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Are academics ready for smart learning?

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Abstract

Ownership of smartphones and tablets amongst the student population is growing. Students are using their devices to support their learning. Employers and employees are increasingly bringing their own smart devices into private and public organisations to support their business. This is leading to employees driving the Bring Your Own Device (BYOD) agenda in organisations. It is not clear the extent to which academics are embracing smart technology to manage their workload or to enhance the student experience of learning. This paper presents a qualitative study of how engineering academics are using their own BYOD or institutionally provided smart devices. A 6Cs (connect, communicate, collaborate, curate, create, and coordinate) framework has been used to analyse the results. The findings indicate that academics are primarily using devices to create materials, secondly to coordinate their work and thirdly to communicate with students about their learning. However, there are a number of inhibiting and enabling factors that need to be addressed by academic institutions to develop the effective adoption of smart technologies for academic practice. Infrastructure, including developing widespread access to WiFi, and the prioritisation of opportunities to support staff to learn how to apply the technology to enhance student learning and experience are key areas of necessary development.

Keywords: BYOD, smart devices, apps for learning, tablets, mobile learning

Structured practitioner notes

What is already known about this topic

- BYOD brings a set of challenges for any organisation in terms of security, infrastructure and data/device ownership.
- BYOD and institutional devices are bringing changes to how professionals practice, particularly in the Health sector.
- Students are engaging with BYOD to enhance their learning and experience of the university.
- There are numerous apps that can be used by students for learning which can be categorised using the 5Cs: connect, communicate, curate, collaborate and create.
- BYOD extends the reach of learning across formal and informal spaces.

What this paper adds

- Academic staff are embracing personal and institutionally provided portable devices in 6Cs context: to create, communicate, collaborate, connect, coordinate and curate dimensions of their practice to enhance their students' learning and experience.
- The uneven quality of university IT infrastructure is impacting on the effective adoption of BYOD and institutional devices for academic purposes.
- Baby Boomer generation academics are more willing to find the time to digitally innovate than X and Y generation academics.
- Academics begin by trying to map existing manual or PC tasks to their devices. It takes time to innovate and see the potential to develop new ways of working using smart devices.

Implications for practice and/or policy

- Institutions need to do more to support academics use of smart devices for learning by giving them informal development opportunities which allow them to experiment pedagogically and share innovative practice.
- More research, innovation case studies and examples of good practice are needed to demonstrate the academic value of smart devices to academics and to develop accessible and easy-to-use methods of using devices to enhance students' learning and experience of university.
- Universities need to address infrastructural issues including WiFi, sockets, and the updating of devices through login.

Introduction

Dodds and Fletcher (2004) highlighted how modern technology is inexpensive and accessible anytime and anywhere and has the potential to meet learners' pervasive educational requirements.

Today's mobile technologies are truly pervasive devices and have the potential to interact with the learning environment (Ballagas et al., 2006). IDC (2012) predicted that in 2015 4.5 billion personal devices will connect to corporate networks. Enterprise users are embracing and driving the Bring Your Own Device (BYOD) agenda (Cox 2015), and if corporate users are not permitted to connect legitimately, they will circumvent regulations and connect anyway. BYOD, therefore, is recognised as a reality in any organisational workplace. BYOD has shown to have a positive impact in supporting employees and employers in commercial practice (Chen, Park, and Putzer, 2010; Durbin, 2011; Lin & Brown, 2007; Jewell, 2011) where it has also been shown to increase employee productivity (Mitrovic, 2014) and job satisfaction (Calder, 2013; Shumate & Ketel, 2014). However, Matteucci (2014) highlighted that BYOD presents real commercial risks for an enterprise, including increases in the inappropriate use of technology by employees, unsecure networks, malware, and device theft. An enterprise BYOD policy can mitigate the commercial risks and lead to the reaping of the benefits of BYOD including increased employee productivity and increased revenue, and reduced company cost (Singh, 2012).

Universities are large enterprises, often with thousands of employees and students, all working and studying within and outside the establishment's structural and virtual space. In light of this, will BYOD have the potential to benefit and enhance t academic practice? Can BYOD support Universities to be more productive and efficient in terms of time and cost for the core business of enhancing student learning and experience? On the other hand, from the academic perspective: Can BOYD perceivably, easily and effectively support academics' and students' professional practice?; and/or can BYOD assist in the development of new learning technology paradigm and promote an immersive learning environment?

