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Digital Learners in Higher Education: Exploring Technology Ownership Patterns and Learning Engagement

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Abstract: Recent studies into *'digital learners'* have pointed to the high level of digital skills which many UK and US based students entering HE are now demonstrating (White & Beetham, 2013; Pew, 2013). However while students may display high levels of functional skill or competency in digital media this is often evidenced in a narrow corridor of involvement with social media and may not indicate a well-rounded digital identity. Using digital devices informally for leisure opportunities does not necessarily foster the digital literacies required to develop the critical thinking and learning skills of university graduates. This is in line with Beetham & Sharpe (2014) who suggest that: *'digital literacy looks beyond functional IT skills to describe a richer set of digital behaviours, practices and identities*.'

This perspective of wide-ranging digital competency but indeterminate levels of digital literacy amongst undergraduates is explored through the outcomes of two recent surveys, one undertaken in Australia (2012-3) previously reported at the Ascilite conference (Jefferies,2013), and the other at a German university in 2013-2014 which is the focus of this paper.

This paper examines the evidence for digital competency and literacy displayed by German university students in support of their studies. In a quantitative study using an online survey tool based on previously published and widely acknowledged metrics, students were asked about digital ownership and their technology use during their HE studies. The questions asked about their use of common hardware platforms and popular software.

The outcomes from the German study and the earlier Australian study are considered in the context of recent research into *'digital learners'* in the UK.

Overall, the students' use of technology for learning, whichever country they were studying in, tended to be personally focussed, lacking evidence of active contribution to producing and critically evaluating material. In short, their contribution to digital engagement could be termed as surprisingly passive and consumerist (cf. Cochrane and Antonczak, 2015) rather than a pro-active engagement.

Keywords: technology ownership for learning, technology in HE, digital engagement

1. Introduction

A number of recent studies (Caruso, J., & Salway, 2007; Dahlstrom, 2012, Jisc, 2013) which have focused on student technology ownership and use have primarily considered countries across the Anglophone world. These reports have highlighted the changing usage of technologies across tertiary education, as well as in the post-16 age group, to support student learning. This paper is the first in an anticipated series which will report on the use by German university students of a set of technologies used in tertiary institutions as previously proposed by ECAR (see Caruso & Salway, 2007) and which have been used to inform research into student technology ownership. The study described below explores the self-reported use of technology for learning and leisure by a large cohort of students (n= 275) in Business and Engineering disciplines at a German university and draws

comparisons between technology used for tertiary education and other studies including research into their use in an Australian university context and in the UK.

Interest in developing digital literacy among the Higher Education (HE) population has grown in the past decade and has been the subject of multiple research projects globally. In Europe, Horizon 2020 funding has contributed to this (Horizon 2020, 2016) and in the UK, institutions involved in supporting learning across the Further Education (FE), HE and Adult and Community Learning Education sectors have been supported by national funding from Jisc between 2012 to 2016 (Beetham, 2016) to make the most of digital tools for supporting learning on and off-campus and through the Managed Learning Environments (MLE).

While it is generally acknowledged in English-speaking countries that there is a high expectation that students now entering HE are confident and competent users of technology, a recent report suggests a rather patchy picture of digital engagement and connectivity across Europe. The Survey of Schools ICT in Education 2013, produced by the European SchoolNet in partnership with the University of Liège in Belgium, featured results from the first Europe-wide survey since 2008 and offered a country by country review of access to technology for pupils. It showed mixed results for engagement with learning technologies in secondary schools. In that report there was insufficient data available from the UK and Germany and this paper therefore partially redresses the balance with regard to students' experiences embarking on a German university programme.

The underlying context for the current study is the growing availability and embedding of MLEs across Higher Education Institutions (HEIs) which has developed alongside the growth in blended, online and distance learning in HE. The growth and use of MLEs in the USA, Australia and the UK is seen in the wide availability and relative affordability of personal technology for participants in the tertiary education group. The research motivation that lies at the heart of this study is to understand what technologies students have access to and own, and from the wide range available to determine what is important to them for supporting their studies and to develop a deeper digital literacy to enhance their use of technology across their studies. The study revealed a blurred division between those technologies and software which may be used solely for study and those which students use personally for connecting with family and friends through social media and for their leisure activities.

