on the scenario. As a child, he was excited about any technology, and this was because it was novel to him. However, as an adult, he feels apprehensive about new technologies until the purpose is apparent, and only after that is he able to get excited about new technology. This is an interesting difference between technology attitudes in children and adults. The difference may be related to novelty; although new technologies encountered as an adult are novel to the student, the concept of technology as a whole is more novel to children, which may be why they get more excited about it.

Novelty is one of the reasons participants found technology enjoyable. Chun thought that some of it is a function of age:

I'm not the one eager to accept new things, but I think the younger one, especially born after the new century, they like it, they like the new things, because they're cool, they're fashion. (Chun)

Perhaps this is a generational phenomenon, or perhaps it is simply age, where younger people can be more excited by technologies. This would certainly fit with Harris' experience.

Several participants said that their enjoyment changed over time. In most cases, enjoyment increased: the reasons given range from enjoying technology more when it's more familiar (Gwen), to the technology itself changing to be better. However in some cases enjoyment decreased, as participants got bored with specific technologies. A previous study done by the author of this paper shows that there are few differences in the types of technology used between different age groups (Staddon, 2020b), and therefore technology use and familiarity is linked to specific technologies rather than technology types.

Barriers

All participants talked about barriers to choosing or using technologies, whether barriers they have faced previously, or hypothetically.

Participants felt that they needed support for new or difficult technologies. The kind of support sought differed between participants. Bill attempted to solve any problems he encountered himself first, and then sought support from the internet. Only after that would he ask for help from "those who do know it so they can explain it to me" (Bill). This is a common workflow for many of the participants. In contrast, Felix always asked for help from real people first. Chun assessed the situation before deciding who to ask for help – for fixing technology or programming help, she will go straight to a "professional", whereas for general technology knowledge, she will ask her classmates. In all scenarios, participants considered the situation, and felt they would seek support from those they felt most comfortable in doing so, whether YouTube or an IT department.

A greater proportion of the participants from older age groups said that they were anxious about technology, and they were more likely to be anxious before beginning use; this was usually due to being unfamiliar with the technology. This finding is in keeping with findings from Czaja and Sharit (1998), who found that attitudes (in their case, to computers only) are generally more positive post-task than pre-task. In contrast, younger participants who are anxious are more likely to be anxious whilst using technology, and often give the reason as worrying about doing something wrong, or finding a technology unexpectedly complicated or difficult when starting to use it.

Four participants mentioned that they would be put off using certain technologies if they were unreliable. Anne discussed how she finds it frustrating when there are problems and she doesn't have time to sort them, and therefore unreliability seems to be a barrier for her. Similarly, Daniel said he will reject a particular technology if it is unreliable, outdated, or just poorly designed. Reliability also links to trust. Participants may choose not to use technologies that they do not trust.

Three of the participants who chose not to use much technology for their personal use suggested that they were put off by technology being too pervasive. Sophia said:

I'm not always on my cell phone, whereas I see younger people usually, and their cell phone is like part of their hand. They're always there and it's something that bothers me because I don't need to look at my cell phone all the time. (Sophia)

While Sophia suggested this is an affliction of young people, Aylen suggested that it is a problem with people of all ages, and that phones should be functional, not to dominate your life.

DISCUSSION

It was clear from conversations with participants that familiarity with technologies increases one's confidence with them and leads to a positive attitude. In contrast, having to use unfamiliar technologies can lower overall technology confidence and increase anxiety. This is in agreement with the literature that experience with a technology or ownership of a particular technology can improve attitude towards it (Al-Emran et al., 2016; Samani et al., 2020).