BYOD in Education

Students are increasingly bringing their personal devices into classrooms. BYOD from the students' perspective brings educational benefits provided that they are utilised in the learning environment with clear educational goals. For example, their devices can be used to make notes, for class e-learning voting and to access learning materials (Zhu Kaplan, Dershimer, & Bergom, 2011). The worldwide (from Australia Asia, Europe, USA, India to even parts of Africa), trend of students bringing technology into the classroom is likely to increase with students' prior educational experience which now includes many developing and developed country governments supporting investment in 1 to 1 laptops, BYOD and tablet initiatives in the school classroom (Tamim, Kaplan, Dershimer, & Bergom, 2015). It should be noted that historically BYOD referred to WiFi enabled laptops. However today, it is more about Institutions expecting to support students and academics with their own handheld smart devices such as phones and tablets Walton (2014). Sharples *et al.* (2012) highlights that BYOD has the potential to reduce institutional IT costs, develop new pedagogy practice, and make it an attractive prospect to Institutions to embrace BYOD. BYOD is now a common reality for the majority of the UK

student population - 85% percent of UK & US KS-12 educational institutions currently allow BYOD on their networks; 72% of students use their own devices for assignments; 52% of devices are integrated into the classroom experience (Bradford Networks, 2013). At HE level, an Armstrong (2012) survey, distributed to 5,300 students in the Faculty of ACES at the Sheffield Hallam University, identified that 87% of the 474 student respondents confirmed that they own a smart device. As evidenced, BYOD is already becoming a common reality for Institutions.

However, Andersson, Hatakka, Grönlund, and Wiklund (2014) notes that technology in the classroom is a distraction to learning especially for the weaker students. He also explains that teachers lack strategies to overcome this problem, leaving them unsure of how best to embrace technology to support student learning. Student feedback highlights that current teaching lacks innovation with respect to technology, and that it is necessary to create new technologically immersive 21st century teaching methods (Swallow 2015). This means that academics need to first experience the technology in order to identify how they can appropriate the technology in the classroom before creating effective learning technological paradigms that are beneficial to all stakeholders.

It should be noted that BYOD technology is mobile, and its wireless capability means that the technology is not tied to the classroom. It therefore opens up learning opportunities to be shifted from e-learning to mobile learning (m-learning), and to ubiquitous learning (u-learning) outside the classroom (Liu and Hwang, 2010). Reychav, Dunaway, and Kobayashi (2015) discovered that the level of use for learning outside the classroom varied according to the mobile device, for example tablets were more supportive of, and influential on, learning outside the classroom than mobile phones. However, previous research into smart device users versus PC users has identified that the former is more passive than the latter type of user (Tuttle, 2012). Emery (2012) emphasises that mobile learning is not a replacement for face to face. Instead, it provides the means and opportunity to extend learning from a formal learning environment into semi-formal and informal learning spaces.

Ongoing research shows that students are embracing smart devices to support self-learning. In particular, they are seeking out useful apps to improve skills such as organisation, productivity, referencing, communication, and multi-tasking (see Nortcliffe, Clark, & Parkes, 2013; Nortcliffe and Middleton, 2012;

Woodock, Middleton, & Nortcliffe, 2012; Woodcock, Armstrong, Nortcliffe, & Middleton, 2012;

). Furthermore, Woodcock's, Middleton *et al* (2012) 272 student respondents' rationale for using smart technology for learning is consistent with previous research and has found that smart devices:

- are ubiquitous and do not constrain the when, where, what, how and with whom of learning (Traxler, 2009; Sharples, Arnedillo-Sánchez, Milrad, & Vavoula, 2009);

- are easy to operate (Kang, Cho, & Lee, 2011);
- promote learning autonomy (Camargo, Bary, Boly, Rees, & Smith, 2011));
- enable learners to create and configure, and are accessible, easy, efficient, supportive, congenial, convivial and personal learning spaces (Goodyear, 2000).

The student landscape of learning is shifting further towards ubiquitous learning as smart devices have become more popular. In the U.K. 17.7 million smart devices have been sold (Arthur 2014). Gikas and Grant's (2013) research shows that students are adopting these devices and changing how they learn through connectivity and communication with peers and academics; fostering learning collaborations with their peers; knowledge collection anytime and anywhere; interaction with learning content; creation of learning content. BYOD is therefore continually providing opportunities to develop new pedagogy practice to engage student learning and experience.

