Using Information and Communications Technology as a Pedagogical Tool: a survey of initial teacher education in Scotland

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ABSTRACT In common with other parts of the United Kingdom, teacher education in Scotland is facing a period of rapidly changing demands with respect to the use of information and communications technology (ICT), together with high levels of investment, rising expectations, and increased scrutiny and accountability. In this article, we present an account of a national survey of the ICT skills and attitudes of students entering and exiting from the teacher education institutions in Scotland in the session 1996-97. The students are extremely positive in their attitudes, their enthusiasm for ICT use in education is high and their aspirations clear – they expect ICT to permeate their professional work now and in the future. Their experiences during their period of training fall considerably short of their expectations. We discuss the reasons for some of the difficulties and consider the challenges faced by tutors in initial teacher education courses who must now ‘model the message’ of a learner-centred approach to the education of their students.

Introduction

A series of United Kingdom government publications has set out the aspirations of those in the political and business sectors for benefits to national prosperity which would arise from increased use of information and communications technology (ICT) (Department for Education and Employment [DfEE], 1995; DfEE, 1997a). The Scottish Office has already introduced initiatives to promote the use of ICT in classrooms (Scottish Office Industry and Education Department [SOEID], 1998a) and funded a major research programme to monitor the progress and effects of these in schools (SOEID, 1998b). The aims of these initiatives are to promote and
extend the conventional uses of information technology which involve interactions with and around the computer, to include communications at a distance – using electronic networks to access resources, to create resources and to communicate with others. The intended effects upon classroom learning include: improved subject learning, the development of network literacy, improved motivation and attitudes towards learning and the development of independent learning and research skills (DfEE, 1997b). Although education in Scotland has evolved over the past 10 years to have somewhat different national curriculum and teacher education requirements from those in other parts of the United Kingdom, we clearly share the common condition that, with respect to the use of ICT, we are facing a period of rapidly changing skill requirements, rising expectations and high levels of investment, scrutiny and accountability.

Monitoring of the computer competency of students entering teacher training in many countries indicates that the levels of their skills are steadily rising (Summers, 1990; Mellar & Jackson, 1992; Liénard, 1995), reflecting, amongst other things, the increasing use of computers at home and in schools. The range and scale of current initiatives to promote the use of ICT in Scottish schools suggest that there will soon be few entrants to teacher education institutions (TEIs) who are not computer literate and that those elements of the courses hitherto devoted to teaching all students the basic skills will no longer be necessary. Indeed, it has been informally suggested by a member of the teacher registration body, the General Teaching Council (personal communication) that computer literacy should soon be a requirement of entry to Scottish teacher education courses. There will then be an expectancy that the courses will focus entirely on the use of ICT as a sophisticated and empowering tool to be used by all learners and as something to be understood and used in expert and specialist ways by the teachers of young people. The specific requirements for novice teachers are already being set out for England (Teacher Training Agency, 1998) and similar specifications have been issued for consultation in Scotland (SOEID, 1998c).

In the study reported here, which was funded by the Scottish Office, we set out to determine some national baseline information for the 1996-97 cohort of trainee teachers in Scotland. What are their ICT skills on entry to their courses? To what extent are these built on and extended into the pedagogical applications during their training? What are the implications for the future planning of initial teacher education?

**The Research Methods**

The investigation was conducted as three separate and semi-independent strands concerned with:
the ICT competence and confidence of pre-service students on course entry and exit;

o the range of ICT-related skills and strategies deployed by staff in TEIs;

o the perceptions and requirements of the students’ future employers.

A full report of the research procedures and findings can be found in Simpson et al (1997) and the information from the staff survey is presented elsewhere (Simpson et al, 1999). In this article, we present data on the skills of the trainee teachers as they entered and exited from the courses offered in the teacher education institutions in Scotland, and on the views and attitudes towards ICT and their courses which they revealed through interviews and diaries.

