Exploring differences in trainee teachers' ICT literacy: Does gender matter?

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Abstract

Gender differences in self-reported ICT experience and ICT literacy among first year graduate trainee teachers are investigated. Dynamic model of ICT literacy is employed. Three main components of aspiring teachers' ICT literacy are covered: (1) present general problem-solving and technical ICT capabilities; (2) situational and longitudinal sustainability; and (3) transferability of ICT capabilities into future professional domain. No significant differences were found between females and males previous experience with ICT. However, males on average worked with computers significantly more hours per week than females. Significant differences between males and females technical ICT capabilities and situational and longitudinal sustainability were observed. Males' scores were higher. In the regression analysis, when the impact of the background and ICT experience variables was controlled, gender failed to be a significant predictor of the sustainability scores. However, it remained a significant predictor of some trainee teachers' scores, related to their technical ICT capabilities.

Keywords

pre-service teachers' training, ICT literacy, gender, theory of planned behaviour, self-efficac.

Introduction

The introduction of information and communication technology (ICT) into the educational sector created new social stereotypes and gender inequalities. Since the invention of a computer, ICT-related activities have been viewed as a "male domain" (Brosnan & Davidson, 1996) or "something for boys" (Reinen & Plomp, 1996). In schools, a computer was primarily associated with programming and logical scientific thinking. Thus, old stereotypic gender differences in attitudes and achievements that previously existed in mathematics and technological disciplines were extrapolated to the area of ICT. As several research reviews and metaanalyses summarised, boys were more interested in ICT than girls, they were heavier users of computers, had more positive attitudes about computers and consequently outperformed girls in their ICT literacy[1] (Reinen & Plomp, 1996; Volman & Eck, 2001).

During the last two decades, the role of ICT in education changed radically. New technologies became an indispensable aspect of learning, work and everyday life. A number of researches argued that computing is not considered as a male domain anymore (King, Bond, & Blandford, 2002; North & Noyes, 2002; Whitley, 1997). According to them, canonical gender gaps in the educational sector are disappearing and, probably, do not have any practical importance for the future.

However, a number of recent studies evidenced that ICT-related differences between females and males lessened mainly in the access to ICT and basic computer skills (Busch, 1995; Rainer, Laosethakul, & Astone, 2003). Meanwhile, gender inequalities now emerged in new areas of ICT use (Rainer et al., 2003). As researches showed, boys are more intensive users of the Internet, they enjoy more competitive forms of e-learning and encounter different problems while using ICT than girls (Colley, 2003; Copper & Weaver, 2003; Volman & Eck, 2001; Volman, Eck, Heemskerk, & Kuiper, 2005). Moreover, several investigations indicated that gender gaps probably became more latent and more complex. While gender differences in ICT-related attitudes and cognitions disappeared at scale level, they seem to persist at factor level (McIlroy, Bunting, Tierney, & Gordon, 2001). In addition, female and male students are likely to be different in terms of the types of computer use rather than in all areas of ICT application (Colley, 2003; Mitra et al., 2001).

[1] "ICT literacy" is used as an umbrella term in this paper. It covers all other similar terms, such as "ICT competence", "computer literacy", "digital literacy", "ICT fluency", "ICT skills", "ICT proficiency", that are used for the description of ICT-related knowledge, skills, capabilities, values and other attributes.

ICT-related gender inequalities concern not only students, but also educators (Rosen & Weil, 1995). As research reviews reveal, female teachers tend to be more anxious, less experienced and less confident about their ICT competences and it is less likely that they will apply computers for various teaching and learning purposes. The majority of school staff positions that are related to ICT (e.g., computer coordinators, teachers of computer literacy) are occupied by males (Reinen & Plomp, 1993). The way in which teachers interact with students during ICT-related activities contributes implicitly to the impression that boys are inherently better in ICT than girls (Volman & Eck, 2001).

Researchers suggested that educators might have an important role as models when technology is involved (Shashaani, 1993; Weil, Rosen, & Wugalter, 1990). Negative teachers' attitudes towards ICT and lack of technical ICT competence could impact negatively on a child's perceptions of ICT and can be predictive of later technological discomfort (Weil et al., 1990). In particular, female and male teachers, by providing different patterns in ICT adoption, might negatively impact a "sex-specific socialization" (Reinen & Plomp, 1996; Shapka & Ferrari, 2003; Volman & Eck, 2001).

