

CHAPTER 5

THE PRACTICE AND PROFESSIONAL DEVELOPMENT OF TEACHERS

Teachers – with a changed and extended role – are central to the way ICT is adopted and used at the classroom and student level. The supposition that teachers might be displaced by the technology has been largely discounted, even though the media and popular opinion seem still to characterise the technology as valuable independent of teachers. Not only does this fail to understand the key role of the teacher in using ICT in schools, but by dis-empowering the teacher and stressing the technology, it undermines the educational potential of the technology itself (Selwyn, 2001). Parents may fail to support radical school reform, supposing ICT to be no more than an operational skill to be taught for vocational purposes. They see young people who feel comfortable with a mouse, a keyboard and a screen, and perhaps conclude too readily that they have the capacity and motivation to learn independently through ICT.

This chapter indicates how ICT both demands and facilitates a broader, more challenging view of teacher professionalism. It discusses the critical area of teacher professional development, both initial and in-service. If the educational investments in ICT are to reap the rewards expected of them, this must be the focus for sustained policy action. The chapter concludes with the views expressed by the students in the OECD network. They are convinced of the importance of the teacher role, and the positive impact this has when the system is supportive

and everything is working well. They offer remarkable examples of the power of ICT to transform the learning environment. It is salutary also to note their criticisms of schools and teachers when the use of ICT is not wisely planned and effected.

TEACHER ROLES AND PROFESSIONALISM

The teacher must play a central and crucial management role regarding ICT in schools. Apart from certain limited applications available through *closed* software systems, as discussed in Chapter 3, the *open* applications of ICT introduce a dynamic, interactive environment that is likely to require more routine planning, preparation and one-to-one intervention than that needed for traditional curriculum delivery. The teacher becomes manager of the learning environment – a creative, interesting, demanding and professionally rewarding role.

The teacher functions more as a tutor and facilitator, less as a lecturer. The teaching is more individualised, the move from whole-class teaching – that was already on its way – has accelerated.

Sweden (country note)

In the Netherlands, we can see a slow, but steady, change from traditional, teacher-centred education, to more richly differentiated learning environments in which the role of the teacher is becoming more supportive. The adoption of ICT in schools stimulates this change.

Netherlands (country note)

This expanded role for the teacher in a changed learning environment has considerable resource implications, in terms of staffing levels and professional development needs. Teachers will need to be able to modify their pedagogy dramatically and on a continuing basis, whereby they will become for their students role models for lifelong learning. This will not be widely attained without major and sustained commitment, and cannot in itself – as often supposed – lead to significant educational cost saving. Rather it offers the prospect of a better-quality and more inclusive learning environment, but crucial to this is the digital literacy of the teacher, the teacher's levels of ICT skill and understanding.

Teachers' pedagogical beliefs play a central role in the adoption of ICT. For the most part they incorporate ICT in the first instance by adopting those elements that serve their existing teaching style, rather than entirely changing to match

the opportunities the technology may offer. A long-term study of the impact of the Education Superhighways initiative in schools in England and Wales showed that teachers with Internet access tended not to alter their pedagogy dramatically; but did better what they had done before (McFarlane and de Rijcke, 1999). Meaningful integration of ICT beyond this threshold level involves changing teachers' beliefs, and is inevitably a time-consuming and complex process (Niederhauser and Stoddard, 2000). It takes time and resources for teachers to become knowledgeable about technology and confident enough to use it effectively in the classroom. This adds to the demands upon teachers, going well beyond ICT skills *per se*, and extending to the transformation of pedagogy, for the full educational potential of ICT to be exploited.

As we discuss in the next chapter, ICT opens up professional roles in other ways by breaking down traditional notions of school boundaries and teacher expertise. Teachers must be comfortable when working with students whose ICT skills surpass their own. A dynamic classroom will often combine materials produced by the teachers and learners themselves with those provided elsewhere – possibly on a commercial basis. For this to happen, favourable circumstances have to be created, through interaction between the makers and suppliers of educational software and their clients, the students and teachers.

