Graduating Teachers' Dispositions for Integrating Information and Communications Technologies into Their Teaching

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Abstract: Previous research has identified graduating teachers' dispositions towards teaching with Information and Communications Technologies (ICTs) as a significant issue for teacher preparation programs. Both increased community access to ICTs and changes to the teacher preparation program may have affected those dispositions in recent years. Although it is not clear which factors have contributed most to the change in dispositions, it is clear that teachers graduating from the class of 2002 are better prepared for, and more positively disposed towards, integrating ICTs into their teaching.

Background

Despite substantial expenditures on equipment and professional development, it appears that the impact of information and communications technologies (ICTs) on teachers' work in school classrooms is limited. In Queensland, a review of funded initiatives in government schools characterized the overall outcomes as "patchy", with exemplary practices occurring in some classrooms but with little impact on student learning outcomes in the majority of classrooms (Galligan, Buchanan, & Muller, 1999). An Australian national study (Meredyth, Russell, Blackwood, Thomas, & Wise, 1999) reported that, although most teachers and students have access to ICTs and basic skills in their use, there is limited integration into typical classes.

In the USA, a national study involving 4000 teachers in 1100 schools (Becker, 2000) concluded that computers have not transformed the teaching practices of a majority of teachers. Even in Silicon Valley, where access and community expectation might be expected to support extensive use of ICTs in schools, there was only very limited integration of ICTs in typical classrooms (Cuban, 2001).

Various explanations have been offered for the restricted impact of ICTs on schooling. One factor identified in Queensland was the limited opportunities available to teachers for relevant professional development. Although schools were permitted to spend up to 20% of technology grants on teacher development, only 2% of total grants over a 5 year period was used for that purpose (Galligan et al., 1999). Cuban (2001) notes that teachers' responses to ICTs are similar to those for earlier technological innovations such as film and television and that their selective uptake of ICTs is similar in many respects to the responses of other professionals such as engineers and physicians. He argues that, although provision of equipment, training and support may make some difference, teachers are making contextually constrained choices consistent with their circumstances and beliefs. Becker (2000) suggests that ICTs are making an impact where teachers have the necessary computing skills, some freedom in the curriculum, convenient access to equipment, and personal philosophical beliefs supporting constructivist pedagogy. Thus, it seems that, given essential skills and access to equipment, teachers' decisions about integrating ICTs are likely to be influenced by their personal visions and beliefs (Albion & Ertmer, 2002).

An Australian government inquiry into the status of the teaching profession (Senate Employment Education and Training References Committee, 1998) considered the impact of technology on teachers and noted that the potential of ICTs for teaching and learning appeared to be largely unrealized. It suggested that the most significant reason might be related to the average age of teachers, then 46 in Australia, which makes them unlikely to have had extensive experience of computers during their teacher preparation. The report noted also that many teachers were making significant efforts to adapt but that they were hampered by limited opportunities for relevant professional

development and other demands of their employment. Some evidence was found to suggest that younger teachers are less stressed by the challenges of working with ICTs.

If we accept that teachers' visions and beliefs will exert a powerful influence on their use of ICTs (Albion & Ertmer, 2002), it is reasonable to expect that teachers' ages might play a significant role in developing those visions and beliefs through life experience. The divergence between teachers and students in response to the Internet has been compared to the different experiences people may have of countries (Williams & McKeown, 1996). A common first experience is that of a tourist who seldom achieves more than a superficial appreciation of the country visited. Immigrants may be uncomfortable at first but eventually begin to feel at home. Natives are born in a country and are typically well adapted. School students, not having memories of life without computers and the Internet, are ICT natives but teachers are mostly foreigners, tourists or immigrants, in the new ICT landscape. Could it be that the failure of ICTs to have their anticipated impact on schooling is a generational phenomenon? Will the barriers go down and ICTs be more often integrated into teaching as a new generation of teachers, natives in the new technological landscape, takes its place in the classroom?

It is difficult to draw a neat line on a calendar dividing the new generation of ICT natives from those who went before. Children born in 1975 or before will have lived some part of their lives prior to the arrival of the first personal computers and will have had limited exposure to computers prior to entering high school where their experience may have been equally limited. They will have graduated high school before the Internet and World Wide Web became accessible to most schools and may have completed teacher preparation prior to 1997. Some of them may be ICT natives but most will be among the last of the immigrant generations. Children born since about 1980 may possibly have been exposed to personal computers from their earliest years and will almost certainly have had some experience with computers in their high school education. They will have been in high school when access to the Internet and World Wide Web became commonplace. They are almost certainly members of the ICT native generation and they are just now beginning to graduate from teacher preparation programs. It may be time to investigate whether they are noticeably different in their dispositions towards integrating ICTs into teaching.

