The digital divide: real or imaginary?

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Abstract

There has been much written about the existence of a gap between generations when it comes to technology use and knowhow. This gap has been called the "digital divide." Since the early 1990s the prevalence of home computer use and ownership has increased to become the norm. Along with this, children are being exposed to computers at all levels of the education system from pre-school to tertiary study. This exposure has, in part, lead to the premise that this current generation are "good" at using computers. This paper examines the concept of the digital divide from the perspective of a class of students enrolling in an introductory computing class in a New Zealand University in 2009. The mean age of this class was 20 with the most represented age group being those who are younger than twenty. This study found little evidence of the traditional digital divide.

Keywords

Digital divide, first-year students, computing knowledge, computer literate, skills perception, end-user computing

Introduction

It is generally accepted that not only will the generation leaving high school and entering tertiary study be computer literate but it is also accepted that they will be more technology adept than class members from older generations. Tertiary classes have changed over the years to include not only those coming directly from high school but now commonly include people who are older, having already spent time in the paid workforce (McClelland, 2006). While members of the generation born since 1980 who have been given such labels as the "net generation", (Prensky, 2001), may be more proficient at using online resources for communication, this does not necessarily equate to them having have good skills in basic calculations or the management and manipulation of data (Kennedy, Judd, Churchward, Gray & Krause, 2008; Kline & Strickland, 2004; Bartholomew, 2004; Hoffman & Vance, 2005, Gibbs, 2008).

Lincoln University is a small rural New Zealand university just outside Christchurch. The introductory computing subject, Comp101, has been taught in some form or another for about twenty years. It is available to all students in the University. Up until the end of 2008 Comp101 was a compulsory course for all Commerce students. The compulsion was removed as there was a consensus within the Commerce faculty that new students had sufficient knowledge without needing to study computing formally (Eves & Dalziel, personal communication, 23 July 2007). Phelps, Hase and Ellis (2005) say that although computers have become commonplace there are still many school leavers as well as mature-aged people who are insecure in their computer use. They say there is a need for specific end-user computing to be taught within tertiary institutions as this is an area which has been neglected. This view, in a USA context, was recently reinforced by a personal communication from Meg Murray (2010) stating

> *"There exists a gap between the perception of the skill set under-graduates require in their educational experience and their actual functional ability … Major initiatives in the area are under way in the US … It has been mandated that technological literacy become a part of the national assessment of pre-college level students beginning in 2012. "*

A similar view, in an Australian context, has been expressed by Miliszewska, Venables and Tan (2009).

While it is acknowledged that the younger generation appears to be more confident when using and trying new technology it was decided to compare the skills and usage of the different age groups which make up the Comp101 cohort. Did the younger students really have a higher perception of confidence in their ability than their older classmates, and if so, did this translate into actual knowledge? In other words was there a digital divide, based on age, in this cohort of students?

Method

At the beginning of the first semester in 2009 the students in Comp101 were asked to complete a small questionnaire. As well as collecting demographic data, the questionnaire also asked the respondents to complete a small number of competency based questions.

The demographic data collected included the respondent's age, gender, their access to computers and asked if they had studied computing formally at high school. Respondents were also asked to outline the time spent using a computer for different online and offline computing type activities. They were also asked to give a self-rating of both their computing knowledge and their computing confidence.

To gain some insight into a respondent's computing ability three problem-solving type questions were incorporated (see Appendix 1). For each respondent the number of correct answers for these questions was calculated. Similar questionnaires have been undertaken at the start of Comp101 classes over a number of years. The specific end-user computing questions asked have been included for at least ten years and are still considered to be a relevant measure. Computer knowledge, ability and literacy have been defined in a number of ways (Yoon &Lee, 2007; Gibbs, 2009). In this study the authors use the term knowledge to mean having the knowledge and ability to complete specified spreadsheet and database tasks.

Results

In semester one 2009 there were 128 questionnaires returned which represents a response rate of 70% from a class of 183 students. The number of students in the class was the lowest it had been for many years. This downturn was due not only to the drop in the number of commerce students at Lincoln (McLennan & Gibbs, 2008), but also reflects the fact that in 2009 Comp101 was no longer compulsory for commerce students. However, having fewer students means that not as much confidence can be placed in the conclusions as when the class was larger.