Data was gathered using the following three techniques:
1. nationally distributed questionnaires to all students in the three main courses in all the teacher education institutions in Scotland;
2. semi-structured interviews with a sample of course directors and students;
3. diaries kept by students of their ICT experiences in courses and school experience.

Questionnaires were compiled to ascertain the ICT skills and related attitudes of the students on entry to and exit from teacher education courses. In order to maximise return rates, these were distributed through course directors and given during class time to students on the three principal teacher qualification courses offered by all six Scottish teacher education institutions: the 4-year Bachelor of Education (BEd) degree, and the two Postgraduate Certificate of Education (PGCE) courses of one year’s duration which qualify university graduates for either primary school (ages 5-11 years) or secondary school teaching (ages 11-18 years). Data from the courses at Stirling University is not included here since the semester ended outside the period of the project. The other five institutions were visited and interviews conducted with 12 of the 15 course directors and with a total of 45 students exiting from these three qualifying courses. The interviews were semi-structured and were designed to explore further some of the factors which had emerged from the data gathered by the questionnaires. The responses to open questions in the questionnaires and data from the interviews and diaries were used to illuminate, confirm and exemplify the interpretations of the questionnaire data.

The Data from the Incoming Students

Most of the sample of BEd students (n = 541, 68% of the total national population) entering courses in September 1996 were in the age range 17-23 years and represented a cohort of students of which the majority came directly from school. The PGCE student sample (n = 772, 62% of the total national population) had left school at least 3 years prior to the survey and
had gained most of their ICT skills at university and in workplace experiences.

**Attitudes towards ICT**

The incoming cohorts of students exhibited very positive attitudes towards ICT and clearly appreciated its educational value and potential (see Table I). The overwhelming majority (>80%) indicated they are not bored by computers but enjoy using them, are enthused and motivated by their engagement with them and feel it is important that they learn how to use them. They feel that neither age nor gender are barriers to confident engagement and mastery, although half are concerned that computer use can lead to less socialisation between people, and are disturbed that their future pupils may know more about ICT than they do. They recognise that computers are going to shape almost every aspect of life in the future.

Table I. Incoming students: attitudes to ICT (percentage of questionnaire responses).

**Qualifications and Skill Levels**

The majority of incoming students (over 80%) indicated that they had had previous experience of using information technology, with 21% of BEd and
32% of PGCE Secondary respondents describing their experience as “a lot”. In none of the institutions did more than 20% of any group indicate that they had had no experience at all. For the majority of BEd students (64%), the experience had been gained in school and a significant proportion of students had undertaken formal ICT-related courses at school (Table II). Around half (42-51%) of students had access to a computer at home, most of which were PCs.

Table II. ICT-related courses undertaken by incoming students (percentage of questionnaire responses).

The level of skills and competence in text and information-handling are presented in Tables III and IV. In general, the data presents a picture of cohorts of students who differ widely in their skills, but a substantial proportion of who have already mastered the basic procedures of text handling, and to a lesser degree, information-handling; more than half indicate they can do most or all of a range of text handling procedures and around 70% feel confident they have a good basis for developing their skills further. The corresponding proportions for information-handling are lower; nevertheless, more than a third feel confident in undertaking activities associated with information retrieval and half feel they already have a good basis for further development of their skills. Between 37% and 50% of the graduate entrants have used email or the Internet. The corresponding figures for the entrants from school are below 20%; however, this proportion is likely to rise rapidly as a consequence of government initiatives to link all schools to the Internet and the British Telecom launch of Mill-e-Mail – which provides a free email address service for anyone over 11 years of age (reported in Educational Computing and Technology, May 1998).
Table III. Incoming students' experience in specific uses of ICT: TEXT HANDLING: word processing/ desktop publishing (percentage of questionnaire responses).

