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LEARNING WITH MOBILE DEVICES: THE CHANGING PLACE AND SPACE OF DISTANCE LEARNERS' STUDY

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Abstract

This paper examines the changing study practices of UK distance learning students as they employ, adapt and integrate the use of new portable digital devices such as tablets, e-books and smartphones into their learning. The paper uses data from 1700 students that have been collected in a series of surveys at The Open University by the E-Pedagogies Project between 2012 and 2016. The data cover study habits, patterns of use, study tasks and student experiences of distance learning students, showing how these change over time. Data from open comments provide further insight into how, why and where students are studying, or attempting to study. The evidence paints a nuanced picture where the combination of handheld digital devices being used is in flux, where course learning designs need to allow students more flexibility in study technology and pedagogies, and where the opportunity time for study remains fluid. The insights presented in this paper will be of interest to all those involved in Higher Education and distance learning both.

Keywords: Mobile Learning, Learning Spaces, Distance Learning, eBooks.

1. INTRODUCTION

The Open University's E-Pedagogy of Handheld Devices project (E-Ped Project) was conceived in 2012 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 insight is considered essential to the university for the improvement of current teaching and learning provision [1], meeting student needs for greater use and integration of handheld devices in learning [2] and for the development of appropriate and effective new learning and assessment designs, pedagogic practice and study materials. To achieve these goals, the project has moved beyond understanding 'what the landscape *looks* like for [users] that have adopted this new form-factor product so readily' [3] and towards deeper, more nuanced, insight into how existing and emerging study habits with mobile devices impact on student learning. The project also seeks to address the acute lack of data in respect to UK distance and online learners, of all ages from under 25 to over 55, and to provide findings comparable to those emerging from US research [4].

This paper considers two research questions. First, how does the geographic reach of handheld use for study purposes affect students' perception of changing study habits? The paper will present trend data in respect to where students study and analysis of the relationship between study reach, number of devices owned, length of use and range of study tasks performed. Second, what indications are there of changes in how students use handheld devices for study? Data from three student questionnaire surveys collected between 2013 and 2016 comprise the main dataset used in the analysis.

Evolution of the three main types of handheld devices now available to students today has been extensively described in technical literature. Of particular note was the launch of the Sony (e-)Reader in 2006, the Amazon Kindle and Apple iPhone in 2007 and the Apple iPad in 2010. Collectively, these mark what many believe to be a major shift in the availability and affordability of handheld technologies (technologies with a form factor small enough they can be held and operated in the hand) and in the importance of handheld devices to students for their learning. Building on early research into the potential educational role of mobile devices and PDAs [5], initial research into e-readers identified a range of perceived benefits including convenience, portability, ease of finding content (e.g., resources for reference), keeping content up to date, building personalised libraries, incorporating hypertext links, novelty, environmental benefits of reducing paper use, and optimising reading time [6], [7], whilst concerns ranged from the perceived loss of study focus when reading on a screen, small screen size, lack of page numbering, navigation and preference of use for leisure rather than academic study [8], [9], [10].

By 2012, when the E-Ped project began, the benefits of using handheld technologies were considered to include: 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 [11]. Other student surveys in the US such as that by the Pew Research Center [12] and in Australia [13] were providing further insight in to student use of handheld devices. There was also a growing awareness that convenient concepts on which pedagogic decisions were being made – such as that of a 'net generation' – were less robust and more nuanced [14]. In light of this, other factors, not least whether a student has or has not access to certain technologies, why and where they study, and their proficiency in digital literacy skills, were beginning to become more important considerations. Now, in 2016, the need to understand how students are using handheld devices is even more acute: especially in the context of newly emerging roles for handheld devices such for authentication of student identity in online assessment, for informal learning, and social collaborative learning at a distance.

2. 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%). The response was broadly representative of the sample, apart from a slight over-representation in responses from older age groups. Some initial findings from the 2013 survey have been reported by Cross et al. [15]. The 2014 survey was sent to a similar number of students and included both undergraduate and postgraduate learners. Within the stratified sample there were approximately equal numbers of students from each of four study levels (undergraduate levels 1 to 3 and postgraduate), from each discipline area and from each age group. There were 502 valid responses from undergraduate students.