The mean age for this class was 20 with a range of 17 – 51. For the purposes of this study the class has been divided into three age groups: 20 years or younger; between 21 and 24; and 25 years or older. The rationale for this grouping of ages was that those in the younger group could be typically described as "recent school leavers" often with no experience in the workplace aside from the odd after school job. The next group is those who have been out of formal education for a short period, it is likely they have been in paid employment. This group is, along with their younger colleagues, likely to be labelled as digital natives by virtue of having been born since 1980. The last group, those 25 or older, are those who have been described traditionally in New Zealand as "mature-aged" students (McLennan, 2003). These people have been in paid work and are returning to study or studying for the first time in order to make a career change or to update their skill-set. This breakdown is shown in Table 1.

Fifty four percent of the respondents had studied computing formally at high school. The group, with the highest number having studied computing formally, was the youngest group but curiously the mid-aged group had the highest percentage (Figure 1).

Table 1: Breakdown of age groups within the class

Age Group	Number	% of class
20 or younger	89	71%
21 to 24	23	18%
25 or older	13	10% *
*Note: one respondent did not give his or her age.		

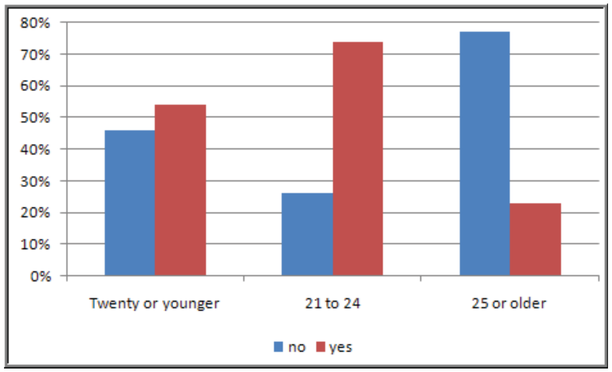

Figure 1: Percentage of each age-group who had studied computing at high school

Some of the expectation that those entering tertiary study will have good computing skills comes from the notion that they all study computing at school. This is not necessarily true. What is true is that, certainly in New Zealand, all schools, both primary and secondary, provide some level of computing technology for their pupils to use. Unfortunately sometimes this use has not come with appropriate tuition.

Self rating of computing knowledge

One of the most common ways of gaining insight into a person's perception of their ability is to ask them to rate themselves using a Likert type scale. Although commonly used there are flaws associated with 'ask and rate' type assessments. One of the most common flaws is the propensity for people to overestimate their ability. Often over-estimation is associated with those who have lower skills. Windschilt, Rose, Stalkfleet and Smith (2008), report that it is likely for people to overestimate their ability with tasks they perceived to be easy, likewise make more conservative estimations when a task is considered to be difficult. Gibbs (2008) made similar observations when interviewing students regarding their computer use.

The questionnaire asked each respondent to rate their knowledge of computing on a five point Likert type scale. The knowledge scale ranged from one for absolute beginner to five for expert. Results (Table 2) show that the majority of respondents rated themselves as having some or average knowledge with an overall mean of 2.7 (sd = 0.9).

Table 2: Breakdown of Knowledge Categories for whole class

Knowledge Category	Number	Percentage
Absolute Beginner	13	10%
Some Knowledge	37	29%
Average Knowledge	55	43%
Pretty Knowledgeable	22	17%
Expert	1	<1%

When these results are scrutinized by age group it is interesting to note that the younger group have a higher perception of their own knowledge than the older groups. This can be seen in Table 3 and Figure 2 where younger students appear to have higher scores. Regression analysis between age and knowledge perception returned a non-significant correlation.

Table 3: Mean results of perceived knowledge by age group

Age Group	Mean response
twenty or younger	2.8 (0.9)
21-24	2.7 (0.8)
25 or older	2.5 (1.0)

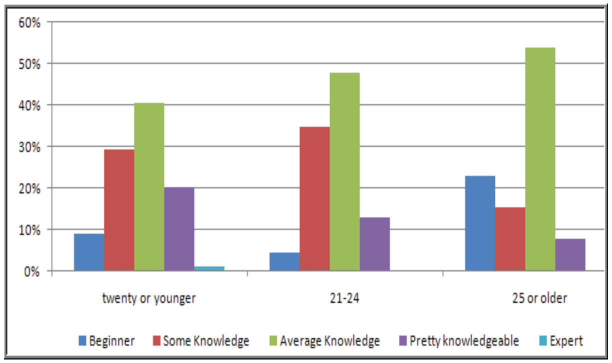

Figure 2: Knowledge broken-down within age group

Self reported confidence

Often, when talking about an individual's computing skills, confidence and knowledge are confused. Anecdotally the authors have had the experience, when asking someone to rate their computing ability, of the answer including the words "I am quite confident using computers". With this in mind it is considered important to discuss the results of the student's self-rating of their confidence level.