Using a range of technologies can allow students to begin to recognise and learn the universal iconic language that is emerging across many modern technologies. This shared iconic language, which consists of icons such as the 'hamburger menu' and 'account circle', can help students navigate the frustration of learning new or complex technologies. Complexity in a technology reduces student confidence and can increase the feeling of overload or being overwhelmed, so strategies to avoid this are important. The shared language icons provide users with a feeling of familiarity, and a starting point that they can understand. Another strategy to avoid overload is keeping the formatting and layout simple. Participants expressed a preference for mobile-friendly formats, as mobile formats tended to be simpler and less cluttered, as well as most of them integrating icons from the shared language. Unsurprisingly, participants are more confident with technologies that are easier to use, whether physically or through user interface design; therefore, having these familiar icons from the shared language can mean a difference in attitudes and confidence for students of all ages.

Participants also mentioned that if a technology is used too much, their enjoyment, interest, and attitude can decrease due to boredom with it. This means that some students find technologies that are new (to the student) or novel (new to the world) exciting and enjoyable once they become familiar with using it, but that technologies mustn't be overused. Enjoyment of technology is important, since if the student doesn't enjoy a technology, their desire to learn it is lower; since technologies introduced in HE tend to be required for specific tasks or assessments, it is important that students learn them. This finding is in agreement with the literature which suggests that boredom demotivates students and creates negative attitudes to technology (Loderer et al., 2018). Additionally, the difficulty and complexity of a technology affects students' interest and enjoyment. From the results, it's clear that most participants do enjoy technology generally, and all but one enjoys technology for learning. Technologies they mentioned specifically enjoying included quizzes, videos, and technologies such as the Internet or mobile phones that allow flexible working. This is an interesting finding, since students

will express displeasure at using specific technologies for learning, whereas they don't for personal use. This may just be a function of choice, and therefore when students are allowed to choose their own learning technologies, they are much more likely to enjoy them.

It is also possible that the purpose of a technology is the reason for enjoyment, and seems to be the main reason they choose a technology. Whether a technology is suitable for a given purpose seems to be the main driving force behind whether the student feels confident or not with the technology, as most participants said they were more confident with technologies that are fit for purpose. Different technologies are available for different circumstances, depending on the task and the location, and students take this into account by only choosing technologies that they think are useful and practical (or at least, think that they should choose these). It is clear that some students only use technology when absolutely necessary, and this is an extreme example of choosing technology based on purpose. Sun et al. (2016, p. 3) suggest that students can be "mindful adopters" of technology, where they consider the functionality and novelty of the technology, as well as how it fits their needs, and how it compares with alternatives. This mindful adoption positively affects their perception of the fit of the technology to a given task, which then influences how useful they perceive the technology to be, and their attitude towards it. Sun et al. (2016) therefore support the finding that students consider purpose as a major factor in choosing technology. Similarly, if a technology isn't necessary, or isn't better than an analogue paper-based version, students will choose the one that makes their life easier, which may be the one that requires the least effort, or that they are most familiar with.

In terms of communication, the replacement of face-to-face interaction, both for teaching and in relationships is interesting. Several students viewed it as a good thing as it made communicating easier, but several other students thought that technology actually makes us less sociable. There are probably several factors that affect whether a student perceives the replacement as positive or negative. It may depend on the type of face-to-face experience that is being replaced, whether it is social (e.g. chatting in the pub), organisational (e.g. arranging to meet somewhere), or educational (e.g. seminars). For educational purposes, it may depend on an individual's learning preferences, such as whether independent or collaborative study is preferred (Balakrishnan & Gan, 2016). It may also depend on how introverted or extroverted the individual is, particularly surrounding social interaction; the literature suggests that introverts tend to prefer developing an online presence asynchronously, whereas extraverts tend to prefer face-to-face situations (Balakrishnan & Gan, 2016; Orchard & Fullwood, 2010). This suggests that introversion or extroversion as a characteristic may influence students' preferences towards online communication, with introverted students tending towards more positive attitudes and confidence. In an interesting example from this study, the participant Felix labelled himself as "gregarious", which would therefore indicate he views himself as an extrovert. Felix mentioned 'Purpose' the fewest number of times, and talked about refusing to have a mobile phone. He frequently mentioned he preferred face-to-face interaction, so this would seem to support the literature.