The 2016 survey was sent in April 2016, again to a sample of similar size to the previous two surveys. A stratified sample was selected at random with equal numbers of students from each of five academic levels of study (Foundation Level 0, Undergraduate Levels 1, 2, 3 and Postgraduate) and from each age group. There were 754 responses (a response rate of 13% and coincidentally exactly the same number as for the 2014 survey) of which 535 were from undergraduates. In respect to the undergraduate group there were similar numbers of students from each age grouping (Table 1) and in respect to educational level; 29.9% had less than an A-Level (post-16) qualification, 38.3% had A-Levels or equivalent, and 31.8% had a Higher Education qualification. 9.2% of the 2016 undergraduate response group had a declared disability and there were more women (n=333) than men (n=202).

Table 1. Ages of the 2016 survey respondents

Age group	Undergraduate Group	Postgraduate Group
Under 25	17%	0%
26-35	18.5%	12.3%
36-45	25.2%	19.2%
46-55	18.5%	31.5%
56 over	20.7%	37.0%

The questionnaires used in 2013 and 2014 predominantly comprised groups of closed questions based on a set of questions developed for, and previously used in, the 2012 post-graduate survey. The 2016 questionnaire was based on the 2013 version. Some minor changes to question wording and vocabulary were made in order to keep meaning clear and additional questions were added in order to further explore issues identified in the 2013 and 2014 surveys.

Every survey used in the E-Ped project asked students about: access to 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. From 2014, the survey has asked which technologies the student would like to use more of in future and from 2016 the survey has asked in detail about the general tasks students use their technology for, asked about more types of technology (emerging technologies such

as internet TV, games consoles, and also the traditional technology of printed materials) and increased the detail in some question items. The evolution of the questionnaire has been made in reference to surveys conducted elsewhere [1], [2], [4], research interests of the project team and key issues that have emerged from the quantitative and qualitative analysis of the survey data [15], [16].

Each survey has also asked at least four open questions which focus on reasons for change 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. Optional text boxes for adding further clarity were also offered for some other questions. In the 2013 survey, 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 [15]. Coding of the 2016 survey is currently underway.

3. RESULTS

3.1 Handheld Ownership and use

Patterns of ownership, access and use differ between undergraduate and postgraduate students. This paper will focus on the former, so the analysis presented excludes postgraduate student survey responses. The proportion of undergraduate students with access to a tablet computer has risen slightly from 50% in 2013 to 58% in 2016 whilst the proportion reporting access to an e-reader has fallen from 37% in 2013 to 25% in 2016. Part of the reason for this difference could be a change in how students categorise a tablet made by Kindle. There has been little change in the proportion of students who own a mobile phone (either a smartphone or ordinary mobile phone): 82% in 2013 and 82% in 2016. However, the proportion of students with a smartphone has risen from 64% in 2014 to 77% of all students. The 2016 survey also asked about other technologies that could allow students to access online study and found that 17% of students owned a game console with an internet connection and 24% owned an internet connected TV.

82% of students who have access to a tablet use it often or occasionally for university study whilst 42% of students with access to an e-reader use it for study. The lower incidence of e-reader use for study may reflect the challenges many students have in downloading and reading online materials on the e-reader form-factor and format. 66% of students with a Smartphone use it for university study. Chi squared analysis found no statistical difference between student age (as grouped in the categories shown in Table 1) and access to tablet (X^2 = (4 d.f.) = 3.74, p=.442) or be between age and access to e-readers (X^2 = (4) = 10.17, p=.038). However, there was a difference between age and access to smartphones (X^2 = (4) = 30.31, p=.000).

3.2 Changing study spaces and study habits

Every E-Ped survey has asked students whether they used their tablets, e-readers and smartphones for a variety of common study tasks. Analysis of these study tasks and their interactions helps to define the student study space and it is therefore important to understand the role that handheld technologies plays in this. The 2013 survey asked about seven tasks whilst the 2016 survey asked about twelve (the original seven plus five more). From this data, the incidence of use for study task can be calculated (number undertaking the task using the device, divided by the total number with access to the devices).