In the emerging pedagogy of BYOD practice,

Sharples, Taylor, & Vavoula, (2005) highlighted that the use of mobiles enable informal learning to be brought into the classroom. Certain functionality can support student learning in the formal, semi-formal and informal learning environments, for example students gathered verbal feedback (Middleton, Nortcliffe, & Owen,, 2009). Conole (2012) highlighted that institutions are ensuring learning materials are accessible on mobiles so students can consume learning anywhere and at any place. Mobile technology accessibility must not only ensure that file formats are compatible on any platform, but it also needs to ensure that it is readable, useable and searchable on tablets and phones, (Anonymous, 2011). There is a need to design learning resources with the mobile learner in mind, (Beetham and Sharpe, 2013). This therefore encourages the academic to rethink and redesign their digital learning resources for mobile accessibility. For example, Laurillard (2013) provides an example of an academic providing mobile friendly extracts of their presentation for students to download onto their personal device to complement traditional lecture. Chiou, Su, Liu, & Hwang, (2015) found that smart technology is instrumental in supporting seamless flipped classroom practice both inside and outside the classroom.

This raises a number of important questions - how are academics responding to this paradigm shift in the learning technology landscape? Are academics using their own devices or institutionally provided devices to support learners? How are academics supporting and promoting the best technologically led learning in and outside the classroom? In reality, if academics are to identify and develop best pedagogical practice for their learners, they themselves need to understand the technology and have experience of its use.

BYOD Implementation in Education

Afreen (2014) recommends a staged management approach to researching, developing and implementing a BYOD policy in educational establishments. According to Afreen, this ensures that all stakeholders benefit. As wireless communication is a critical enabler for in-class

activities as well as m- and u-learning activities outside the classroom, Santos (2013b) highlights that HE institutions need to reconsider their network infrastructure. He recommends small pilot studies with faculties who are already using learning technology. In addition, Gordon (2015) recommends that institutions shift from ensuring the security of the device to that of the data. Shin, Shin, Choo, and Beom (2011) identifies that the perceived quality and usability of smartphones are critical factors to the wide-spread adoption of academic campus u-learning. Integration of the technology into the formal learning environment promotes further learning discussion inside and outside the classroom (Santos, 2013a).

In the academic year (2013-14), more than 2,500 Sheffield Hallam University staff, both academics and central administrators have connected a personal or institutional smart device to the University email exchange server. Academics are reminded each time they configure a new device to the University mail system that if they use their personal device for work related activities they are:

- personally responsible for the security of University data on their device
- required to password protect their device.

Furthermore, the University intranet, virtual learning environment, student record information systems and the web based application systems are password protected and require users to login. Users are automatically logged out after a period of inactivity.

Further quantitative research of University staff's smart device use (see Nortcliffe, 2015), has identified that staff are using their devices for work related activities; albeit admitting to using their devices primarily for the calendar and email apps, i.e. as a communications tool. They are essentially using their devices as an alternative to previous established methods and tools. These results highlight the lack of current academic innovation and engagement with the potential of smart device technology. Or, do the results indicate an issue of staff development and lack of opportunities to explore the potential of smart apps available in app stores? It should be noted that app stores are a minefield for users looking to find a useful app; 700,000+ each in the Apple and Android stores (Costello, 2012), and 120,000 for Windows Phone OS (Tibken, 2012).

This paper will explore if academics are "smart ready", and whether or not tablets have a role in the current and future academic landscape. The following sections will present the results and critical analysis of a qualitative study of engineering academics at Sheffield Hallam University who are using institutionally provided tablets or their own smart devices to support their work, learning, and student learning at the university. As a part of this process, the paper will categorise which apps are being used by staff and how they are being used, and will codify the common issues that support or hinder staff adoption of smart technology in general, and specifically for student learning.