Table IV. Incoming students' experience in specific uses of ICT: INFORMATION HANDLING: databases/ spreadsheets (percentage of questionnaire responses).
Data from the Students at the End of their Courses

The exit questionnaires were again distributed through the course directors of the three principal courses in the five Scottish TEIs. The BEd students had just completed a 4-year degree course, while the PGCE Primary and PGCE Secondary students had completed a year-long course, of which 18 weeks had been spent on campus. The sample of PGCE students exiting from their courses in 1997 were therefore drawn from exactly the same population which had responded to the entry questionnaire, whereas the BEd respondents had entered their courses 4 years previously. These BEd students had clearly benefited less from recent developments in ICT use in schools and both the students and the course directors pointed out in their interviews that their courses had recently been undergoing change. Nevertheless, this cohort represents a significant entry into the teaching force and their needs in professional development will subsequently have to be met.

Attitudes towards ICT

The three exiting cohorts of students show a similar pattern of positive attitudes to using ICT to those in the incoming cohorts. Over 80% enjoy using a computer, are more enthused and motivated the more they use ICT, and disagree with the statement (20% strongly) that the time and effort required to master its use are not worth it in terms of actual returns.

Their attitudes towards the general use of ICT in education are presented in Table V. Although many indicate that they would like to have experience in managing the class before they use ICT, the majority are confident that they will be able to integrate ICT into the curriculum, to organise ICT resources in the classroom and be able to use ICT to differentiate tasks for pupils. The more they use ICT, the more they see how ICT can be used to extend children’s learning and are confident they will be able to keep up with future developments in ICT.

It is clear that these beginning professionals have a very positive attitude towards ICT, value its potential contribution to education and are confident they will be able to use ICT effectively in their professional duties. While 50% of new BEd entrants consider having access to a computer at home as an essential requirement for teachers, this proportion has risen to 78% by the end of the course as the exiting students anticipate the inevitability of ‘homework’ in their professional lives.

To what extent have the course experiences exploited and built on this general enthusiasm by developing further their skills in the use of ICT and in its application for pedagogical purposes?
General Skill Levels: the BEd graduates

It wasn’t thought of as a core subject. There wasn’t any emphasis on making it part of the core, integrating it with the other subjects would be better because you would be learning IT through the subjects and through IT you would be learning other subjects. That might be a bit more interesting than just sitting down for two hours working through sheets and after an hour thinking “Och I’m away, I can’t take any more”. (BEd 4th year student)

Although the courses had advanced the basic skills of many students, particularly in the areas of word processing and use of spreadsheets, there was a significant minority who expressed dissatisfaction with their experiences. The major difficulties were associated with the time allocation, the style of delivery and the lack of integration of the use of the skills into the other areas of the course.
General Skill Levels: the PGCE graduates

The IT component of the course was very little, I think it was one lesson. I was so angry that we were at a teacher training college and the guy who was teaching us didn’t even say “Has anyone ever used a computer before?” He assumed that everyone had some level of competence. I didn’t know what an icon was, a floppy disc was. I didn’t know anything at all. It was complete gobbledygook and I was just sitting there getting angry. (PGCE Secondary student)

I’ve been using the computer for word-processing for all my resources and all my materials, and I’ve used the Internet. I’ve downloaded a lot of material from that for use in the classroom. And I’ve used spreadsheets – not for accounting or anything like that, but for making up graphs for the project, so I developed that this year. And I’ve used email as well. (PGCE Secondary student)

The major difficulty identified within the postgraduate courses was that of the diverse levels of skills brought by the students on entry to the course.

Table VI. Exiting students’ ICT-related course experiences (percentage of questionnaire responses).

The set courses appeared to be pitched to the middle level and there was wide variation in the data from different institutions on the proportion of students who indicated that the elements of the course were at about the right level – few reached 50%. Two groups of students appeared to cause difficulty for the tutors: those with skills substantially below the norm, and those with skills substantially above the rapidly rising norm who were
clearly more skilled in the use of many applications than their TEI tutors. Table VI indicates the range of differences in experiences across the different courses and institutions. Less than one third indicated that they had used electronic communications and were now confident about using them.