2. Background to personal technology use by students in the UK and Germany

Technology has become a ubiquitous part of daily life for both learning and leisure for many people, evidenced in the UK where in 2015 95% of adults owned a mobile phone, as reported by OfCom (2015), and ownership of smartphones, which have only generally been available since 2010 had grown to 70%. Tablet computer ownership in this report was estimated at 57% of the adult population (OfCom, 2015) and laptop ownership at 65% of adults. Broadband is now accessible in 80% of households and digital TV ownership is present in around 96% of households. It is beyond doubt that there has been a steep increase in accessing the internet through personal mobile devices in the past decade.

Germany now reportedly has the largest mobile subscriber base in Europe, with about 107 million subscribers and a penetration rate of around 130 percent, (Research and markets.com, 2013). With a well-advanced digital telephony, broadband in the home is widely available there.

3. Methodology for the German study

An online survey was drawn up and made available via its url to undergraduate students at a German university of applied sciences. The survey was hosted on a secure server in the UK. The original source of the questionnaire was the ECAR studies of HE student use of technology, with a small reduction in the types of technology included (Dahlstrom, 2012; Caruso & Salway, 2007).The content of the survey had previously been developed for a research study with undergraduates at an Australian university (Jefferies, 2013). The survey material has been used with university students based in the USA, on a regular basis and reported by Educause. Some items of

technology were not considered relevant to this group of students and so were either omitted or clustered into small groups, for example the range of cameras and audio-visual equipment were reduced. The surveys were conducted within the ethics approval frameworks of the lead universities in each case.

Invitations to take part in the survey were sent to all students in the target groups of undergraduates by the research leader in Germany. After discussion it was agreed that the language used for the survey would be English as this would allow swifter comparison with comparative surveys and the intention was to have the outputs written in English. The students were deemed to possess a high level of written and spoken English understanding and the high completion rates indicated that the use of English in the questions was not a barrier to their participation.

The survey remained open for two months from September 2013 to the start of November 2013. Analysis was then undertaken using standard tools provided by the survey host and SPSS. Initially it had been planned to interview some of the students to gather some qualitative feedback but the students dispersed to placements and this became impossible to organise effectively.

4. Findings

The authors present their findings with a summary of figures indicating ownership of various items of hardware, the use of software for learning and leisure and subsequently the learning usage relations between leisure and learning usage of technologies drawn out from the analysis. Table 1 includes the full list of technologies that appeared in the survey.

4.1 Demographics

In terms of the demographics of the 275 participants in the study, 53% of the respondents were female and 47% of the respondents were male. 65% were aged 24 or under and 35% were aged 25 or over. 98% of the students identified as being Home students and resident in Germany and 96% identified German as their native language; other native languages stated included a variety of European languages. None of them identified as international students.

4.2 Technology Ownership

It has already been noted above that Germany has a high level of mobile phone ownership and this was evident in their stated ownership of phones. However at 92% the reported ownership of phones was less than in the general population reported above. This was an unexpected outcome and it is inferred that some students may not have answered the questions on phone ownership. Overall analysis of their phone ownership however showed that students more often used their phones for supporting their learning than any of the other clusters of technology. At the time of the survey very few iPhones were owned or used, the most likely choice of phone was an Android type. The participants owned 190 smartphones, 116 of which were Android type and including 14 Blackberries. There was significant ownership of other non-smart mobile phones (n=62) but it was inconclusive how many students owned multiple phones as this question was not asked.

There was high ownership of audio devices by these students (74%), where audio comprised a cluster of iPod and mp3 players and similar. However there was low reported usage of their audio devices for supporting their learning. During a period of time where the use of podcasts to support learning has generally risen in the UK and Australia it was surprising to note that less than 9% of respondents indicated that they used their audio devices to support their learning. There was also high ownership of cameras and videos for leisure and general use but low reported use of these for supporting their learning.