Previous research

Expectation, or hope, that newly graduating teachers might be better prepared to integrate ICTs into teaching is not new. For the most part it has been based on the provision of specific ICT courses or other components in teacher preparation programs. Unfortunately the results of research conducted with teacher education students or newly graduated teachers have often been disappointing.

In studies conducted in the UK during 1987 and 1988 (Summers, 1990), a substantial minority of students (34% to 43%) admitted to negative feelings about computers. The majority had little or no experience of computer use but generally agreed that knowledge of computers was important for teachers. A comparative study conducted in Australia during 1989 yielded generally similar results (Wilson, 1990) although only 24% of students in that study reported negative feelings about computers. Data collected from 170 final year teacher education students at the University of Southern Queensland (USQ) in 1991 revealed that 68% of students had positive feelings about computers, 63% thought it was very important for teachers to know about computers but only 37% considered their own computer knowledge to be "good" or "very good" (Albion, 1996).

Dunn and Ridgway (1991) examined the use of computers during initial and final teaching practice sessions for the same cohort of 103 student teachers in the UK. The proportion of students using computers for teaching increased from 45% in the initial practice to 71% on the final practice, with almost 80% of the latter qualifying as more than token usage. However, the researchers considered this unacceptably low because 12% of the responding students would graduate with no experience of using computers with children and the experience of those who had used computers was generally limited to a narrow range of applications. In one Australian study, Downes (1993) investigated use of computers in practice teaching at three different stages of a program. Although there were significant increases in the frequency of use later in the program, there were still fewer than 50% of student teachers using computers in their final practice teaching session. The most significant factor influencing student teachers' use of computers with children was found to be the supervising teachers' use of computers with children. This finding was confirmed by the 1991 USQ study which also found fewer than 50% of student teachers making significant use of computers on their final field experience (Albion, 1996).

Based on a review of the research, a convincing case can be made that teachers' use of computers in their teaching is influenced by their relevant self-efficacy beliefs (Albion, 1999). A study using regression analysis (Albion, 2001b) found that the most significant predictor of student teachers' self-efficacy for teaching with computers was a measure of their comfort for using computers. Another study of the effect of computing courses on the development of confidence for working with computers found that the most important influence was the amount of time spent using computers (Albion, 2001a). Student teachers from the first generation of ICT natives might be expected to have had more extensive experience of computers resulting in greater levels of comfort and self-efficacy for their use. If the current population of pre-service teachers are ICT natives, then we might expect there to be measurable differences in their dispositions towards working with ICTs when compared with previous cohorts.

Just one published study of trends in pre-service teachers' ICT capacities was located. In a study of trends in computer literacy skills among students entering a US teacher education course between 1991 and 1997 (Sheffield, 1998), students were asked to rate themselves for several computer related skills. The scale ranged from 1 (no experience), to 3 (basic familiarity), to 5 (expert). A generally upward trend was observed from year to year especially for the use of the word processor and the mouse. However, the only category on which the mean rating in the final year exceeded 3 was for use of the mouse. The mean for word processing rose from 2.13 in 1991-92 to 2.89 in 1996-97 but mean ratings for databases and spreadsheets both remained below 2 for the duration of the study. Although these trends were in the direction that might be expected for an emerging generation of ICT natives, the overall changes were not large. It may be that the study slightly anticipated the emergence of the ICT natives in teacher preparation programs.

Against this background, it seemed opportune to examine the dispositions of USQ teacher graduates towards integrating ICTs. In addition to any generational change that may have occurred, since the earlier study (Albion, 1996) the Faculty has made changes to its teacher preparation program with the intent of increasing graduating teachers' skills and confidence for integration of ICTs (Albion, 2000b). A required course with a direct focus on integrating ICTs into teaching and learning has been added to the program. In addition, computers have been located in teaching spaces used by key courses in order to support the modelling of ICT integration by faculty members working in the teacher preparation program.

The study described in this paper sought to answer the following research question: How do the dispositions for teaching with ICTs among final year Bachelor of Education students differ from those found in previous studies?

