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Introduction

For over ten years there has been a wide spread discussion about the relationship between a new generation of young people and the new forms of networked and digital technology. A range of terms have been coined to describe this new generation including Millenials (Howe and Strauss, 1991; 2000; 2003), Generation Y (Weller, 2004) and most notably Net Generation (Tapscott, 1998; 2009) and Digital Natives (Prensky, 2001a; 2001b, Palfrey and Gasser, 2008). The argument for the term Digital Natives is that a new generation of young people is distinct from older people characterised as Digital Immigrants because of their immersion in new technologies since birth. Prensky provides no definite start date for the generation but Palfrey and Gasser suggest those born after 1982. Howe and Strauss also identify those born after 1982 and before 2001 as Millenials. The term Net Generation has been given a start date of 1977 in Tapscott's most recent work and an end date of December 2007. Oblinger and Oblinger (2005), who use both the term Millenials and Net Generation, place the generation between 1982 and the end of 1991 (Oblinger and Oblinger, 2005). If we accept the most common starting date for the new generation as 1982, then this new generation students are still entering university. This paper investigates how these students use technological tools at university, what characteristics young students display and whether they are distinct from older non-Net Generation students.

The young people characterised by the terms Millenials, Net Generation, Digital Natives and Generation Y (henceforth Net Generation) are said to be distinct because they have grown up with both digital technologies and the Internet. It is claimed that this has led them to have both a natural aptitude and high skill levels in using new technologies. Those who are older are described, in different degrees, as having less fluency with the new technologies, displaying a learned set of skills rather than a natural aptitude. This generational shift is related to new generational approaches to learning. The Net Generation is said to require rapid access and quick rewards, to be impatient with linear thinking and to display a capacity for multi-tasking and collaboration. In recent years these arguments have come under critical review from both theoretical standpoints (e.g. Bayne and Ross, 2007; Bennett, Maton and Kervin, 2008) and from empirical studies (e.g. Kennedy, Judd, Churchward, Kay and Krause, 2008; Jones, Ramanau, Cross and Healing, 2010). The empirical studies suggest that the picture amongst Net Generation age students is complex with age being the most significant factor but with other factors also being influential, such as gender and mode of study. These studies suggest that demographic factors such as gender may have an influence on engagement with technology and that contextual factors such as mode of study may also be influential. Overall the studies suggest that the new generation of young students entering university has a variety of different characteristics and that young people cannot be described as a single generational cohort. If that is the case then it becomes important to understand how the student population is segmented and patterned in relation to new technologies.

Two recent studies that are currently reporting their findings have attempted to use cluster analysis to provide characterisations of the kinds of differences found amongst Net Generation age young people. These recent studies are in the Netherlands (see Van den Beemt, 2010) and Australian contexts (see Kennedy, Judd, Dalgarno and Waycott, forthcoming). In their recent conference paper, Van den Beemt, Akkerman and Simons (2009) investigated over 2000 Dutch students from various education levels (primary school to higher education) on their use of interactive media. From this research, they suggested that there were four types of students based on a cluster analysis of their frequency of use of interactive media: traditionalists, gamers, networkers and producers. They described traditionalists as those students who used basic functionalities of interactive media but not Web 2.0 (primarily web engines and email). Gamers were those students who played games. Both gamers and traditionalists were composed mostly of primary school students but traditionalists were mostly male. The networkers were mainly students from the pre-university level and female. These students used all types of social networking software. The producers group was mainly higher education students who were very active users of all types of interactive media. They suggested that the producers were perhaps the group most like the characterisation of Net Generation students found in the literature.

Kennedy *et al* only investigated first year students at university level within the Net Generation, that is students aged between 17 and 26. They surveyed 2096 students about their frequency of technological tool use at three universities. Through cluster analysis, they found that even within the Net Generation students there were disparities in how students used technologies. They identified four types of students: power users, ordinary users, irregular users and basic users. They indicated that power users used a wide range of technologies whilst ordinary users used mainly web and mobile technologies. Irregular users were similar to ordinary users but their frequency of using web and mobile technologies were lower and were less likely to use emerging technologies except for Web 2.0 publishing. Their final category of basic users represented almost half of their student population (45%). These students were irregular users of new and emerging technologies but were regular users of standard mobile phones.

