

Article

# The Impact of Embedded iPad Use on Student Perceptions of Their Digital Capabilities

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**Abstract:** Digital capabilities are recognized as key skills that students must possess to learn and work in our increasingly digital world and have been the subject of a growing focus over recent years. Similarly, smartphones and, to a lesser degree, tablets are now ubiquitous within the student body, and many academics are beginning to leverage these devices for the purposes of learning and teaching in higher education. To further explore the possibilities of mobile technology, the iPilot project was created to explore the effects that embedded iPad use had on undergraduate students' creativity, ability to collaborate with their peers and their perception of their digital capabilities. Focusing on the digital capabilities aspect of the project, this paper explores the results gathered. While the results are mixed, when combined with data taken from the Joint Information Systems Committee (JISC) Digital Experience Tracker, it does appear that using iPads in the university classroom can have a positive impact on certain digital behaviors and students' perceptions of their digital skills.

**Keywords:** iPads; mobile devices; digital capabilities; digital literacy; higher education

## 1. Introduction

We live in an increasingly digital world, one in which more and more of our daily lives, both personal and professional, are becoming reliant on digital systems. As such, today's students must be equipped with the skills necessary to thrive at university and, beyond that, "to respond with agility over their lifetimes to shifting labor market requirements and fast-changing developments in technology" [1]. As such, digital literacy or, as it is now often referred to, digital capability [2] (please note that the terms are used interchangeably within this paper), is quickly becoming one of the most important skillsets that students require for studying and when entering into the job market.

Marc Prensky's often quoted 'Digital Native, Digital Immigrants, Part 1' proposes that most of our current students think differently to previous generations thanks to growing up surrounded by digital technology. They are, as he puts it, "'native' speakers of the digital language" [3] (p. 5) and as such, appear to have an affinity with digital technology. While some have argued that this view is an "academic form of a 'moral panic'" [4] (p. 783) and others have gone on to fully debunk the idea [5,6], the fact that our students make use of a large range of hardware (laptops, smartphones, tablets) and software (social media, web browsers, games, word processing, and design packages) cannot be denied. However, using digital technology on a frequent basis in their personal lives does not guarantee that our students are gaining the skills necessary for them to thrive in a digital work environment.

JISC defines digital capability as "the capabilities which fit someone for living, learning, and working in a digital society" [7] and provides a framework of the six core elements they believe that a digitally capable individual needs [8]. Based on JISC's latest model, the six elements of digital capability are:

- ICT proficiency (functional skills)

- Information, data and media literacies (critical use)
- Digital creation, problem solving and innovation (creative production)
- Digital communication, collaboration, and participation (participation)
- Digital learning and development (development)
- Digital identity and wellbeing (self-actualizing)

For a number of years JISC has worked on projects creating resources to help institutions [9], academics, and the students themselves [10], embed and improve digital capabilities in the curriculum, and foster digital skills in all involved. Links between teaching excellence and digital capability have been drawn [11], and concerns regarding students' use of technology and conventional study practices have been addressed [12].

Coinciding with, and likely the cause of, this increased focus on digital capabilities is the continued rise of mobile technology, with smartphones especially being ubiquitous among the student body, with 93% of 16–24-year-olds in the UK using one [13] (p. 23). While smartphones may be popular with the student body, it is tablets and their potential for learning and teaching that appear to have caught the attention of the Higher Education (HE) sector, with the Apple iPad being the device most frequently discussed.

Released in April 2010, and having sold over 350 million units worldwide, the iPad is the world's most popular tablet [14]. Many studies have been undertaken to explore the potential that iPads, and tablets more widely, have for learning and teaching. The use of iPads has been seen to increase student engagement [15–19], promote collaboration [16,17], and offer an enhanced learning experience [18] by providing new and creative environments in which students can learn as well as an intuitive touch interface. Despite these benefits, a systematic literature review by Nguyen et al. found that, while use of iPads did enhance the learning experience it did not necessarily lead to better learning outcomes [20].

For the implementation and use of such devices to be successful, time and effort are required by both staff and students [18], and the support provided must be robust and readily available [18,21,22]. Existing pressures on staff time must be considered [19,23] as the creation of learning activities that make use of the devices can be time-consuming. Staff confidence in using, and knowledge of, technology must also be considered [21] as well as their opinions surrounding effective teaching, more widely [24].