Method

A composite instrument based on those used in previous studies (Albion, 1996, 2000a, 2001a) was prepared for use in this study. Some items from the earliest study (Albion, 1996) were removed or modified to reflect what were thought to be significant changes in the environment over the past decade or to facilitate comparison with data from the later studies. Hence, participants were not asked how frequently they had used computers in secondary school and instead of describing home computer use as "often" or "very often", they were asked to select a range of hours of use in a typical week. In the question about types of software used in class, Logo was removed because it is no longer widely available in Queensland classrooms and the web browser was added to reflect the ready availability of the Internet in most schools. The ACT and SCT scales (Kinzie, Delcourt, & Powers, 1994) were used in the slightly modified form described previously (Albion, 2000a, 2001a).

Participants in the study were students in the final year of their Bachelor of Education program and had completed a practice teaching experience over six weeks during the previous semester. Questionnaires were distributed and completed during in tutorial classes in a core course during the latter part of second semester.

Results

For simplicity, comparative data from previous studies will be identified by the years in which data were collected. These were 1991 (Albion, 1996), 1997 (Albion, 2001a), and 2000 (Albion, 2000a). Participants in 1991 and 2002 were in the final semester of their 4 year program, those in 1997 were in the first semester of the program and those

in 2000 were the same cohort as in 1997 but in the first semester of their final year. Because of the variations among the studies, only some data items were collected in each of the years but there is sufficient commonality to permit useful comparisons. For simplicity of presentation and comparison, most data in the tables that follow are reported as percentages of valid responses. Because data analysis is still at a preliminary stage descriptive data are reported and interpreted without testing for statistical significance.

The number of completed questionnaires in 2002 was 60, representing 50% of the total enrolments in the course, which was required for final year students. Of these, 44 (73%) were female, which is a similar proportion to previous studies. Comparative values were 86% (1991), 86% (1997), and 82% (2000). Table 1 shows the distribution of participants in the present study by gender and age.

Age	Males Frequency	%	Females Frequency	%	Total Frequency	%
Less than 22 y	6	38	17	39	23	38
22 – 25 y	6	38	16	36	22	37
26 – 29 y	2	13	2	5	4	7
More than 29 y	2	13	9	21	11	18
Total	16	100	44	100	60	100

Table 1: Participants by gender and age

Participants were asked whether they had access to a computer in their usual off-campus study location. Depending upon their circumstances, this may have been a student residence associated with the university, shared accommodation in the city or a family home. The proportion of participants with access in 2002 was 93%, which is much greater than the 36% recorded in 1991. The comparable figure for 1997 was 78% for students at the end the first semester of their degree. That figure grew to 92% by the time those students reached their final year in 2000.

In the 1991 sample, 24% of participants indicated that they used a home computer "often" or "very often". In subsequent studies participants were asked to estimate the number of hours they worked with a computer in a typical week. Table 2 summarizes the relevant responses.

	Less than 1	1 – 5	6 – 10	More than 10
1997	21	42	22	15
2000	12	46	26	16
2002	2	43	35	20

Table 2: Hours per week using a computer

Participants in 1991 were asked to rate their current knowledge of computers on a 5-point scale from "none" to "very good". Participants in 2002 responded to the same question for comparison and also completed the Self-efficacy for Computer Technologies (SCT) questionnaire as used in the 1997 and 2000 studies. The SCT uses a 4-point Likert scale and the results are reported as mean values for each of the sub-scales and for the composite (SCT). Tables 3 and 4 summarize these data. Some values are combined in Table 3 because original data from the 1991 study are no longer available.

	Very little	Little	Quite good	Very good
1991	8	55	37	
2002	2	33	62	3

Table 3: Current knowledge of computers

	E-mail	Internet	Word processing	System	Spreadsheet	Database	CD-ROM	SCT
1997	2.5	2.2	3.3	3.0	3.0	2.9	2.5	2.8
2000	3.3	3.0	3.7	3.3	3.2	3.0	2.7	3.2
2002	3.8	3.6	3.8	3.5	3.4	3.0	3.0	3.5

Table 4: Self-efficacy for Computer Technologies (SCT)

The 1991 and 2002 questionnaires asked participants to rate their feelings about computers on a 5-point scale from "very negative" to "very positive", their degree of nervousness about using computers in the classroom on a 4-point scale from "very nervous" to "not nervous" and the importance of teachers knowing about computers as "not important", "important" or "very important". In each of the 1997, 2000 and 2002 studies students completed the Attitudes towards Computer Technologies (ACT) questionnaire. The ACT uses a 4-point Likert scale and the results are reported as mean values for each of the two sub-scales. Tables 5 to 8 summarize the relevant data. Some values are combined in Table 5 because original data from the 1991 study are no longer available.

