Computer Self Efficacy And Gender

East and West Europe

A. DURNDELL, Z. HAAG, D. ASENOVA, & H. LAITHWAITE

A. Durndell, and H. Laithwaite, are at the Department of Psychology, Z. Haag, is at the Department of Computer Studies, and D. Asenova, is at the Business School, Glasgow Caledonian University, Glasgow, Scotland, G4OBA. Email: adu@gcal.ac.uk

Abstract: In Western Europe, research has indicated that males on average are often found to be more experienced in computing than are females, and to have more positive attitudes and self-efficacy (self-confidence) towards computing. Research has also shown that some East European countries have historically had relatively greater female involvement with technology, engineering, and computing than has Western Europe. It is an interesting question as to whether this greater involvement will continue into the new circumstances of Eastern Europe. 200 Romanian and 148 Scottish students completed a computer self-efficacy scale. Overall males were more confident than females in advanced software computer skills, but had similar confidence for beginning skills. Scots of both genders were more confident than their Romanian equivalents for beginning computer skills, whilst Romanians were more confident for advanced computer skills. The visibility of gender effects in both countries raises the possibility that the relatively greater female involvement in technology in East Europe may not continue.

1. INTRODUCTION

Much, although not all, recent research finds that males are more experienced with, and more positive about, computers than are females e.g. [7, 17]. When North America, particularly the USA, e.g. [17] is compared to West Europe, including Britain [7], it would seem that the extent of gender effects tends to be larger in Western Europe. However, at the same time, there are considerable indications that the extent of these effects are actually increasing in the USA. For example, if it is measured by participation rates

E. Balka et al. (eds.), *Women, Work and Computerization*

in computing courses, [10, 18], and this contradicts some of Whitely's [17] comments about the lack of behavioural gender effects visible in the USA. Research has included the assessment of the use of computers [7], the measurement of computer anxiety [12] and particularly the assessment of computer related attitudes, broadly defined [15, 17].

Bandura's work on self-efficacy [2] has been relatively influential, with a major statement being published recently [3]. Self-efficacy can be measured in particular domains, and not surprisingly it has been measured in relation to computing. Broadly speaking, computer self-efficacy can be seen as a measure of an individual's judgement of their own abilities with computers, an assessment of self-confidence. Bandura presents evidence which he argues shows that self efficacy, as well as ability, is able to predict career choice and persistence in education, both in the West and in a number of other cultures, including the former East Germany [2]. Given the research that exists pointing to the frequent identifying of gender variations in relation to computing, it would be expected that computer self efficacy would in general produce a gender effect, with males being more self confident in this area than females. This indeed has been found by Murphy, Coover and Owen [13] as well as Torkzadeh and Koufteros [16], utilising their own computer self-efficacy scales. Additionally Brosnan [4] argues that computer self-efficacy is a major determiner of choice of subject to study and persistence in studying computing.

A relatively small amount of research has looked at these types of questions in relation to the ex communist countries of East Europe [1, 6, 11, 14]. These countries are of interest because historically their educational systems have produced a population of technologists, engineers and physical scientists that have been far more likely to be female than was the case in West Europe [5, 8]. For example, Durndell [5] pointed out that in 1987 the educational authorities in Bulgaria were still *restricting* the proportion of female engineering students to 50%, a situation inconceivable to western engineers. When asked about this more recently, Bulgarian engineers put it down mainly to the economic need for women to work, and the policy of the previous (communist) system of emphasising both the importance of engineering itself and of gender equity in the educational system [8]. The respondents gave considerable credibility to the 'former system' in setting up a situation where both engineering and gender equity were given high priority and positive images. The emphasis in education on lectures rather than practical work was also seen to be rather important. There was something of a contradiction here with western feminist analyses which have often argued that women could be drawn into studying engineering by the provision of real world practical examples that connect with women's lives. However, the respondents also gave a clear contemporary picture of

declining interest in and status of engineering, as well as rapidly increasing female unemployment.

The advent of computing is a more recent phenomenon. Reinen and Plomp [14], as part of a large cross cultural study, found that school children in a number of countries produced the usual results that males were significantly more knowledgeable about computers, enjoyed using computers more and perceived less problems with software. However, their Bulgarian sample provided results that showed amongst the smallest gender differences, often not significant although still to the advantage of males. Wright [18], utilising UNESCO data in another cross national comparison of a large number of countries, also found that the majority of students in maths and computing in Bulgaria and Romania were female, making up more than double the proportion of females that are found on similar courses in the UK. These ex communist societies have changed very rapidly, and with much dislocation, and it is of interest to assess whether their relatively gender neutral technology situation will continue into their changed circumstances or not.

Research has thus indicated in Western Europe that males tend to be more confident about computers than females, as indicated above, and Durndell et al. [6], showed that whilst males and females in Romania have less direct experience of computers than their western counterparts, they are at the same time more positive about computers. It was therefore hypothesised that this would transfer into greater Romanian than Scottish computer self-efficacy, and that this would be especially apparent in the case of females.