Ownership of e-readers was 11% of students, with a third of these students also using them to support their learning. Now that personal e-readers have largely been replaced by e-reader apps such as Kindle, on phones

and tablets, it is expected that e-reader ownership will diminish further since it demands the owner to carry an extra piece of equipment. However as can be seen in the list of software used by students noted below (Figure 1), the use of e-readers is around 30% and we assume this is due to the availability of e-reading software through library collections and embedded links to journal articles and other materials accessed from the MLE by the students.

Finally in this section on technology ownership we consider the ownership of handheld and stationary gaming devices. Handheld gaming devices were owned by 18% of students and stationary gaming devices such as X-Box or PlayStation were owned by 33% of students. This was lower than expected as figures for gaming device ownership across this generation of students and young adults in Western Europe and North America have shown the devices to be extremely popular. Games console ownership was at 55% among the 18-29 age range in the USA according to the Pew 2015 study.

Table 1: List of device ownership for student learning and /or leisure

iPhone
Android Phone (e.g. Droid, Galaxy, EVO,)
Windows OS Phone (e.g. HTC)
Blackberry
Other smartphone
Other mobile phone
Digital point and shoot camera
Digital SLR camera
Digital Video camera
DVD Player
Blu-ray Player
HD TV/ set top box
3D TV
Mp3 player/music device other than iPod
iPod
Desktop Computer
Laptop Computer/Netbook
iPad
Other tablet (e.g. Galaxy Tab, Xoom) not iPad
E-reader (e.g. Kindle)
Webcam
USB thumb drive/portable hard drive
Handheld/portable gaming device (e.g. Sony PSP, Nintendo DS Lite)
Stationary gaming device (e.g. Xbox, Sony PlayStation)

4.3 Student ownership of computers

Just 26% of students claimed to own a desktop computer but 30% indicated that they used desktop computers for supporting their learning. It is inferred from this that they either used a family computer or one at the university instead. Ownership of laptops and tablets together was 55%, so it is apparent that many students are using the computers provided at the university to complete their studies. Ownership of iPads included in the tablet figures above, was low at 6% overall. A figure of 81% ownership of computer or tablet or laptop is around the average of what might be expected for students in Higher Education, especially when considered alongside the figures above showing widespread ownership of mobile phones in Germany. According to figures from the Pew Research institute (PEW, 2015) ownership of desktop and laptop computers across the USA is 73% overall but at 78% for the 18-29 age range and overall ownership of mobile phones is comparable at 92%, with the statistics for phone ownership among these students.

Since student figures on which technologies they used for learning were higher than the ownership percentages, this would appear to confirm that they would expect to be accessing the university computers for completing their studies or possibly computers at home which were shared with other family members. The impact of the use of an MLE gauged from their software usage, would indicate that students were focusing their study time during the hours that the library and computer facilities were open and that 24 hour access to online materials was less of an issue for them compared with students studying purely at a distance.

Access to the more costly Apple products was less common than for the widely available and generally cheaper computers using Microsoft® software products. In the review of software discussed below it was clear that the MS Office® suite of programmes was widely used. Does the hardware lead to the software use or the other way round? Perhaps it is familiarity with the software and associated computers since their early school age which has driven the predominance of Microsoft® compatible machines among the students? Results from the 2015-16 study with a later cohort of German students will shortly be available and it will be interesting to note whether there has been an increase in the use of iPads in this German university to match the general growth in iPad use across the rest of Europe. Ownership of tablets was estimated to grow to 31.8 million in the UK during 2016 (EMarketer, 2016) of which nearly 60% would be iPads.

4.4 Student use of Software for Learning

In Figure 1 below we indicate the types of software accessed by students. It is clear that as mentioned above there is a dominance of MS Office® related products for managing course materials (word-processing, spreadsheets and presentation tools) and completing assessments. The use of Apps came as something of a surprise and at this stage without further investigation we take this to mean the use of mobile phone as well as tablet apps to support their learning. More recent versions of MS laptops with Windows 8 and later software encourage the sharing of Apps across multiple portable electronic devices. The use of more technical software tools for programming, graphics packages, simulations and LaTeX for document management is indicative of the type of courses that these Business and Engineering students are following.

