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Hosein, A.; Ramanau, R. and Jones, C. (2010). Are all net generation students the same? The frequency of technology use at university. In: IADIS E-Learning Conference, 26-29 Jul 2010, Freiberg, Germany.

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ARE ALL NET GENERATION STUDENTS THE SAME?: THE FREQUENCY OF TECHNOLOGY USE AT UNIVERSITY

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ABSTRACT

This paper looks at the results of a longitudinal study on how frequently the Net Generation students (i.e. those born in the 1980s) use technologies in their first year of university. Eight technology groupings were explored including web 2.0, social networking and computer software. The research investigated whether older Net Generation students (21-25 years) used technologies differently to the younger Net Generation students (≤ 20 years). Additional factors such as gender, university type (distance-learning or place-based) and nationality (UK or International) were accounted for during the study. The research found that nationality and university type were influential factors in determining the frequency of use across all technologies at the beginning of the academic year and continued to be influencing factors along with gender at the end of the academic year. Age only seemed to be an important factor for the use of Web 2.0 and social networking sites but these uses of technology were also dependent on students' university type, gender and nationality. Thus these demographic and social factors have to be considered when analysing technology use or designing educational tools. The findings of this study have implications for research into age-related differences in students' use of digital technologies and universities' digital technologies training provision.

KEYWORDS

Net Generation, Digital Natives, Social Networking

1. INTRODUCTION

Some authors such as Prensky (2001) and Tapscott (1998) have suggested that young people who were born from somewhere in the early to mid-1980s are different to those born prior to 1980 based on their digital technology use. These young people are sometimes referred to as 'Digital Natives' or the 'Net Generation'. One of the common assumptions of the literature on this subject is that the "Net Generation" students are a homogenous group in terms of their proficiency, frequency and nature of digital tools use. However, there has been continuous development of new digital technologies since the 1980s. For example, during the early to mid-2000s, new digital technologies and applications such as internet-enabled mobile phones, Web 2.0 and social networking sites became increasingly popular. In 1999 both Livejournal and Blogger were launched (Lankshear and Knobel, 2006) whilst in 2003, there was a spate of social networking sites launched including Orkut, Myspace and Hi5 (Boyd and Ellison, 2007). Young people (born after 1988) growing up in this era whilst exposed to similar technologies that were available prior to 1999 would have also been bombarded with the newer digital technologies. These students may perceive and utilise these technologies to support their learning differently to those students born prior to 1988 and hence there may be implications on how these students are taught with digital technologies as well as the design of educational tools.

There is much debate as to whether these premises are true. Some studies focus on exploring the nature of digital divide looking at the experiences of 'The Digital Natives' and 'The Digital Immigrants' (those born before the 1980s). The evidence in support of the notion of the Net Generation is only partial and it varies depending on the cultural context. For example, McNaught *et al.* (2009) reported more salient differences in their experiences of technology use between students and staff in the Chinese University of Hong Kong, than Kennedy *et al.*'s (2008a) research conducted in the context of three universities in Australia. This lack of

conclusive empirical evidence has led Bennett *et al.* (2008) to question the notion of the Net Generation and to describe the debate around it as a form of “moral panic” (p.2). More recent research in the area that looks at a wider range of factors that shape young people’s use of digital media and technology and questions the validity of the claims made by much of the “Net Generation” commentary. For example, Schulmeister’s (2008) survey of 2098 students in Europe and suggested that there were several sub-groups of participants with different orientations in their use of digital media and stressed the necessity of considering the nature of young people’s use of technology in more depth. Based on the results of this study and a review of other relevant research, Schulmeister (2009) concluded that studies of media use tend to emphasise the diversity within user sub-groups and that is also the case with Net Generation studies (e.g. Horrigan, 2007).