Research Project

This paper reports on a qualitative research project involving engineering academics in the Faculty of ACES. It is a small pilot study of those who use tablets to support their students and also their institutional work. The project involves four categories of academics - those who:

- are using their own personal iPad- 2 academics
- are using their own Samsung Android tablet - 1 academic
- volunteered to be provided with an institutional iPads mini - 7 academics
- volunteered to be provided with an institutional Samsung Galaxy Note - 3 academics

The first two categories of academics chose their own devices. The latter two categories are academics that were recruited or volunteered to be part of two separate Faculty pilots. The choice of tablets for the projects was determined by the particular project requirements for:

1. a particular application only available on the iOS platform at the time of the project and institution policy of only purchasing iPad Minis as opposed to iPod Touches or iPads.
2. an effective and easy-to-use stylus and an application determined as only available on the android platform at the time of the project.

The pilots were institutionally funded enhanced teaching studies in engineering to investigate and develop methodologies for using smart technology to increase efficiency, depth, and quality of assessment feedback to students. This research project will further identify how staff have used the provided devices to support both, students and their work outside of these projects. Although the devices were supplied and intended for the specific purpose of the funded projects, staff were not constrained to using the devices solely for the specified projects. In fact, they were encouraged by the Faculty and IT services to use the devices beyond the original remit of the projects.

The research presented in this paper of the investigation into how staff use their smartphones and tablets to enhance student learning has the approval of the Faculty of ACES, Sheffield Hallam University research ethics committee and complies with the University guidelines for ethical research involving human participants.

The iPad Mini project provided six academic volunteers with an iPad Mini each, pre-installed with audio and annotation apps. The aim of the project was to enable academic staff to provide summative and formative individual visual and audio feedback to large cohorts of students receiving employability development, i.e. student CV submission. Audio feedback has been shown to be an effective tool in providing quick feedback (Rotheram, 2007). iPhone audio feedback can reduce the turn-around further - a critical issue for employability feedback when students would like feedback sooner. It also provides personalised one-to-one feedback that motivates and assists students to move forward (Nortcliffe and Middleton, 2011). Audio and video feedback technology provides rich and clear feedback that students returning to study can effectively feed forward to improve their learning (Gould and Day, 2013).

The academics were offered formal training in the use of iPad Minis; two colleagues attended the seminar. Others received a more informal half-hour one-to-one tutorial. All staff expressed the desire to explore the technology in their own time and return with any questions. The occasional queries were addressed on an ad hoc basis and were primarily related to issues of institutional constraints, i.e. institutional apple IDs, IT systems and logins. This paper will discuss and illustrate the issues arising from this project further.

The Samsung Galaxy Note tablet project on the other hand, equally desired to address the issue of timely and quality feedback in order to improve student learning and experience. Timeliness and quality of feedback have been found to be perennial problems of student experience (Gibbs and Simpson, 2004). However, the primary objective of this project was to find a method that would enable users to write and draw the digital feedback - diagrammatic annotations are far more suited to technical engineering submissions than purely written feedback, but are time-consuming and difficult to execute using a traditional keyboard and mouse. Therefore the project needed a device with an effective stylus, and an appropriate app that:

- supported drawn annotations
- had the means to efficiently download and upload student submissions
- reduced the time spent by academics and administrative support staff on collating and distributing assessments and feedback.

The iAnnotate app on iPad can be used constructively to provide visual annotations on drawings, and written and stamp feedback using a stylus on students' e-submissions to provide personalised and student-welcomed feedback (Upson-Saia and Scott, 2013). At Sheffield Hallam university, in the Department of Engineering and Maths, the trials by an academic using their own personal Samsung Galaxy Note and annotation SNote app with a stylus to provide visual feedback yielded positive anecdotal evidence from the students in terms of feedback turnaround efficiency and quality. Three tablets were provided to academics (recruited by the project lead with the academics' co-operation) to enable them to provide digital annotated feedback on the assessment submissions for a new suite of level 5 thermofluids engineering module. No formal or ad hoc training was provided. However, all thermofluids engineering academics shared the same office space and were in position to learn from one another.

This paper presents the research results of staff's perception of their devices and applications, and details how the academics used the devices both for the teaching enhancement project and per se.

Project Research Methodology

For this qualitative research, a semi-structured interview approach was adopted, (Cohen et al, 2000). Interviews with the academics were arranged when it was convenient for them, and were typically 1/2hr long each and conducted by student research assistants employed on the research project. The semi-structured nature of the interviews enabled the interviewer and interviewee to

talk around and demonstrate issues on the tablets especially in terms of how these devices were being used to support student learning and experience.