The research reported here examined first year university students but like Kennedy *et al* (forthcoming) it went beyond students' use of interactive media to examine use of software as well. Furthermore, this research investigated how students' profiles of technology use changed between the beginning of the academic year the end of the academic year. This may be important to discern if the profiles of students have on arrival at university are modified following their engagement with other students and exposure to e-learning at university. One further point of difference is that Kennedy *et al* only looked at students less than 26 years old whereas this research collected data from all students in the first year of university regardless of age and from both place-based and distance-learning universities.

Data Collection

The data collected for this paper forms part of an UK Economic and Social Research Council (ESRC) funded project, "The Net Generation: Encountering e-Learning at University". Three surveys (Surveys 1, 2 and 3) were conducted in this project where Survey 1 is reported elsewhere (see Jones *et al*, 2010). Data for this paper were collected through two survey instruments which are referred to as Surveys 2 and 3. Surveys 2 and 3 had similar items and were sent out respectively in autumn of 2008 and

in spring of 2009 which represented the start and the end of the students' academic year. The questionnaires were sent out as either paper-based copies or online using a web link to students in fifteen courses at five universities. Students were either given the paper-based questionnaires to fill in during class or they were provided with the web link to access the survey. Access via the web was either during class time or in the students own time following an introduction given by a member of the research team during a class. Because electronic access was provided, almost all students on the courses had an opportunity to fill in the questionnaires. These universities were purposively selected to represent five types of English universities (see Jones *et al*, 2010). Four of these universities were place-based and one was solely distance-learning.

Students were asked questions based on their background, their access to technology, their frequency of using technology, their competence with technology and their experience of learning with technology. The data presented in this paper deals with the students' frequency of using technology and in particular the frequency of using information, communication and technology (ICT) tools. Students were asked to rate their frequency of use for 40 items at the beginning (Survey 2) and 39 items at the end of the first year (Survey 3). A duplicate item on the use of email was removed in Survey 3. These items covered the frequency of use in the past month (1 = never to 5 = very often) for various types of technologies:

- Audio, video and images
- Messaging and chat
- Social networking sites
- Wiki, blogs and web 2.0
- Mobile phones
- Games
- Computer software (Excel, Word etc.)
- University resources (e.g. accessing university course notes)

Data for 1093 students were collected in Survey 2 and 713 students in Survey 3. Of the 713 students answering Survey 3, 369 students could be clearly identified as having also answered Survey 2. All students, regardless of whether they answered only one questionnaire, were included in the analysis. The lower response rate to Survey 3 was probably because of a combination of three causes. Firstly the attrition of students during their first year due to either changing of courses or dropping out of university. Secondly because students were nearing examinations and were attending fewer classes and were focused on completing their courses. The last possible reason is that because of the similarity between Surveys 2 and 3, students may have thought they had already filled in the questionnaire. It was difficult to ascertain the exact response rate because of the uncertainty about the numbers of students enrolled on the courses at the time of each survey (Survey 2 took place as students enrolled and Survey 3 after some attrition), however the response rate for Survey 2 was approximately 43% and for Survey 3 28% of the student sample.

The aim of this paper is to profile students' association with technology based on their frequency of use and to determine whether their association changed during the academic year as they met their peers and became more involved with technology available at university. Furthermore, we wanted to determine whether this was dependent

on their social and demographic characteristics such as age, gender, nationality and type of university. Our aim is not to investigate whether students' frequency of technology use for each questionnaire item was different between the two surveys.

In ascertaining students' association with technology, we wanted to know whether there were some technologies that naturally grouped together because of similar frequency of use. For example, if we found that students who were frequently editing audio were also frequently editing video, this would suggest that there was a proportion of students' whose association with technology was related to manipulating media. Whilst it is interesting knowing that students may have a particular association or orientation to particular sets of technology, determining which students (based on social and demographic data) are most likely to have a high or low association with a set of technology can shed light into how different types of students appropriate technology.

Thus to determine students' tool use and their profiles, a two prong analysis approach of principal components factor analysis followed by a cluster analysis was implemented. Firstly, the factor analysis was performed on the items from both Surveys 2 and 3 as this analysis provides a method of determining which items naturally grouped together based on the frequencies. Factor analysis was also used because the items were highly correlated with each other. Further whilst the items covered various types of technologies, not all of the items had a high reliability within their groupings. Therefore, factor analysis provided a way of grouping items that were alike and hence form the types of technology use. Four factors were found in both Surveys 2 and 3 and are referred to as the technology orientations. Using the eigenvalues, students' regression scores for each technology orientation were calculated. The scores for each factor had a mean of 0 and a standard deviation of 1.