In one of the recent empirical studies, Jones *et al.* (2010) have found that although age plays a part in student use of technology, there is not a clear divide between the Net Generation age students and the non-Net Generation students. In fact, the way that students of all ages use the digital technologies is more complex and is influenced by a number of other factors, such as nationality, gender and university affiliation (Jones and Hosein, 2010; Ramanau *et al.*, 2010). While comparative studies between the Net Generation and older students continue to emerge (Kennedy *et al.*, 2008b), less work has been done so far to find out more about the variation *within* the Net Generation cohort based on age, that is, the intra-generational difference. This paper reports on the results of the second stage of a study that looked at students’ uses of technology in university studies (see more background information on the study aims and context below). The focus of analysis is on the intra-generational differences of students within the Net-Generation cohort and how these students use digital technologies when they arrived at university and at the end of their first year.

During the first stage of this project, Jones *et al.* (2010) found that there were intra-generational differences on how frequently students used social networking sites, mobile phones for messaging, instant messaging and downloading and streaming of audio/video files. Their sample was drawn from five English universities with students at place-based (i.e. campus) and distance-learning universities and included international students. However, the analysis did not identify whether nationality, university type or gender contributed to the differences that were found. Further, only students at the end of their first year were surveyed, hence it was difficult to ascertain whether these patterns of use were developed whilst at university or prior to entering university. The paper seeks to explore the degree of difference in frequency of ICT use between students belonging to different age, gender, nationality groups and university types within the Net generation age cohort. The second section of the paper describes the samples under study and explains the context of quantitative data collection and of the research project as a whole. In the third section, statistical tests results on the frequency of ICT use are reported for the surveys carried out. This is followed up by a discussion on the findings.

2. STUDY CONTEXT AND METHODS

This research forms part of the Net generation: encountering e-learning at universities project which is funded by the Economic and Social Research Council (ESRC) in the UK. This study had two phases where in Phase 1 a survey (referred to as Survey 1) was sent out to students in various subjects in five different universities in England that represented the five types of English universities: urban red-brick, 1960s ‘New University’, large Metropolitan post 1992, a recent university (ex-University college) and distance-learning. The results from Survey 1 are discussed elsewhere (see Jones *et al.* (2010). In Phase 2 a longitudinal survey was conducted in the same five universities where the main aims were to examine students’ attitudes towards digital technology and the frequency of their digital technology use. Two surveys, referred to as Survey 2 and Survey 3 were administered to students either online or in a paper-based format at the beginning and towards the end of the first year of university studies respectively. Surveys 2 and 3 were mostly identical. All of the three questionnaires were designed by the project research team and were mainly self-report standardised instruments. The results reported in this paper are based on student responses to a battery of items on frequency of digital technology use during one month preceding the study. These frequency items were measured on a five-point Likert scale from 1 (“Never”) to 5 (“Very often”). Copies of both Surveys 2 and 3 can be accessed at http://www.open.ac.uk/researchprojects/netgeneration/p2_2.shtml.

Whilst students of all ages were invited to answer both of these surveys, to find out more about the nature of age differences the sample was split into two age bands - students born between 1983 to 1987 (older Net

Generation students) and those students born between 1988 to 1990 (younger Net Generation students). The results of our previous research (reported in Jones *et al.* (2010); Ramanau *et al.* (2010) suggested that the distance-learning students were different in the way they used digital technologies to that of the place-based students, thus the variation by mode of study is also explored. In addition to that, students' gender and nationality were seen as possible contributors to differences in students' technology uses and were also included in the analysis. In Surveys 2 and 3, we had 959 and 613 responses respectively for the two age groups with over 85% of the responses coming from the younger Net Generation students (see Table 1).

Table 1. Demographics of Survey 2 and Survey 3 by age, gender, university and nationality

	Survey 2			Survey 3		
	20 and under	21-25	Total	20 and under	21-25	Total
Gender						
Males	337	51	388	184	50	234
Females	494	75	569	297	80	377
No Info	2	0	2	1	1	2
Nationality						
UK	653	98	751	392	91	483
International	176	28	204	86	39	125
No Info	4	0	4	4	1	5
University						
Place-Based	811	76	887	459	77	536
Distance-Learning	22	50	72	23	54	77
No Info	0	0	0	0	0	0
Total	833	126	959	482	131	613

To investigate if there were different patterns as to how younger and older Net generation students used various technologies all of the questionnaire items on frequency of digital technology use were grouped into eight categories: audio, video and images; messaging and chat; social networking; Wikis, blogs and Web 2.0; mobile phones; games; computer software; using a search engine and purchasing or selling items online and university resources (see Table 2 for examples of items for each group of items). In Table 2 the bracketed terms under technology groupings represent the shorter terms that will be used in the analysis tables.

