

## Pedagogic Benchmarks for Information and Communications Technology in Teacher Education

Henny P.A. Boshuizen & Iwan G.J.H. Wopereis

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## **Pedagogy of Training in Information and Communications Technology for Teachers and Beyond ...**

**HENNY P.A. BOSHUIZEN & IWAN G.J.H. WOPEREIS**

*Open University of the Netherlands, Heerlen, Netherlands*

**ABSTRACT** This article analyses the required content and strategies of information and communications technology (ICT) training for teachers in terms of learning to know, learning to do, learning to live with each other and with others, and learning to be. We conclude that the fast-changing role and nature of ICT in education, combined with the low level of penetration of ICT into present educational practices, requires a strategy that includes three aspects. These aspects are the training of students within teacher training institutions, the high-level implementation of ICT in schools as a joint effort by students, schools and teacher training institutions, and the formation of cooperating communities of practice to ensure the continued flow of emerging knowledge and practices to the educational field. Special attention should be given to unwanted and unforeseen side effects that may affect pupils' lives today and in the future.

### **Introduction**

According to the International Commission on Education for the Twenty-first Century (1996), education has four main domains in which it must help the new generation to prepare for their future role in society and for life. These domains are learning to know, learning to do, learning to live with each other and with others, and learning to be. This applies to education in general as well as specifically to information and communications technology (ICT) learning in education.

ICT is a rapidly developing field, which is the reason that preparing teachers for their role in helping youngsters and young adults to become skilled and versatile ICT users can be quite difficult. It is even more difficult to learn how ICT affects all aspects of human life than to learn the subject matter itself. An example of such unexpected effects popped up while the authors were working on this article. A German television programme on SAT3 posed questions such as: suppose you die, who will become the owner

of your web site. In the following article we try to unravel the implications of these developments for the pedagogy, content and planning of teacher training for ICT in education.

### **Learning to Know**

Helping pupils and students to learn to know is not easy when we are dealing with ICT. The introduction of ICT has changed both the process of learning and the content to be learned in many ways. ICT is not only a matter of equipment, computers and informatics; we are also moving towards an information and communication society, affecting all aspects of life, work, and play. Also, the disciplines taught in schools and universities are changing as a consequence of these new technologies; depending on the domain new tools have been developed that are instrumental to the domain and to working in that domain. For instance, ICT has brought new tools for analysis as is the case in DNA research and remote sensing, new tools for documentation such as word processors, databases and spreadsheets, and new tools and strategies for searching databases such as the visible web (using search engines and subject directories) or the invisible web (by consulting specific databases like *Librarians Index*, *AcademicInfo* and *Infomine*). Also, ICT is changing the scale of analysis both in breadth and depth (e.g. the increasing amount of data that can be dealt with has changed the face of astronomy or DNA research), it has changed the process of text composition from linear writing to parallel text processing, it has given rise to new metaphors like the information processing metaphor that has changed psychology, and it has given birth to new methods (such as in mathematics). These changes all influence the way these disciplines develop and how they are being taught. The introduction of the graphical calculator in mathematics education has changed the face of high-school maths from an elegant science grounded in theorem proof to a toolbox grounded in processing power. Developments like these also have indirect and unexpected influences on other domains of life, such as the cold cases in crime that are now being reanalysed using large databases and DNA technology. Many of these effects are unexpected and unintended and have both desirable and undesirable aspects. It takes some time before these indirect effects become apparent.

Not only do disciplines and their applications change, but the resources that are available to study also change due to ICT. This is especially the case with respect to the privilege of access to knowledge. At first, knowledge could only be found at 'protected sites' such as libraries and teachers' heads, which were protected in more than one way. Access was often regulated by school enrolment or membership cards, while the quality of what was offered was controlled by inspection agencies and councils. Think of school boards in the United States that determine what books are

fit to be part of a school library collection. These resources remain available, but are complemented by open Internet sites, which are available from everywhere for everyone. This means that learning may change in two ways: the answer to learning goals is no longer only found by asking an authority (either in person or in the form of a recommended book) but also on the Web; as a consequence students must learn how to search, and maybe more importantly, they must learn how to determine the relevance and the quality of the information found (Marchionini, 1999; McKenzie, 1998; Shapiro & Hughes, 1996).