Once the technology orientations were determined, cluster analysis was used to determine which types of students were more likely to have high or low technology orientations. Cluster analysis is an algorithm that tries to classify participants by the similarity of their scores. When participants are being grouped according to demographic and social data as in marketing analysis, the two-step cluster analysis is often used. Therefore, a two-step cluster analysis was performed on the students' factor scores using their nationality, university type, age and gender as the grouping variables. Students' nationality was classified as being either international (including European Union) or home (i.e. UK) students. University type was considered to be place-based or distance-learning. Age was categorised into four groups of students: 20 years or less, 21 to 25 years, 26 to 35 years and 36 years and over. The first two age groups represented the Net Generation students. The results from Surveys 2 and 3 are now presented separately.

Survey 2: Start of the academic year

A factor analysis using a varimax orthogonal rotation was performed on the 40 items. Using a scree plot, 4 factors were identified which accounted for 40.9% of the variance. The rotated loadings on the factors for each item are presented in Table 1. Only 907 students were used for the factor analysis based on a listwise exclusion. Factor loadings that were more than ± 0.4 are in bold. The cut off point of 0.4 allowed an easy examination of which items loaded highly on the factors. Based on the loadings, the four factors appeared to represent:

- Factor 1: Web Interactive Oriented – this factor had loadings that were high for web 2.0 e.g. wikis, blogs, RSS feeds, file sharing

- Factor 2: Work-Oriented – this factor had loadings that were high for ‘work’-type software and ICT e.g. using Word, Excel, accessing university resources
- Factor 3: Social Network Interactive Oriented – this factor had loadings that were high for social networking e.g. using instant messenger, using a social networking site
- Factor 4: Technically-Oriented – this factor had loadings that were high for more technical aspects of ICT e.g. editing video and audio, uploaded video on the web, being online with a mobile phone.

To determine what type of students fitted into these four factors, the students’ regression loadings for the four factors were analysed using a two-step cluster for the categorical variables of age, gender, university type and nationality. The centroid means for the factors in the four clusters found are presented in Table 2. Note that all the factor scores have a mean of 0 and a standard deviation of 1 and hence the centroid means are scaled on these values. As the factor scores are rescaled, they are not comparable in terms of frequency. For example, the same score on the web-interactive oriented and the work-oriented factors, does not mean that students’ frequency of use for these technologies were the same. However, we can compare the scores for one factor across the clusters. For example, a high score for web-interactive oriented on Cluster 1 and a low score for web-interactive oriented on Cluster 2, will indicate that students in Cluster 2 had a lower frequency of use.

All clusters of students had similar frequency for the time they spent on work-oriented and technically-oriented ICT. The distinction between the clusters was due to the frequency with which the students used the web-interactive and social interactive components of ICT. Cluster 1 represents very high web interactive students with a low social interactive orientation. Cluster 2 is made up of students with low frequency on both the web and social ICT items. Cluster 3 represents people who have a high social interactive usage whilst Cluster 4 represents students with high web and social interactive elements. Cluster 4 is thus the opposite of Cluster 2 students and Cluster 3 is the opposite of Cluster 1 students. These results are presented in Table 3 (where the following range of centroid values ≤ -0.6 : very low, > -0.6 to ≤ -0.2 : low, > -0.2 to < 0.2 : average, ≥ 0.2 to < 0.6 : high and ≥ 0.6 : very high, are used for classification purposes in this paper).