The interview conversations were recorded by the research assistants who used their own personal smart devices; one used the Recorder Pro app recording in AAC format on an iPhone, and another used a standard audio recording app producing an MP3 file on an android phone. The students manually transcribed the audio recordings into google docs, and analysed and codified the results using the following methods:

- The ways in which academics use smart devices to support students and their personal institutional work were analysed and codified using the 6Cs; connect, communicate, collaborate, curate, create, coordinate. These are expanded from Nerantzi and Beckingham's (2014) 5Cs; connect, communicate, collaborate, curate, create analysis of BYOD4L (Bring Your Own Device for learning).
- Glaser's (1964) qualitative analysis and codifying method to identify any factors which might inhibit and enable the adoption of tablet use to support their institutional work and to support their students. The latter in particular to identify how the University can enable the adoption of tablet use to support academics' role and work.
- Transcript data was further triangulated for each method of codification to identify common reflections between the academics on using devices to support their academic role and factors that inhibited and enabled the use of their devices to support their academic role.

The engineering academics interviewed consisted of one female (age range 40-50) and 10 males (age range 30-70). The age demographic of the academics is shown in table 1:

Table 1: Academic age demographic

Academic	*Age (years)*
A, C, D, F, J	30-40
B	60-70
E, G	50-60
H, I, K	40-50

Results and Discussion

During the interview it was identified that in some cases, for reasons outside the control of the academics, some were unable to use the smart devices to the fullest extent that they would have liked. This is largely due to being too busy to take the time to integrate the technology into their work lives. There was also one academic who had finished teaching for the academic year when they were given the tablet (due to delays in the purchase of the equipment and the nature of

individual academic timetable loading), so they were unable to integrate the technology into the learning environment with students. However, during the interview this was overcome by asking those participating how they would like to use the device in the future, thus allowing those who have not yet had the chance to practically explore the use of the smart technology to its fullest, to express their knowledge of an application and their desire to use the smart technology in a learning context. The recurring theme expressed by the academics was not a lack of willingness to embrace smart technology in the learning context to enhance the student learning and experience, but a lack of time to investigate its possibilities and the best method and application for the task at hand, as shown by the following comments:

> "I ought to be able to simply connect the iPad and deliver a presentation from the iPad and be able to do things like scribble on the slides which would be great. I haven't had the time to try and do it this year. "Academic A
>
> "No, honestly I wish I had had the time to look at all these applications." Academic B
>
> "Partly because I don't have the time really to sit down and play with it I still don't know what it can do."Academic C

The analysis and codification of the interview transcripts to the 6Cs (create, connect, communicate, collaborate, curate and co-ordinate as seen in table 2 below) identified that the results can be pooled into two groups:

- How the academics have been using their smart devices to support student learning:

  > "I use Prezi quite a bit - not for my teaching but when I'm presenting less technical aspects of work on Prezi and I have shown students things on that." Academic A
  >
  > "Reading emails on the move. Even meeting someone in a café, or in campus, discussing things, can download, go to networks, download papers." Academic B
  >
  > "It works quite well for ad hoc marking, so I'm trying to move everything from paper base to electronic." Academic D
  >
  > "I also use a clicker system called Socrative, … in a lecture I can throw questions up on the screen, there is a student version and a teacher version…It has a number advantages, firstly it gives students who don't normally want to put their hand up in class the opportunity to say what they think and to answer a question, it gives them the opportunity to ask me questions without putting their hand up." Academic E

- How academics would like to use smart devices in the future, for example one common theme was how they would like to be able to present and annotate live from the device in a lecture theatre:

  > "I would like to be able to use it to actually present so rather than having to use a laptop or PC" Academic A
  >
  > "I would also like to be able to control presentations using this, which I haven't managed to find a way of doing yet, but I know there is a way in which you can do it" Academic F
  >
  > "I would like the possibility to annotate live on slides." Academic G
  >
  > "One of the things I would like to do, as an aide memoir during lectures, so what I'm starting to do is write complementary notes to my lectures so I can have that." Academic F

"I have not been able to use it in classes, because all the classes have finished. However, I have been exploring some of the apps. I've been along to some of the teaching and learning activities, particularly looking at Google Docs and sharing and exploring how I could use them in the teaching or in the support for the modules." Academic G

