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E-Pedagogy of Handheld Devices 2013 Survey: Patterns of student use for learning

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E-Pedagogy of Handheld Devices 2013 Survey: Patterns of student use for learning

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Introduction

The Pedagogy of Ebooks (E-Ped) project began in 2012 and seeks to document, analyse and explain the changing study practices of UK distance learning students as they employ, adapt and integrate the use of new portable digital devices such as e-book readers and tablets into their learning. This report describes the results of an undergraduate survey undertaken in 2013 at the Open University (UK) which asked students how they used e-readers, tablets and smartphones for study. This research represents a snapshot of the rapidly changing interaction between technology and education, and highlights issues and opportunities for Higher Education in supporting student adoption of appropriate technologies and development of effective new methods of study.

Background to the E-PED Survey

The E-Ped project was conceived against a background of mounting interest in the role and adoption of handheld devices in learning, and in the changing study habits and learning experiences of students using such devices. This meant a conscious move beyond the understanding of device adoption - what Muller et al. (2012) described as the 'the need to understand what the landscape looks like for tablet users that have adopted this new form-factor product so readily' – and towards deeper, more nuanced insight into how existing and emerging study habits were impacting on student learning. Furthermore, with research tending to focus on learners in the US and campus universities, the E-Ped project sought to address the acute lack of data in respect to UK distance and online learning students.

The E-Ped research is of value to: established distance learning institutions; those UK institutions seeking to reach out beyond their traditional student cohort (for example with MOOCs or new blended/distance learning courses); those elsewhere in the world wanting to better understand the UK international students they teach (Song and Lee, 2012). The 2013 undergraduate survey reported here was commissioned after the success of a similar yet smaller

survey and semi-structured telephone interviews of postgraduate students in 2012 (Sharples & Cross, 2012). A third repetition of the survey followed in 2014 and the dataset from this will be reported in 2015. All three surveys share key questions, thereby providing future scope for a cross-sectional analysis of changing study patterns over time.

Research questions

This report considers the following three research questions which each contribute to the broader E-Ped project of documenting, analysing and explaining the changing study practices of UK distance learning students in respect to their use of handheld devices.

- 1: How do patterns of ownership, adoption and use differ – for example: by student age, subject area, and study location?

- 2: How are study habits and learning experiences changing and how do students perceive this?

- 3: Do students who purchase handheld devices primarily for study tend to use them more in their learning than those who purchase them for other purposes?

Context

The role and value of e-books and e-book readers in Higher Education has received increasing attention since the first launch of the Sony (e-)Reader in 2006 and the Amazon Kindle in 2007. Analysis by Jamali, Nicholas & Rowlands (2009) of 16,000 open comments from a UK student survey run by the JISC National Observatory Project found that ease of online access was the most commonly mentioned advantage, followed by searchability, cost, portability and convenience. A student survey at the University of Strathclyde also found that the most popular use of e-books was as a reference resource – for 'finding relevant content' (Noorhidawati & Gibb, 2008). To this list of perceived benefits could be added keeping up to date, building personalised libraries, incorporating hypertext links, novelty, environmental benefits of reducing paper use, and optimising reading time (Lam et al., 2009).

Common early themes in e-book studies during 2008 and 2009 were awareness, use, and the advantages and disadvantages of the technology (Camcho & Spackman, 2010; Bierman, Ortega & Rupp-Serrano, 2010; Foster & Remy, 2009; Rickman et al., 2009). Research indicated staff remained cautious (Bierman, Ortega and Rupp-Serrano, 2010) and there was little observable improvement – indeed often a negative impact – on reading enjoyment and comprehension (Lam et al., 2009). Concerns included: the loss of the 'study focus' that students enjoy when reading paper print, students showing little interest in using e-books beyond what was required in their study, data showing e-books were preferred for leisure rather than academic reading, the lack of absolute page numbering for reference in class, page recall times, inability to effectively highlight text, student difficultly in rapidly moving between pages, and the need in class to refer to more than one page simultaneously (Cliatt, 2010; Darden School of Business, 2010; Marmarelli & Ringle, 2010). These studies demonstrate that e-books had perhaps yet to overcome important barriers to academic use.