Figure 1 shows the incidence of use for three common study activities:

- Reading module materials
- Accessing module forums
- Preparing for an assignment[1]

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[1] OU students usually undertake between three and six assignments during a taught module in addition to a final exam or end of module assignment.

This selection is intended to provide insight into changes in use. Detailed analysis of all will be presented at a later date.
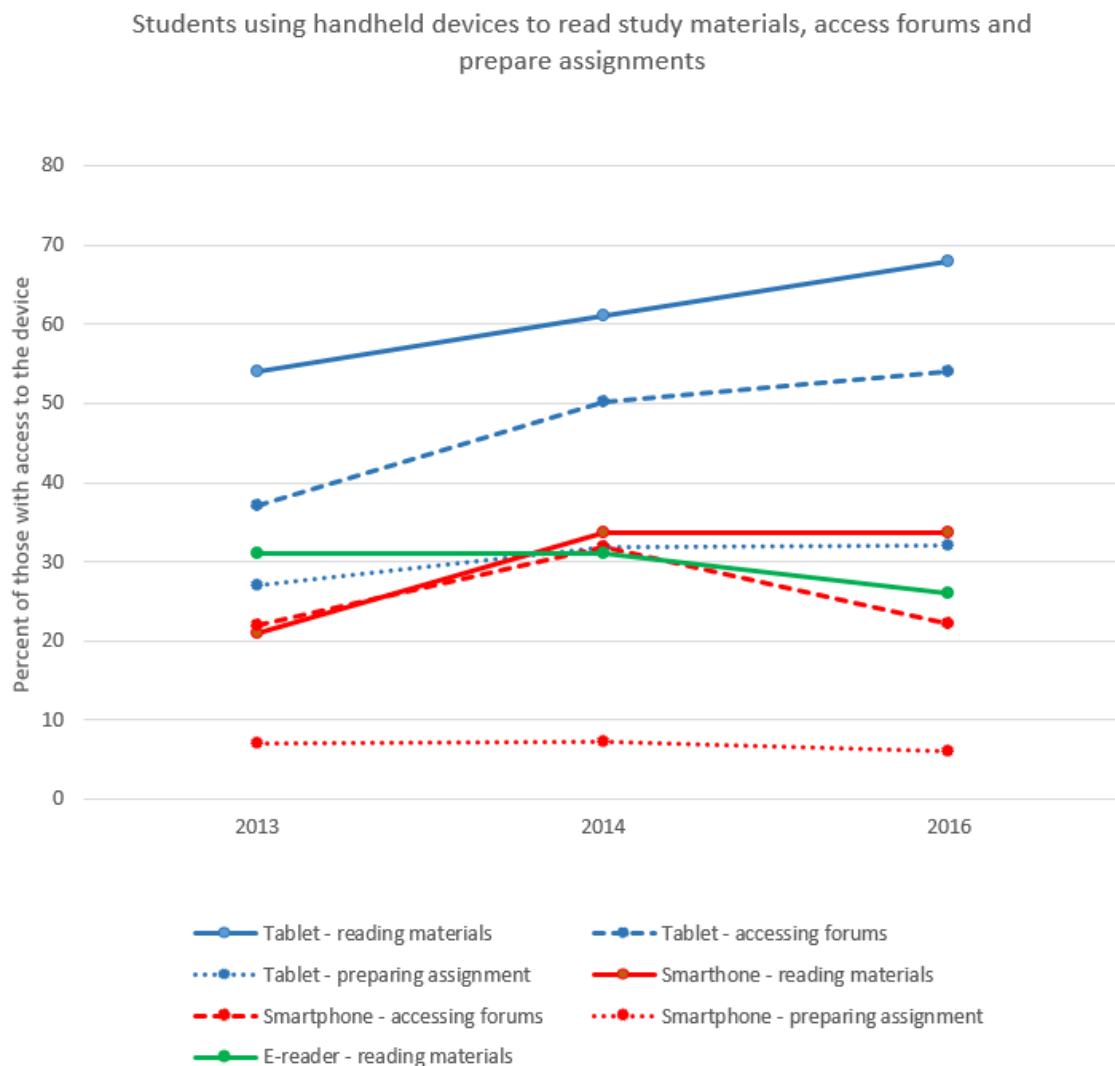