ICT-related gender inequalities create specific challenges for pre-service teachers' training. Pre-service training programs should consider possible gender differences. They should provide aspiring teachers with versatile gender inclusive ICT training, which allows females and males to attain equally high level of ICT literacy.

This paper aims to get an insight into gender differences of aspiring teachers, who have just started postgraduate pre-service training. It reports the first research results from a study on trainee teachers' ICT literacy at the University of Sydney. The main research questions of this paper are the following:

i. Do female and male aspiring teachers have similar background characteristics and ICT-related experience at the beginning of their postgraduate pre-service training?

ii. Do female and male students have similar beliefs about their capabilities in the following areas of ICT literacy: (1) present ICT literacy (general cognitive and technical ICT capabilities); (2) sustainability of ICT literacy (coping with ICT problems and self-learning of new ICT applications); and (3) transferability of ICT literacy into their future professional domain.

iii. Could existing gender differences in trainee teachers' ICT literacy (if any) be justified by the inequalities in their background characteristics and ICT-related experience?

Research on gender issues in pre-service teachers' training

Previous researches on ICT-related gender gaps in pre-service teachers' training can be clustered into three large groups: (1) trainee teachers' attitudes about ICT, which include computer anxiety, technophobia and technology acceptance; (2) trainee teachers' ICT literacy, which covers computer self-efficacy, skills to apply various software applications and other ICT-related cognitions; and (3) e-learning, which includes various aspects of learning with ICT.

The majority of research in pre-service teachers' education investigated computer anxiety. Rosen and Weil (1995) reviewed a number of early studies, conducted in 1985–1990, and concluded that the research conclusions had been conflicting. Two studies had found no gender differences while three others had found female trainee teachers to be more anxious than males. The results of more recent studies tend to be more consistent with the former rather than the latter finding. Shapka and Ferrari (2003) did not observe any gender differences in computer-related attitudes of aspiring teachers. Yuen and Ma (2002) also found no significant gender differences in undergraduate trainee teachers' attitudes towards computers. However, they observed that linear computer acceptance models for male and female students were different.

Several studies investigated computer self-efficacy or/and actual ICT use of female and male trainee teachers. They came to a variety of conclusions. Above mentioned Yuen's and Ma's (2002) study investigated actual usage of ICT and did not find any significant gender differences. Qutami and Abu-Jaber (1997) researched computer self-efficacy of undergraduate trainee teachers. They did not find gender inequalities in total computer self-efficacy and in advanced computer skills, but they did note significant differences in some specific low-level computer skills in favour of males. Shapka and Ferrari (2003) studied several aspects of ICT literacy, which included strategies for dealing with challenging and novel computer tasks, proximal and distant self-efficacy, and actual performance on a computer task. They did not find any gender differences in self-efficacy and actual outcomes from a challenging computer task. However, they observed significant differences in students' choices of strategies when faced with a difficult computer situation – specifically, females were more likely to use the help function than males.

Fewer studies have been done about gender issues in e-learning in pre-service teachers' training. Braten and Stromso (2004) investigated Internet-based learning activities and text processing strategies in the sample of aspiring teachers. They found significant gender differences in self-reported learning patterns; namely, males indicated higher levels of participation in Internet-based communication activities, whereas females reported higher levels of strategy use when learning from conventional texts.

A number of studies investigated trainee teachers' attitudes and abilities to use ICT in their professional domain (Albion, 2001; 2003; Francis-Pelton & Pelton, 1996; Hakkarainen et al., 2001; Iding, Crosby, & Speitel, 2002; Jones, 2002; Kellenberger, 1996; Wang, 2002). However, none of the above studies aimed to examine professional attitudes and/or capabilities of trainee teachers from the gender perspective.

Method

Instruments

The study of trainee teachers' ICT literacy was based on a dynamic model of ICT literacy comprising of three groups of interacting capabilities: (1) present capacities of ICT literacy; (2) sustainability of ICT capacities; and (3) transferability of these capacities into the future professional domain (Markauskaite, 2005). The structure of the present ICT literacy capacities is based on a "blended" approach to ICT literacy, which includes general cognitive and technical ICT capabilities (Candy, 2004; ETS, 2002). The sustainability of ICT capacities is also composed from two components: situational and longitudinal sustainability. The situational sustainability is defined as a capability to cope with ICT stress in a problem-focussed manner (Kohn, 1996; Ropp, 1999). The longitudinal sustainability is defined as a capability to learn new ICT applications independently (Compeau & Higgins, 1995).