In addition to technology fulfilling a specific purpose, the participants often commented that technology can make their lives more convenient, by saving them time and effort. Time and effort were also the primary types of convenience found by Mitzner at al. (2010). If a student encounters a technology that helps them in their everyday life, they are more likely to continue using the technology; since they will use it frequently, they will be less likely to view it as scary, and will view it more as a utensil, thus becoming more confident with it. In contrast, however, when technologies are deemed inconvenient by taking more time or effort to use, that leads to negative attitudes. Participants are generally more apprehensive about technologies until the way it affects them and their lives is clear. This is in agreement with Mitzner et al. (2010) who found that convenience was one of the top three benefits considered when adults were choosing technology. Additionally, the literature suggests that when people are used to their lives being more convenient in one medium, they also expect that convenience to be carried across to other media (Dekimpe et al., 2020); this is not always optimal, particularly if a new technology in being introduced in the classroom, since savings in time and effort don't necessarily apply in the initial learning phase of a new technology (Russell, 1995). However, once the learning phase has been completed, then students can reap the benefits of convenience.

Students explored a number of barriers to being confident with technology and learning technologies, resulting in them choosing not to use it. One of the barriers is difficulty. If a technology is difficult to use and takes a lot of effort, the student's confidence is reduced, and they are likely to stop using it. This makes the technology inconvenient for regular usage (Mitzner et al., 2010). Another demotivating factor is if a technology is perceived as unreliable or outdated; students are reluctant to attempt to use technologies that they view as redundant or non-functional, both for work and personal use (Mitzner et al., 2010). This is particularly important in university courses, as students are very aware of how their lecturers and tutors use technology. Students feel that it is the role of the lecturer to be competent using the technology, as well as being able to support students' use (Khoo et al., 2010). If a technology is not being utilised well, it will negatively affect students' attitudes towards it. There are a number of things that affect whether a student views the technology as well-utilised. The most obvious is the lecturer's skill in using a technology, which is again in agreement with the literature (Maclaren et al., 2017). This is the first thing a student sees, and if the student feels the lecturer is failing to use a piece of technology, they will have little patience with both the lecturer and the technology. This in turn leads to a negative attitude towards the technology. It is therefore also important that lecturers choose the technologies they are asking students to use carefully. If a student is being forced to use a particular technology, they will begin to feel resentment if they think the technology isn't very good, or if it's not being used well. This is important on an institutional level as well, as different universities have different policies on using virtual learning environments and integrating learning technologies into teaching practices, as seen in universities' Learning and Teaching Strategies.

A further barrier to technology confidence may be the societal view of technology. The media can portray frequent use of technology as addiction (e.g., Manjoo, 2018). The

accusation of technology addiction is often directed towards younger people and students, and therefore students may feel a pressure to avoid using certain technologies in order to avoid succumbing to this addiction. Several participants mentioned the idea of technology addiction, and actively tried to avoid it. Some students feel like technology such as social media can be particularly invasive, and feel judged through it, and nearly half of students have felt that they had had negative experiences on social media (Ricciardelli et al., 2020). Negative experiences lead to negative attitudes and therefore students who have had bad social media interactions are less likely to use it or be confident with it. This is a problem since social media has become a part of teaching in HE, and is often lauded as a useful form of technology for communication or dissemination (Stathopoulou et al., 2019; Tess, 2013).

Some technologies, particularly mobile technologies, were also avoided due to students feeling there were too pervasive and distracting in everyday life, resulting in phenomena such as 'phubbing' (looking at a smartphone during a real-life conversation) (Al-Saggaf et al., 2019). The presence of mobile phones makes some students feel like they are missing out on face-to-face interaction. This may carry over to the classroom as well, with students potentially resenting technologies that they feel interrupt the types of learning they prefer, which may include face-to-face teaching or group discussion.