Research undertaken in 2010 and 2011 seems to report a more positive shift in the perceived value and use of e-readers and handheld devices, with the emergence of tablet devices and improvements to the functionality of e-readers. Research by the University of California sought to examine students' general preference for print books as compared to e-books (Li et al., 2011) and found use of e-books in academic work was generally just over 50%, with 34% of of students saying they preferred e-books. Indications of more positive perceptions and use were also found by Weisberg (2011) who remarked that perceptions towards e-readers devices had changed rapidly between 2009 and 2011, and that 54% of the students he surveyed at the Sawyer Business School read 'most' or 'all' of the material for assignments on an e-reader. The majority of respondents still saw e-books as a secondary reference point to be used when needed, yet almost a third said they would use a tablet or iPad as their primary way to get content if it were available (Weisberg, 2011).

Whilst encouraging, such high levels of adoption were not universally observed. For example, Foasberg (2011) reported only 20% of students used e-books for academic purposes and just 4% used e-readers, whilst the study by Oklahoma State University (2011) on iPads found that whilst students reported using them had enhanced the overall academic experience the specific use of the iPad as an e-reader showed 'substantial decrease' over the trial period.

In general, however, data indicate the adoption of e-readers and tablet devices for reading has continued to increase in the last few years. The Pew Research Center (2014) found that between 2011 and 2014 the proportion of US adults reading e-books on tablets has risen from 23% to 55%, whilst reading e-books on e-readers has also risen, although more modestly, from 41% to 57%. Perhaps more importantly, this study also found that reading of e-books on laptop computers fell from 45% in 2011 to 31% in 2014.

Furthermore, the emergence of the iPad and other tablet computers has obliged researchers to look beyond the handheld device as a 'reader' and to consider the wider range of learning and study related tasks increasingly available to students. Dahlstrom et al. (2011) for example reported four major academic benefits to handheld technology: easing access to resources and reducing the burden of administration tasks; improvement in productivity; becoming more connected; and enabling learning to be more creative, authentic and reflective.

Also of interest has been how new emerging spaces could be used for learning and teaching yet also, conversely, the 'stationary environment' of the home in which most tablets and smartphone use occurs (Church & Oliver 2011, Muller 2012). In response to this latter work, we intentionally use the term 'handheld' rather than 'mobile' device in this report so as not to prejudge student responses in respect to how or where they use their technologies and because some handheld devices evidently remain geographically fixed.

The E-Ped project can also be situated within wider research into student ownership, use of and expectations for use of technology in their learning (Dahlstrom, Walker & Dziuban, 2013; Sanky, Tynan and McKeon, 2012; Jenkins, 2011) and the critical analysis of constructs such as 'net-generation' and 'digital natives' (Jones et al., 2010). Unlike many studies that tend to focus on students aged 18-22, a key advantage of the E-Ped study is that it includes adult learners of all ages.

Methodology

The 2013 undergraduate survey was sent in April 2013 to a sample of 3003 taught undergraduate students. A stratified sample was selected at random from the overall Open University (OU) student population and within this there were equal numbers of: male and female students, students studying at undergraduate Level 1, 2 and 3 (equivalent of Years 1, 2 and 3 at a traditional face-to-face university), and students from each faculty. There were 518 responses to the survey (a response rate of 17.2%). The response was broadly representative of the sample, apart from a slight over-representation in responses from older age groups (a common feature of distance learning student surveys at the OU).

The questionnaire predominantly comprised groups of closed questions based on a set of questions developed for and previously used in the 2012 postgraduate survey. The 2013 survey questions asked about: access or ownership of technologies; frequency of tablet, e-reader and smartphone use for university study; whether devices were used for a range of study specific tasks; location of use: perceived change in study habits; length of use; and their satisfaction with the course. Many of the questions in the survey were identical to ones in the previous 2012 survey and subsequent 2014 survey.