Figure 1. Use of handheld devices for three common learning tasks

Figure 1 shows four key trends. The first is that use of tablets and smartphones for access to and reading content has increased since 2013 and tablets are now used by around two-thirds of students who have access to these devices. The second is that use of e-readers to read module materials has remained constant, if not fallen slightly. This may reflect the fact that the primary method of accessing OU module materials, schedules, and activities (including forums and online tutorials) is online via the Virtual Learning Environment. Whilst modules do provide options to download content, the main method of delivery perhaps works better for devices with internet browsers than for e-readers. Traditionally, use of forums has been optional for most OU students but more modules now lude forum activities and this seems to be reflected in an upward trend in tablet use for forum access; although there has been no comparable increase in use of smartphones for forum access. The final trend is that there has been no change in the proportion of students using their devices for preparing assignments. This could indicate that there remains potential for better supporting the use of handheld devices in writing assignments, or that some students prefer to write assignments on a laptop or desktop computer with a keyboard.

Many surveys have asked about student access to 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 2014 E-Ped survey of undergraduate distance learners, 29% of all students surveyed responded that their study habits had changed as a result of using handheld devices for study. Two years later, about

the same proportion, 27%, indicated that their study habits had changed. These figures relate to all students, including those who do not have access to handheld technologies: just focusing on the group with access to handheld technologies, approximately half reported that their study habits had changed.

The 2013 survey found a statistically significant difference in reported change in study habits between discipline areas ($X^2 = (6) = 47.2$, p=.000) at the 0.01 level. However, by 2016 these differences seem to have disappeared and there was almost no difference ($X^2 = (7) = 2.81$, p=.902). Neither the 2013 nor 2016 survey found a statistically significant difference in changing study habits by age ($X^2 = (4) = 6.5$, p=.17, and $X^2 = (4) = 2.30$, p=.681 respectively).

3.3 Locations of learning

The 2013 and 2014 E-Ped surveys asked students whether they used their devices for study in four key locations. A further three locations were added to this list for the 2016 survey in response to analysis of student comments in previous surveys. The seven types of locations asked about in 2016 were:

- 'Quiet private' (the home study room)
- 'Communal private' (living or other communal room)
- Workplace
- Travelling/in transit
- 'Quiet public' (library)
- 'Communal public' (cafes, pubs, etc.)
- 'On holiday'