The implications that these developments will have for educating and raising new generations are hard to keep track of, let alone predict. The faster things develop, the fewer ready-made products, procedures or teaching principles will be available. Things are even more complicated because present learning generations have their own stake in this process. The Internet, with its easily accessible resource repositories, is heavily used for school and hobbies (for downloading music files, book summaries and all kinds of reports, all of unknown quality and through legal and illegal services). Finally, students are increasingly using facilities such as chat rooms, communities, SMS (short message service) sites, etc. In this respect they may have more experience than their teachers.

### **Learning to Do**

ICT has provided society with a large variety of new tools. At first many of these tools were improvements on the old office automation tools: calculators and accounting systems, typewriters and copiers, filing systems, telecommunication tools, etc. They were efficient substitutes for products and processes that already existed. These were soon followed by innovations which changed the way we did our work, such as desktop publishing systems, graphical and drawing programs, and library and bibliographical systems, integrated into large packages with added features such as spelling checkers. Finally, certain activities were either transformed into completely different ones, or new and until recently unknown activities were 'born'. Examples are mindtools, which have been developed to support our intellectual or creative work (Jonassen, 2000; see also the article in this issue by Kirschner & Wopereis). Outlining and brainstorming tools, concept mapping, and argumentation mapping for individuals or in collaborative situations are examples. Pupils and students must learn when and how to use these tools; which ones, apart from the 'general' and learning tools, will largely depend on their field of studies. Teachers must learn when and how to use these tools for carrying out their profession.

### **Learning to Live with Each Other and with Others**

ICT and its penetration into daily life has changed the face of society. It changes the way we work, for the younger generation maybe in a faster way than for grown-ups who act as teacher trainers. I see my daughter working on a paper for school, and simultaneously searching the Internet and chatting with her friends about the paper they are working on and emailing parts to and fro. Needless to say, parts of the chat are just small talk, taking a considerable proportion of the chat time, but in essence a true example of multitasking. Ph.D. students are seen doing similar things in a more sophisticated way, synchronously and asynchronously working together, sometimes over long distances, choosing media that best suit their purposes.

The introduction of the Internet, cell phones and SMS is even changing interpersonal relations. Ten years ago, telecommunication between teenagers was largely supervised by adults, in the sense that parents knew when there was someone on the phone and often knew who it was. Nowadays, many households have Internet access and many children and adolescents in Western and Asian countries have their own cell phones; hence they can communicate with friends any moment they like, unless parents and schools are able to negotiate or enforce certain rules of conduct. The 'disembodied nature' (Dreyfus, 2001) of the use of these new media and the very fact that they enable unsupervised and unnoticed communication have a liberating and disinhibiting effect, which children and adolescents may heartily welcome, but which have several unpleasant side effects as well. (The term 'disembodied nature' has several connotations: disengaged, anonymous, invisible, no personal involvement, no emotional involvement. All aspects contribute to the negative effects described, not only because they lower the threshold for action, but also because they remove the 'danger signals' associated with the approach of an unfamiliar or hostile human being.) For example: SMS has added an extra dimension to courting ('you just SMS 'CU2nite 0/ XXX' and you send a message you would not even dream of saying', an 18 year-old boy says), but this also makes it much easier to break up a relationship (the same boy was dumped by his girlfriend via SMS). Children can easily communicate with other children about whatever topic they have a common interest in, but the disembodied nature of chatting makes it very easy to present oneself in a more favourable way, which makes it very difficult for the other to discriminate between friend and foe. This is a feature that is taken advantage of by paedophiles, who parade as contemporaries in chat rooms that are frequented by children, and married people who pose as single people. Many are not aware of this. Other examples are the new ways of harassment through email or SMS. At this moment it is even possible in the Netherlands to use a commercial service for it; the SMS 'tormenting line' will send all your funny or nagging messages to whomever you want.