The study was based on self-assessment research methodology. The questionnaire combined multiple measurement tools and included seven parts. Two parts measured students' background characteristics and ICT-related experience, other five parts measured different aspects of ICT literacy (Table 1). Theories of Planned Behaviour (TPB) (Ajzen, 1991), task-specific self-efficacy (TSSE) (Agarwal, Sambamurthy, & Stair, 2000) and general self-efficacy (GSE) (Bandura, 1993; Compeau & Higgins, 1995) were employed for the operationalisation of constructs. The GSE and TTSE were used for those constructs that were largely related to cognitive capabilities to perform various tasks; the TPB was applied for those constructs that concerned not only capabilities, but also an individual's beliefs about the appropriateness of a given behaviour. Some measurements were based on already validated instruments; others were newly developed (see Table 1). To achieve consistency, all instruments were adapted to the theory of either self-efficacy or the TPB and, respectively, to the six or five-point Likert scales (Markauskaite, 2005; Markauskaite, Reimann, Goodwin, & Reid, 2005).

Subjects and procedure

The participants were the first year Master of Teaching program students at the University of Sydney. Two hundred and seventeen students were enrolled in the program: 151 (69.6%) were females and 66 (30.4%) were males. The questionnaires were prepared and made available in two forms: printed and online. Invitations to participate in the study were distributed to all students during the first day of the semester, in March 2005. The participation was voluntary. Students were asked to complete either online or printed version of the questionnaire within a two-week period at any time convenient to them.

One hundred and twenty-two students (56.2%) volunteered to participate in the survey: 96 (78.7%) were females and 26 (21.3%) were males. The sample was quite homogenous — every respondent had a bachelor's degree (4.9% also had a master's degree); the average age was 29.6 (standard deviation — 8.9) years. More than one-fifth of students (22.1%) had a previous degree in science or engineering; others had degrees in various areas of arts and/or human sciences. There were no significant differences between female and male students' background characteristics.

Table 1: Summary of the information about the research instrument

Measurement	Main theory	Instrument, scales (number of items)
Background		
1. General information	NA	New, nominal and ordinal scales (6)
2. Experience with ICT	NA	New, nominal and ordinal scales (13)
I. Present level of ICT literacy capacities		
3. General cognitive capabilities	TSSE	New, items based on (AECT, 2001; USyd, 1997, 2004), six-point scale[&] (10)
4. ICT technical capabilities	TSSE	New, items based on (AECT, 2001; NSW BoS, 2003; NSW DET, 1997, 2004), six-point scale[&] (25)
II. Sustainability of ICT capacities		
5. Situational sustainability: ICT coping strategies	TPB	Partly based on (Ropp, 1999), five-point scale[$] (10)
6. Longitudinal sustainability: Beliefs about self-learning to use ICT	GSE	Based on (Compeau & Higgins, 1995), six-point scale[&] (10)
III. Translferability of ICT capacities		
7. Beliefs about the use of ICT in future carrier	TPB	New, partly based on (Benson, Farnsworth, Bahr, Lewis, & Shaha, 2004; Lewis, 2003; Pelgrum & Anderson, 2001; Wang, 2002) five-point scale[$] (34)

NB: [&] — Six-point Likert scale (0–5): 0 — "Couldn't do that"; 1 — "Not at all confident"; 2 — "Not very confident"; 3 — "Moderately confident"; 4 — "Quite confident"; and 5 — "Totally confident". [$] — Five-point Likert scale (0–4): 0 — "Very unlikely"; 1 — "Unlikely"; 2 — "Possible"; 3 — "Likely"; and 4 — "Very likely".

Results

To answer the research questions, the analysis of the data was accomplished in three steps. In the first step, ICT-related background characteristics and previous experience with ICT of female and male trainee teachers were compared. The chi-square test (for dichotomous variables) and the independent pair t-test (for ordinal and scale variables) were used for the detection of gender differences.

In the second step, various aspects of students' ICT literacy were examined. Initially, females' and males' scores on each individual item were compared. Then, the total scale scores for each of five groups of ICT capabilities were examined. Next, using exploratory Principal components' analysis and Alpha reliability analysis, the main subgroups of ICT capabilities (i.e., factors) were determined. The subgroup scores for females and males were then compared again.