Teacher networking and co-operative practice

New channels of communication are opened up by ICT, to take teachers beyond the classroom confines, as they engage in electronic dialogue with colleagues inside and outside the school system, and with parents, ICT suppliers and the wider community. This move from an individualistic and isolated concept of teacher professionalism has been identified as a prerequisite for schools to become *learning organisations*, as argued in the OECD analysis of knowledge management in education:

At the level of the individual teacher, there needs to be a psychological transition from working and learning alone, with a belief that knowledge production belongs to others, to a radically different self-conception which, in conformity with interactive models, sees the co-production of knowledge with colleagues as a natural part of a teacher's professional work. At the system level ways have to be found to bring teachers together in such activity. OECD (2000*b*), p. 74

ICT offers manifold possibilities to encourage such corporate working, but the conceptions of professional activity held by teachers shape the nature of the introduction of the technology into schools. According to Riel and Becker (2000), the extent of teacher-to-teacher discourse is linked with the way that ICT is adopted. They classify teachers on a continuum of professional engagement, from *private-practice teachers* – who engage in little dialogue or activity beyond the classroom – to *teacher leaders*, who place a high value on sharing with colleagues. In a survey of 4 000 US teachers, the teacher leaders consistently proved to be better educated, continuous learners, and computer users, who promoted student-centred methods. Those teachers who had many professional contacts with other teachers at their school were three-and-a-half times more likely to employ a strong knowledge-construction approach to learning than teachers with few contacts (CRITO, 1999a).

It is to be expected that teacher-to-teacher contact will be important in the diffusion and development of methodology. Teachers who engage in dialogue with colleagues are likely to value the views of other teachers, and accept their experiences as valid. The importance of peer views is highlighted in a US study (NCES, 2000): although teachers cited independent learning most frequently as preparing them to use technology (93%), this was closely followed by professional development activities (88%) and exchange with colleagues (87%). Such dialogue between practitioners is a mark of professionalism. The opportunities for teachers to engage in it are considerably enhanced by ICT.

E-mail communication between teachers has been slow to develop, reflecting traditional styles of working in relative isolation, with low levels of collaboration and sharing of ideas. A survey of US teachers in Spring 1998 showed that only 16% had conducted a regular e-mail conversation with a teacher in another school (CRITO, 1999b). Even among teachers who make high use of ICT, only a small proportion report increases in collaboration between teachers (Pelgrum and Anderson, 1999, p. 224). The *Northern Ireland Network for Education* provides conferencing spaces for teachers to discuss ideas and methods; use of this facility is now a required part of their initial period of training and practice.¹ Projects such as IBM's *Wired for Learning* aim to use Internet communications to strengthen links between home and school. Even when the communication networks are in place, however, it cannot be assumed that teacher-to-teacher collaboration will develop without encouragement.

1. See www.nine.org.uk.

- ➔ *Teachers are central to the successful use of ICT for school learning, in any realistic and comprehensive awareness of its huge and complex educational potential. The teacher becomes manager of the ICT-enhanced learning environment – a creative, stimulating, demanding and professionally rewarding role.*
- ➔ *Dialogue among teachers is increasingly apparent and desired, with a widespread move away from the traditional individualistic and isolated modes of operation. ICT offers manifold possibilities to encourage such corporate activity, which will promote the development and dissemination of successful learning strategies and a sharing of expertise.*

TEACHER PROFESSIONAL DEVELOPMENT

Initial professional development

The initial teacher education curriculum is often crowded, and scarcely offers space for more activity. Even so, ICT is increasingly being introduced as an element in the initial professional development of teachers. In some countries ICT skills form a compulsory component of teacher education, but in other cases it is left to the discretion of the individual institution, or made an optional part of the programme. In one instance, the Netherlands (country note), teachers are required to obtain the *European Computer Driving Licence*,² devoted to ICT skills – word-processing, presentations, the World Wide Web and e-mail. A number of countries expect beginning teachers to have developed *both* ICT skills *and* pedagogical insights for their effective use.