## **Learning to Be**

Learning to be is the field of identity development, self-fulfilment, finding your place under the sun, and finding, planning and deciding your way to a future that might best realise your potential as a human being. Since a human being is always part of a group and of society, learning to be is strongly linked with the previous paragraph regarding ethics and social interaction. Many policy documents link self-fulfilment to community development and citizenship and emphasise skills as literacy, ICT literacy and numeracy. This type of learning, possibly more than the other three, has become a question of lifelong learning (Department for Education and Skills, 2002a, 2002b).

## **Implications for Teacher Training Pedagogy**

The main message emerging from this analysis is that ICT itself and its influence on all aspects of society is emerging and evolving so quickly that teacher training cannot be simply characterised as aiming at a moving target. It is rather Hercules fighting the Hydra, the many-headed monster with the body of a serpent and nine heads, where cutting one head results in the emergence of two new ones. In this case new heads materialise, not as a result of the fighting being done, but as a spontaneous process. In such emerging fields, the role of the teacher as a helper in knowledge construction, as a trainer, as a coach, as a role model, as a person who can be trusted, and as a liaison between the adult world and the community on the one hand, and the children's and adolescents' world on the other, is hard to define and will change from day to day and from occasion to occasion. These changes occur so fast that teacher training pedagogy is only a part of the answer to keep teachers and their environment best prepared for those tasks.

The community that deals with the topic of ICT in education largely agrees on the topics that teachers should be able to deal with. They should be competent personal users of ICT, competent users of ICT as a tool for teaching, competent users of ICT as a mindtool, master a range of educational/pedagogical paradigms that make use of ICT, master a range of assessment paradigms that make use of ICT, understand the policy dimensions of the use of ICT for teaching and learning, and finally have insight into more far-reaching implications of ICT for schools, schooling and society. In their research into good practice in teacher training, Kirschner & Wopereis (2002) found that most of the programmes which can be considered to be examples of good practice cover these topics to a large extent. The first four are found in most of them (between 95 and 100% of the programmes), while the other topics have a presence in between 71 and 91%.

We also find a clear trend in the way teacher training institutions teach these skills and insights. The programmes chosen as best practice conform largely to the ideas of modern constructivist education and learning, where learning is seen as an active process by the student and where a balance is required between learner support and teacher guidance. Hence instruction is seen as supporting the students' knowledge construction rather than communicating knowledge. In line with this assumption is the programmes' underlying psychology of learning, which is cognitivist rather than behavioural. The programmes are contextualised in that they are designed in line with modern insights that state that learning in relevant contexts improves the possibilities of transfer. Learning in context promotes the possibility that something that has been learned on one occasion can be applied in another, provided that measures are taken to help students to differentiate between relevant and irrelevant context and develop a deeper insight into underlying principles and conditions for application (Perkins & Salomon, 1988; Van Merriënboer et al, 2003). The programmes are quite flexible, so that modifications can be easily introduced, which is a prime necessity in a field that changes as fast as ICT does. Most programmes also have possibilities for students to fulfil their personal needs: they are sensitive to individual differences in skill and personal interest and needs; much is under the control of the learner and a broad range of user activities are supported. Another important aspect is that most programmes have in-built facilities to support cooperative learning. Sharing experiences and actively learning from each other does not only broaden and deepen the learning outcomes, it also leads to reflection and the development of metacognitive skills (Palincsar & Brown, 1984). When this is done with a computer-supported cooperative learning or computer-supported cooperative work environment, students also learn how to use these instruments and can use them in their own lessons. Finally, most programmes are characterised as having the issue of cultural sensitivity integrated. Contrary to the previous aspects that emphasise the learning process and its efficiency, this is a topic that deals with the aspect of 'learning to live with each other' and how future teachers can learn to play a role in that aspect. An example is the Ulster case in Northern Ireland, where as part of their experience of ICT, some student teachers have been involved in tutoring pupils in citizenship using a combination of video and computer conferencing; others have been working in schools that are involved in a major cross-border ICT project called 'Dissolving Boundaries through Technology in Education'.<sup>[1]</sup> This project links schools in Northern Ireland with those in the Republic of Ireland and offers pupils the opportunity to undertake curriculum-based work using ICT as the main channel of communication. This integration is both the strength and the weakness of such an approach. Cultural sensitivity can only be dealt with as an integrated part of a bigger whole, but at the same time requires the undivided attention of the teacher and students at least at some time during