Figure 2 shows the changing proportion of students who studied using their handheld device in two of these locations: quiet room at home and workplace.
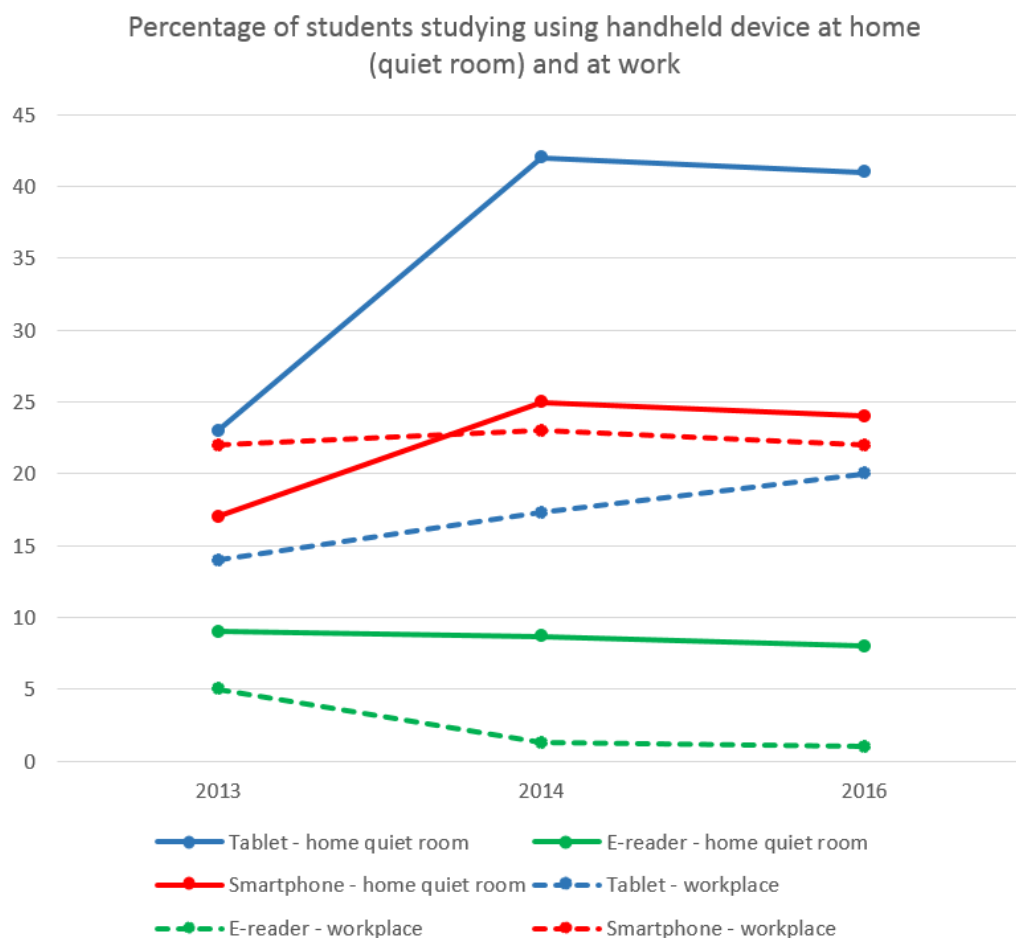

Figure 2. Changes in use of home quiet rooms and workplaces for handheld learning, 2013-16

The period of greatest change in use of handheld devices for studying at home and at the workplace appears to have been 2013 to 2014. Use of most devices seems to have plateaued from 2014. With respect to studying in a quiet room at home, the 2016 survey shows just over 40% of students were using tablets, almost 25% were using smartphone and around 8% were using e-readers. Use of e-readers at work has fallen to just 1% in yet use of tablets appears to be rising.

A central interest of this paper is to determine if there is relationship between the geographic 'reach' of students' study, perceptions of changing study habits, and the number of study tasks performed using handheld devices. Using the 2016 survey data, a measure for the geographic 'reach' of study was made by counting the number of different types of location where students used handheld devices to study (giving a number from 0 to 7). Similarly, a measure of the 'range' of study tasks was made by counting the number of study tasks undertaken using a handheld device (giving a number from 0 to 12). Data about perceived change in study habits were already available from the survey. A correlation analysis was undertaken between these three variables and two others: number of handhelds used for study (from 0 to 3) and length of time handhelds had been used for study (0, 1, 2, 3, or more than 3 years). The results are shown in Figure 3.
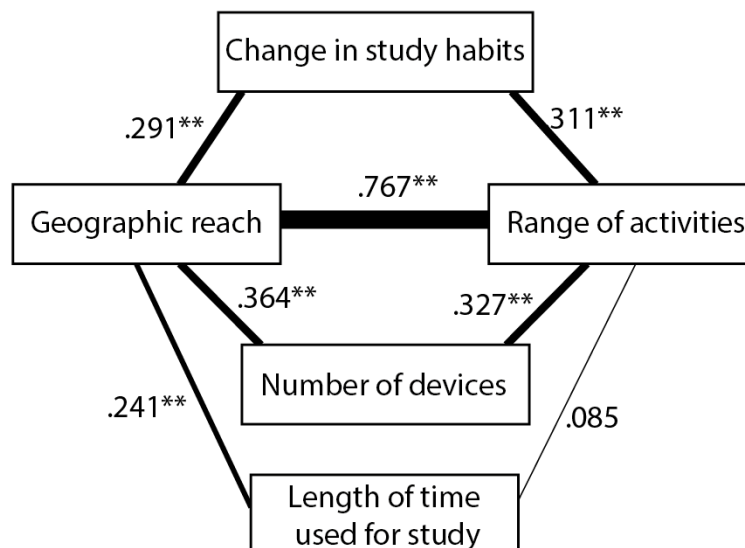