Canada sees many teacher-training institutions striving to balance the pedagogical implications of ICT in pre-service programmes with the need for student-teachers to learn about curriculum, teaching methods, and classroom management (country note). Norway incorporates 25 hours of instruction, guided practice and self-study devoted to ICT in the first year, after which it is an integral part of pedagogy, methodology and subject content. Subsequently, many institutions offer popular elective specialist courses in ICT, in which about half of the content relates to pedagogy (Norway, country note).

2. See <http://www.ecdl.com/index.html>. By June 2001, one million people world-wide had taken this.

An optimum balance between operational skills and an understanding of the pedagogical implications is difficult to achieve. First, however, a starting low level of technical skill among student teachers must be remedied, both because it will be a barrier to classroom use and because the pedagogical implications will make little sense without some technical competence. While initial teacher education cannot go very far in equipping teachers to evaluate educational materials or to analyse learning processes, beginning teachers need some basic pedagogical frameworks within which they can readily and enthusiastically accommodate ICT. With a good basic understanding of pedagogy, they will subsequently be able to refine their own methodology and judgement related to ICT, as they gain experience and as the technologies advance.

New-entry teachers often now bring with them a certain level of ICT expertise, whether acquired as part of their initial qualifications or through other personal experiences. Many are likely, however, to encounter senior colleagues who are reluctant to change long-established techniques, in favour of unfamiliar and unproven ICT approaches. Especially this will be so where the trusted techniques are associated with a record of success (for instance, in public examinations). Those on teaching practice may wish to introduce ICT, but find little opportunity to innovate without the encouragement of established colleagues. This indicates the importance of the informed and committed support of the school management, as discussed in the next chapter.

In-service professional development

Japan acknowledges the desirability of all teachers being able to use ICT, while recognising the wide variation in ICT skill levels among them (country note). In pursuit of such an aim, and if ICT is really to make an impact on the nature of school learning, *in-service* professional development is crucial. The scale of the task is, however, daunting. In the majority of OECD countries, most teachers are aged 40 or more (OECD, 2001a, p. 210). They joined the profession at a time when there were few computers in schools and little awareness of their potential, so apart from personal initiatives they have no background in ICT. Thus it will often happen that the senior and most influential posts in schools are held by teachers who are not themselves digitally literate (see Chapter 6). The number of teachers is very large – and accounts for the bulk of school expenditure – so the costs of providing significant professional

development for all teachers are considerable. In its current programme for implementing ICT in schools, Norway surveys the scale of the need:

A survey (...) in January 1999 shows that half the teachers had participated in courses concerning the use of ICT tools such as spreadsheets, word-processors and the Internet. Less than 20% stated that they had received training in the use of ICT as a pedagogical tool in actual teaching. Four out of every five teachers said they needed such training.

Norway (2000)

There are few direct incentives for teachers to develop expertise in ICT. Whilst to do so *may* help their prospects of promotion, for a considerable number the motivation arises from their own professionalism: they sense the importance of ICT for their schools and students, in direct relation to its widespread adoption in society. Encouragingly high levels of take-up of training in some countries, and the burgeoning demands being placed on support and advisory services, indicate the level of interest. Experience in Norway over recent years (country note) may be typical of other countries. Initially, young male teachers tended to be the first to introduce ICT into their teaching. In time, women became as keen and interest spread across all ages and all curriculum subjects, including music and physical education. This advance was helped by the greater versatility and user-friendliness of the technology with passing time.

Short in-service courses are often attended by teachers on a voluntary basis, and have been enthusiastically welcomed. Thus, during the 1997-98 school year, more teachers in the US chose to undertake professional development related to computer use than other in-service courses (CRITO, 1999*a*). In Belgium (French Community), in-service training in ICT is highly recommended but not compulsory (country note). Most schools in the Netherlands have included ICT training in their policy documents, but only a small proportion have implemented training of all teachers (country note). Even though every teacher were to attend a short in-service development course, it is unrealistic to suppose that any such one-off intervention could suffice. Given the speed of innovation in technology and methodology, teacher development must be viewed as an ongoing and integral part of professional activity (NCREL, 2000).