Table 1: Rotated factor Loadings for four factors in Survey 2 (Beginning of the First Year)

	Factors			
	1	2	3	4
Listened to audio	0.25	0.10	0.52	0.11
Uploaded audio to the Web	0.14	0.08	0.06	0.58
Edited digital audio	0.28	0.01	0.05	0.65
Watched video online	0.40	0.11	0.39	0.17
Edited video on a computer	0.32	0.01	0.03	0.63
Uploaded video to the Web	0.26	0.02	0.08	0.66
Edited a digital photo	0.18	0.26	0.29	0.38
Sent MMS messages	0.01	0.10	0.12	0.32
Sent or responded to an e-mail	-0.09	0.51	0.33	0.09

Used an instant messenger	0.23	0.23	0.58	0.05
Participated in a text-based chat room	0.53	0.06	0.06	0.18
Visited virtual world	0.50	0.00	-0.01	0.27
Used conferencing via the Web	0.37	0.13	0.14	0.18
Looked at messages on social networking sites	0.05	0.12	0.87	0.01
Sent messages on social networking sites	0.04	0.11	0.87	0.04
Edited my profile on social networking sites	0.08	0.12	0.77	0.18
Used Wikipedia	0.37	0.27	0.18	0.06
Used a wiki (not Wikipedia)	0.54	0.24	0.06	0.08
Read blog	0.75	0.12	0.10	0.03
Maintained own blog or website	0.71	0.00	0.07	0.05
Contributed to another's blog	0.74	0.04	0.04	0.09
Used social bookmarking	0.59	0.07	-0.06	0.16
Used RSS feeds	0.60	0.15	-0.02	0.13
Used file sharing	0.47	-0.03	0.13	0.21
Made calls via mobile phone	-0.05	0.18	0.37	0.28
Went online via mobile phone	0.14	0.13	0.14	0.57
Sent e-mail via mobile phone	0.23	0.15	-0.04	0.57
Played multiplayer video games online	0.48	0.02	0.17	0.30
Played browser based games online	0.37	0.03	0.35	0.28
Played games with no network	0.35	0.02	0.24	0.28
Frequency sent or received email	-0.06	0.52	0.30	0.08
Used a word processing programme	-0.02	0.67	0.18	0.12
Used a spreadsheet	0.14	0.64	-0.01	0.30
Used presentation software	0.15	0.65	0.05	0.26
Used a Web search engine	-0.02	0.41	0.31	-0.04
Purchased or sold products online	0.06	0.39	0.16	0.31
Accessed materials relating to course online	0.18	0.65	0.08	-0.12
Accessed general information relating to course online	0.08	0.72	0.06	-0.06
Accessed/ used university resources online	0.28	0.54	-0.02	0.10
Communicated with other students online	0.32	0.45	-0.01	0.19

Table 2: Centroid means and standard deviations for the factors based on their cluster membership for Survey 2

		Cluster			
		1	2	3	4
Factor 1: Web Interactive (blogs, wikis etc)	Mean	0.89	-0.40	-0.41	0.27
	SD	1.00	0.80	0.74	0.96
Factor 2: Work-oriented (MS Office, library)	Mean	0.01	0.05	-0.01	-0.04
	SD	0.91	1.08	0.97	1.03
Factor 3: Social Interactive (social networking)	Mean	-0.26	-0.68	0.38	0.26
	SD	0.91	1.21	0.73	0.81
Factor 4: Technical-oriented (mobile phones, editing videos)	Mean	0.10	0.04	-0.09	0.01
	SD	1.18	0.91	0.85	1.12

Table 3: Membership of groups to the clusters for Survey 2

	Cluster			
	1	2	3	4
Web Interactive	V. High	Low	Low	High
Work-oriented	Average	Average	Average	Average
Social Interactive	Low	V. Low	High	High
Technical-oriented	Average	Average	Average	Average
Gender				
Males	68 (18%)	76 (21%)	0 (0%)	224 (61%)
Females	95 (18%)	124 (23%)	320 (59%)	0 (0%)
Age				
≤ 20	140 (20%)	16 (2%)	320 (46%)	224 (32%)
21-25	22 (21%)	85 (79%)	0 (0%)	0 (0%)
26-35	1 (2%)	48 (98%)	0 (0%)	0 (0%)
≥36	0 (0%)	51 (100%)	0 (0%)	0 (0%)
University				
Place-based	161 (20%)	86 (11%)	320 (41%)	224 (28%)
Distance-Learning	2 (2%)	114 (98%)	0 (0%)	0 (0%)
Nationality				
UK	0 (0%)	193 (26%)	320 (43%)	224 (30%)
International	163 (96%)	7 (4%)	0 (0%)	0 (0%)
Total	163 (18%)	200 (22%)	320 (35%)	224 (25%)

Clusters 3 and 4 were comprised of only UK students from place-based institutions who were 20 years and under. Cluster 3 was made up of females and Cluster 4 of only males. The singular difference between Cluster 3 and Cluster 4 was that Cluster 4 (only males) had a high web interactive element. Cluster 1 was entirely composed of international students from mostly place-based institutions who were mainly 25 years and under.