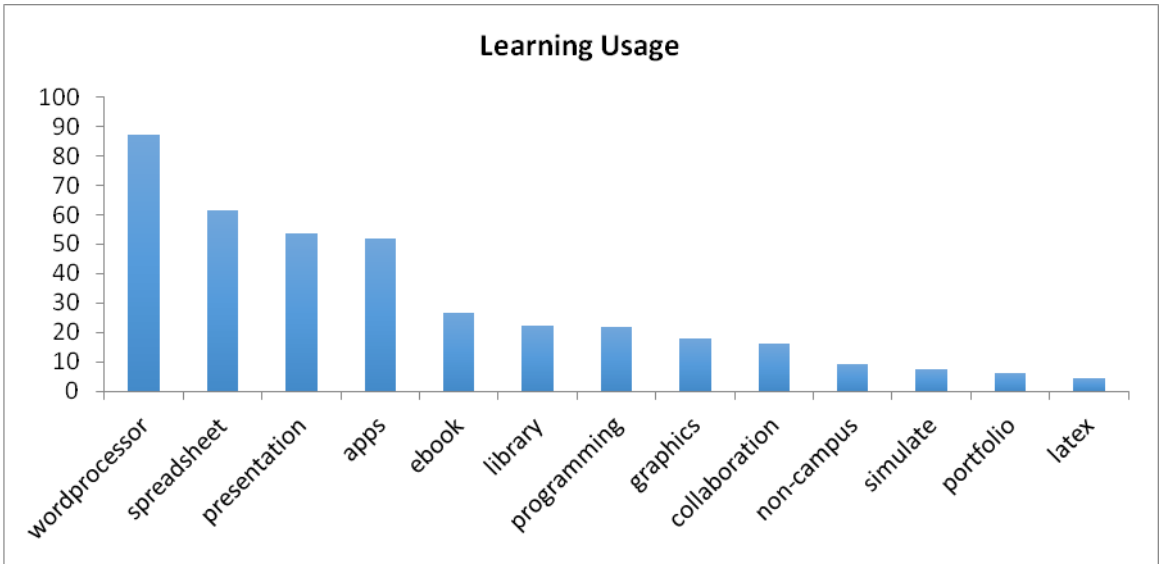

Figure 1: Percentage of students using different software tools for learning

With an increasing number of institutions requiring electronic submission of assessments in the future then the use of word processing, spreadsheets and presentation software is likely to increase further.

4.5 Using technology to link learning and leisure

The research team considered to what extent students were using general software applications which crossed over from home and leisure use to their study time and back again. Figure 2 identifies the preferred software that they used regularly and at least weekly. It was no surprise to find that email, texting and instant messaging were all well used, the figures indicating overall technology use. In the details of the analysis 65% of students reported that they accessed instant messaging several times a day either via Facebook or texting. Overall 77% of participants were accessing their email at least once a day and 74% of students accessed Facebook at least once a day. Other social networking sites were largely spurned by the respondents as 69% of students did not access any others at all. Among technologies used in moderate proportions, skype, reading blogs, tagging materials for others and sharing photos and contributing to discussion fora showed around 30% usage by the students.

This is all much as would be expected and in line with research reported from multiple sources in the last several years. Of greater interest to the researchers were those applications which had a low level of engagement. Twitter clearly did not engage this group of students as just 5% used Twitter daily and 84% claimed never to use it. LinkedIn which is a business social media networking application similar to Facebook where business people can connect and promote their activities and profile was unused by 90% of participants. This came as a surprise since it had been expected that the students on Business courses would have been more likely to engage with this and to see LinkedIn as an important route for enhancing their future employability. Geotagging which has a niche social and leisure following was unused by 90% of the students.