In the third step, the significant differences between females and males total and subgroup scores were analysed. It was aimed to determine, whether gender differences appeared exclusively due to the sexual category or, possibly, because of differences in students' backgrounds and previous experience with ICT. The hierarchical multiple regression was employed for this purpose. The main results of this analysis are reported here.

Students' background and experience with ICT

General characteristics and previous experience with ICT of female and male students were quite similar. On average, the students used computers for more than 15 years and the Internet for more than 8 years. Just more than half (50.8%) of students had been taught to use ICT in a secondary school (grades 7–12) or/and later during the last four years at a university; 61.5 % of them had used ICT for learning various non-ICT subjects in a secondary school (grades 7–12) or/and during the last four years at a university. Many females and males (87.7%) indicated that they learned the most about computers at work and/or were self-taught with or without someone's help. There were no differences between females and males. However, significantly more males (M) than females (F) indicated that they learned the most about computers without any help from others (F = 31.3%, M = 53.8%; $\chi^2(1) = 4.53$, $p < 0.01$).

The majority of participants (93.4%) had easy access to a computer off-campus; 88.8% of them also had an access to the Internet. There were no gender differences. However, on average, male students used computers significantly more hours per week than females (F = 13.2 (9.8), M = 20.4 (16.2), t = 10.73, N = 119, $p < 0.01$). On average, both genders allocated for learning activities about a half of their computer time: 44.6% (28.90).

Students' ICT literacy

Present ICT literacy

Overall, the students were between "Moderately confident" (3) and "Quite confident" (4) about their general cognitive capabilities. Males were significantly more confident just about two specific capabilities: to outline a plan (F = 2.98 (1.11), M = 3.54 (0.91), t = 2.37, N = 120, $p < 0.05$) and to find information and select appropriate tools for the solution of a problem (F = 3.31 (0.98), M = 3.73 (0.83), t = 2.00, N = 120, $p < 0.05$). Meanwhile, both genders were similarly confident about other general cognitive capabilities, such as to manage, integrate and evaluate information, produce and convey a solution, judge the final product and reflect problem-solving process. The average score of all scale was 3.52 (0.66) and there were no significant gender differences. The subgroup scores for females and males were also similar (see Table 2).

Table 2: Total and subgroup scores of trainee teachers' ICT literacy

	Total sample			Females			Males			Signif.
	N	M	SD	N	M	SD	N	M	SD	
1AV: General cognitive capabilities	*120*	*3.52*	*0.67*	*94*	*3.47*	*0.67*	*26*	*3.72*	*0.64*	*NS*
1F1: Problem solution	120	3.43	0.77	94	3.36	0.79	26	3.69	0.65	NS
1F2: Communication & metacognition	120	3.66	0.66	94	3.63	0.64	26	3.76	0.75	NS
2AV: ICT capabilities	*120*	*3.03*	*1.01*	*95*	*2.87*	*0.97*	*25*	*3.64*	*0.93*	***
2F1: Basic ICT capabilities	120	4.13	0.85	95	4.00	0.88	25	4.62	0.47	***
2F2: Analysis & production capabilities	120	2.70	1.27	95	2.56	1.27	25	3.25	1.10	*
2F3: Information & Internet capabilities	120	2.63	1.13	95	2.46	1.06	25	3.30	1.17	***
3AV: ICT coping strategies	*118*	*2.59*	*0.54*	*93*	*2.54*	*0.50*	*25*	*2.81*	*0.63*	*
3F1: Independent or ICT support-based coping	118	2.57	0.74	93	2.47	0.73	25	2.93	0.69	**
3F2: Human support-based coping	118	3.06	0.74	93	3.08	0.73	25	2.99	0.81	NS
4AV: Self-learning to use ICT	*119*	*3.37*	*0.80*	*94*	*3.28*	*0.77*	*25*	*3.70*	*0.86*	*
4F1: Self-based learning	119	2.48	1.17	94	2.36	1.12	25	2.92	1.26	*
4F2: Experience or ICT support-based learning	119	3.46	0.88	94	3.35	0.83	25	3.84	0.98	*
4F3: Human support-based learning	119	3.73	0.73	94	3.68	0.71	25	3.94	0.76	NS
5AV: ICT use in future career	*118*	*2.60*	*0.59*	*93*	*2.58*	*0.56*	*25*	*2.68*	*0.68*	*NS*
5F1: Enrichment of teaching & learning	118	2.84	0.72	93	2.85	0.72	25	2.82	0.75	NS
5F2: Communication & self-based learning	118	2.43	0.73	93	2.38	0.70	25	2.60	0.84	NS
5F3: Constructivist learning	118	2.31	0.70	93	2.26	0.69	25	2.46	0.75	NS
5F4: Teaching of general cognitive capabilities	118	3.00	0.72	93	2.97	0.75	25	3.10	0.64	NS
5F5: Teaching of ICT capabilities	118	2.47	0.80	93	2.44	0.81	25	2.61	0.78	NS
5F6: Professional activities & development	116	2.96	0.66	92	2.98	0.63	24	2.87	0.79	NS