There were four main open questions which asked students about the changes in study habits (if reported), the benefits and issues of using handheld devices for study, and how the university could provide better support in using handheld technologies for learning. Over 150 students responded to one or more of these questions, and their answers – comprising over ten thousand words of comment – were thematically coded using content analysis to identify key themes.

Results

Research Quesiton 1: How does ownership, adoption and use by distance learning students differ by age, discipline and location?

Ownership and Access

Half (50%) of undergraduate students owned or had access to a tablet device, and 37% owned or had access to an e-reader (Table 1).

Table 1. Proportion of students owning or with access to tablet and e-reader devices

	n	Tablet	e-Reader	Tablet &/or e-reader
Arts	99	52%	41%	68%
Business and Law	65	54%	38%	71%
Languages and Education	67	49%	43%	72%
Health and Social Care	55	51%	31%	62%
Computing, Mathematics and Technology	71	48%	24%	59%
Science	79	43%	30%	61%
Social Science	82	56%	45%	61%
Total	518	50%	37%	67%

There was a statistically significant difference in the proportion of students with access to e-readers between discipline areas (X^2=(6) 13.8, p=0.03). Access/ownership of e-readers was greatest for students studying social science, education, language and arts subjects, and lowest for those studying technology, computing and maths. The respective data for tablet ownership show no significant difference across discipline areas (X^2=(6) 3.4 p=0.76).

In respect to age, there is a difference in tablet access/ownership (X^2=(4) 12.0 p=0.02) and this is statistically significant at the 0.05 level. Access is greatest for the 36-45 age group and is lowest for students who are 56 years or older (Figure 1). However, there is no statistical difference in e-reader access/ownership with age (X^2=(4) 3.80 p=0.43) and for all but the 25 and under group access/ownership is between 36-40%.
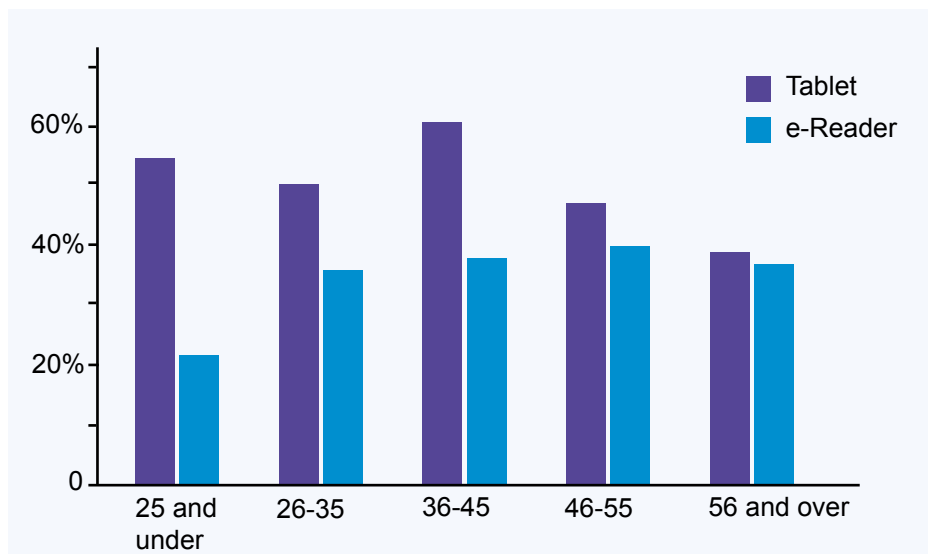