Figure 3. Diagram showing correlations with geographic reach
(**denotes significance at p=<.01 level)

There is a very strong association (r = .767, p<.01, N=535) between the geographic reach of study (the number of locations in which handhelds are used for studying) and range of tasks using handheld devices. Whilst this would have been expected, this paper confirms there is a strong and statistically significant correlation. There is also a moderate statistically significant correlation between the perceived change in study habits and reach (r = .291, p<.01, N=350) and range (r = .311, p<.01, N=350) of use.

This paper reports a weak but statistically significant association between reach and how long students have used the devices for study (r = .241, p<.01, N=350). There is no such association between range of tasks and length of time used (r = .085, p<.01, N=350). One interpretation of this finding is that the longer students use devices for studying, the more sophisticated they become in finding ways to use the devices in a greater number of locations.

Chi-squared analysis found no significant variation between the number of locations at which handhelds are used for study – 'study reach' – and age (X^2 = (28) = 25.24, p=.615), highest education qualifications (X^2 = (14) =15.33, p=.356), and disability (X^2 = (4) = 2.94, p=.567). This shows that the correlations identified are likely to apply for distance learners in general rather than one specific group.

However, a statistically significant difference was found between the number of locations used by students who perceived no change in their study habits and the number of locations used by students who did ($X^2 = (6) = 32.51$, p=.000).

The bar chart in Figure 4 shows that the students who perceive a change in study habits tend to use their devices in more locations than those who do not. This finding demonstrates a clear relationship between what could be termed 'geographically active' students and the impact that using handheld technologies is having on their study.
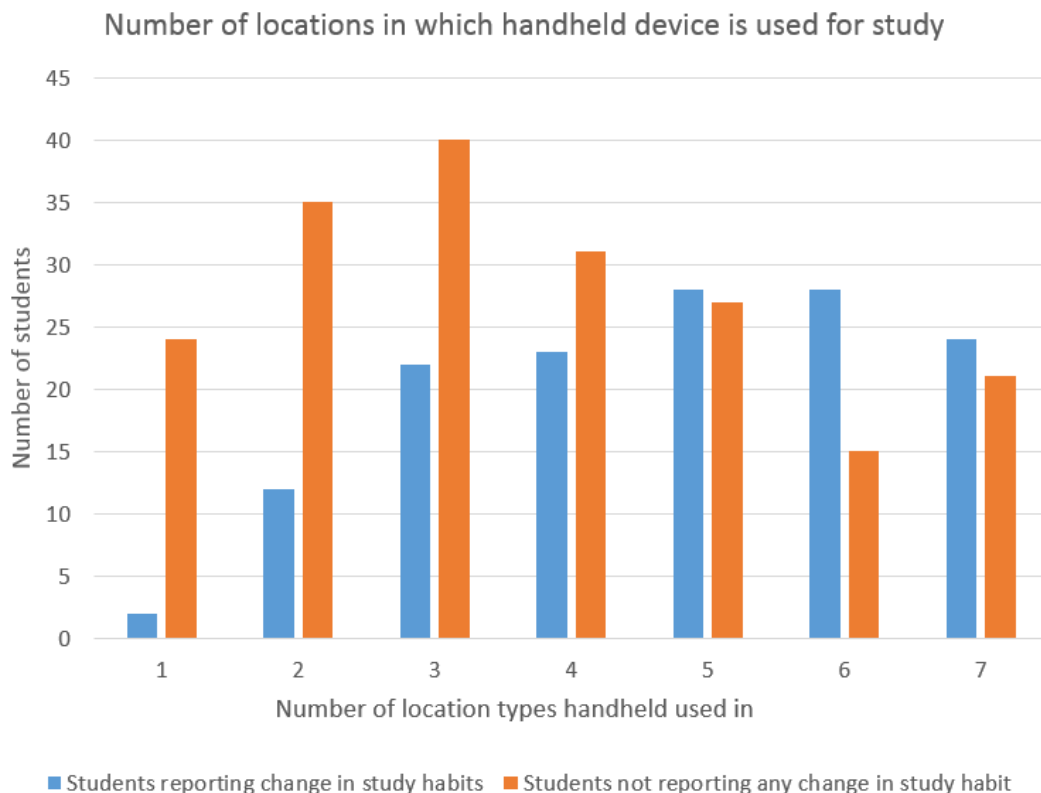