Other emerging themes include aiding academic module administration;

"I'd like to use it for attendance monitoring; we don't have a formal attendance monitoring program in the University as far as I'm aware. What I would like to do next year is set up a Google doc that tracks student attendance, limitations occurred (both limitations of the academic themselves or the technology)" Academic H

"… and smarter feedback processes:"[Electronic marking and feedback] just to be able to have a marking criteria [electronically on iPad], tick the boxes, save it and send it out there" Academic D

Table 2: Examples of how academics are using multi-functionality of smart devices to support the many aspects their university life

Category	*No. apps identified in 11 interviews*	*Examples*
Create	20	Create student quizzes (socrative), sketching tool, annotate feedback (Snote), ad-hoc marking & feedback, calculate, notetaking (Notability), mindmap (iMindMap HD), wordprocessing (KingSoft)
Connect	2	Google+, Twitter, Contact people and companies,
Communication	8	Email
Collaborate		Share work developed with students
Curate	1	Research collation (Scrapbook)
Co-ordinate	12	Access data sources , Access documents in meetings, Attendance monitoring, Dropbox, Google drive, Access and read research papers, Calender, Blackboard

Though a small study, 6Cs analysis identifies that academics are beginning to explore the use of the devices to support their academic practice in creating learning content and coordinating

student learning, thereby broadening the use of the devices for academic practice. This is a move in the right direction as previous research identified that the majority of academics were using their personal devices solely to communicate (primarily via email) (see Nortcliffe, 2015).

Further analysis of the codified interview transcripts for inhibiting and enabling factors in table 3 identified two common themes consistently raised by the academics:

- Limitation factors both of the academic themselves and of the technology - see table 3: Inhibiting factors, for example the limited functionality to annotate on student work:

  "I can still circle, mark, and annotate on the paper but I just find the text writing option pretty poor." Academic I

  "Writing with your finger makes it look like writing with a crayon"

  Academic A

  "It's quite frustrating actually because there are quite a few times I have wanted to circle the answers and say 'what's this?' but I think I've got fat fingers so it didn't work." Academic C

  "It would be nice to have a single application [on Android] which could combine audio, video, annotated feedback, which would then spit out a file which was non-proprietary for a student" Academic J

- How the University could help in the integration of smart technology into learning - see table 3: Enabling Factors. One typical bone of contention is the limitation of our IT management:

  "Every so often it tries to install things from iTunes and a couple of times it would be ask me first for somebody in our IT department's iTunes password which I don't have" Academic A

  Another is the University Intranet's software configuration:

  "We want to use electronic feedback and save students [printing cost]… need to download all the files [from Blackboard] and then copy [them] to dropbox and try to mark it over there [on the smart device via dropbox]. And then we need to put [them] back [on Blackboard]. That's difficult because we also need to do it one by one [each file] to put it on blackboard site." Academic K

  "for Hallam [Google drive] you have to sign in through the Hallam portal, the app can't read two things, it won't let you do like a third party gateway. [Therefore you are unable to directly download/view a student's e-submission on another app]. The only way I can mark-up students work is to save it to my own drop box" Academic D

It is clear that the University needs to review its IT management with respect to smart devices. It would be appropriate to provide wireless dongles on the projectors in teaching rooms, so staff can project from smart devices. This would enable teaching rooms without digital white board facilities inadvertently to become digital white board enabled.

The Apple ID problem needs a solution to enable multiple ID apps or it must allow all staff to use their own apple ID and be provided with app store vouchers for institutional apps, so that staff can easily upgrade and download apps.

It should be also noted that for three academics using the 8" Samsung and iPad mini an inhibiting factor was the screen size as some academics preferred a bigger screen for writing activities opposed to reading. The latter was never mentioned as an issue by the participants;

"for writing on things a larger size screen would be better." Academic A

In contrast, there were also some academics who preferred the smaller screen size. Although they acknowledged that a small screen size did pose some issues, they were willing to use it as trade-off between portability and user ability. The latter can be achieved by adapting the technology to their requirements:

"I can cope with a smaller screen size. I chose the 8 inch because it's easier to take with you compared to a 10 inch device which I wouldn't carry around with me most of the time and that would defeat the purpose of being able to do the marking anywhere. But yes a little bit bigger screen size will make it easier to mark, but after a while I got used to rotating it and zooming in and out and doing the annotation that way. In the beginning it was too small but once you get used to it, you accommodate." Academic G