NB: N — number of respondents; M — Mean; SD — Standard Deviation; NS — Not Significant; * — $p < 0.05$; ** — $p < 0.01$; *** — $p < 0.001$

Overall, the trainee teachers were between "Not very confident" (2) and more than "Quite confident" (3) about their capabilities to perform various tasks with ICT, such as to use general computer and network tools, design text, manage data, create images, presentations and webpages. Males' scores were significantly higher ($p < 0.05$) than females' scores on 20 items out of 25. The largest differences between genders were

related to the following capabilities: to maintain a computer; manage simple data using spreadsheets; edit and design graphics; create basic and multi-page website; use personal management tools; deliver the results using presentation tools and networks. The insignificant differences were mainly related to the basic ICT skills, such as: to operate a computer and software; create simple images; search and gather information and communicate via email. The average scale score was also significantly higher for males than for females ($F = 2.87$ (0.97), $M = 3.64$ (0.93), $t = 3.51$, $N = 120$, $p < 0.001$). Males' scores were significantly higher ($p < 0.05$) than females' scores in all subgroups of technical ICT capabilities.

Sustainability of ICT literacy

Overall, trainee teachers' intentions to apply various strategies for coping with ICT problems ranged from more than just "Unlikely" (1) to almost "Very likely" (4). Males were more likely than females to apply just two strategies: browse the available menus ($F = 3.13$ (1.00), $M = 3.68$ (0.48), $t = 2.56$, $N = 118$, $p < 0.05$) and visit a website for the users of software and/or hardware ($F = 1.71$ (1.14), $M = 2.52$ (1.05), $t = 3.21$, $N = 118$, $p < 0.01$). Meanwhile, both genders were equally likely to apply all other strategies. The total score of situational sustainability was significantly higher for males than for females ($F = 2.54$ (0.50), $M = 2.81$ (0.63), $t = 2.32$, $N = 118$, $p < 0.05$). In the subgroup "Independent or ICT support based coping", the sub-score for males was also significantly higher than for females ($F = 2.47$ (0.73), $M = 2.93$ (0.69), $t = 2.81$, $N = 116$, $p < 0.01$). However, the there was no gender difference in the subgroup "Human support-based coping".

The students were between more than "Not very confident" (2) and just above "Quite confident" (4) about their capabilities to learn new software and/or hardware applications independently under variety of conditions, such as: without any help; with various kinds of human support or with ICT help tools. Males were significantly more confident about their capabilities to learn new ICT applications in three situations: even if there was no one around to tell what to do ($F = 2.49$ (1.16), $M = 3.08$ (1.29), $t = 2.21$, $N = 119$, $p < 0.05$); if they had a lot of time for that ($F = 3.51$ (0.89), $M = 4.08$ (1.04), $t = 2.74$, $N = 119$, $p < 0.01$) and if they had used similar software before to do the same job ($F = 3.94$ (0.81), $M = 4.36$ (0.70), $t = 2.38$, $N = 119$, $p < 0.05$). The students were equally confident about their capabilities to learn new applications under other conditions. The average scale score was 3.37 (0.80) and it was significantly higher for males than for females ($F = 3.28$ (0.77), $M = 3.70$ (0.86), $t = 2.32$, $N = 119$, $p < 0.05$). Males' confidence was also significantly higher in all subgroups of self-learning capabilities, with the exception of human support-based learning.

Transferability of ICT literacy

Trainee teachers' intentions to apply ICT for various teaching, learning, administration and professional development purposes ranged from just more than "Unlikely" (1) to "Likely" (3). In general, at this initial stage of pre-service training, the majority of students did not have strong views about the use of ICT in their future job. Thus, the mode answer to 17 items out of 34 was "Possible". There were almost no significant gender differences. Thirty-three scores out of 34 were similar for both genders. Male students however were more likely to design assignments in which students will need to make presentations with ICT ($F = 2.38$ (0.91), $M = 2.80$ (0.94), $t = 2.01$, $N = 118$, $p < 0.05$). The average score of all items was 2.60 (0.59) and there was no significant gender difference. Students' scores were also similar in all subgroups.