The mean scores, computed using a Likert type score similar to the previous section returned a mean value of 3.07 (SD = 0.9). The actual numbers in each of the categories are shown in Table 4 with the mean results in Table 5.

Table 4: Breakdown of Confidence categories for whole class

Confidence Category	Number	Percentage
Not confident	7	5%
A little confidence	23	18%
Average confidence	61	48%
Confident	28	22%
Very confident	9	7%

Table 5: Mean results of perceived confidence by age group

Age Group	Mean response
Twenty or younger	3.2 (1.0)
21-24	3.0 (0.8)
25 or older	2.7 (0.8)

The results reported in table 5, while not significantly different, might suggest that the younger students believe themselves as being more confident in their computing ability than the older students do.

It is interesting to consider this result by age group by examining the graph in Figure 3. What this shows us that for each group the most common category is, not surprisingly, Average Confidence. However, it is again not surprising, to see that the younger age group is the one where there is a larger proportion who rate themselves as being more confident, than in the other age groups.

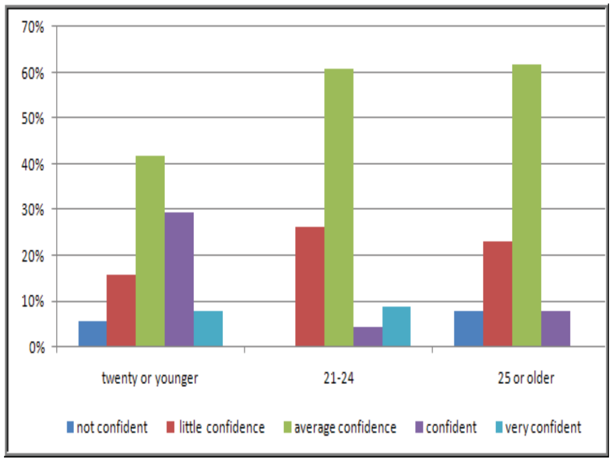

Figure 3: Confidence by age group

Ubiquitous computing

In part, the higher levels of confidence with the young group can be explained by the greater access they have had to computer technology. They were born when ownership of computers increased to high levels. They have also had the benefit of having access to computers at all levels of their education. The NZ 2006 Household census reports that at that time 71.6% of New Zealand households owned at least one computer and 64.5% of households had access to the Internet (http://www.stats.govt.nz/~/media/Statistics/Browse%20for%20stats/HouseholdUseofICT/HOTP06/householduseofict2006hotp.ashx). In contrast access to computers is much higher for the 2009 Comp101 students with 97% having a computer at home and 92% having an Internet connection. This statistic suggests it would to safe to assume that the most students are used to using computers. Much of the younger generation's computer use has been reported as being online activities such as social networking, online gaming and buying and selling via online auctions (Kennedy, et al., 2008). With this in mind, and having collected information about the types of activities the students used computers for, it was decided to take the three activities mentioned and compare the frequency of use between our three age-groups. This is displayed in Figure 4.

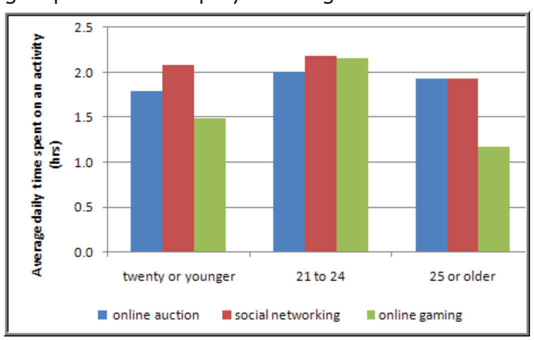

Figure 4: Mean time spent on online activities by age-group

An interesting result is that the mid-aged group, the older digital natives, appeared to have the highest use of online activities overall. This is a little surprising, given that all most young people are rumoured, by popular media, to spend a lot of time social networking, etc. However, Kennedy, et al. (2008) had a similar finding where they report that in a class of first-year students only 24% used social networking regularly and 64% had never communicated this way. These data, collected more recently than Kennedy's, showed 25% of the students did a lot of social networking and only 20% did little or none. What was especially surprising was how little difference there was between all three groups in their online use in all three categories.