In the United Kingdom, £230 million has been allocated for a four-year scheme that began in April 1999, to enable serving teachers to reach the level of

ICT capability now expected of newly-qualified teachers.³ This is still only the equivalent of a little under £500 per teacher, however, and a much smaller proportion of the technology cost than would be expected in a commercial environment (Selwyn, 2000). The scheme, focused on classroom use and conducted in the classroom whenever possible, has precisely-defined aims and is offered by approved suppliers:

The expected outcomes for teachers include ensuring that teachers know:

- when, when not, and how to use ICT in teaching their subject;
- how ICT can be used in teaching the whole class;
- how ICT can be used when planning, including the use of ICT for lesson preparation and the choice and organisation of ICT resources;
- how to assess pupils' work when ICT has been used; and
- how ICT can be used to keep up-to-date, share best practice and reduce bureaucracy.

The programme from one such supplier⁴ starts with an induction day for the subject department, science in this case. Each teacher receives 36 fully-prepared lesson outlines matched to the national curriculum, in which ICT is integral, including background information and help sheets. Many of the lessons incorporate complementary software showing simulations, data analysis and modelling. Selecting from these materials, every teacher has to teach six of the lessons over a year, each followed by an evaluation sent to a personal on-line tutor. In addition to iterative support from the tutor, help is available from a Web site and another visit may be arranged to the department.

UK teachers who registered for one of these approved ICT courses became eligible to participate in a *Computers for Teachers* purchasing discount scheme, that was introduced in 2000 and subsequently extended for a further three years with increased funding.⁵ A number of countries have introduced similar schemes. The Netherlands allows a teacher to buy a computer at a reduced price (country note), and every teacher in Sweden who takes part in the national in-service training programme is given a computer (country note). This approach provides teachers with the equipment needed for lesson preparation and research, while

3. The *New Opportunities Fund*, see <http://www.canteach.gov.uk/infolict/nofindex.htm>.

4. See www.scienceconsortium.co.uk.

5. See <http://cft.ngfl.gov.uk/>.

at the same time stimulating the teachers' development of digital literacy by encouraging home use.

Engaging the entire staff of a school in thinking about ICT at the same time may offer considerable potential for facilitating classroom change. Greece is an example of a country using a *cascade* model (country note), whereby selected teachers follow university courses in both technical and pedagogical issues, and subsequently share their experience with colleagues. The approach is novel in that it goes on throughout the year, is school-based, and counts the teachers as co-developers. Courses involve dynamic participation to develop computer-based projects related to school and community needs.

In Canada, the requirement to be able to demonstrate ICT competence varies across jurisdictions, but demand for courses generally exceeds the available supply (country note). Some Canadian schools form their own school-based ICT learning communities, to facilitate ICT integration and professional development. Each teacher outlines a personal ICT professional development plan, the response to which identifies forthcoming in-service training, online resources, courses, and staff mentors who may be able to help. Regional expertise networks are being developed in the Belgian Flemish Community (country note), intended for all kinds of co-operation. In pursuing their basic purpose – to provide in-service training, along with technical and organisational support – the networks identify and use already-existing ICT expertise amongst teachers.

There has been a phenomenal uptake for 20-hour courses developed in Ireland by the National Centre for Technology in Education, covering ICT skills, classroom pedagogy and subject-specific issues (country note). Many teachers complete a course – on a voluntary basis outside school time – and return for a second or third. Additionally, a number of third-level institutions have begun to offer teachers diploma and master's degree programmes in ICT in recent years. Increasingly such courses incorporate research into school-based projects, as well as the opportunity for in-depth study of current thinking on the educational implications of ICT. They provide a further stimulus for change.

The Irish National Centre for Technology in Education maintains that teachers should themselves possess the skills to decide if a particular piece of educational software is suitable. In pursuit of that objective, it adapted the TEEM framework (see Chapter 3), *both* to establish teams for software evaluation *and* to be a component of all relevant in-service ICT courses. The development was piloted over a ten-month period, with more than one hundred teachers receiving training on using the evaluation framework. Following modifications

arising from the pilot, classroom evaluations of two hundred digital-content items were planned for 2001, with a Website *Software Central* to be developed for giving access to the findings. The framework is to be expanded to include content-free software and the World Wide Web.