Cluster 2 incorporated almost all the distance-learning students (although there were place-based students in this group) and was made up of persons mostly 21 years and older who were UK students. These students were mostly likely to be low on their technology use. These results from the cluster analysis show that 98% of the students less than 20 years were high users of ICT.

Survey 3: End of the Academic Year

A correlation of the 39 items in Survey 3 found that most items were significantly correlated with each other and hence meant a factor analysis could be used. Using a scree plot, 4 factors were identified. The factor analysis used a varimax orthogonal rotation and accounted for 39.8% of the variance. The rotated loadings on the factors for each item are presented in Table 1. Factor loadings that are more than ± 0.4 are in bold. Only 618 students were used for the factor analysis based on a listwise exclusion. Based on the loadings, the four factors appeared to be:

- Factor 1: Web Interactive/ Technically-Oriented – this factor had loadings that were high for web 2.0 e.g. wikis, blogs, RSS feeds, file sharing, editing video and audio. This factor is similar to Factors 1 and 4 from Survey 2
- Factor 2: Work-Oriented – this factor had loadings that were high for ‘work’-type software and ICT e.g. using Word, Excel, accessing university resources and is similar to Factor 2 from Survey 2
- Factor 3: Social Network Interactive Oriented – this factor had loadings that were high for social networks e.g. using instant messenger, using a social networking site. This is similar to Factor 3 from Survey 2
- Factor 4: Game-Oriented – this factor had loadings that were high for gaming aspects e.g. playing online games, computer games.

To determine what type of students fitted into these four factors, the regression loadings for the four factors were analysed using a two-step cluster using the categorical variables. The centroid means for the factors in the four clusters found are presented in Table 5. As in Survey 3, almost all students used average amounts of work-oriented ICT. Although not significantly different, students in Cluster 3 appeared to use slightly more work-oriented software (0.16) whilst students in Cluster 4 appeared to use slightly less work-oriented software (-0.16) than the rest of the student clusters. Table 6 presents the results for groups and the factors across the clusters.

Cluster 1 closely resembles Cluster 1 from Survey 2, consisting of only international students who are quite web-interactive/ technically oriented but are low gaming-oriented. Cluster 2 resembles Cluster 2 from Survey 2, as all the distance-learning students have membership in this cluster. What is interesting about this cluster is their low use of social networking and interactive ICT. Cluster 3 resembles Cluster 3 from Survey 2, consisting of female UK students, 20 years of age and under, from place-based universities who are high social networkers.

Cluster 4 is primarily made up of students who are high users of social networking, interactive ICT and gamer-oriented ICT. This cluster shares the same demographic characteristics of students in Survey 2’s Cluster 4. Here as in Survey 2, the students were all UK male students who were 20 years of age and under from place-based institutions. As overall students’ ownership of games consoles dropped between Surveys 2 (43%) and Survey 3 (29%), it may mean that early in the first year in Survey 2 a broader range of students were playing games, whilst later in the year, represented in Survey 3, only a narrower range of students who had retained games consoles were displaying this gamer-orientation. Cluster 4 males are similar to Cluster 3 females in the social-interactive and work oriented factors, however the female students are not game-oriented and have low web-interactive/ technical ICT usage.

Table 4: Rotated factor loadings for the four factors in Survey 3 (End of first year)

	Factors			
	1	2	3	4
Listened to audio	0.08	0.04	0.49	0.26
Uploaded audio to the Web	0.50	0.18	0.02	0.13
Edited digital audio	0.60	0.09	-0.02	0.21
Watched video online	0.24	0.07	0.45	0.29
Edited video on a computer	0.55	0.07	-0.04	0.31