When participants sought support, they usually initially used the Internet, by Googling problems or seeking answers on message boards. If they were unable to solve the problem themselves using the internet, they would then approach real life sources, whether friends, tutors, or university-provided IT support. This is in agreement with Liyana and Noorhidawati's (2017) findings. The Internet could have been the first source of support since it is more instantaneous than in-person support, and convenience and time-saving are important considerations when students are seeking information (Connaway et al., 2011). The Internet allows you to find an answer within just a few minutes, depending on how adept at using search engines you are, but real life sources tend to take time. Asking your friends may take a few minutes, or it may take an hour. Some participants mentioned university IT services taking a very long time to respond. Participants may have felt comforted knowing that in-person support was available, but were willing to invest a few minutes trying to solve the problem by themselves first.

Familiarity also has a bearing on how one seeks support. The more familiar a student is with a technology, the more likely they are to attempt to fix it by themselves, since they are more likely to know the specific terms to search for, what's relevant and what isn't, and to put the effort into doing so (Khosrowjerdi & Iranshahi, 2011; Liyana & Noorhidawati, 2017). If the problem is with a technology that a student is less familiar with, they may feel that they just don't know how to get started with searching for a solution. Finding one's own solutions using the Internet or other 'self-support' situations such as trial and error also gives students a feeling of ownership over their own learning of technology.

LIMITATIONS

This study has a number of limitations. The study was set within the University of Sheffield. This is a UK-based Russell Group institution, and therefore may not be

representative of the UK student population as a whole. The results may not be transferable to other societies, or even other non-Russell Group institutions within the UK. There may be very different results in societies where access to technology differs or cultural attitudes towards technology or education are different.

Participants were recruited via email. This may have affected the sample since the study was looking at student attitudes to technology, and students who are less confident with technology may check their emails less frequently. There may also be a self-selection bias in the students who volunteered to be interviewed. Self-selection bias is impossible to avoid in research involving interviews since it is ethically integral that the interviewees are volunteers. Lastly, only 11 participants were interviewed. Future research may wish to expand the sample size of participants.

Further research directly following on from this study could include running qualitative focus groups to allow participants to expand upon their individual interview answers. This has the advantages of allowing participants to "jog each other's memories" in a more relaxed atmosphere (Wellington, 2000, p. 81), and some interesting analysis could be made of the discussion between participants.

It would also be interesting to do an international comparison of students from HE institutions in countries and societies that do not have the same widespread access to technology that we enjoy in the UK.

CONCLUSION

Universities have been pressuring educators to use innovative technologies throughout their courses for years. Combined with the necessary pivot to online teaching due to the COVID-19 pandemic, it is important to consider the factors underlying students' use, attitudes, and confidence with technology. This study found that there are complex and interconnecting factors. The highest coverage factor was confidence, which is underpinned by a number of things, including ease of use, which in turn is affected strongly by familiarity. This important factor of familiarity with technology, and the emergence of a universal iconic language allowed students to feel familiarity with new or novel technologies. This universal iconic language is something recognised by students as vital in order to become competent with technology as quickly as possible, and this is a new finding from this study. Students strongly considered the purpose and convenience of a technology before choosing it, and contrary to popular belief, students of all ages would rather use an analogue option if it made their life easier. Most participants enjoyed using technology for learning and generally, and novelty was a factor in enjoyment. All students expressed barriers to using technology, such as technical problems, personal anxiety, finding support, and fears about the pervasiveness of technology. Additionally, some factors may affect certain groups of students differently, such as mature students, students from particular disciplines, or students with trouble accessing technology.

From the results of this study, I suggest five key recommendations when HE educators are considering the use of technology in their classrooms. Firstly, educators should only use technologies that they are comfortable with and competent using. This may involve training themselves before attempting to use the technology. Secondly, technologies

need a clear and explicit purpose, must be easy to use or learn, and be more useful than analogue solutions. Next, consider whether it may be necessary to train students to use specific technologies, and if so, offer optional training sessions that introduce the technology gradually. It may be worth choosing technologies that fit into the iconic shared language discussed above, where possible. Fourth, technology-based learning resources need to have the same rigour as non-technology learning design, using appropriate instruction, scaffolding, pacing, and interactivity. And lastly, learners want ownership over their own learning, and this is true of technology learning and use as well.

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