a project to fully grasp the integrated message. Due to time pressures, such integrated learning goals often remain implicit and hence run the risk of neglect.

### **Implications for ICT Training Pedagogy**

With this overview in mind, we come to a couple of conclusions. First, apart from the fast-changing quality of ICT there are no major differences between ICT training for (future) teachers and training for any other training strategy in any other domain, for example problem-based learning in medicine (Evenson & Hmelo, 2000).

Second, for initial training this strategy might suffice, but in so fast-changing a field a more extended strategy is needed. Such a strategy should have two goals: the first goal should be to prevent skills obsolescence (de Grip & van Loo, 2001), and the second should be to get a handle on emerging developments that should be incorporated into education and training.

Prevention of skills obsolescence due to rapid changes in the workplace requires that training prior to entering the workforce should be as brief as possible. This period should be followed by advanced competence development in the workplace; in the schools in this case. In 1992 the United Kingdom Association for Information Technology in Teacher Education, the National Association of Advisers for Computers in Education and the National Council for Educational Technology proposed a framework for competence development that seamlessly fits this proposal. It describes a path that starts in the initial teacher training institution but extends into professional life where learning by doing and continuing professional development should ensure further growth.

Unfortunately, schools do not always provide or even have the technical and educational ICT environment that is needed for further professional development. For that reason projects such as the 'Galileo' project (Jacobsen, 2001a, 2001b; Jacobsen et al, 2001) that include an outreach service from the teacher training centres to the schools, are very important initiatives.[2] In this way schools, training centres and students jointly innovate, provide good training places and develop skills and procedures at the same time.

Since the primary goal of such enterprises is innovation, precautions should be taken to learn from them and to make the result of such joint projects explicit and to transfer them from one situation to another. John Seely Brown and Paul Duguid (2000) emphasise the necessity of the organisation of communities of practice where members develop and share implicit and explicit knowledge and skills. Over the lifetime of such a community, implicit and explicit individual knowledge and skills increase, and so does the shared part. This happens as a result of joint problem solving (the tacit segment of the knowledge dimension) and reflection on



successful and unsuccessful experiences. According to Wenger (1998) and Schank (1997), this sharing process is grounded in story telling. These stories, success and horror stories alike, are told following a standard format. Each 'war story' is told as vividly as possible and ends in a credo that can form the basis of lessons learned that can culminate in best practice.