Table 2. Example of a frequency item for each technology grouping

Technology groupings	Example of an item
Audio, video and images (Audio)	Listened to an audio file (e.g. MP3) or a podcast
Messaging and chat (Chat)	Used and instant messenger
Social networking (SNS)	Looked at messages or postings on a social networking site
Wiki, blogs and web 2.0 (Wikis)	Used Wikipedia
Mobile phones (Mobile)	Made calls using a mobile phone
Games (Games)	Played multiplayer video games online
Computer software (Software)	Used a word processing programme (e.g. Word)
University resources (Uni. Res)	Accessed materials relating to your course outline (e.g. lecture notes, slides, podcasts etc.)

In the 'Audio, video and images' grouping students were asked if they edited, listened to or uploaded any of these media. The grouping 'Messaging and chat' had items on the use of instant messengers, emailing, video conferencing and visiting virtual worlds. 'Social networking' was about whether they edited their profile, received or sent messages on social networking sites. 'Wikis, blogs and web 2.0' dealt with their contributions and reading of blogs and wikis as well as using social bookmarking, file sharing services and really simple syndication (RSS) feeds. The 'Mobile phones' grouping asked students about whether they made calls, went online and sent email from their mobile (cell) phones. For the 'Games' category, students were asked items on online games, internet browser games and console games. 'Computer software' dealt with software used for most university work such as word processing, spreadsheets and presentation

software. Additionally they were also asked about *using a search engine and purchasing or selling items online*. The last grouping of 'University resources' dealt with students accessing materials relating to their courses, library resources and communicating with other students via university online services.

The reliability of the items for each technology grouping for the Net Generation students were assessed for Surveys 2 and 3 (Table 3). In some technological groupings, the Cronbach's alpha was low; Nunnally (1978) has indicated for exploratory studies, 0.6 is a reasonable cut off figure. Most of the technological groupings' alphas are above this figure however, the technology grouping on messaging and chat falls below this reliability cut-off and hence any results for this technology grouping should be treated with caution.

Table 3. The number of items and Cronbach's alpha for the technology groupings in Surveys 2 and 3

Technology Groupings	No. of Items	Survey 2		Survey 3	
		Mean	Cronbach's alpha	Mean	Cronbach's alpha
Audio, video and images	7	2.6	0.73	2.5	0.70
Messaging and chat	6	2.8	0.51	2.7	0.51
Social networking	3	4.0	0.90	4.1	0.88
Wiki, blogs and web 2.0	8	2.0	0.78	2.1	0.77
Mobile phones	3	2.8	0.61	2.8	0.61
Games	3	2.5	0.75	2.4	0.75
Computer software	5	3.9	0.72	3.8	0.56
University resources	4	3.4	0.73	3.8	0.66

3. RESULTS

The data was analysed according to age, gender and nationality for both Surveys 2 and 3 using a multivariate analysis of variance (MANOVA) and a full factorial analysis of variance (ANOVA). The MANOVA was used to determine if there was any significant variation across all the technology groupings based on students' gender, nationality and university they attended. For example, the MANOVA determined whether age influenced all the technology groupings. The ANOVA helped determine if there was significant variation within a technology grouping, for example, whether age influenced how students messaged and used chat.

3.1 Survey 2

The MANOVA for Survey 2 indicated that nationality ($F(8,919) = 5.34, p \leq 0.01, \eta_p^2 = 0.04$) and the interaction of university type by nationality ($F(8,919) = 2.42, p = 0.01, \eta_p^2 = 0.02$) affected the frequency that students used technology overall. Investigating why these significant differences occurred required looking at the individual technological groupings within the ANOVA further. Table 4 presents the factors that were significant for the 8 technological groupings where A, G, U and N represent age, gender, university type and nationality respectively. As expected from the MANOVA, nationality was significant for five of the technological groupings (audio, chat, social networking, wikis and university resources) and the interaction term of university by nationality was highly significant for one technological grouping (social networking). This is later discussed below, for now, our main attention turns to age. Survey 2 did not show any main effects of age for any of the technological groupings.