Figure 4. Graph to show variation in the number of locations handhelds were used for study

4. DISCUSSION AND CONCLUSION

This paper has analysed the results of three surveys of undergraduate distance learners in the UK from 2013 to 2016. These surveys present a unique perspective in to how online and distance students in the UK use their handheld devices to learn.

One key finding presented in the paper has been a clear relationship between 'study reach' – the number of different types of locations in which handheld devices are used for study – and whether a student perceives that study habits have changed as a result of using handheld technologies. This is supported by a complementary finding that there is a correlation between study reach and 'study range' – the number of different types of study task performed using handheld devices. Taken together, this demonstrates that students who use their handheld devices ubiquitously across the multiple spaces they inhabit are not simply migrating existing study practices on to their new handheld devices [3] but experiencing changes in how, when and where they study. This group of learners are not just using their handheld devices at a distance from their university – in their homes and workplaces – but in locations more 'distant' again such as cafes, restaurants, libraries and on holiday (e.g., 22% of students surveyed used a tablet to study whilst on holiday). We argue that this group should be defined as 'distant learners' not just 'distan*ce*' learners. These learners transcend stationary environments [17] and demonstrate more mobility in their study routine. Data from the 2016 survey indicates that that distant learners comprise about a quarter of the undergraduate distance learning students surveyed.

A second finding is that over the last three years the proportion of students using handheld devices for assessment tasks such as preparing assignments has been less than for other study tasks such as reading materials. For example, whilst use of tablets and smartphone for reading materials has increased (by 14 percentage and 13 percentage respectively points between 2013 and 2016), their use in preparing assignments has increased less for tablets (by 5 percentage points) and remained static for smartphones. This could be interpreted as signalling an underutilisation of handheld devices in distance learning for assessment purposes: whether in the preparation of assignments as reported above, or for other aspects of assessment currently less well supported such as revision or examination preparation [18]. This is particularly noteworthy because the 2015 ECAR survey [4] found that assessment-related tasks comprised three of the top five study-related activities that students would prefer to do online.

The final key finding is that ownership and use of tablet technologies by UK distance learners is broadly similar to that reported by US students but there are difference in respect to e-readers and smartphones. For example, the 2015 ECAR Survey found that tablet ownership stood at around 55% in the US [4] whilst this paper has shown that for UK distance learners in 2016 it was 58%. Smartphone ownership was higher amongst US students – 92% compared with 82% for UK distance learners – yet some of the difference may be because a greater proportion of younger students (the majority group in the ECAR survey) tend to own smartphone. Comparison also reveals a difference in the relative use of tablets and smartphones for study. Data presented in Figure 1 shows that UK distance learners used tablets more than smartphones for three common study activities (and indeed there is an indication of smartphone use plateauing or falling), whilst the 2015 ECAR survey found the opposite: that almost twice as many US students were using used smartphones for coursework than tablets [4].

This paper has demonstrated the need for further research in to widespread student use and adoption of handheld devices. Whilst not reported here, the E-Ped project is presently analysing free-text answers from over five hundred students in respect to how study habits have changed and what could be done to improve the learning experience. The results of this analysis will be available later this year. The relative lack of use of tablets, and to a lesser extent smartphones, for study purposes could signal an underutilisation of this technology and that there remain barriers. There therefore remains a need to research and develop flexible pedagogies, learning designs and resources that allow students to take control and adapt their learning to the specific mix of technologies and locations in which they study.

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