Table 3: Issues that the academics identified had affected their uptake of the technology

Inhibitors	*Enablers*
Updating the apps	Solution to allow the updating/upgrading of apps without IT support
Apps accessibility controls, non-compatible with Hallam login portal	Improved IT support
Small screen	Stylus
VLE lack of integration to other smart app	Improved roaming WiFi
Turnitin lack smart technology integration	iPad or 10" Galaxy
Android iAnnotate lacks Apple functionality	Integration of Institutional systems (hardware and software)
Lack of time to learn and explore	Office app
Difficult to type, time consuming to type	WebDav
Download more than one student file at a time	Solution to updating without IT

With regard to the 6Cs, Table 2 shows that most of the academics were using the devices to create and mostly to give digital feedback on student assessments. However, the academics with tablets involved in the level 4 CV feedback did not use the devices specifically to provide feedback on student CVs, but they also used the devices to provide feedback on other student assessment activities as well. All staff agreed that the devices allowed them to return feedback to the students in a quicker fashion, eradicating the time consuming method of students physically submitting an assessment, academics marking the assessment with pen and paper and

then dropping off the assessments for the students to pick them up. Participating academics were able to mark a student's presentation and have it sent back to the student by the time the student had finished their presentation and sat down:

“because it tends to be that you can mark something up and then while you’re sat there you can email it to them so by the time they get back to their computers it’s all sorted”. Academic D

Those who were part of the visual feedback project on the module did use the Samsung devices to provide feedback on the level 5 thermofluids module assessments. Two of the academics involved were able to effectively use the devices and app to efficiently and easily provide feedback:

"[In] S Note there is a button that says add another page, so if you're reading a student's document and you're annotating and you need more space, just press the extra page button and you've got a whole blank page to write assessments on" Academic H

"I can use it just like I would use paper to do the marking. So I can now do marking wherever I am without having to carry about all the paper submissions. We use the electronic submissions and then sync it to the tablet and them re upload the annotated pdfs for student feedback." Academic G

The academics demonstrated that they value the thoughtfulness of the functionality of the app and the same ubiquitous qualities of smart devices which students also value. However, one academic (H) highlighted that the feedback method was not straightforward, not necessarily efficient and consequently was not for everyone. Academic K found it very challenging:

"There are some issues with the way the software works which put barriers in the way of doing things quickly... you can't batch import files form the file management software...if you have 100 assignments, you have to do that [import] process 100 times. Export, you can export [in] batch, so you can do 100 in one go and leave the thing running for an hour." Academic H

"It's not a straightforward way… you can't download all the files and upload all the files in one go, with one folder. The thing is you got to give individual feedback - you need to contact, touch, mark and files one by one." Academic K

Outside these projects (Samsung and iPad), academics employed various methods to give feedback using their devices. Some used a generic marking template in a PDF reader to circle and write feedback with either a finger or a stylus before emailing it back to students, whilst others batch imported the assessments, marked them (again by writing on the tablet with either a finger or a stylus) and then emailed them to students using apps like Dropbox. Others annotated the assessments by typing on the device itself – this was incredibly time consuming. It is clear that a variety of apps and methods were used to achieve the same task and most academics expressed problems with the apps and methods they used to achieve the goal of digital feedback The problem one academic faced, however, had been overcome by another showing that if the academics had discussed their limitations amongst themselves, the best solution would have been found. The issues and challenges the academics faced were similar, regardless of which device, the ideas the academics had for supporting student learning were similar, however it was the

academics execution of those ideas that varied. There is an opportunity for colleagues to support one another, exchange ideas, and share good and efficient practice.