## 2. Materials and Methods

The iPilot project grew out of previous technology-related initiatives at the university, such as FASTECH, which paired staff and students to use technology to overcome problems with assessment [25], and the Mobile Device Scheme, which recruited students with high digital capability skills to mentor staff on the use of mobile devices [26].

The iPilot, which was co-developed between the Learning and Teaching team and the University's Student Union [27], sought to build on these initiatives by exploring the impact that embedded mobile device use had on the student learning experience.

All undergraduate programs were eligible to apply to be a part of the iPilot, with interested parties required to submit a written application and then present their proposals for how the devices would be used to a panel consisting of members of the Learning and Teaching team, the Student Union, and the First Deputy Vice-Chancellor. Based on these presentations seven undergraduate programs were selected to be a part of the project in 15/16, with the same seven continuing with it into 16/17.

Staff and first-year students on these programs were given an iPad mini 2 and case, with the staff being tasked with embedding the use of the devices into the delivery of their modules. The student devices were not provided on loan and were theirs to keep. Prior to the beginning of the semester, all participating staff were invited to attend training sessions facilitated by an Apple Professional Development Authorized Trainer.

480 students received an iPad in 15/16 with a further 469 receiving a device in 16/17 (see Table 1). In total, approximately 100 members of staff were involved in the project. The total number of students participating in the iPilot at the end of the project were as follows:

**Table 1.** Student numbers.

Program	No. of Students
American Studies	46
Digital Media	46
Law	168
Media and Communication	93
Primary Education	400
Social Work	90
Sport	106
	949

Although the project investigated several different areas relating to iPad use in the classroom, this article will focus on whether the regular and embedded use of the devices had any impact, perceived or otherwise, on students' digital capabilities.

A number of different methods were used to gather information regarding how the students were using the iPads, both inside and outside of the classroom.

Surveys, featuring free-text, five-point Likert scale, and multiple-choice questions, were issued to students at the end of each semester. These surveys were new and designed specifically for the iPilot project. All survey responses were anonymous, and students gave informed consent before participating. Survey questions were designed to reflect the six elements of digital capability, as outlined in JISC's digital capability framework.

Small, semi-structured group interviews were also conducted with students. There was no financial incentive to participate in these group interviews, although pizza was provided.

Lectures and seminars were observed for the author to gain first-hand experience of how the devices were being used in the classroom. Where possible, a class from each program was observed at least once every academic year.

For the purposes of this study, only the survey data will be discussed, however, information gathered from the student interviews and from lecture observations will be used to inform the narrative surrounding the results. During semester 2 of 16/17, JISC launched their Student digital experience tracker [28], and the relevant results from this will also be discussed.

### 3. Results

The number of responses received by each survey varied depending in which semester it was conducted, with the semester 2 surveys receiving far fewer responses (see Table 2). While it is unclear what caused this variance, the author speculates this may be due to the presence of exams in semester 2 (no centrally organized exams take place in semester 1) causing the students to be under additional time restraints and pressure. The number of responses to each survey can be seen in Table 2, below.

**Table 2.** Survey responses.

	No. of Responses	Percentage of iPilot Students
Semester 1 15/16	394	82.5%
Semester 2 15/16	166	34.6%
Semester 1 16/17	375	80.0%
Semester 2 16/17	257	54.8%

### 3.1. Digital Literacy

In the semester 1 survey of each year, students were given a definition of digital literacy (“the capabilities for living, learning and working in a digital society” [29]) and asked to rate how digitally literate they were on a five-point Likert scale. The weighted averages for each year were 4.12 and 4.16 respectively, indicating that the students perceive themselves to be digitally capable individuals.

The fact that students perceive themselves to have such high levels of digital literacy is perhaps unsurprising, given how embedded technology appears to be in their lives. When asked about the devices they already own, the results show that mobile device ownership, particularly that of smartphones and laptops, is prevalent (see Figure 1).