**The Pedagogical Uses of ICT**

It could be argued that the main focus of the courses should be primarily on the range of uses to which ICT can be put within a teaching and learning environment. To what extent did the students experience induction into or modelling of the pedagogical uses of ICT?

Well they gave you the Logo package, but there wasn’t any actual teaching on how to use it in the classroom. It was just to teach you how to use it. That’s what everything has been like. I haven’t at any point been shown how to use IT as a teaching tool. I’ve just been taught how to use IT for my own purposes. (PGCE Primary student)

I need to know how pupils learn from it. I am happy to produce worksheets for pupils to use. I do not know how to use the computer with the pupils to facilitate learning. (PGCE Primary student)

I also found it quite difficult to organise the class so that a small group were using the computers. I didn’t know if it was acceptable to have, say, three children working on the same computer. We hadn’t really been told anything about that on the course. (PGCE Primary student)

We need to spend more time exploring areas other than word processing and discovering how valuable they are when incorporated into the curriculum. (BEd 4th year student)

It was clear from the questionnaire data and from the student interviews that in none of the institutions did the courses provide the students with what they regarded as an adequate introduction to the pedagogical use of ICT. In the responses from staff, it appeared that while many encouraged students to consider the use of ICT in a number of contexts, few actually covered its specific uses in their courses, demonstrated its use or required the students to engage with ICT in curriculum-related contexts. In Table VII, for example, we present the proportions of students who had incorporated particular aspects of ICT related to the Scottish curriculum guidelines into some of the teaching materials they had prepared during their courses.
Table VII. Exiting students’ use of ICT in teaching and learning (percentage of questionnaire responses).

Learning to Use ICT on School Experience

With respect to school experience, the data shows that with the exception of text handling, only around a third have seen or used a range of ICT in the classroom (Table VIII) and a wide variety of practices in terms of technical competence and professional use had been encountered:

At placement A they were great with computers. The teachers had obviously all done something with computers. My teacher was middle aged and you wouldn’t assume she’d be au fait with computers. She had paid helpers coming in every day doing computer input with the children. They had some amazing resources there. That was very different from other schools where you saw the dusty BBC in the corner that nobody ever touched. (PGCE Primary student)

My experience in one school was slightly depressing. When we shadowed people in secondary, I discovered in one school they don’t do any computing in first and second year. They haven’t got enough seats for everybody to do Standard Grade computing who wanted to. It’s slightly depressing that for some children their primary 7 level of computing is their life skill. (PGCE Primary student)
On a few occasions, we got them to do a project so they could go down to the school library where they could use CD-ROMs. We had Encarta and one or two other encyclopaedia type of disks. So that was available, and that’s available to all. That’s not specifically science. But, having said that, it wasn’t really encouraged. Again, I suppose it’s up to me as a teacher to use it. I never saw any other member of staff taking a class down to the school library and saying “Let’s do a bit of research. You four go down just now. It’s free”. It tended to be “That’s a library. That’s for when we have an English class. You don’t go down there now.”
(PGCE Secondary student)

Table VIII. Exiting students’ use of ICT on school experience (percentage of questionnaire responses).

Review and Implications
Our data on the incoming and exiting students indicates that the level of basic technical competency of students is rising rapidly, and that the overwhelming majority of students, even on entry to their courses, have a positive attitude towards engaging with and using ICT in a professional capacity. However, while they are from the outset keenly aware of the educational potential of ICT, few consider they have been significantly advanced by their course experiences in understanding the ways in which they can realise that potential in the classroom. Only a minority are of the view that they have been given exemplification, experience or practice in the pedagogical capabilities of the technology. In few areas of the courses in
Scotland did we find outstanding or innovative practice. It is also clear from the students’ reports of their experiences in schools that it will be difficult for some time to ensure that trainee teachers see, or are supported in, the effective use of ICT on their school experience placements. Loveless (1995) and Williams (1996) report similar situations in England. Course directors in two of the TEIs indicated that initiatives to promote cooperation with local schools in the experiences offered to students had lapsed; the variety of types of ICT equipment currently in use in education was largely responsible.