Figure 1. Access to tablets and e-readers by age

Most students had access to one or both of a tablet or e-reader (67%) yet this means some students had access to neither (33%). This latter group are excluded from using tablets or e-readers to study, by virtue of not having access to them. The proportion without access to either device varies by age (Figure 2). The proportion without access to either device is greatest for the youngest and older age groups (25 and under, 46-55, and 56 and over).
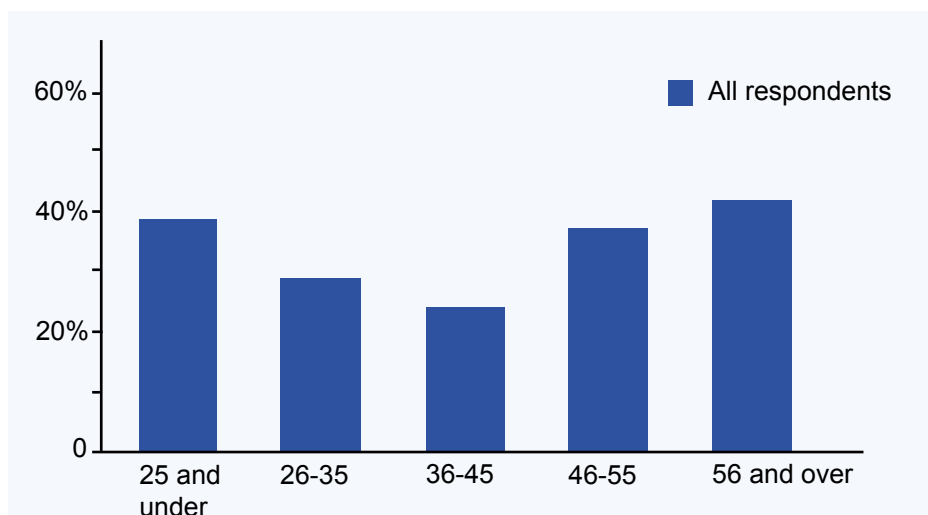

Figure 2. Students with no access to a tablet or e-reader by age

Comparison with the 2013 Pew Research Center survey of American adults shows the proportion of the US population owning tablets and e-readers to be around fifteen percentage points less than OU students in the UK (Pew Research Center, 2014). Like the E-Ped survey, the Pew report also shows ownership of e-readers to be greatest in the 30-49 age group for both tablets and e-readers.

Use of handheld devices for study

Exactly half (50%) of those who had access to handheld devices said that they used them at least once a week to access study materials related to their university studies. 77% (n=103) of those who owned both a tablet and an e-reader accessed university study materials at least once a week. This compares to 72% (n=158) who owned just a tablet, and 37% (n=87) who owned just an e-reader (no tablet). Almost all of those who owned or had access to a tablet or e-reader also had a mobile phone.

Students were asked if they had used their e-readers, tablets and/or mobile phones for undertaking a range of common study tasks during the past year (Table 2).

Table 2. Proportion of device owners using it for seven common study tasks

	Tablet (n=261)	e-Reader (n=190)	Mobile phone (n=423)
Reading learning materials	52%	41%	68%
Reading non-OU learning materials	54%	38%	71%
Accessing online tutor group or module forums	49%	43%	72%
Checking news or other information on the StudentHome VLE	48%	24%	59%
Planning study time	43%	30%	61%
Preparing assignments	56%	45%	61%
Downloading marked assignments	50%	37%	67%

Table 2 shows that almost twice as many students with tablets use them for reading study materials (54%) compared to students with e-readers (31%). One explanation for this difference is that those with e-readers are more frequently encountering insurmountable barriers to using them for study; for example, when the study materials are not available in 'readable' E-Pub format or when PDFs are difficult to read due to screen-rendering issues. Mobile phones were used by a smaller proportion of owners, yet the total number of phone owners means that overall more students were using phones (n=89) than e-readers (n=59) to read study materials . Fewer e-readers were used for reading non-OU materials, which may reflect the availability of resources compatible with e-readers.

Around a third of students with tablets used them for other study-related activities such as accessing their tutor group or module forums, checking news on the student VLE, and assignment preparation. Use of e-readers for all other tasks besides reading is very low.

There were as many students using mobile phones to access forums (n=93) as students with tablets (n=97) yet use of mobile phones for assessment-related tasks was lower. Use of handheld devices for the preparation of assignments was lower than for any of the other eight tasks. This could indicate that there remains potential for using the affordances of handheld devices to support students in this activity.