Regression analysis of significant gender differences

The significant gender differences in students' ICT literacy were investigated further using hierarchical multiple regression. Three total and six subgroup scores were used as dependent variables in the regression analysis: 2AV; 2F1; 2F2; 2F3; 3AV; 3F1; 4AV; 4F1 and 4F2. On the basis of literature review, the following background and ICT experience indicators were selected as potential predictors of ICT literacy scores: (1) age (AG); (2) years since the first computer use (YR); (3) easy access to a computer at the place of off-campus study (AC); (4) hours of computer use per week (HR); (5) previous degree in science (DG); (6) previous learning to use ICT (PL); (7) previous use of ICT for learning various non-ICT subjects (PU); (8) experience of learning about computers independently with or/and without support from others or/and at work (LH); and (9) experience of learning about computers autonomously without support from others (LA). The significances of the relationships between the background indicators and students' total and subgroup scores of ICT literacy were investigated using t-test (for dichotomous variables) and correlation analysis (for ordinal variables). Two ordinal and four dichotomous variables had significant relationships ($p < 0.05$): YR; HR; DG; PL; PU and LA. These indicators and gender (GN) were selected as independent variables for the factor analysis.

Initially, the six variables were entered into regression analysis together in the first step, whereas gender was entered separately in the second step. The regression coefficients of PU, PL and LA were insignificant for all

nine students' scores. Therefore, these indicators were removed the regression and the analysis was repeated again just with the three independent variables in the first step and gender in the second. Table 3 shows the summary of the results.

At the first step obtained regressions explained from 10% to 24% of variances in the students' scores and always were statistically significant. Gender, entered at the second step, explained further from 1% to 4% of variances. For the six scores, gender did not explain a significant increment in proportion to the variances explained by other background variables. However, the changes in variances were statistically significant ($p < 0.05$) for the following three scores: (1) Total technical ICT capabilities (2AV); (2) Basic ICT capabilities (2F1); and (3) Information and Internet-related capabilities (2F3).

Table 3: Summary of the results of hierarchical regression

	I step (DG, YR, HR)		II step (GN)			Standardised beta coefficients			
	R^2	F (3,110)	R^2	R^2 Ch	F Ch (1,109)	DG	YR	HR	GN
2AV	0.22	10.62***	0.26	0.04	5.93*	0.24***	0.13	0.28***	0.21**
2F1	0.20	9.23***	0.24	0.04	5.38*	0.15	0.25***	0.24**	0.20*
2F2	0.19	8.52***	0.20	0.02	2.42	0.26***	0.11	0.25**	0.14
2F3	0.20	8.99***	0.24	0.04	5.93*	0.22**	0.07	0.29***	0.21*
3AV	0.10	4.03***	0.12	0.02	2.38	-0.06	0.22*	0.16	0.14
3F1	0.13	5.53***	0.16	0.03	3.73	-0.02	0.20*	0.23**	0.18
4AV	0.23	10.79***	0.23	0.01	1.01	0.17*	0.24**	0.31***	0.09
4F1	0.24	11.29***	0.24	0.00	0.66	0.15	0.27***	0.32***	0.07
4F2	0.20	9.11**	0.21	0.01	1.94	0.19*	0.20*	0.28***	0.12

NB: * — $p < 0.05$; ** — $p < 0.01$; *** — $p < 0.001$; R^2 Ch — R^2 Change; F Ch — F Change.

The average time of computer use per week (HR) was a significant positive predictor of students' scores in the eight out of nine regression models. In six cases, it had the highest partial correlation coefficient. The degree in science (DG) was a significant predictor of non-basic technical ICT capabilities. It also explained a significant part of the variance in students' capabilities to learn new software applications independently with various ICT-based scaffolders (manuals, online help, etc.). The years of ICT use (YR) was a significant predictor of basic ICT capabilities and all sustainability scores.

Discussion and conclusions

Almost all new trainee teachers had a substantial experience of ICT use. The majority of females and males had easy access to a computer and Internet outside the university campus. These results are consistent to the findings of many other recent studies (King et al., 2002; North & Noyes, 2002; Whitley, 1997). They confirm that gender gaps related to ICT access diminished and probably do not have practical importance. Nevertheless, even having similar technical opportunities, female students were significantly less intensive users of ICT than their male classmates.