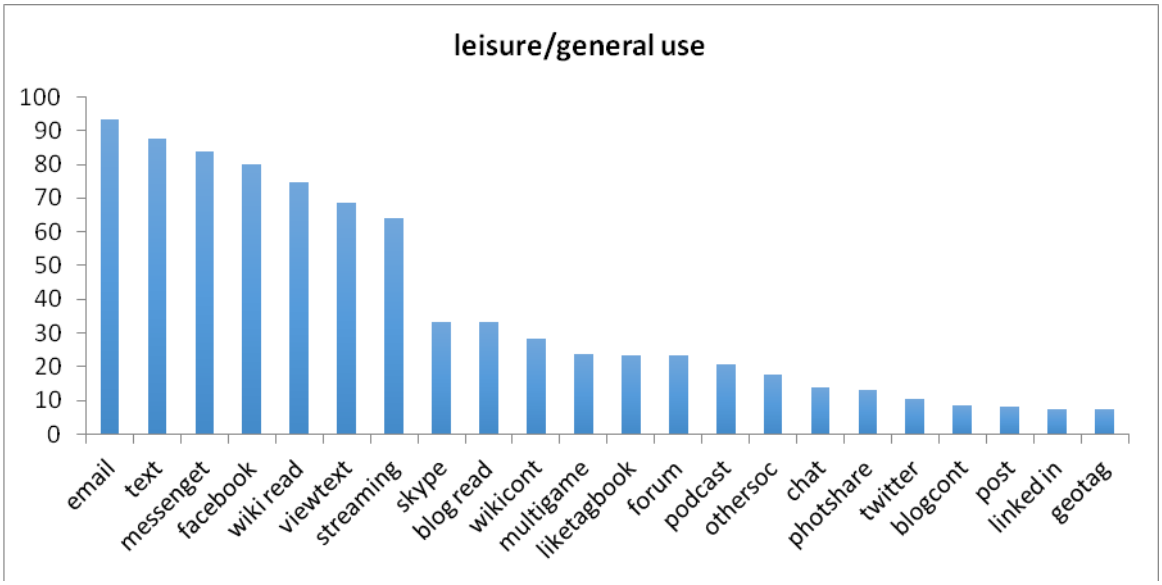

Figure 2: Percentage making frequent use of technology for leisure or general purposes

The students in this study showed many similar characteristics to those reported in earlier studies (see for example the literature reported in Jefferies (2015)), in terms of their use of online materials for viewing. There was a pattern of regular access to sites such as YouTube from which they could download or view audio and video material and visit blogs, forums, and podcasts for viewing materials. Far less evident was a willingness on the part of students to pro-actively post their own materials for sharing with others in the wider learning community. This was especially true in relation to sharing with those outside their immediate social group on Facebook or for other tasks including posting videos they had made for learning activities on YouTube, editing material on Wikipedia or contributing to blogs whether their own or others'. This passivity previously recognised in other studies (e.g. Cochrane & Antonczak, 2015; Beetham & Sharpe, 2014) and evidenced here will be discussed in more detail in the Conclusion.

5. The relationships between technology for learning usage and leisure/general usage

In analysing the data the researchers also used SPSS to identify if there were particular relationships across the software types used for learning when compared with the general and leisure usage.

27 relationships showed significance at a raw 5% level out of 182 possibilities and these are documented below. All were positive relationships indicating that higher leisure use of some applications by participants was associated with higher learning use in the particular relationships described.

More frequent podcast viewing (measured under the leisure and general use of software) was associated with more frequent learning use of: graphics software, e-portfolio use, simulation software use, spreadsheets, presentation and the use of apps.

More frequent skype viewing was associated with more frequent learning use of: presentation software, graphics software, spreadsheet and simulation software and word processing programmes, i.e. most of the suite of MSOffice® programmes.

More frequent blog reading was associated with more frequent overall learning use of programming and e-books. More frequent multi-person gaming activity was associated with more frequent learning use of the following: simulation software, programming and LaTeX use, i.e. this was drawing in the more technically minded students.

More frequent Twitter use (while at a low level overall) was associated with more frequent use of collaboration in learning, the first time that a positive link has reported between these two.

There were few statistically significant relationships identified between ownership and non-ownership of the technologies. The main contrast identified was between types of ownership. Learning ownership of hardware was positively associated with more learning use for some technologies, specifically phone ownership for learning was associated with collaboration, programming and app use. Ownership of audio devices showed a significant relationship with word processing and spreadsheets. Computer ownership showed a strong relationship with spreadsheets and apps.

In summary of the overall relationships between technology ownership and leisure use, some of these indicated a positive impact overall on usage for learning, and this is deemed more satisfactory than recording a negative impact.