Uploaded video to the Web	0.55	0.17	0.05	0.20
Edited a digital photo	0.35	0.27	0.27	0.10
Sent MMS messages	0.13	0.22	0.16	0.15
Sent or responded to an e-mail	-0.04	0.40	0.32	0.03
Used an instant messenger	0.20	0.09	0.59	0.26
Participated in a text-based chat room	0.46	0.07	0.12	0.29
Visited virtual world	0.59	-0.01	0.01	0.13
Used conferencing via the Web	0.43	0.04	0.11	0.15
Looked at messages on social networking sites	0.04	0.07	0.89	0.00
Sent messages on social networking sites	0.06	0.10	0.90	0.00
Edited my profile on social networking sites	0.16	0.16	0.76	0.03
Used Wikipedia	0.16	0.16	0.22	0.28
Used a wiki (not Wikipedia)	0.38	0.06	0.12	0.24
Read blog	0.65	0.08	0.16	0.01
Maintained own blog or website	0.78	-0.02	0.12	-0.20
Contributed to another's blog	0.81	0.02	0.07	-0.17
Used social bookmarking	0.68	-0.01	0.01	-0.01
Used RSS feeds	0.45	0.10	0.01	0.23
Used file sharing	0.49	0.14	0.10	0.14
Made calls via mobile phone	0.01	0.33	0.38	0.08
Went online via mobile phone	0.27	0.29	0.15	0.36
Sent e-mail via mobile phone	0.39	0.28	-0.05	0.31
Played multiplayer video games online	0.21	-0.05	0.08	0.73
Played browser based games online	0.19	0.04	0.31	0.57
Played games with no network	0.06	0.04	0.17	0.74
Used a word processing programme	-0.04	0.53	0.07	0.09
Used a spreadsheet	0.18	0.51	-0.08	0.20
Used presentation software	0.21	0.61	0.19	0.01
Used a Web search engine	-0.12	0.20	0.38	0.13
Purchased or sold products online	0.13	0.32	0.10	0.33
Accessed materials relating to course online	0.02	0.66	0.25	0.03
Accessed general information relating to course online	0.03	0.73	0.11	0.00
Accessed/ used university resources online	0.13	0.64	0.05	-0.10
Communicated with other students online	0.36	0.46	0.00	0.05

Table 5: Centroid means and standard deviations for the factors based on their cluster membership for Survey 3

		Cluster			
		1	2	3	4
Factor 1: Web Interactive/ Technical Oriented (blogs)	Mean	0.94	-0.09	-0.37	-0.07
	SD	1.16	0.98	0.69	0.82
Factor 2: Work-Oriented (MS Office, library)	Mean	0.04	-0.07	0.16	-0.16
	SD	0.91	1.17	0.81	1.04

Factor 3: Social Interactive Oriented	Mean	-0.09	-0.64	0.44	0.23
	SD	0.87	1.21	0.63	0.80
Factor 4: Game-Oriented (online games, console games)	Mean	-0.23	-0.01	-0.36	0.76
	SD	0.93	0.95	0.83	0.95

Table 6: Membership of groups to the clusters for Survey 3

	Cluster			
	1	2	3	4
Web Interactive/ Technical Oriented	V. High	Average	Low	Average
Work-Oriented	Average	Average	Average	Average
Social Interactive Oriented	Average	V. Low	High	High
Gamer-Oriented	Low	Average	Low	V. High
Gender				
Males	43 (19%)	50 (22%)	0 (0%)	134 (59%)
Females	61(16%)	123 (31%)	207 (53%)	0 (0%)
Age				
≤ 20	74 (17%)	20 (5%)	207 (48%)	134 (31%)
21-25	29 (28%)	76 (72%)	0 (0%)	0 (0%)
26-35	1 (3%)	32 (97%)	0 (0%)	0 (0%)
≥36	0 (0%)	45 (100%)	0 (0%)	0 (0%)
University				
Place-based	104 (20%)	69 (13%)	207 (41%)	134 (26%)
Distance-Learning	0 (0%)	104 (100%)	0 (0%)	0 (0%)
Nationality				
UK	0 (0%)	165 (33%)	207 (28%)	134 (26%)
International	104 (93%)	8 (7%)	0 (0%)	0 (0%)
Total	104 (17%)	173 (28%)	207 (33%)	134 (22%)

Discussion

Our initial work has identified four groupings amongst first year students, the composition of which was relatively stable over the period of one academic year. Cluster 1 contained students who were highly web-interactive using Web 2.0 technologies and was composed of mainly international students at place-based universities. Students in Cluster 2 were very unlikely to use social networking technologies and were composed mainly of mature UK students who were at the distance-learning university. Both Clusters 3 and 4 were made up of young (≤ 20 years) home (UK) students at place-based universities. Students in Cluster 3 and 4 were more socially interactive than students in the other clusters. Cluster 3 was composed of young females and Cluster 4 was composed of young males. They were distinguished by differences in technical orientation and web interactivity. From Surveys 2 and 3, whilst the demographics of

Cluster 4 remained the same, this cluster shifted in character to be more highly gamer-oriented over the course of the academic year. Figure 1 and Figure 2 show the clusters and their characteristics for Surveys 2 and 3.