Age by itself was not an influence on the frequency of technology use, however an interaction between age and gender was noted for the frequency of use of wikis, blogs and web 2.0 ($F(1,926) = 5.57, p = 0.02, \eta_p^2 \leq 0.01$) and social networking sites ($F(1,926) = 5.28, p = 0.02, \eta_p^2 \leq 0.01$). For wikis, blogs and web 2.0 usage, the younger Net Generation students regardless of gender were using this technology to almost the same extent (male students: 2.1; female students: 2.2). However, in the older Net Generation, the male students were using this technology more than the older Net Generation female students (2.3 vs 1.9). This picture becomes more complex for the use of social networking sites. Whilst age by itself did not play a part, it seems that that the interaction of age with both gender and university type did. Firstly, the age by gender interaction showed that in general, the 21-25s male and female students were using social networking sites to almost the same extent (3.6 vs 3.8). However, in the ≤ 20 years category, female students were using this technology grouping more than the male students (4.0 vs 3.5). When university type, along with gender and

age was taken into account (three-way interaction), this difference between male and female students for the younger Net Generation only occurred at the distance-learning university. The distance-learning, male Net generation students were using the social networking sites less frequently (3.3) compared to the younger, male Net Generation students at place-based universities who were using social networking sites comparably the same to the other students (3.8).

Table 4. ANOVA tests for the 8 technological groupings by university, nationality, gender and age for Survey 2¹

	Audio	Chat	SNS	Wikis	Mobile	Games	Software	Uni. Res.
U	*				*			
N	**	**	**	*				**
A x G			*	*				
U x N			**					
A x G x U			*					
A x G x N	*							
G x U x N								*

As noted earlier, both university type and nationality as main effects influenced the frequency of use of audio, videos and images technology grouping. Distance learning students manipulated audio, videos and images less frequently than place-based students (2.8 vs 2.3) and international students used this technology grouping more frequently than the UK students (2.9 vs 2.3). The frequency of use for this technology grouping was more complicated as an interaction between nationality, gender and age was noted. The results suggest that older, male, international Net Generation students (3.1) were more frequent users of this technology grouping than the other students.

Whilst not of our main concern, nationality and university type were influencers in the frequency of technology use. Distance-learning students were generally less frequent users of the audio, video and images; and mobile phones grouping. International students also used audio, video and image; chat and messaging; social networking sites; wikis, blogs and Web 2.0; and university resources more than the UK students. From this section, note that when students entered university, the major factors influencing their technological use were nationality and university type. In terms of age, the evidence indicated that the older, male Net generation students were the most frequent users of Web 2.0 technologies and the younger male Net Generation students were less likely to use social networking sites at the distance learning universities.

3.2 Survey 3

Survey 3 was more similar to Survey 1 in terms of timing as they were both sent in spring, that is, at the end of the student's first year of study. The MANOVA for Survey 3 shows that university type ($F(8,575) = 5.85$, $p \leq 0.01$, $\eta^2_p = 0.08$), nationality ($F(8,575) = 1.95$, $p = 0.05$, $\eta^2_p = 0.03$), gender ($F(8,575) = 2.07$, $p = 0.04$, $\eta^2_p = 0.03$) and the interaction of nationality and university type ($F(8,575) = 2.24$, $p = 0.02$, $\eta^2_p = 0.03$) were all significant. It is interesting that at the end of the first year, there were clear differences on the frequencies of technology use in terms of gender and it is perhaps university life that is shaping this gender difference. The data still showed that across the technological groupings, age was still not a major influencing factor on the frequency of digital technology use.