6. Discussion

As mentioned in the abstract, this study set out to discover whether the undergraduate students at this German university might exhibit some of the characteristics of digital capability which have been raised by recent research. Beetham and Sharpe (2014) have previously reported on students in the UK exhibiting *'high levels of functional skill or competency in digital media …often evidenced in a narrow corridor of involvement with social media and may not indicate a well-rounded digital identity'*. This survey's findings also correlate with their research, in part.

The German students reported here were frequently accessing a variety of hardware and software technologies to support their learning, but they personally owned fewer items of technology on average than students reported in a recent small-scale Australian study (Jefferies, 2015). Some of the survey responses were surprisingly similar to those of the Australian students in terms of student usage of learning technologies. There was wide-ranging access to learning technologies but ownership was at a lower level in Germany. 100% of those responding to the ownership questions in Australia claimed to own a laptop computer or netbook. The pattern for software access was similar with frequent use made of the university MLE (Blackboard in this case) and high daily access of Facebook (74%) as their social media of preference. Students showed only occasional and sporadic use of Twitter (16%) and low levels of uploading their own self-generated material. While 62% downloaded YouTube videos at least weekly, less than 5% would post videos online; only 7.5% contributed to a blog weekly. Student technology use in the Australian study was thus reported as being primarily passive with very few indicating that they participated in sharing their own materials online and with an associated very low reported usage of Twitter, LinkedIn, and uploading of materials for the general community use to YouTube or discussion fora. These studies both accord with recent research reported in UK-based studies where students are perceived as being more conservative in their use of technology for leisure and learning than media reports had inferred (Jisc, 2016). Results from the German and Australian research studies indicate a similarity in HE students' ownership and usage of learning technologies as they develop greater personal digital literacy during their studies. Highly digitally competent students nevertheless appear unwilling and unpractised at critiquing material further or engaging in the critical evaluation suggested as a key skill above. This issue was identified among UK HE students by White and Beetham (2013:3), when they commented that: *'Students rarely use technology for advanced knowledge-related activities or problem-solving unless they have been required to do so by their course or tutor'.*

Students are freely pulling information down for personal use from their university's MLE and other media but there is no convincing evidence that they are '*producing, sharing and critically evaluating information'* (Jisc, 2013). Cochrane and Antonczak identified this same issue of passivity and selective use of social media outlined above in their own recent study of technology use among this generation of young adults.

'In contrast to the myth of the 'Digital Native' and the ubiquity of Facebook use, we have found that students' digital identities are predominantly social with their online activity beyond Facebook limited to being social media consumers rather than producers. (Cochrane & Antonczak, 2015)

In related research the findings from the SchoolNet report (Wastiau et al, 2013), where widespread access to Information Communications Technology (ICT) was reported across various European countries, proposed among other issues that even where access to ICT is widely available, there was less evidence of deep digital confidence: *'There is no overall relationship between high levels of ICT provision and student and teacher confidence, use and attitudes.'* (Trocano, 2013). The studies across tertiary level students have not measured the contribution of teachers and academics but staff engagement and its impact on student engagement with technology use for learning has been shown to be a significant contribution to greater student involvement and growing digital confidence by recent work from Jisc (Beetham, 2016).

7. Conclusion

Tertiary students in Germany, Australia, the US and the UK may demonstrate extensive ownership and use of personal technologies to support their learning with high levels of perceived competency. What steps should now be taken to develop their critical faculties and ensure high levels of digital literacy as they graduate and seek employment? How can we encourage a wider engagement with and contribution to communities of practice (Wenger, 1998) during their studies?

There is growing use of technology in schools in Europe and the UK and 70% of UK pupils now use tablets according to Pew (2014) but students apparently remain unprepared for the development of key digital literacy skills in universities. Multiple studies of developing digitally literate HE graduates indicate the need to move students on from a consumerist and passive culture described above to more pro-active engagement with digital media. The 'richer set of [collaborative] digital behaviours' identified by Beetham & Sharpe (2014) should be encouraged at all levels and by our universities. How might this be encouraged across HE practice in Germany, Australia and further afield?

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