Figure 1: Characteristics of the Clusters for Survey 2

Figure 2: Characteristics of the Clusters for Survey 3

The factors we identified for Survey 2 were different in two areas from those identified in Survey 3. Two factors remained stable, work-oriented, which included the use of Word, Excel and accessing university resources and social network interactive that had high loadings for the use of social networking sites and instant messaging. The two factors that changed over the year were Factor 1 and Factor 4. Factor 1 began the year as web interactive and included wikis, blogs, RSS feeds and file sharing and ended the year, with a similar demographic profile and including the same items to that of Survey 2 but extended to areas of technical orientation that had previously been part of the fourth factor in Survey 2, such as editing audio and video. Factor 4 in Survey 2 ceased to be a separate factor in Survey 3. The demographic grouping that had high means for Factor 4 in Survey 2 remained the same, young male place-based students, but they now had high means for the new factor, games oriented.

The results we report add to the discussion about the way the student population entering universities is segmented and patterned. By including students of all ages who entered the first year at university we could identify patterns related to age and the way in which an intra-generational pattern emerged amongst students who were 20 years of age and younger. Secondly by including a distance-learning based university, we could identify the way students differed from place-based students in their first year of studies. Finally by examining students at two points in their first year of study we could identify elements of both stability and change in the student clusters.

Whilst the four groups of students we identified have some superficial similarities to those identified by Van den Beemt *et al* (2009) it should be remembered that the population had a significantly different age profile. Van den Beemt *et al*, described traditionalist as being mainly from primary school with basic ICT functionality and with no Web 2.0 interaction. These traditionalist students appear to have a similar profile to the way in which most of the distance-learning students were using ICT in our study, that is, ICT was used for basic functionality with little use of Web 2.0 at the start of their university lives. For the distance students this changed slightly over the first year of study and their interaction with ICT became more like the students in other clusters but their frequency on the social interactive element remained low.

The gamers' group that emerged in our data in young male students also had a similar profile to the cluster Van den Beemt *et al* identified as composed of mainly primary school students. However the gaming ICT element did not become apparent amongst young male students until Survey 3 and this change could be related to local contextual factors such as increased access to local area networks and the developing social dynamics amongst young male students.

Students who had high means for web-interactive in Survey 2 were mainly international students (Cluster 1) and this social group continued to cluster in Survey 3 but at this stage these students also showed technical oriented characteristics shown in Survey 2 by young male place-based students in Cluster 4. The international students in our sample were found to be mainly from a single course (Accounting and Finance) at one university and this may have influenced our results. However, Kennedy *et al* (forthcoming) also found that a high proportion of international students when compared to local students had a high usage of Web 2.0 media (irregular users). It is possible that this is how the international students keep abreast with news and events occurring back home.

Interestingly, the clusters suggest that older students (≥ 21 years) are less likely to be social interactive (both from Surveys 2 and 3). These initial results confirm that there are age related differences but that there is no single generational difference between the Net Generation and non-Net Generation students (Jones *et al*, 2010). It would seem that there are intra-generational differences such that, even within the Net Generation student age group, there are differences between those students who are less than 20 years old and those aged between 21-25. If there was indeed an age related change it was more marked amongst students 20 years old or younger. It may be that these students born in 1989 or after were particularly well placed to catch the wave of social networking sites and had good reasons to use them. In 2005, MySpace was the largest social networking sites which would have placed these students at 16 years or under. They would have been at the right age to be caught up on the popularity of social-networking sites in the close social context of schools.

Caution has to be taken with these initial results because two-step cluster analysis tends to force membership amongst students, such as grouping all females or all males together. Further analysis of our data will examine how other clustering techniques may affect group membership and the categories derived in this analysis.

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