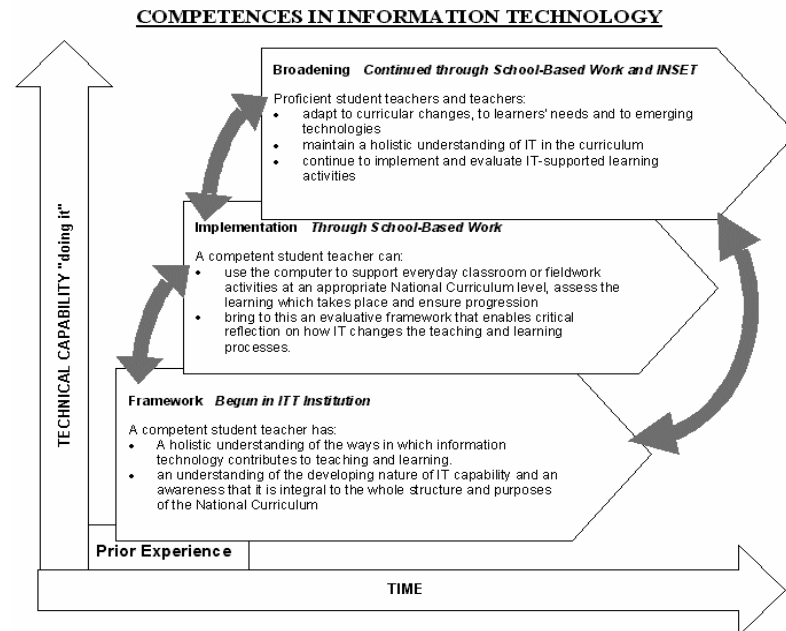


Figure 1. Competences in information technology (from *Competencies in Information Technology*, by the Association for Information Technology in Teacher Education, the National Association of Advisers for Computers in Education and the National Council for Educational Technology, 1992. Reprinted with permission of the authors.)

Within a community, sharing and learning from each other is more or less guaranteed though not automatic. However, how can one keep track of developments that take place in communities of practice that one is not part of? In order to see the implications of these developments for education and teacher training, other arrangements must be made. In brief this can be done in two ways: either central objects are shared between communities (e.g. two communities let children use digital video for their projects) or one or a few persons participate in both communities and function as 'knowledge brokers' (Brown, 2002). As long as one community is not aware of the other, or of the importance of the other, these methods will not work. And when one community has the advantage of not sharing with others, it will be even more difficult to find out which developments are taking place.

Maybe this unawareness is the most dangerous enemy. Therefore the educational field should find strong partners with the same concerns, and form communities within or across educational institutions and other parts of society. By doing so the flow of knowledge about recent developments to the educational field can be improved, but the main focus should be to develop a good grip on emerging, unwanted side effects that influence the educators' task in helping future generations learn to be and learn to live with each other. Neglect in this respect will not only affect their future but also all other present learning since in the best case they will develop naïve and unworldly beliefs about life 'out there', and in the worst case safety in schools will also be at risk.

Finally, the sooner ICT loses its status as something special and the sooner it becomes fully integrated in all normal tasks in teacher training, the better it is. As Kirschner & Davis indicate in this issue, in the end talking about computer-assisted learning should be as strange as talking about book-assisted learning. The best way for future teachers to learn to use these tools is to work with them on a day-to-day basis, walking the walk instead of merely talking the talk.

### Note

- [1] Dissolving Boundaries through Technology in Education - <http://www.dissolvingboundaries.org/>  
The Northern Ireland Network for Education - <http://www.nine.org.uk>  
University of Ulster School of Education - <http://www.socsci.ulst.ac.uk/education/>
- [2] Galileo Educational Network Association - <http://www.galileo.org>

### Correspondence

Henny P.A. Boshuizen, Open University of the Netherlands, PO Box 2960, NL-6401-DL Heerlen, Netherlands (els.boshuizen@ou.nl).

### References

- Association for Information Technology in Teacher Education, National Association of Advisers for Computers in Education & National Council for Educational Technology (1992) *Competencies in Information Technology*. Coventry: National Council for Educational Technology (now the British Educational Communications and Technology Agency).
- Brown, J.S. (2002) An Epistemological Perspective on Organisations and Innovation - how can organisations afford knowing? Keynote address presented at the Third European Conference on Organisational Knowledge, Learning and Capabilities, Athens, 5-6 April. Available on-line at: <http://www.alba.edu.gr/Uploads/Browntalk.pdf>