Knowledge based questions

Three knowledge based problem solving questions were included in the questionnaire given to the students. These questions, 12 to 14 in the questionnaire (see Appendix 1), were designed to test students' basic knowledge of spreadsheet techniques and database query logic. Possibly competence in solving these problems indicates a sufficient level of knowledge of end user computing for tertiary study and later employment. Summarised results by age group are given in Table 6 with the full results shown graphically in Figure 5.

Table 6: Mean number of correct answers, out of 3, by age group

Age group	
twenty and younger	0.5
21-24	0.3
25 or older	0.4
Overall Average	0.4

The results show us that no one group stood out above the rest as having more knowledge. In fact all groups performed equally as poorly as the others with only one class member getting all three questions correct and the majority getting one or none correct.

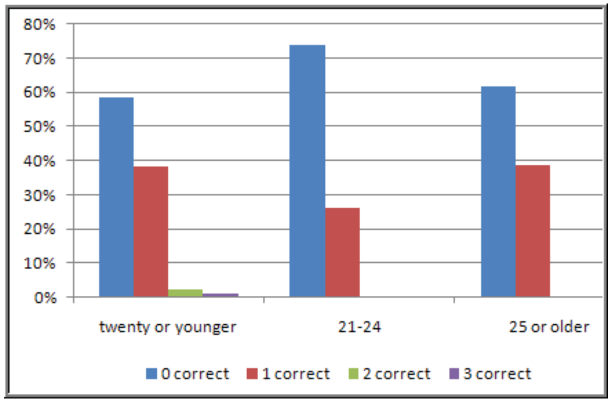

Figure 5: Results of knowledge based questions by age-group

What is interesting is that the mid-aged group (21-25) appears to have performed the worst. This is the group that had the most members who completed high school computing (74% compared with 54% for the younger group and 23% for the older group) and also the group that had the highest daily online usage. They might have been expected to have been the most computer literate of the three groups. This is not apparent from our results.

Findings

Given that the survey took place with one medium sized class at one small university it would be wrong to generalise too much. However it would seem fair to say that within this cohort, there is discrepancy between the computing knowledge students need and the knowledge they actually have on arrival for tertiary study. This applies to all students in this study regardless of age. There was little evidence of what is traditionally called the "digital divide". The results suggest that those who say that the young people do not need to take an introductory computing course when embarking on a tertiary degree are mistaken. As noted by Kennedy, et al., there is a diverse range of technology available and therefore a diverse range of skills. So while the younger students may be more confident they have computing knowledge than their older colleagues, this confidence does not appear to translate into actual knowledge.

Conclusion

Colleagues in the USA and Australia have already realised the need for introductory computing courses for incoming tertiary students is no less important now than it was a decade ago. Unfortunately, it is harder to encourage students into computer literacy courses than previously and harder to convince colleagues from other faculties of their value. It is our responsibility, as IT educators, to continue to pressure for the retention of these tertiary courses. If we don't, students may struggle to efficiently complete their coursework and may enter the workforce under-prepared.

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Appendix 1: End user computing questions included in the survey

1. The formula =IF(J2+5<10,10-J2,J2/2) is in cell I2 of a spreadsheet. If the value in J2 is 7, the value in I2 will be: (Choices were a: 3.5, b: 3, c: 12, d: 1.5, e: 6.5 or f: don't know.)

2. The cell reference =$D4 is entered into a spreadsheet in cell A1 and copied to cell B2. How would it appear in cell B2? (Choices were a: =$D4, b: =$D5, c: =$E5,d: =$E4, e: error or f: don't know.)

3. A database keeps information about students which includes information about their age and whether they are living "at home" (residence = "at home"). Which of the following expressions would select all students who are under 18 as well as all students living "at home"? (Choices were a: Age <19 AND residence = "at home", b: Age <18 OR residence = "at home", c: Age <18 AND NOT (residence = "at home") or d: don't know.)