2. METHOD

2.1 Sample

The Romanian sample, 85 males and 115 females, was obtained from two higher education institutions, comprising students towards the end of their first year. A slightly smaller sample with approximately similar characteristics, 43 males and 105 females, was obtained in Scotland. The average age of both the Romanian sample and the Scottish sample was 21 years, with S.D.'s of 4.2 and 4.1 respectively.

2.2 The Self Efficacy Scale

Torkzadeh and Koufteros [16] describe the development of their Computer Self-Efficacy (CSE) scale that was used here. It utilises a Likert type response, (1=strongly disagree to 5=strongly agree), and comprises three components - 'beginning skills' CSE, 'advanced skills' CSE and 'file and software skills' CSE, identified via factor analysis. Participants were instructed that 'The following statements relate to your self-efficacy with computers. Please use the following scale and, for each statement, circle the response that best describes your current belief.' The items are shown in Table 2.

The scale was translated into Romanian by a completely bilingual Romanian working in Scotland who spoke English like a native speaker. This translation was independently checked by a bilingual Romanian in Romania.

2.3 Procedure

The Romanian version of the Computer Self Efficacy scale was distributed in a teaching situation in the Romanian higher education institutions towards the end of the students' first year. One year later the Scottish sample of students at two equivalent institutions was presented with the scale in the same conditions and time of the academic year. Data analysis was then carried out using SPSS6.

3. RESULTS

The study examined the data for gender and/or nation effects. Anova of gender by nation was carried out on the Computer Self-Efficacy (CSE) total score, and individually on each of the scores on Torkzadeh and Koufteros' three components of 'beginning skills' CSE, 'advanced skills' CSE and 'file and software skills' CSE. Table 1 displays the results for gender and nation. No gender/nation interactions were significant.

Table 1: Mean Scores and Significance levels from Anovas of Computer Self Efficacy (CSE) Questionnaire: Gender and Nation

Gender

Nature of CSE score	Male mean	Female mean	F ratio
Total CSE score	110.2	105.9	F=4.235*
Beginning skills CSE	39.8	39.4	ns
Advanced skills CSE	44.0	41.0	F=6.525*
File and software skills CSE	26.3	24.9	F=5.489*

Nation

Nature of CSE score	Romanian Mean	Scottish Mean	F- ratio
Total CSE score	108.8	105.7	ns
Beginning skills CSE	38.8	40.6	F=7.011**
Advanced skills CSE	44.3	40.0	F=20.125**
File and software skills CSE	25.6	25.1	Ns

*=p<.05, ** = p<.01, ns = not significant

Correlations for the whole sample between components of the CSE scale showed that all three correlations between the three components of the total computer self-efficacy score were highly significant (p>.0001). Beginning skills CSE correlated at +0.64 with 'advanced skills' CSE, 'beginning skills' CSE correlated at +0.74 with 'file and software skills' CSE, and 'advanced skills' CSE correlated at +0.79 with 'file and software skills' CSE.

The reliability of the CSE scale was assessed using alpha separately for each nation: for the Scots, the alpha was .9575, and if single items were deleted the minimum alpha was .9549. For the Romanians, the alpha was .9476, and if single items were deleted the minimum alpha was .9442. The CSE scale with corrected item-total correlations is shown in Table 2 (below).

Table 2: Corrected Item-Total Correlations, Computer Self Efficacy Items, by Nation

I feel confident:	Scots	Romanians
1. working on a personal computer (microcomputer)	.72	.74
2. getting software up and running	.69	.69
3. using the users guide when help is needed	.66	.51
4. entering and saving data (numbers or words) into a file	.60	.65
5. escaping (exiting) from the programme (software)	.62	.52
6. calling up a data file to view on the monitor screen	.66	.69
7. understanding terms/words relating to computer hardware	.70	.65
8. understanding terms/words relating to computer software	.71	.68
9. handling a floppy disc correctly	.71	.63
10. learning to use a variety of programmes (software)	.73	.48

11. learning advanced skills within a specific programme	.72	.48
12. making selections from an onscreen menu	.64	.62
13. using the computer to analyse number data	.63	.64
14. using a printer to make a 'hard copy' of my work	.64	.45
15. copying a disc	.69	.59
16. copying an individual file	.70	.63
17. adding and deleting information from a data file	.72	.64
18. moving the cursor around the monitor screen	.46	.22
19. writing simple programmes for the computer	.32	.56
20. using the computer to write a letter or essay	.51	.54
21. describing the function of computer hardware	.72	.63
22. understanding the three stages of data processing	.66	.75
23. getting help for problems in the computer system	.72	.31
24. storing software correctly	.70	.68
25. explaining why a programme will or will not run	.60	.64
26. using the computer to organise information	.74	.76
27. getting rid of files when they are no longer needed	.65	.70
28. organising and managing files	.78	.71
29. troubleshooting computer problems	.55	.72

4. DISCUSSION

A gender effect was found in both national samples. This was that males in general had higher computer self-efficacy than females, and that this was more so with advanced than beginning skills. This is perhaps what would be expected from the research carried out in the West, illustrating the commonly found gender effects identified in this type of research. The fact that the same pattern of results was found in Romania mitigates against the idea that there is an absence of gender effects in that country, and that instead the Romanians are producing the same pattern as in West Europe. It should also be noted, again as often has been found in the literature, that whilst many of the gender differences were significant, in absolute size they were often not very large.