- Brown, J.S. & Duguid, P. (2000) *The Social Life of Information*. Boston: Harvard Business School Press.
- Department for Education and Skills (DfES) (2002a)  
<http://www.dfes.gov.uk/keyskills/>
- DfES (2002b) *Education and Skills: delivering results, a strategy to 2006* [on-line]. Available at: <http://www.dfes.gov.uk/delivering-results>
- Dreyfus, H.L. (2001) *On the Internet: thinking in action series*. New York: Routledge.
- Evenson, D.H. & Hmelo, C. (2000) *Problem-based Learning: a research perspective on learning interactions*. Mahwah: Lawrence Erlbaum.
- Grip, A. de & Loo, J. van (2001) The Economics of Skills Obsolescence: a review, *Tijdschrift voor Arbeidsvraagstukken*, 13, pp. 213-221.
- International Commission on Education for the Twenty-first Century (1996) *Learning: the treasure within. Report to UNESCO of the International Commission on Education for the Twenty-first Century*. Paris: UNESCO.
- Jacobsen, D.M. (2001a) Building Different Bridges: technology integration, engaged student learning, and new approaches to professional development. Paper presented at AERA 2001: What We Know and How We Know It, the 82nd Annual Meeting of the American Educational Research Association, Seattle, 10-14 April. Available on-line at: [http://www.ucalgary.ca/~dmjacobs/aera/building\\_bridges.html](http://www.ucalgary.ca/~dmjacobs/aera/building_bridges.html)
- Jacobsen, D.M. (2001b) *The Galileo Network – case-specific report executive summary. A report on the Galileo Network case study for the Office of Learning Technologies (OLT) evaluation of learning technologies initiatives in continuing professional development (CPD)*. Principal Investigators: Dr. Bert Einsiedel & Dr. Stanley Varnhagen, University of Alberta. Available on-line at: [http://www.ucalgary.ca/~dmjacobs/papers/gena\\_olt\\_exec.html](http://www.ucalgary.ca/~dmjacobs/papers/gena_olt_exec.html)
- Jacobsen, M., Clifford, P. & Friesen, S. (2001) New Ways of Preparing Teachers for Technology Integration: what we did and how we did it. Paper presented at the Prairie Conference on Women in Science and Engineering, Calgary, October. Available on-line at: [http://www.ucalgary.ca/~dmjacobs/papers/prairie\\_wise\\_2001.html](http://www.ucalgary.ca/~dmjacobs/papers/prairie_wise_2001.html)
- Jonassen, D.H. (2000) *Computers as Mindtools for Schools: engaging critical thinking*, 2nd Edn. Upper Saddle River: Merrill.
- Kirschner, P.A. & Wopereis, I.G.J.H. (2002) *ICT3 Information and Communication Technology for Teacher Training: pedagogic benchmarks for teacher education*. Heerlen: Open Universiteit Nederland.
- Kirschner, P.A. & Wopereis, I.G.J.H. (2003) Mindtools for Teacher Communities: a European perspective, *Technology, Pedagogy and Education*, 12, pp. 107-126.
- Marchionini, G. (1999) Educating Responsible Citizens in the Information Society, *Educational Technology*, 39(2), pp. 17-26.
- McKenzie, J. (1998) Grazing the Net: raising a generation of free-range students, *Phi Delta Kappan*, 80, pp. 26-31.
- Palincsar, A.S. & Brown, A.L. (1984) Reciprocal Teaching of Comprehension Monitoring Activities, *Cognition and Instruction*, 1, pp. 117-175.

- Perkins, D.N. & Salomon, G. (1988) Teaching for Transfer, *Educational Leadership*, 46, pp. 22-32.
- Schank, R. (1997) *Virtual Learning: a revolutionary approach to building a highly skilled workforce*. New York: McGraw-Hill.
- Shapiro, J.J. & Hughes, S.K. (1996) Information Literacy as a Liberal Art: enlightenment proposals for a new curriculum, *Educom Review*, 31(2), <http://www.educause.edu/pub/er/review/reviewarticles/31231.html>
- Van Merriënboer, J.J.G., Kirschner, P.A. & Kester, L. (2003) Taking the Load off a Learner's Mind: instructional design for complex learning, *Educational Psychology*, 38, pp. 5-13.
- Wenger, E. (1998) *Communities of Practice: learning, meaning, and identity*. Cambridge: Cambridge University Press.