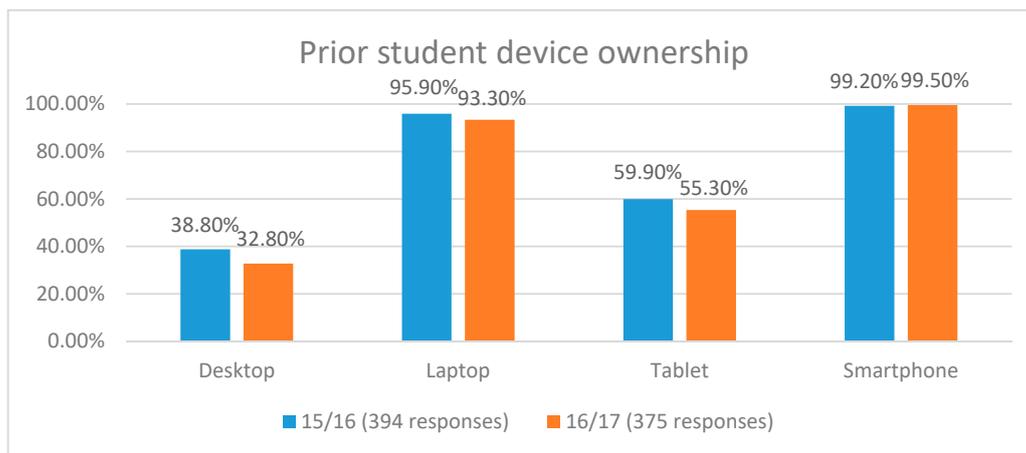


Figure 1. Prior student device ownership.

The data demonstrate that students are prioritizing the ownership of laptops and smartphones over that of desktop computers and tablets. The low ownership of desktop computers could be seen as a move by students to ensure that their technology is portable, although this does not explain why tablet ownership is also comparably small. It is possible that, as tablets bridge the gap in functionality and screen size between laptops and smartphones, many students do not feel a need to possess such a device if they already own the other two. Figure 2, below, provides a more detailed breakdown of tablet ownership by type and confirms that, in this study at least, iPads remain the most popular tablet.

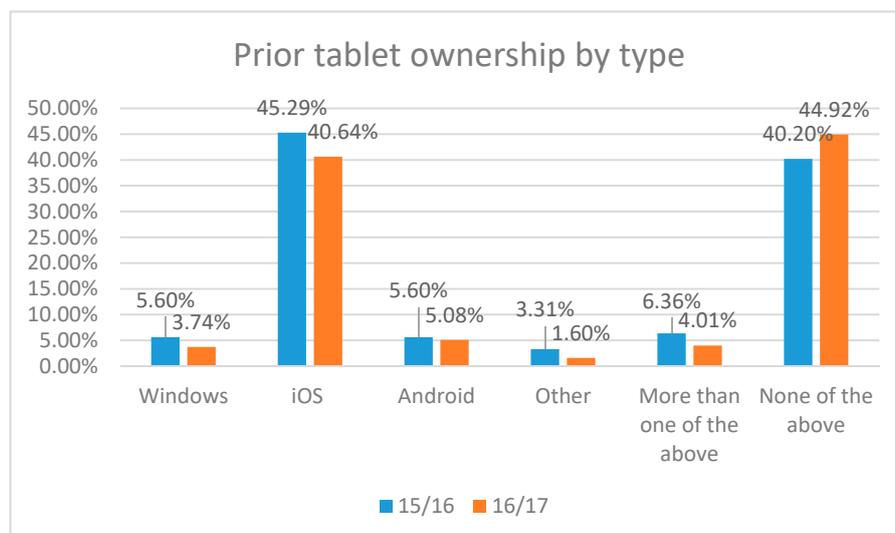
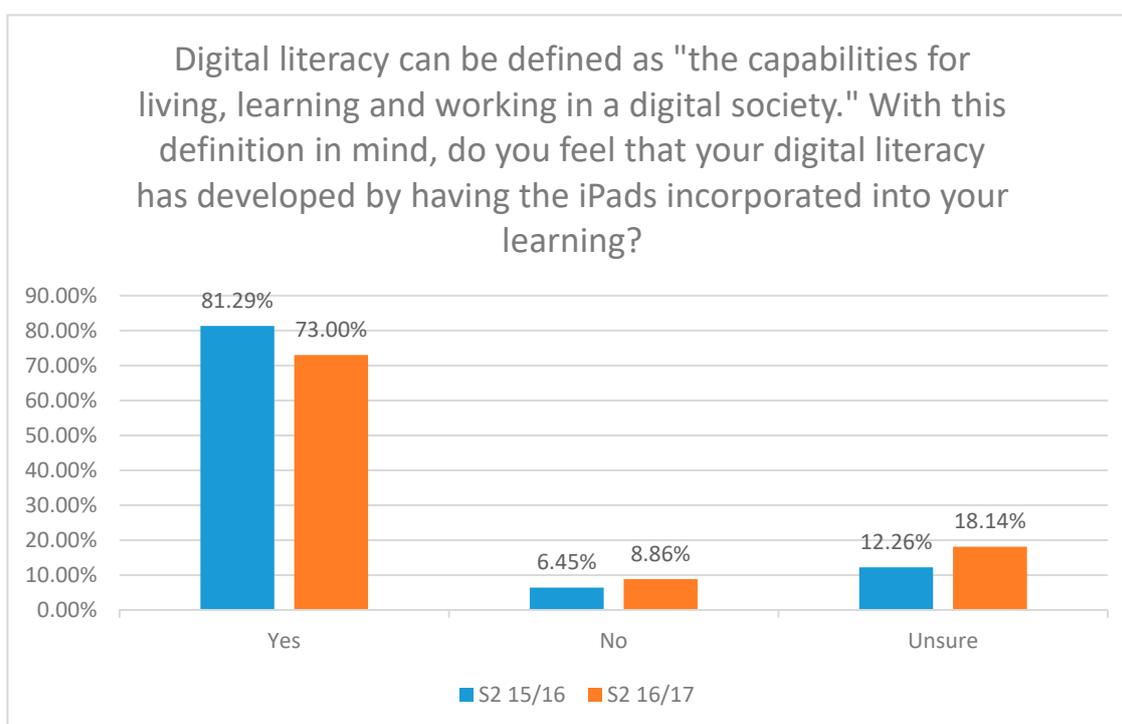