Conclusion and Recommendations

The research project aimed to identify how engineering academic staff were using their own or institutional smart tablet devices in the learning and teaching context. However, any issues associated with the use of tablets and the challenges academic staff faced stemmed from their unfamiliarity with the technology and being unaware of productive applications that they could have used on the device. The issues were common whether institutional or their personal device. This being consistent with Callum *et al*'s, (2014) conclusion that academics own behavioural intentions towards and digital literacy of mobile technology has an impact on their self-efficacy. The project at Sheffield Hallam University found that the academic staff were not exploring applications further in order to understand how they could be used or they could use them to their advantage for themselves and students. There is a need to develop academic's technological self-efficacy. It might be worth underlining that each academic could have resolved their issues by talking to other staff members using similar devices or by seeking the ongoing support to which they have access. As a result, one of the project recommendations institutions hoping to promote BYOD would be to facilitate for staff using their own or institutional tablet devices a regular Show-and-Tell session,. BYOD Show'n'tell sessions would provide opportunities for colleagues to share their favourite application, discuss any issues they are facing, and provide peer support. Also, such events could also provide informal guidance to colleagues who are contemplating in terms which device and screen size would meet their requirements. In particular, it would enable academics to identify which device provides the right functionalities for them and their discipline allowing them to be academically productive. Academics are like students in that they have clear requirements that is like students they need devices that support them to do more in less time (Edmund Thorpe, & Conole, 2012). For example, being able to easily annotate on equations, diagrams and graphs is an important functionality for engineers and mathematicians.

The popular belief is that young adults are early adopters of technology and are therefore the most likely age group to use tablet devices, but in our research we found that it was the older staff who were more willing to play around with their devices. Their confidence had grown to such an extent that they were exploring the market to identify the right tablet for their BYOD requirements and personal investment. One of the reasons for older academics' active engagement could be that they had more time on their hands as their teaching materials had developed over several years whereas the others, who were new to academia, were busy developing teaching materials and trying to balance work and family life. Since our study only uses a small sample, it does not permit too much generalisation. However, it appears that the barriers or obstacles to taking the technology further include staff’s personal time, effort and skill

- the same factors observed to be limiting the uptake of Web-based technology by University Teachers in a USA University in 2007 (see Pajor and Wallace, 2007), oppose to age of the user.

One issue that came up constantly from iPad users was the lack of a stylus. Using a stylus makes writing on the tablet device remarkably precise. It is important to buy the right kind of stylus for the task. Since most staff used their tablet devices for annotating and note-taking, the project recommends that the institution provides a stylus with the device. For staff using their own device, it is recommended that they buy a stylus with a pixel-point nib. Other findings provide insights into some issues that are inherent in technology like the size of the screen and the lack of a tactile keyboard.

The majority of staff, when asked how they would like to use the device in the future, said they would like to use it in lectures as more than a simple clicking device, especially by being able to annotate slides in real time. For this purpose to enable BYOD for teaching related activities, the University needs to invest in technology solutions in teaching rooms which enable academics to present using their own devices. These results concur with the research at University of Brighton (see Greener and Wakefield 2015) which found that barriers will prevent the adoption and utilisation of the technology, and that institutions need to address the institutional inhibiting factors to enable BYOD adoption.

The perceived advantages boil down to the creation of multimedia resources and having access to digital feedback that is more responsive, whereas the perceived disadvantages revolve around physical practicalities (size of screen) and the limitations of applications. We found that the disadvantages can be effectively mitigated by raising awareness around the device and application usability. Some of the technical issues encountered may be eliminated in the near future as software application manufacturers tackle the needs of educational use.

Staff found that using tablet devices poses certain challenges for use, but they believed that these could be overcome with experience. Overall, the study has shown that academics enjoyed using the tablet devices and are happy to continue using them to facilitate learning. The continual growth in use of tablet devices requires staff to explore new ways to use technology for student support. Therefore, to support and promote the academic use of BYOD by academics, institutions should provide access to additional training and support that boost staff professional development in the pedagogical use of new technologies. Departmental BYOD Show'n'tell sessions could provide best practice subject pedagogical support, quickly addressing common issues as noted as occurring in this project between the engineers. However, inter-discipline sessions could enable synthesis of synergies leading to new best BYOD pedagogic practice.

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Statements on open data, ethics and conflict of interest

a. Anonymous Interview Transcripts are stored on a secured cloud, access to the transcripts can be made upon request.
b. The research project and presented in this paper, "The investigation into how staff use their smartphones and tablets to enhance student learning" has the approval of the Faculty of ACES, Sheffield Hallam University research ethics committee and complies with the Sheffield Hallam University guidelines for ethical research involving human participants.
c. No conflicts of interest, project was funded by institution with only conditions student researchers to be employed to research and identify the project results and the results were published.

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