Length of ownership

Survey data shows that around a quarter of all students surveyed (27%) said they had been using a handheld deivce (either a tablet, e-reader or smartphone) for university study for less than a year (Table 3). A further 13% had been using a device for two years, with few (5%) using one for longer. The remaining students either did not have access to a device or did not use it for study.

Table 3. Length of ownership

	n	More than 3 years	3 years	2 years	1 year
25 and under	36	0%	0%	11%	53%
26-35	128	2%	4%	17%	53%
36-45	130	4%	8%	26%	62%
46-55	121	1%	5%	19%	31%
56 and over	103	2%	6%	12%	26%
Total	518	2%	3%	13%	27%

These data highlight the rapid increase in tablet ownership in late 2011 and 2012 and the technical improvements being made to e-readers and smartphone. Several comments in the survey allude to this point. For example, one respondent noted 'I have been studying … since 2009 and at that point my studies and research was done 100% by use of a laptop … Since 2010 … I am now using the hand held device about 70% and the laptop about 30%. The laptop is now mainly used to complete final draughts [sic] of my [assessments].'

Location of Use

Table 4 shows the percentage of device owners who used their device for study in each of six locations. The most common location for use of handheld devices is in a living or other communal room for tablets: 74% of tablet owners and 52% of e-reader owners use them in this space. The bedroom and home study room are also popular with tablets and e-readers are used more by owners in these locations than mobile phones. Phones are used more than tablets or e-readers at work and whilst on public transport. Also of note is that all three handheld devices were being used by at least a quarter of device owners in every one of the six locations.

Table 4. Locations in which handheld devices were used

	Tablet (n=192)	e-Reader (n=111)	Mobile phone (n=223)
Home study room	61%	41%	39%
Living or other communal room	74%	52%	55%
Bedroom	64%	46%	42%
At work	38%	24%	50%
On public transport	48%	36%	51%
Other location	38%	26%	31%

Research Question 2: How are study habits and learning experiences changing and how do student perceive this?

Change in study behavior

Many surveys have asked about student access and use of devices, yet few ask whether students are aware of their changing patterns of use, and if and how these are influencing their studies.

In the 2013 E-Ped survey of undergraduate distance learners, 61% of students who owned a handheld device said that their study habits had changed as a result of using it. There is a statistically significant difference at the 0.01 level between discpline areas ($X^2=(6)$ 47.2, p=0.000). Less than 50% of those studying maths, computing, technology and arts subjects reported a change whilst over 70% of students on health and social care, education, languages and social sciences courses said their study habits had changed. There was no signficant difference between age groups in the perception that study habits had changed ($X^2=(4)$ 6.5, p=0.17).

Table 5. Study habit, number of tasks and student age correlation coefficients

			Study habits changed	Number of tasks performed on tablet	Grouped age of student
Spear-man's rho	Study habits changed	Correlation Coefficient	1.000	.239**	.105
		Sig. (2-tailed)	.	.000	.111
		N	232	232	232
	Number of tasks performed on tablet	Correlation Coefficient	.239**	1.000	-.150**
		Sig. (2-tailed)	.000	.	.001
		N	232	525	518
	Grouped age of student	Correlation Coefficient	.105	-.150**	1.000
		Sig. (2-tailed)	.111	.001	.
		N	232	518	518

**. Correlation is significant at the 0.01 level (2-tailed).

A Spearman Rho analysis of tablet users (Table 5) gives a weak but significant positive correlation at the 0.01 level ($r_s(230)=.239$ p=.000) between percieved change in study habits and the number of study tasks performed using the tablet.

This provides firm evidence for what is intuitively logical; that the more study tasks a student undertakes using a handheld device, the more likely students are to percieve their study habits have changed. The analysis also shows a weak but statistically significant negative correlation at the 0.01 level (r_s=(230)=-.150 p=.001) between the age of the student owning the tablet and the number of tasks performed on a tablet. However, there is not a significant correlation between the age of the student and whether they feel their study habits have changed.

Student Feedback and Comments

In order to explore possible reasons for changing study habits the survey asked two open-ended questions: 'what benefits, if any, are there in using a hand-held device for your OU studies?' and, if the student indicated study habits had changed, 'Please explain how your study habits have changed.'