Within in-service activities, Irish teachers learn how to use the TEEM-based evaluation framework and have an opportunity to evaluate educational materials. The Irish teaching profession has embraced the evaluation process, which augments their capacity for professional judgement and empowers them to make key decisions regarding the learning environment for which they exercise responsibility. Software publishers are also supportive and have provided evaluation copies of their materials to all evaluators. Multiple copies of a summary booklet⁶ have been freely circulated to all colleges of education and university education departments. Many faculties are integrating the approach into existing courses and providing a copy of the booklet for all new teachers. It seems entirely appropriate that ICT, which is the *object* of professional growth, can at one and the same time provide the *medium* through which such growth is achieved, in collaboration with colleagues and other partners.

- ➔ *Increasingly, ICT is being introduced into the already-crowded programmes of initial teacher education. In the first instance, the aim is to equip beginning teachers with key ICT skills, relating to word-processing, multi-media and presentations, the Web and e-mail. More ambitiously, some systems also want beginning teachers to have addressed strategies for using ICT in their teaching.*
- ➔ *For ICT to make a genuine impact on the nature of school learning, in-service professional development is crucial. As education is such a large, labour-intensive sector, the costs of ensuring this on a continuing basis for all teachers are considerable. Such investments must be made, however, as without them the strategies for effective technology integration into schools cannot succeed.*
- ➔ *Promising approaches to in-service development include providing teachers with subsidised or free ICT equipment, and the development of whole-school strategies. It may be especially fruitful when ICT is both the object of professional growth and the medium through which it is achieved. Despite a lack of incentives for participation, some programmes have enjoyed overwhelming popularity.*

6. NCTE (2001), *Evaluating Educational Software: a Teacher's Guide*, Dublin.

TEACHERS AND ICT THROUGH THE EYES OF THE STUDENTS

In probing the practical realities of how ICT has been introduced to education, its effects, and potential – realised and unrealised – whom better to ask than the students themselves? Those who have passed through secondary school over the past decade have lived within these changes and have first-hand experience of the developing use of ICT in the classroom. Unlike their teachers – and their parents – they take computers for granted and generally know more about them. Often, it is they who take the lead at home when it comes to choosing computers and other equipment. Many have the imagination and vision to see what could be done with ICT to make dramatic changes in the possibilities for learning. They have the fresh perspective of the young to observe critically what has been and is being done, and are frank in their observations.

The student criticisms seem often to focus on teachers, but should more properly be seen as directed to the system, within which teachers can only function effectively with ICT when fully supported to do so. They recognised that many teachers had not enjoyed the opportunity for professional development, and saw an urgent need for this to be rectified. There were big differences between their teachers in regard to their aptitude for ICT and their use of it. In one school, most of the teachers were seen by their students to find ICT exciting and useful, but this was not the norm. A perceptive student observed the double advantage that accrued to the students who possessed their own laptops *and* were in classes taken by teachers who were enthusiastic about ICT.

In my school, there is a big difference between teachers who know about the pedagogical use of computers, and the others. Teachers need to learn how to use computers in order to deliver quality in their teaching.

You will always have teachers who want to learn about computers in education and others who do not. In reality it is this which makes the big difference in the classroom.

In some science classes, teachers made little movie presentations to explain concepts like chemical reactions or processes in the human body. In other classes where the teachers were not as well trained, the computer and other equipment sat in a corner getting dusty.

Participants in OECD International Student Network

The students were uniformly agreed on the importance of teacher skill and enthusiasm if the potential of ICT to enhance learning is to be realised. Not surprisingly, they confirm that a well-planned course incorporating ICT needs competence on the part of the teacher in respect of the subject matter – its sequencing and presentation – along with familiarity and fluency in the use of current technology. Teachers in one school had successfully introduced ICT to make for a better-structured learning environment, which was obviously warmly welcomed by the students, as offering a range of useful information and examples of high-quality work:

Teachers often put educational materials on the homepage, such as essay topics, books to read, and sometimes information about where we can find more data related to specific issues. For example, in history we were asked to choose an essay topic from a list prepared by our teacher. On the teacher's homepage, we could see the books he recommended for use with each topic. Teachers also post on the homepage our essay marks and mid-term test results (...). Sometimes student essays and other work are put on the Internet, when the teacher finds one essay better than the others, so that other students have good examples to follow.