The course directors are aware of the general lack of the pedagogical use of ICT within their courses, see the need for more use of ICT to be integrated into the teaching of students and are aware of staff limitations in terms of skills; however, many seem to lack the information or authority to ensure coordination, coverage and appropriate programmes of directed staff development. Institutions have offered a range of ICT courses and staff development opportunities; these were described by one course director as “opportunistic rather than organised”. In one ‘split-campus’ institution, the staff use of ICT had been heavily promoted and as a result the staff skills were markedly more advanced than elsewhere with respect to email and administration, video conferencing and visual presentations. However, the pedagogical use of ICT was no more prominent in the delivery or content of their courses than in those elsewhere. Access, training and institutional support are clearly insufficient to secure the type of changes which are required. The ‘resistance to change’ associated with the practice of classroom teachers (Underwood et al, 1996) is likely to be equally applicable to teachers who have become teacher educators and there is a need for this to be acknowledged.

The ICT policy adopted in a number of the institutions we studied appeared to have taken account of many of the factors identified as necessary for effective technology planning by many developers, e.g. Hoffman (1996) lists administrative support, availability of technology, technology use coordinator, facilities and maintenance, etc. The result is a smattering of ICT ‘integrated’ into the well-established methods and styles of delivery of the existing curriculum through modules or subject areas. Some innovative projects have been undertaken by tutors, for example, STARS, which promoted the use of ICT to network small rural schools in order to support able pupils (Ewing et al, 1997). However, these are typically undertaken by a few relatively isolated and enthusiastic individuals and are consequently of limited general impact in the teacher education courses, even within their own institutions. The majority of staff struggle to master the skills and knowledge which they feel they need in order to pass these onto students. Where the transmission model ceases to be viable because of the lack of staff expertise, students are sent off to learn from resources with
little indication of how to interact with these in ways which would make their learning focused and productive.

What is crucially absent is a reflective analysis of the future roles and the changing demands likely to be encountered by the student teachers, and the application of our understanding of educational principles to ensure that the learning needs associated with these requirements are met. Two recent studies report innovative approaches to this difficult area which are informed in this way. From Australia, Wild (1995) describes the design of a framework for ICT which is rooted in learning theory and sets out strategies which provide experiences to enable students “to learn how to use computers in their teaching, rather than how to use computers or related technology, per se” (p. 17). These strategies include “providing for student ownership of (i) knowledge; (ii) strategies; and (iii) software/courseware resources” and “providing tasks that are obviously real and meaningful and that can be owned by students ... e.g. using content-free software to create courseware that is directly transferable to school situations” (p. 16). Pellegrino & Altman (1997) report a similarly informed initiative in which the learning context was created within which students were required to use the technology to produce the instructional materials they could ultimately use in their teaching practice and in which students ceased to be “consumers” of staff expertise and became the “producers” of their own expertise.

These appear to be exemplifications of the “Fox Fire Technology” described by Muffoletto (1996) as technology applied to the development of a “humanistic, democratic, learner centered environment, controlled and directed by students and teachers” (p. 141) and which stands in contrast to the rhetoric of targets, training, investment returns and accountability mechanisms which pervades so many central government communications to the educational system. Teachers and their trainers have long professed to aspire to the learner-centred approach, but have done little, even in their own practice, to dismantle the entrenched power structures which are created through limits on the ownership of, and access to, knowledge and skills. As Somekh (1992) suggests, our bluff has now been called. The young have the skills they need to access unlimited knowledge. What is our role now? Acknowledging that we are not now the experts and that the students should now be encouraged to experience empowering learner-centred activities by deploying their ICT skills to generate pedagogical resources in ways that we have never done is a difficult challenge, but one which it is essential for teacher educators to meet.
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