	A bit negative	Neutral	Fairly positive	Very positive
1991	16	16	68	
2002	10	7	65	18

Table 5: General feeling about computers

	Not nervous	A little nervous	Nervous or Very nervous
1991	38	47	15
2002	60	37	3

Table 6: Nervousness about using computers in the classroom

	Not important	Important	Very important
1991	0	37	63
2002	0	17	83

Table 7: Importance of teachers knowing about computers

	Comfort/Anxiety	Usefulness
1997	2.7	3.2
2000	3.0	3.4
2002	3.1	3.5

Table 8: Attitudes towards Computer Technologies (ACT)

Both the 1991 and 2002 questionnaires were administered following the 5 to 6 week practicum that is the major field experience in the teacher preparation program. In 1991 the data were collected in the first week after students returned to campus but in 2002 data collection was in the following semester, about 4 months after students returned to campus and a few weeks after a shorter 2 week field experience. In each case participants were asked to respond to a series of items related to computer use during the practicum.

Table 9 summarizes responses to a question asking how often the student teachers used the classroom computer in lessons they taught during field experience.

	1991 (N = 104)		2002 (N= 57)	
	Frequency	%	Frequency	%
Not at all	38	37	3	5
Once or twice	19	18	11	19
Less than once per week	4	4	5	9
Once or twice per week	16	15	16	28
Almost every day	19	18	16	28
Every day	8	8	6	10

Table 9: Student teachers' frequency of classroom computer use

Participants were invited to select from a supplied list of reasons that might have applied to one or more occasions on which they decided not to use a computer in their classes. Responses are summarized in Table 10. Because participants were free to select more than one reason, the numbers do not total 100%.

	1991 (N = 38)		2002 (N = 52)	
	Frequency	%	Frequency	%
Lack of expertise in using a computer in class	11	29	9	17
Lack of software suitable for work being done	9	24	19	37
Computer use was inappropriate for this class	8	21	17	33
Lack of confidence in using a computer in class	6	16	5	10
Lack of familiar software	5	13	14	27
No computer was available	4	11	14	27
The available computer was an unfamiliar type	3	8	3	6
Other reasons	5	13	15	29

Table 10: Student teachers' reasons for NOT using a classroom computer

Table 11 summarizes the problems that participants encountered when using a computer in class. Multiple selections were possible and the percentages do not total 100%.

	1991 (N = 66)		2002 (N = 55)	
	Frequency	%	Frequency	%
Organizing the class	27	41	26	47
Lack of personal computer skills	24	36	17	31
Computer not always available	14	20	29	53
No problems	13	20	2	4
Technical problems	8	12	24	44

Table 11: Problems experienced with classroom computer use

Table 12 summarizes participants' selections from a list of software types they might have used in one or more classes. Again they were able to select multiple options and the percentages do not total 100%. Gaps appear in the columns where the list of software types varied between 1991 and 2002 administrations of the questionnaires.

	1991 (N = 66)		2002 (N = 53)	
	Frequency	%	Frequency	%
Word processor	44	67	49	92
Adventure game	42	64	20	38
Drill and practice	30	46	14	26
Simulation	22	33	6	11
Database	8	12	9	17
Logo	7	11	-	-
Graphics package	-	-	8	15
Spreadsheet	2	3	11	21
Web browser	-	-	29	55
Other	5	8	11	21

Table 12: Types of software used in class

Discussion

The participants in the present study comprised only 50% of the students in the graduating class. However, there appears to be no reason, either in the distribution of students by age and gender as shown in Table 1 or from observations of which students were in class at the time, to assume that they are substantially different from the absent members of the cohort in respect of any of the characteristics examined in this study. Thus it is reasonable to accept that the results obtained here are broadly representative of the entire graduating class of 2002. A substantial majority of participants (75%) reported their ages as less than 25 years, indicating that they had entered the teacher preparation directly from high school or at most a short time after. Thus most of these participants are within the age range that might be expected to make them ICT natives.