150 students responded to both of these questions. In respect to the first, 540 nodes were coded against the responses and a grounded theory approach (Charmaz, 2006) was used to identify 14 category themes. The table below shows how many students mentioned the top ten key themes.

Table 6. Number of students mentioning key themes

	Number of respondents mentioning issue (n=150)
Use in more spaces	95
Portability	95
Access	93
Use at more times	45
Helping with study tasks	43
Change in behaviour	35
Faster start up / turning on	32
Staying connected	25
Logistics and organising study	18
Use in tutorials	7

'Use in more places', 'portability' and 'access' are three most commonly mentioned benefits and often these benefits overlapped; increased portability and access can often result in students being able to study in many more places. The clear message demonstrated by this data is that the 'opening' of more spaces for study is central to how students perceive their changing study habits.

The opening of space allows for increased study opportunity, defined here as the amount of time in a day that a student can potentially engage in useful learning or study-related activity. Students will not use all of this, but merely increasing study opportunity time will give students more choice, and therefore greater control, in when they can study and could lead to reduction in study anxiety and pressure of workload. For example, one student said that without being about to

to use a Kindle to study when print books were impractical then 'I probably wouldn't be to complete the studies'.

Answers from an open response question provide further insight into how student habits are changing. The survey asked respondents to explain how study habits had changed as a result of using handheld devices and 150 students answered this question.

Student awareness of changing routine and habits ranged from comments that listed the new places open to students – '[I read] material in cafés, waiting rooms, in the bathroom, in bed, anywhere that I don't take my notebook computer' – to clear shifts in the relative use of learning technology as illustrated in the following quote:

> '*At times I found it particularly difficult to find time where I get time to sit down in front of my laptop at home. Furthermore it was often difficult to carry around big bulky text books to and from work. With the recent development of modern technologies my learning has gained a totally new dimension and I am now able to study a lot more whilst on the move commuting to and from work by public transport. This is because I am able to download my reading materials on the hand held device and this saves on carrying books with me to and from work. I am also able to conduct research on the move by accessing websites and other reading materials.*'

When talking specifically about their changing study habits, a sizable number of students (over 20% of those responding to the question) expressly mentioned how use of a Kindle or tablet has increased the range of places they could read course material and access the internet. Many students (over 10%) reported that the Kindle and/or tablet enable them to study more, study or check forums more frequently, or to look at a greater breadth of material. Students commented, for example, that 'ease of use means more studying done', that 'I spend more time reading related materials and searching online for journal articles', and 'I find [that] I look at things more frequently'.

Other changes in student learning were noted. In respect to the use of audio, one student reported making audio recordings of tutorials which they then listened to whilst on the move to recap and to 'check I didn't miss anything (taking the pressure off having to make good notes at the time)'. The student still preferred to read printed paper first but 'refer[red] to the audio copy to help me learn new words … and audio books to revise what I have already read'. This highlights the use of audio material for consolidation and reflection of learning. Elsewhere, a student with dyslexia noted the benefit an audio device made to them; issued by the OU Dyslexia support team, it is used to store things to remember such as theories or facts, used when doing mundane activities and for self-recording of pieces of text: 'I am sporadic in its use but it has become an essential tool'.

Annotating on their Kindle or tablet and using bookmarks to jump between course text, glossary and course guides without losing their place were mentioned by around 7% of students. Other changes in study practice included: use of devices for audio dictation of ideas for assessments; assessment

planning; searching PDFs for key words; internet searching for assignments; using a stylus to handwrite formulae and to draw diagrams for assignments; use of mind-mapping software; and using the university's app.

Research Question 3: Do students who purchase handheld devices primarily for study tend to use them more in their learning?

Reasons for buying a handheld device

Students were asked about their reasons for purchasing the handheld devices they owned. 30% of students who owned a tablet said that university study was the primary reason for purchasing the device. 16% of e-reader owners said university study was the primary reason for purchasing it. This is an important finding for it shows a third of tablet owners (and a sixth of e-reader owners) have a specific intention for using their devices for study and will therefore likely be looking to the university to provide materials, services and support that allows them, even helps them, to use their devices for learning.