Figure 2. Prior tablet ownership by type.

In semester 2, the students were provided with the same definition of digital literacy and then asked to answer the question, "Do you feel that your digital literacy has developed by having the iPads incorporated into your learning?"

These positive responses (see Figure 3) were echoed in the qualitative comments, with many students claiming that by using the devices for their studies (both inside and outside of the classroom) they had been exposed to new applications and had been presented with new ways of using technology, all of which had a positive impact on their learning.



**Figure 3.** Digital literacy development.

That said, it is clear that some students do not believe, or are unsure whether the devices have had a positive impact on their digital literacy. The qualitative comments relating to these responses report prior, and strong, confidence and competence using technology and, therefore, the students perceived that, although useful, using the iPads in their studies had not had any noticeable impact on their digital literacy.

### 3.2. iPad Use in Studies

The students were asked to respond to 14 statements relating directly to their use of the iPad and their studies, stating how much they agree, or disagree, with each (Figure 4).

In 15/16, there are significant increases in the weighted average between semester 1 and semester 2 for several of the questions, most notably an increase in the weighted average of 0.38 for 'I feel better connected to my fellow students because of my iPad' and 0.31 for 'My iPad helps me communicate more effectively.'

All the students who took part in the group interviews reported using Facebook Messenger on their iPads to arrange group work, ask questions about course content and assignments, and for sharing resources. Airdrop was also made use of for sharing files. Despite all students at the University having Office365 accounts and access to OneDrive, few reported this as a method of storing and sharing files.



a particular aspect of device use. This is especially likely, due to the 0.13 increase for ‘I feel confident using my iPad.’

The results for 16/17 differ to those of 15/16 and in many cases, demonstrate a downward trend in how the devices are being used, most notably a reduction in the weighted average of 0.20 for ‘My iPad helps me communicate better with others’ and 0.18 for ‘I experiment with new apps regularly.’ There is a decrease of 0.15 for both ‘My iPad helps me learn more creatively’ and ‘I feel better connected to my fellow students because of my iPad’ and a similar reduction for My iPad makes me more productive’ (decrease of 0.14). These decreases come in spite of the students reporting increased confidence in using the devices (increase of 0.07) and wanting less help in using them (decrease of 0.15).

Prior device ownership is comparable between the two years, as are perceptions of digital literacy (variance of 0.04), and lecture observations revealed no significant changes in practice. As such, it is unclear as to why the students in 16/17 appear to find the devices of less benefit, although it is possible that staff may not be making as regular use of the iPads as the observations imply.

### 3.3. Technology Use in Studies

Students were asked to respond to eight statements relating to their use of technology in their studies, stating how much they agree, or disagree with each (Figure 5).