In 1991, a little more than one-third (36%) of graduating students reported having access to a home computer. Almost all recent graduates, 92% in 2000 and 93% in 2002, reported having access to a personal computer for use in their studies. In 2000 it was estimated that 53% of Australian households had a home computer (Australian Bureau of Statistics, 2002). The likelihood of a household having a computer varied according to factors such as age and socioeconomic status but families with school age children were among the groups most likely to have a computer. It seems clear that participants in this study have significantly higher access to computers than either their predecessors or the wider population and would likely be both more comfortable and more skilled in the use of computers. This may be one of the first indications that they represent an emerging generation of ICT natives.

Changes in the reported levels of computer use as shown in Table 2 support the interpretation that 2002 graduates may be qualitatively different from their predecessors in that respect. Comparable data were not obtained in 1991 but, if using a home computer "often" is taken to imply more than 5 hours per week, it seems that 55% of current graduates would meet the description that was applied to just 24% in 1991. Moreover, only 2% of 2002 graduates reported very low levels of use compared to 21% in 1997 and 12% in 2000 and a substantially higher proportion reported high levels of use.

As might be expected for a group reporting increased access to, and use of, computers, the 2002 group were much more likely (65% compared to 37%) than the 1991 group to rate their knowledge of computers as at least "quite good" as shown in Table 3. This is supported by the results of the SCT as shown in Table 4 where the 2002 group demonstrate increased levels of self-efficacy in every sub-scale although confidence with databases has barely increased. These data are consistent with the previous study which found that the most significant influence on higher SCT scores was time spent using a computer (Albion, 2001a).

In addition to reporting greater knowledge and skills relative to ICTs, the 2002 group also reported more positive attitudes than their predecessors. As shown in Tables 5 and 6, 83% of participants reported "positive" feelings about computers compared to 68% in 1991, and 60%, compared to 38% in 1991, reported that they were not nervous about using computers in the classroom. This trend towards increased comfort with, and decreased anxiety about, computers is echoed by the ACT data in Table 8, which shows a consistent increase in the comfort/anxiety subscale from 1997 to 2002. As shown in Table 7, neither study recorded any participant who thought that it was not important for teachers to know about computers and the 2002 data found 83%, compared to 63%, who thought it "very important". These data are echoed by results on the usefulness subscale of the ACT as shown in Table 8.

Probably the simplest interpretation of these data is that increased experience with ICTs, as suggested by levels of access and use, has contributed to the development of skills with, and positive attitudes towards, ICTs. As demonstrated in Table 9, the end result appears to be that almost all of the 2002 graduates (95%) used a computer at least once and 66% used the computer at least weekly with their classes during their major field experience. This compares with 63% and 41% for the 1991 group. Participants in the 2002 study indicated (Table 10) proportionately more reasons for not using a computer on particular occasions. It is unclear why this occurred but, since they could select multiple reasons, it may be an indication that their experience with ICTs has better equipped them to make decisions based on a variety of factors compared to the 1991 group who may have been inclined to use the same reasoning more frequently. This explanation would seem to be consistent with decreased selection in 2002 of reasons related to lack of expertise or confidence and increased selection of reasons related to suitability or familiarity of software and appropriateness of computer use. As indicated in Table 11 and as might be expected for beginning teachers, pre-service teachers in 2002 continued to encounter difficulties in classroom organization. Surprisingly, they were less likely than 1991 participants to report no problems and more likely to report technical problems. This may be a reflection of their being prepared, on the basis of increased confidence, to attempt more or more difficult activities in which problems were more likely to be experienced.

Where direct comparisons of software types used in class (Table 12) are possible, potentially interesting patterns emerge. The 2002 data show increases in the use of tool software, notably the word processor and spreadsheet, and a decrease in use of drill and practice, simulations and adventure games. Although it is difficult to interpret these data as they stand, one possibility is that they indicate a move towards more constructivist class activities. Future studies of pre-service teachers' use of ICTs during field experience might usefully investigate this dimension.

Based on the data presented here it seems reasonable to conclude that, compared to their predecessors, current graduating teachers at USQ are better prepared for, and more positively disposed towards, integrating ICTs into their teaching. How those characteristics will play out in the schools remains to be seen but there is some indication, from their use of ICTs in field experience, that they may contribute towards greater realization of the potential of ICTs for teaching and learning. Whether the observed differences are a consequence of changes made to the teacher preparation program or are related to the arrival of a new generation of ICT natives is not known with certainty at this time. Further studies of students entering the teacher preparation programs may help to answer that question.

Acknowledgements

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