Female and male trainee teachers had quite similar previous exposure to computers and Internet. About half of them were taught to use ICT in school or at university. Nevertheless, the majority of them were mainly self-taught or learned the most about ICT from practical experience at work. Female and male trainee teachers have similar self-learning experience. However, significantly more males than females learned the most about ICT completely autonomously.

Male students were significantly more confident about their capabilities to plan, find information and select ICT tools. However, on the whole, the confidence of female and male trainee teachers about their general cognitive capabilities was quite similar. This result is quite expected, as in terms of educational background, the researched sample was very homogenous, thus the students have quite similar learning experience and cognitive skills

In contrast, females' and males' confidence about their technical ICT capabilities was significantly different. Gender gaps were observed in all subgroups of technical ICT capabilities. This finding is different from the results of some other similar studies (Qutami & Abu-Jaber, 1997; Shapka & Ferrari, 2003;

Yuen & Ma, 2002). The hierarchical regression analysis showed that higher confidence to perform various analytical and production tasks with ICT was associated with longer hours of computer usage per week and a previous degree in science. Meanwhile gender, when the influence of the background and ICT experience variables was controlled, was an insignificant predictor of students' scores. Higher students' confidence about their basic ICT skills and their information and Internet-related capabilities was associated with longer hours of ICT use per week, longer experience of computer use and/or previous degree in science and gender. In the latter cases, even when the influence of the background and ICT experience variables was controlled, gender was a significant predictor. Therefore, the lower females' confidence about these two capabilities cannot be explained by the inequalities in their background characteristics.

Female and male students were equally confident about their capabilities to learn new software and/or hardware applications with a human help. However, male students were significantly more confident about their capabilities to master new applications autonomously. Nevertheless, when the influence of the background and ICT experience variables was controlled, gender did not explain significant additional proportion of the variance. Therefore, gender differences in the capabilities to learn about ICT autonomously could be caused by the inequalities in students' background characteristics and ICT experience. The time of computer usage per week and years since the first computer use were significant predictors of all students' longitudinal sustainability scores. Females worked with a computer significantly less time over the course of a week than males did. It is likely that this factor contributed the most to gender differences in students' confidence about their self-learning capabilities.

Similar patterns of gender differences were observed in students' strategies for coping with ICT problems. Females and males were similarly likely to employ various human support-based coping strategies. However, males were more likely to cope with ICT-related problems autonomously and/or with various ICT-based support tools. In the regression analysis, when the impact of the background and ICT experience variables was controlled, gender failed to explain a significant increment. Therefore, the differences between females and males probably appeared because of the inequalities in other students' characteristics rather than gender *per se*. These findings about students' self-learning to use ICT and coping strategies are quite consistent with the results of other research (Reinen & Plomp, 1996; Shapka & Ferrari, 2003). Female students prefer cooperative learning situations, thus it is more likely that they will seek for human help. Males however like competitive learning style, and consequently it is more likely that they will try to find the solutions on their own.

In the beginning of pre-service training, neither female nor male students had strong opinion about the use of ICT in their future job. They were very neutral about various methods of ICT application in teaching and professional activities. Overall, this study revealed some significant gender differences in trainee teachers' ICT literacy. Gender gaps were observed on both scale and factor levels. The most alarming is the gap between female and male students' confidence about their technical ICT capabilities. The items included in the instrument for the self-assessment of technical ICT skills were based on the national and international standards relevant to trainee teachers and school students (ACDE, 1998; NSW BoS, 2003; NSW DET, 1997, 2004). Thus, the scale covered the basic set of technical ICT capabilities that every school teacher is expected to master. The observed gender gaps, if not addressed properly during pre-service training, could later be transferred into the classroom and negatively affect children's learning.

Although it is difficult to detect precisely what causes gender differences, it is likely that one of the most influential factors is the time spent on various computer activities. Pre-service training programs could encourage female students to spend more time with a computer by integrating ICT across pre-service curricula. In addition, pre-service teachers' training could employ various ICT-based cooperative learning approaches that are well suited to female students. In general, pre-service teachers' training should focus on enhancement of professional understanding and experience about the use of ICT in teaching and learning rather than to develop just technical ICT skills.

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