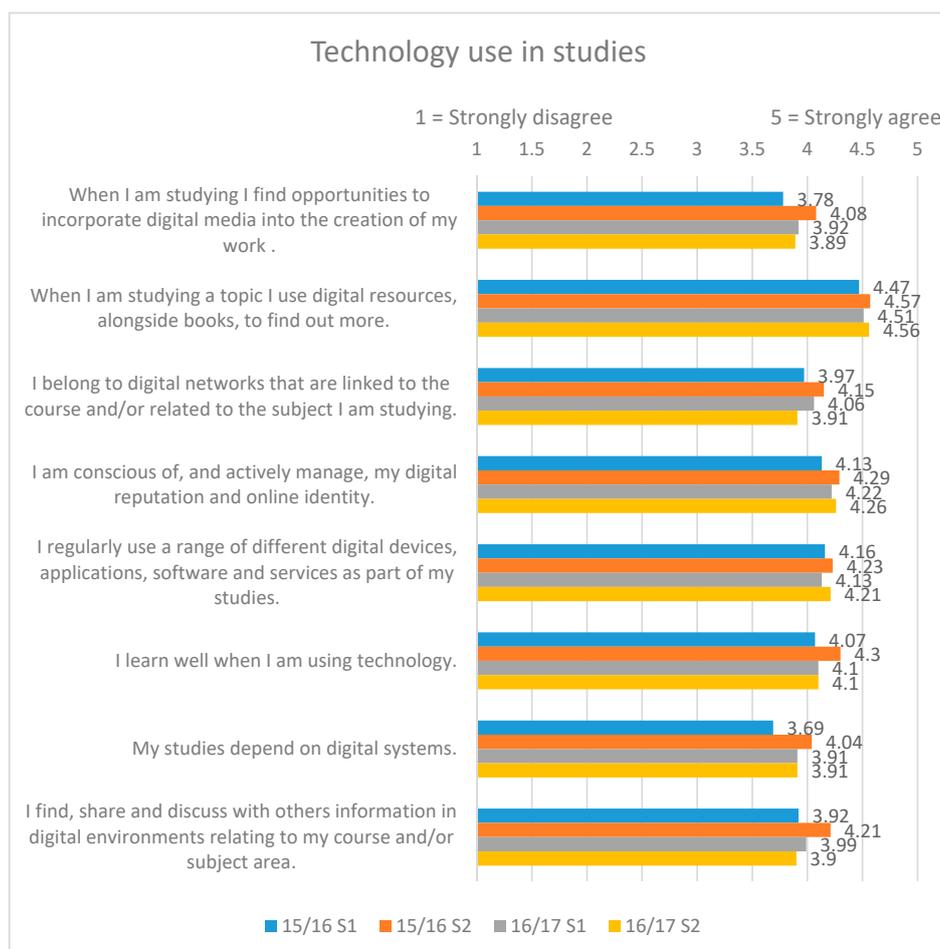


Figure 5. Technology use in studies.

As with the previous set of questions, there are some significant increases in the weighted averages between the semesters for 15/16. Most notable among these is an increase of 0.35 for ‘My studies

depend on digital systems,’ perhaps indicating that by this point in the academic year the use of the iPads has been fully integrated into their studies.

Other significant increases include a rise of 0.30 for ‘When I am studying I find opportunities to incorporate digital media into the creation of my work.’ The group interviews and lecture observations have shown that the students are making use of the iPad’s camera, taking short videos and still images to supplement typed or written notes. In the case of Primary Education students, these digital artefacts are often then being used in the portfolio they are required to keep. The 0.29 increase for ‘I find, share and discuss with other information in digital environments relating to my course and/or subject area’ is likely to relate to the aforementioned use of Facebook Messenger and file sharing tools, such as Airdrop.

The 16/17 results are much more mixed with some smaller increases in weighted average, some small decreases and some remaining unchanged. The most significant change is a decrease in the weighted average of 0.15 for the question ‘I belong to digital networks that are linked to the course and/or related to the subject I am studying,’ perhaps indicating a lack of time, or willingness, to engage with others in their subject area as their degree progresses and their studies become intense.

### 3.4. JISC Digital Experience Tracker

In 2017 the University took part in the JISC digital experience tracker. While the surveys undertaken as part of the iPilot demonstrate changes in perception and behavior over time, the data from the JISC digital experience tracker make it possible to compare the answers of iPilot and non-iPilot students against the national average. It should be noted that this survey took place during semester 2 of 16/17 and as such no data exists for the previous three semesters.

Figure 6 shows the percentage of students who reported never conducting certain digital behaviors and demonstrates that the iPilot students are more likely than non-iPilot students, and the national average, to undertake certain activities. In particular, the iPilot students are much more likely than the national average to ‘access learning on the move,’ implying that their iPads allow them to be more flexible in when and where they learn.