When the effect of the nation variable was taken into account a somewhat more complex picture appeared: Romanians, in spite of their more limited exposure to computers [6] showed no lack of computer self efficacy. In particular, whilst Scots were more confident with beginning skills, Romanians were more confident with advanced skills, and furthermore this applied to both genders. Why this should be is of course not possible to ascertain from this analysis. It could be that the Scots, due to the greater availability of computers are more able to have the opportunities to ensure that they have mastered the basic computing skills; it could be that the Romanians are less realistic about their abilities on more advanced skills, or

it could be that the Romanians being more highly motivated make whatever use they can of opportunities to utilise computers and that those who have the opportunity use it to the maximum. Developing computer skills would probably be an effective way for Romanians to gain entry to the labour market in West Europe or North America. These have to remain speculations however.

Overall, going back to the original hypotheses, the results are a little mixed. On the one hand the Romanian sample of both genders were found to be more self confident for advanced computer skills than their Scots counterparts, but on the other hand the familiar picture of males being more confident about their computer skills than females was found in Romania as well as in Scotland. It would be interesting to relate computer self-efficacy to actual performance, but this was beyond the scope of this study.

The current economic difficulties of countries such as Bulgaria, Romania or Russia does make it difficult to try and identify any positive lessons from them for Western Europe, as the argument can always be made that their past gender equity strategies were linked to a system which has produced ongoing economic problems. Whilst some people in these countries might now see benefits in the past [8], very few wish to go back. Graham [9] puts the dilemma well, referring to Russia, and commenting that many highly educated people are now free but unemployed. On the other hand it could be argued that these societies do at least show that if a culture wishes to for example involve women with engineering, it can be organised.

It is still (see research reviewed in the introduction) unclear whether aspects of Eastern Europe's relative technological gender equity are going to survive the change to their systems, although it is beginning to look as though they will follow the Western European example and in a small way the study reported here tends to support this view. Another major complication is that the rapid growth of the Internet means that all current and future research in this area will probably have to take the Internet into account.

REFERENCES

1. Alting, A., & Brand, M. (Eds.). (1992). East and West European conference: Ten years GASAT activity in a changing Europe. Eindhoven, Holland: GASAT/Eindhoven Technical University.
2. Bandura, A. (Ed.), (1995) *Self-Efficacy in Changing Societies*. Cambridge: Cambridge University Press.
3. Bandura, A. (1997). *The Exercise of Control*. New York: W. H. Freeman.
4. Brosnan, M. (1998). *Technophobia*. London: Routledge.

5. Durndell, A. (1991). Paradox and practice: Gender in computing and engineering in Eastern Europe. In G. Lovegrove & B. Segal (Eds.), Women into Computing: Selected Papers 1988-1990 (pp.392-400) London: Springer Verlag.
6. Durndell, A., Cameron, C., Knox, A., Stocks, R. & Haag, Z. (1997). Gender and computing: West and East Europe. *Computers in Human Behaviour*, 13, 2, 269-280.
7. Durndell, A. & Thomson, K. (1997). Gender and computing: A decade of change? *Computers and Education*, 28 (1), 1-9.
8. Durndell, A., Uzunova, F.. Asenova, D., Asenov, A., & Thomson, K. (1998). Gender neutral engineering: An impossible dream?--the case of East Europe. International Journal of Science Education, 20, 7, 783-793.
9. Graham, L. (1998). *What Have We Learned about Science and Technology from the Russian Experience?* Stanford: Stanford University Press.
10. Holdstock, L. (1998). The ratio of male to female undergraduates. In Radford, J. (Ed.), *Gender and Choice in Education and Occupation*. London: Routledge.
11. Martin, C., Heller, R. & Mahmoud, E. (1992). American and Soviet children's attitudes to computers. *Journal of Educational Computing Research*, 8 (2), 155-185.
12. Maurer, M. (1994). Computer anxiety correlates and what they tell us: A literature review. *Computers in Human Behaviour*, 10 (3), 369-376.
13. Murphy, C., Coover, D. & Owen, S. (1989). Development and validation of the computer self-efficacy scale. *Educational and Psychological Measurement*, 49, 893-899.
14. Reinen, I. & Plomp, T. (1997). Information technology and gender equality: A contradiction in terminis? *Computers and Education*, 28 (2), 65-78.
15. Todman, J. and Dick, G. (1993). Primary children's and teacher's attitudes towards computers. *Computers and Education*, 20, 199-203.
16. Torkzadeh, G. & Koufteros, X. (1994). Factoral validity of a computer self efficacy scale and the impact of computer training. *Educational and Psychological Measurement*, 54 (3), 813-921.
17. Whitely, B. (1997). Gender differences in computer related attitudes and behaviour: A meta analysis. *Computers in Human Behaviour*, 13 (1), 1-22.
18. Wright, R. (1997). Women in computing: A cross national analysis. In R. Lander & A. Adam, *Women in Computing*. (pp72-83) Exeter: Intellect.