In respect to tablet purchases, there is a statistically significant difference in the number of study tasks performed by those who purchased a tablet primarily for study purposes and those purchasing it for another purpose (X^2=(3) 20.77, p=.000). Students who purchased their tablet for study tend to use it for more study tasks (Table 7).

Table 7. Number of study tasks performed by students who purchased their device primarily for study or primarily for another prupose.

	Purchased to support university study (n=119)	Purchased for another purpose (n=50)
0-1 tasks	8%	4%
2-3 tasks	22%	16%
4-5 tasks	34%	22%
5-6 tasks	25%	18%
7-8 tasks	10%	40%

Table 8 shows that study use most often featured in the decisions of younger students, yet Chi-Squared analysis shows there is no significant difference between buying for study and age (X^2=(4) 4.02, p=0.4).

The number of respondents owning e-readers was relatively small so it is not possible to compare reason for purchase between age groups. Just 3% of students who purchased a mobile phone (6 of 199) said their decision to purchase it was primarily for study purposes.

Table 8. Reason for purchasing tablet device by age group

	Proportion of students who purchased tablet in order to support their OU studies
25 and under	47%
26-35	31%
36-45	30%
46-55	27%
56 and over	16%
Overall	30%

Conclusion

By 2013, half (50%) of the UK distance learners in our survey (n=518) owned or had access to a tablet and over a third (37%) owned or had access to an e-reader. This means that, overall, two thirds (67%) of surveyed Open University students had access to either a tablet or e-reader handheld device. Tablet ownership differed significantly by age whilst e-reader ownership differed significantly by discipline area. These results raise two complementary questions: firstly, how should universities strive to better deliver and support their students in using handheld devices for study and secondly, how should universities ensure that those without such devices are not disadvantaged or unintentionally excluded from parts of the learning process.

Of those using their handheld devices for study, half (51%) responded that their study habits had changed as a result of using them for study purposes. A weak but statistically significant correlation was found between the number of study tasks a handheld device had been used for and whether students felt their study habits had changed. In addition, there was a very weak but statistically significant negative correlation between the age of the student and the number of the tasks performed on the tablet (indicating that younger students undertook more tasks).

In respect to the third research question it was found that around a third of tablet purchases by students (30%) were primarily for study purposes. Those who purchased a tablet for study used their device for a greater range of study tasks when compared to those who purchased it for other reasons. These findings indicate that students who purchased a tablet primarily for study may have greater expectations and demands for using learning materials on their handheld devices and who may be better motivated to use their technology in learning.

Much of the learning activity undertaken on handheld devices is evidently migrated activity – tasks which previously may have been undertaken on another larger (or smaller) form-factor device. This is to be expected as one initial response by educational institutions to the emergence of handheld devices has been to ensure equitable access and learning experience on handheld devices. Studies such as Muller et al. (2012) have found task migration to be common for

non-educational tablet use and the data from the E-Ped survey shows handheld devices being used for a range of study tasks. Yet, alongside migrated tasks, there is evidence in the E-Ped open-text comments of handheld devices enhancing the study experience – i.e. students undertaking activities the student would not otherwise have done – or in supporting an intentional sub-/re-version of the learning materials to create a learning design that better fits the student's lifestyle and learning needs.

Findings from this survey show firstly that students are mobile within the home and within a workplace (for example, it was found that more students study in a communal place like the living room than in a quiet study space) and secondly that students sometimes exploit the portability of the device to geographically step outside their routine (such as a respondent who took themselves and their device to a National Trust property). This use of handheld devices within 'stationary environments' (Church & Oliver, 2011) as well as outside such environments should not be overlooked.

Content analysis of open comments from around 150 students shows that a key benefit of handheld devices is the opening of more places for study and, as a consequence, increasing study opportunity time. Doing this may help reduce anxiety and workload pressures and give students more choice as to when and how they learn.

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