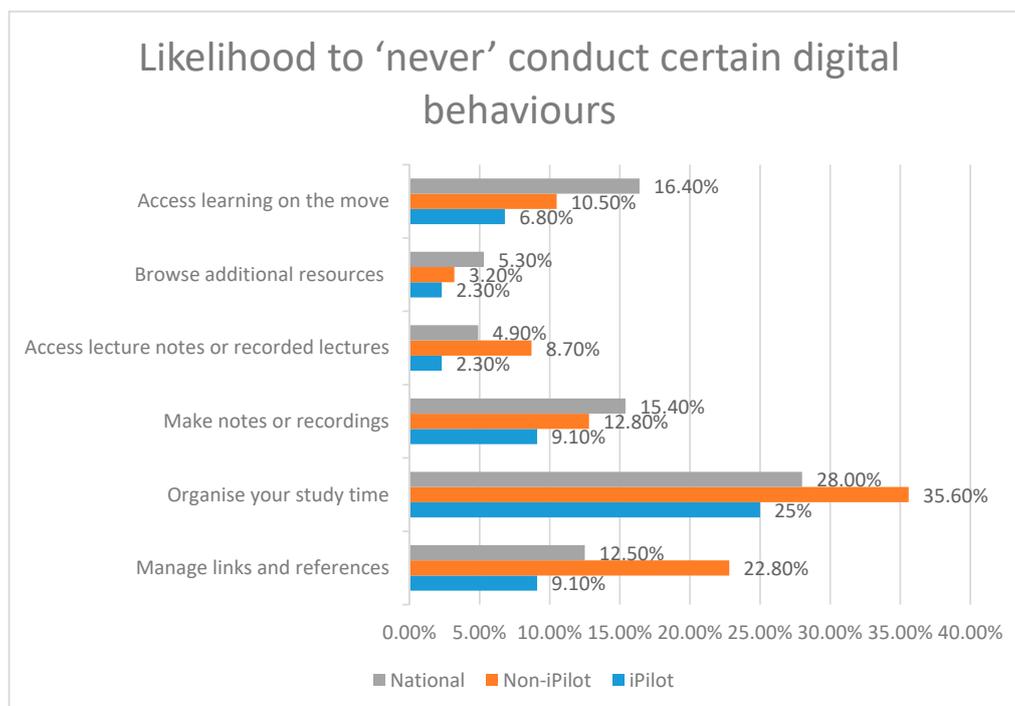


Figure 6. Likelihood to ‘never’ conduct certain digital behaviors.

#### 4. Discussion

Overall, the results of this study showed that providing students with iPads and having the device's use embedded into the delivery of classroom activities has had a positive impact on students' perceptions of their own digital capabilities.

This is especially clear in the data from 15/16 which shows an increase in certain digital behaviors, and opinions relating to technology use in studies. This demonstrates that the more the students are making use of the devices in the classroom, the more opportunities they are discovering for utilizing technology in their learning, and the more vital that technology is becoming to their studies. This shows that the students clearly believe that using the iPads is having a positive effect on their digital capability. The free-text comments from the surveys relating to digital literacy do appear to suggest that the use of the devices has the most benefit for those students who do not already class themselves as very digitally capable, suggesting that those students who are on the higher end of this scale are operating above the level of the tasks undertaken. Future studies may find it beneficial to see whether there is any correlation between initial perceptions of digital capability and growth over time in these perceptions.

The 16/17 data are more troubling as it displays a reduction between semester 1 and semester 2 in student opinions relating to the iPads, technology and their studies. While this is not the case for all of the questions, enough display a downward trend to suggest that something had changed, despite lecture observations indicating that this was not the case. As alluded to earlier in this paper, tutors may have been making more of a 'show' in using the devices while they were being observed, as they were given at least a week's notice prior to the observation taking place. It is possible that by the final semester of the project the initial enthusiasm that staff displayed for using the devices had waned with time-pressures preventing staff from designing appropriate activities. This is supported by some comments from the group interviews and free-text comments from the surveys that indicate that the devices were not being used as often as some students expected or wanted.