Using the ANOVA, the individual technological groupings are further explored. Table 5 presents the factors that were significant for the 8 technological groupings where A, G, U and N represents age, gender, university type and nationality respectively. By the end of the first year, whilst age was not an influencing factor across all technological groups according to the MANOVA, the analysis from the ANOVA showed that age was an influencing factor for social networking sites which agrees with the findings from Survey 1. The results from Survey 3 and Survey 1 did not correspond exactly. In Survey 1, there were age differences for social networking, mobile phone for messaging, instant messaging and downloading and streaming of audio. In Survey 3, age was not a main factor but it was an influencing factor (i.e. had interactions with other factors) for only two of these similar groupings, social networking and audio, video and images. The instant message item in Survey 1 was different to that of Survey 3, as Survey 3 included items such as chat room

¹ * $p \leq 0.05$

** $p \leq 0.01$

based messaging under the grouping of chat and messaging. Further, this group of items had a low Cronbach's alpha and may explain why a difference seen in Survey 1 was not observed here. Similarly, in Survey 3, the items related to mobile phones also included accessing the internet and sending emails not text messaging alone and hence was not similar to the item asked in Survey 1.

Table 5. ANOVA tests for the 8 technological groupings by university, nationality, gender and age for Survey 3²

	Audio	Chat	SNS	Wikis	Mobile	Games	Software	Uni. Res.
A			*					
G						**		
U	**		**	**			**	**
N							*	
A x U			*					
A x N			*					
G x U			*					
U x N				**			*	*
A x G x U	*		*					
A x U x N			*					
A x G x U x N							*	

Students less or equal to 20 years were using the social networking sites more frequently than the 21-25 year old students (4.1 vs 3.4). Age was not the only factor that influenced the frequency that students used social networking sites. University was also a factor, in that place-based students used social networking sites more regularly than the distance-learning students (4.1 vs 3.4). Further, the 21-25 year old students in the distance-learning universities were the least likely to use social networking sites (2.8). In comparison, the ≤ 20 year olds in the distance learning university (4.1) were using it to a comparable frequency with those students at the place-based universities. There was also a gender, age and university interaction for the use of social networking sites where the male students in the distance-learning university were using this technology the least (2.9) but the female students at the same institution (3.9) were using it in comparable amounts to the students at place-based universities. In fact, male students who were in the 21-25 year old grouping were very unlikely to use social networking sites if they were at the distance learning university (1.8). This is interesting since in Survey 2, the younger Net generation, male students were the least likely to use social networking sites if they were distance-learners. There thus appears to be a complete shift in the frequency of use of social networking sites particularly amongst the males at the distance-learning universities.

Within the social networking grouping, ≤ 20 year olds who were international students were the most active users (4.4) with the 21-25 years old international students the least frequent (3.2). The difference in frequency of using social networking sites amongst the international students was particularly pronounced amongst the distance-learning students, where the younger (≤ 20 years) were very frequently using this technology (4.8) whilst the 21-25 years old were the least frequent users (2.4). A three-way interaction was also noted for age, gender and university in the manipulation of audio, video and images. Note firstly that students who were in the place-based universities were manipulating audio, video and images more frequently than students at the distance-learning university (2.8 vs 2.2). This low frequency was due to two groups of students in the distance-learning university, firstly the females who are ≤ 20 years (1.9) and the males who are 21-25 (1.9).

A complex interaction between age, gender, university and nationality is noted for the frequency of software use. Firstly, place-based students were more frequent users of computer software than distance-learning students (4.0 vs 3.2). Also, UK students were more frequent users than the international students (3.8 vs 3.4). The low frequency of use was predominantly by distance-learning, international students (2.9). Breaking this group (distance learning, international) of students down further, the low frequency of computer software use was due to 21-25, male students (2.2). It appears that the university type was a big influencer on how frequently the older, Net generation students used technology. For the other effects,

² * $p \leq 0.05$

** $p \leq 0.01$

students at place-based universities were more frequent users of wikis, blogs and Web 2.0, and university resources. Whilst for games, male students were more likely to be frequent players than female students.

4. DISCUSSION AND CONCLUSION

This paper examined whether there was intra-generational variation amongst university students on their digital technology use. The main thrust of our argument is that whilst authors such as Prensky and Tapscott suggested that the Net Generation is distinct from the non-Net Generation and the former is sometimes presumed to be homogenous, we, however, take the stance that the Net Generation is heterogeneous. Our assumption is that Net Generation students born in different technology eras would be influenced by the digital technologies that were popular to them during secondary school. We recognise however that if the Net Generation is heterogeneous, that variability would not depend only on age. Therefore, whilst a similar study was conducted previously (Jones *et al.*, 2010), this current study included variation due to gender, university type and nationality and also investigated students' use of technology twice during the academic year.