Participant in OECD International Student Network

One student reported an excellently structured biology module, which encouraged co-operative learning, was highly motivating, and left the teacher free to respond to student queries as they arose. The innovative character of the learning method was welcomed by the students, as was the software clarity, ease of use and elements of humour! It had a clear overall objective:

In our Biology course, to study the nervous system we used software designed by teachers. Guided by a structured brochure (paper), we performed computer exercises from which to deduce the concepts to be learned. The computer brought the usual biology scheme alive, whereby students understood better. The Biology teacher, who was well-informed about informatics, and this software in particular, was available to the class throughout. Students worked in pairs, which encouraged mutual help, both for biology and informatics. The work led to a report given to the teacher a few days later.

Participant in OECD International Student Network

It was observed how much it helps the motivation to learn when the teacher is excited about using ICT, but some teachers admitted during lessons to knowing less than their students, and were not enthusiastic. A student felt this was directly responsible for inattention in class. Many students saw their teachers – the older ones especially – as somewhat afraid of the new technology and therefore resistant to it. There is a policy issue here to be grasped, since more than 70% of the secondary teachers in Germany, Italy, the Netherlands and Sweden are aged over 40 years, and a considerable proportion of these much older (OECD, 2001*a*); for most other countries the problem may not be as severe, but still has to be faced.

One student expressed regret that the computers in the classroom remained unused. In another school, it was estimated that only the teachers of informatics were experienced in using ICT, and even these did not escape the strictures of their students: the lessons were built around out-dated programming languages, that were seen to be neither useful nor enjoyable. In consequence, students associated negative experiences with informatics, and those who were computer-phobic remained unimpressed. Technology advances rapidly, and there will be a continuing need to up-date expertise.

In the cases where CD-ROMs did not work well in lessons, it was not just the programmes themselves, nor that the students were inexperienced; it was mainly because teachers had no idea about how they were going to use them in the subject. I know it sounds terrible, but that is the way it was most of the time. Students are much more comfortable than teachers in using ICT.

Participant in OECD International Student Network

There was some sympathy for the teachers, in recognition that most at that time had never had specific professional development in this area, but a feeling that this had to change. Moreover, the necessary change was not simply professional development for the teachers, but a radical shift in outlook and motivation.

What role might the more experienced students themselves play in meeting these shortcomings? Those who had used ICT extensively out of school had an advantage over their peers – and often, indeed, over their teachers. Some students thought it important to insist on cooperation between the more and the less skilled: one went so far as to criticise the teachers for not actively pursuing such a policy. Others, however, remained cautious, aware that the skilled students

would need patience, that they risked becoming frustrated and would in any case not necessarily make good teachers. The “computer freaks” might take care of all the ICT work in a group project, but then have no time to do anything else, while the others would never learn to use computers. This would be detrimental for all. In addressing this problem, the students themselves re-staged the arguments that have traditionally been put forward for mixed-ability teaching, or sorting into ability groups.

At least as an interim measure, it may be advantageous for an institution to make use of the exceptional ICT skills possessed by certain of its students, particularly those who show some teaching flair. Perhaps they might be employed as instructors, especially when the institution is open outside normal hours, thereby gaining some modest honorarium. They might welcome this part-time employment – something many students are obliged to seek – that is of direct benefit to their community. The arguments for using such students as instructors within their own educational programme are less clear. Any such innovation would have to be carefully justified, in terms of educational objectives appropriate to themselves.

- *The students in the OECD network give dramatic illustrations of the power of ICT when wisely and imaginatively used to transform the learning environment.*
- *The centrality of the teacher is confirmed by the students, if ICT is to contribute to an effective learning environment. They were clear on the importance of teacher enthusiasm and skills, and familiarity and fluency in the use of current technology, in association with skilful application of ICT within their subject expertise.*
- *The students may use their own ICT expertise to enrich the learning environment, sometimes helping their peers and their teachers, contributing to the development of materials, and in certain circumstances being employed part-time in support of training or maintenance.*