Due to the rapid changes that technology tends to undergo, it is possible that changes to iOS (the operating system) could have contributed to the decline in use between semester 1 and 2 in 16/17 by removing or changing familiar functionality. Version 10 of iOS was released two weeks prior to the students receiving their iPad mini 2s and saw a number of minor updates during the academic year with version 10.3.1 being the final version that the students would have had access to during semester 2. However, reviewing the patch notes [30] does not reveal any major changes that would contribute to a decline in use, and software changes were not raised as an issue in either the surveys or group interviews and so, this is unlikely to have contributed.

It is likely that staff levels of digital capability may also have affected the frequency of use and types of tasks undertaken. As the project was so large, it is unsurprising that tutors displayed varying levels of digital literacy, from tutors who had never held an iPad to those who were Apple Recognized Educators, or who specialized in digital pedagogy. Several tutors remarked that they felt uncomfortable making use of the devices in class as they perceived their own digital capabilities to be much lower than the students'. The same tutors expressed an understanding that it is vital for students to possess these digital skills, and that as academics, it is partly their job to help the students acquire them. However, despite showing a willingness to expand their digital skillset, these tutors reported not having the time to attend training or conduct independent research on how to embed the devices into the delivery of their classes. In contrast, some tutors displayed over-confidence in using the devices in their teaching, due to prior experience of using iPads in their personal lives. However, this did not always translate into effective use in the classroom and, as with any piece of technology, it must be remembered that being able to use an iPad does not automatically mean that a tutor will be able to use them appropriately in teaching.

The Technological Pedagogical Content Knowledge (TPACK) framework [31] indicates that the staff referred to above, while all displaying strong content knowledge (CK) and pedagogical knowledge (PK) do not have the required skills and knowledge to effectively integrate these with technology.

It is interesting that some staff members who reported high levels of digital capability, displaying technology knowledge (TK) and technology content knowledge (TCK), were unable to make use of the devices effectively in their teaching, indicating that barriers exist to them truly understanding how technology, pedagogy and content knowledge (TPACK) can, and should, interact. This will help shape future training on mobile devices that staff receive.

While work has already been undertaken to draw relationships between academics' views of education and technology and student usage [21], future studies may wish to consider this with a particular focus on the use of mobile devices.

In contrast to, and despite, the general downward trend in many of 16/17 results, the JISC data suggests that the use of the devices is having a positive impact on certain digital behaviors. While non-iPilot students at the institution were less likely than the national average to access learning on the move or browse additional resources, the iPilot students consistently scored higher than both other groups. While this could be attributed to the fact that they all own iPads, the high levels of prior ownership of both smartphones and laptops, imply that new behaviors might be being formed through the use of the devices in-class.

When discussing these results, it is important to remember that the iPads used for this project are merely a tool and in themselves, did not provide any benefit. As Higgins et al. articulately state, it is "the pedagogy of the application of technology in the classroom which is important: The how rather than the what." [32] (p. 3). It is, therefore, the ways in which the students have been making use of the iPads, both inside and outside of the classroom, which will have had an impact on their digital capability skills and not the devices themselves. Due to the number of academics and students involved in this project, it was not feasible to gather precise information surrounding the types of activities that were being undertaken, and this is one area in which this study is lacking. Anecdotal evidence suggests that research tasks resulting in small group presentations are more beneficial than others, such as the use of audience response tools, but not enough concrete information has been gathered to definitively make a statement. Future studies, where the types of activities undertaken by students are categorized to see whether certain tasks provide more of a benefit than others, would be beneficial and would help those colleagues who wish to design curricula with embedded mobile device use.

As this study focused on the use of the devices in the university classroom, staff perceptions of both technology and effective teaching student perspectives of their digital capabilities will undoubtedly have had an impact on how the iPads were used, and as such, the level of impact that their use had on student perceptions of digital capabilities. Previous studies have drawn correlations between student engagement in technology-rich classrooms and tutors that see the importance in developing student self-reliance [24], whereas others have found that some perceptions of how technology impacts learning are unlikely to lead to successful integrations [33]. Related future studies may wish to ascertain staff perceptions of both technology and effective teaching prior to better understand how these factors affect student digital capabilities.

As a large-scale, cross-faculty initiative, where individuals had varying levels of experience of using technology, and tutors displayed differing teaching practices, within teams and across the institution, gathering detailed and granular data regarding device usage, and staff and student views, proved difficult. Future studies may wish to focus on a single discipline with a smaller number of staff and students as this may prove easier to monitor. Smaller studies may find it beneficial to focus on gathering qualitative rather than quantitative data, as the author believes that this may prove to be the richest source of information regarding opinions and device usage.

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