The results reported are not conclusive and one should be cautious when making them generalisable to other contexts. The study sample was drawn across several subjects in five English universities. This questions whether its conclusions would be relevant for describing student uses of technology outside these contexts. The items under analysis represented various technology-related activities, but all of them had to do with the frequency of use rather than learners' attitudes and experiences, which were explored in more detail in another section of the questionnaire. Finally, only quantitative data on students' use of digital technologies is reported in this study and we are cognisant that qualitative data can provide a rich picture of individuals' experiences which is necessary to gain more insights into how technology is embedded into young people's lives. The findings of this study stress the diversity in different types of digital technologies uses within the Net Generation age cohort. There was not a clear intra-generational difference in how students used technology, that is, age was not a main factor influencing the technology use. However, this does not imply the Net Generation is homogenous, in fact there are number of influencing factors, including gender, nationality and university type. When these factors are considered, the heterogeneity of the Net Generation becomes clearer as it is within these demographic and social groups that the variation by age on how students use digital technologies is found.

Therefore, our first significant conclusion of this study is that differences by age group were very few, but when other characteristics (e.g. university type, gender or nationality) were taken into account the differences within the Net Generation age cohort of students were reported. Interestingly, it was more often the case with Survey 3 which was administered at the end of the academic year, compared to Survey 2 conducted in the beginning of the year. Moreover most of the differences were reported on the social networking grouping of items. This highlights the importance of university studies in shaping students' uses of technology and in agreement with the results of the first study, Survey 1, (see Jones *et al.* (2010) which underscores the use of social networking sites as one of the key sources of group differences, including those related to student age.

Second, depending on the timing of the survey used, gender differences and differences across students belonging to different national groups also proved to be quite salient. Some of the findings were not surprising and consistent with the results reported in other sources, for example, gender differences on the frequency of playing games (young undergraduate males tend to play games more often than young undergraduate women, also reported in Ogletree and Drake, 2007). However, the size and nature of cross-national differences were quite surprising, especially in Survey 2 which was conducted in the first few weeks of their first university term. Although detailed data on student nationality and culture was not collected, these results suggest that the international Net Generation students differ in their digital technologies use from their UK peers and that a closer analysis of how and why young people in various countries choose to use the digital technologies would be useful.

Third, one notable change from Surveys 2 to 3 is the increase in the frequency of social networking site use amongst international students, which might be explained by the social milieu of today's UK campus university (see Ramanau *et al.* 2010 for more detail) which encourages the use of these technologies. It is unclear whether the social networking aspect is only a residual of the university social life or if it is part of the university learning process as well. The study showed that there was a high usage in social networking use amongst the place-based students as well as at the distance-learning university, where students are

usually more isolated and are unlikely to have a regular social life with other students. Their frequency of usage of social networking sites was comparable to that of place-based universities except for the older, male students. Thus gender and age appeared to be an influencer in the uptake of social networking tools even when the student is a distance-learner. Thus the profile of the end-users is an important issue to consider when designing educational tools particularly if the tool employs the principles of social networking.

Finally, the findings of this study have implications for digital technologies training at UK universities. Whilst some training in the use of university resources is provided to students as they enter UK universities, it is rarely customised to the needs of individual students and it is not always integrated into student induction programmes. While this study shows that students do have a certain level of digital technologies skills on entry to university, their frequency of use varies depending on a particular technology task and by demographic group. Therefore customising training sessions or materials to particular groups of students (e.g. international students) may be worth considering.

ACKNOWLEDGEMENTS

The research reported was funded by the UK Economic and Social Research Council (Grant RES-062-23-0971). We would like to thank the Survey Office & the Student Statistics team (Open University) for helping to administer the survey and also like to acknowledge the assistance of our colleagues at the participating universities: Susan Armitage, Martin Jenkins, Sheila French, Ann Qualter and Tunde Varga-Atkins.

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