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Summary

To increase and improve the use of ICT in the classroom, a range of obstacles that prevent teachers from using ICT effectively need to be overcome. This report aims to identify these barriers and examine their causes and effects.

Key barriers to using ICT

- lack of access to appropriate ICT equipment
- lack of time for training, exploration and preparation
- lack of models of good practice in ICT
- negative attitudes towards computers in education
- computer anxiety and a lack of confidence
- fear of change and a lack of personal change management skills
- unreliable equipment
- lack of technical, administrative and institutional support.

What the research says about barriers to the use of ICT in teaching

This report is based on an analysis of current research about the barriers to the effective use of information and communications technology (ICT) in teaching. It summarises the key findings and suggests resources for further reading.

For the purposes of this report, a 'barrier' is defined as any factor that prevents or restricts teachers' use of ICT in the classroom.

This report will consider barriers to the use of ICT specifically affecting in-service and pre-service teachers rather than pupils or the wider population. The barriers under consideration here include:

- resource-related factors
- factors associated with training, skills, knowledge and computer experience
- attitudinal and personality factors
- institutional and cultural factors.

'ICT' is used as an umbrella term throughout this report. Much of the literature considers only the use of computers, though many of the factors identified are likely to be of relevance to other aspects of ICT.

Similarly, although this report focuses on barriers to the use of ICT in teaching, many of the issues will also apply to teachers' use of ICT for administrative purposes.

Key research evidence about barriers to the use of ICT

On the basis of Becta's analysis, the following barriers to the use of ICT in teaching have been identified. References for further reading are supplied alongside most of the findings.

The barriers identified in the literature can be broadly grouped into two levels: those relating to the individual (teacher-level barriers) and those relating to the institution (school-level barriers). Although this may be a useful distinction to make in beginning to address the subject, the literature points to a complex interrelationship between school-level and teacher-level barriers, and between the barriers within those levels. These relationships are explored in more detail in the section 'Explanation of findings'.

About Becta's 'What the Research Says...' series

This series of briefing papers is designed in particular for teachers, ICT co-ordinators and school managers, in order to provide an initial idea of the available research evidence for the use of ICT in schools and colleges. We welcome feedback and suggestions for further titles in the series (contact details can be found at the end of this briefing).

Teacher-level barriers

- lack of time — for both formal training and self-directed exploration (Fabry & Higgs 1997), and for preparing ICT resources for lessons (Preston *et al.* 2000)
- lack of self-confidence in using ICT (Pelgrum 2001)
- negative experiences with ICT in the past (Snoeyink & Ertmer 2001)
- fear of embarrassment in front of pupils and colleagues, loss of status and an effective degrading of professional skills (Russell & Bradley 1997)
- classroom management difficulties when using ICT, especially where pupil-to-computer ratios are poor (Drenoyianni & Selwood 1998; Cox *et al.* 1999)
- lack of the knowledge necessary to enable teachers to resolve technical problems when they occur (VanFossen 1999)
- lack of personal change management skills (Cox *et al.* 1999)
- perception that technology does not enhance learning (Yuen & Ma 2002; Preston *et al.* 2000)
- lack of motivation to change long-standing pedagogical practices (Snoeyink & Ertmer 2001)
- perception of computers as complicated and difficult to use (Cox *et al.* 1999).

School-level barriers

- lack of ICT equipment (Pelgrum 2001; Guha 2000), and the cost of acquiring, using and maintaining ICT resources (Cox *et al.* 1999)
- lack of access to ICT equipment due to organisational factors such as the deployment of computers in ICT suites rather than classrooms (Fabry & Higgs 1997; Cuban *et al.* 2001)
- obsolescence of software and hardware (Preston *et al.* 2000)
- unreliability of equipment (Butler & Sellbom 2002; Cuban *et al.* 2001)
- lack of technical support (Preston *et al.* 2000; Cox *et al.* 1999)
- lack of administrative support (Albaugh 1997; Butler & Sellbom 2002)
- lack of institutional support through leadership, planning and the involvement of teachers as well as managers in implementing change (Larner & Timberlake 1995; Cox *et al.* 1999)
- lack of training differentiated according to teachers' existing ICT skill levels (Veen 1993)
- lack of training focusing on integrating technology in the classroom rather than simply teaching basic skills (VanFossen 1999).

Becta ICT barriers survey

Becta has been gathering data on the ICT barriers currently perceived by teachers. The data was collected through a questionnaire available online and on Becta's stands at the BETT Show and Education Show in early 2003.

170 individuals completed the questionnaire, many of them citing more than one barrier, so the total number of suggestions was 226. The numbers of survey responses for each item are as follows:

Lack of confidence	48
Lack of access to quality resources	47
Lack of time	37
Lack of effective training	34
Technical problems	30
Lack of personal access	11
Age	4

This is only an initial survey, and the relatively small sample means it cannot be assumed to be representative of the views of the teaching population as a whole. Nevertheless, it provides an interesting complement to the research literature and indeed echoes many of the findings of refereed studies.

The survey is ongoing and can now be completed on the Becta Research website at <http://www.becta.org.uk/research/contributions/>

Explanation of findings

This section explores in greater depth the barriers identified in the literature, the reasons behind them, and the relations between them.

External and internal barriers

Many authors categorise barriers as external (first order) or internal (second order). First-order barriers include lack of equipment, unreliability, lack of technical support and other resource-related issues; second-order barriers include both school-level factors such as organisational culture and teacher-level factors such as beliefs about teaching and technology, and openness to change (Snoeyink & Ertmer 2001).

A lack of equipment is the highest rated barrier internationally (Pelgrum 2001), often cited even in well-resourced countries. Indeed, one study (Guha 2000) found that teachers who used technology most were more likely to complain about a lack of equipment. It would appear therefore this is less a barrier to the introduction of technology than to its use in creative and innovative ways.

While these first-order barriers are clearly significant, research suggests the importance teachers attach to them can reflect their own second-order barriers (Ertmer *et al.* 1999). In particular, teachers' beliefs about the relevance of ICT to their subject can magnify or reduce the effect of practical difficulties they may encounter. First-order barriers may even mask second-order barriers: perceptions of computers as difficult to use may be as much to do with lack of confidence as with the hardware or software itself (Snoeyink & Ertmer 2001). It is impossible to separate first-order from second-order barriers, or barriers at the teacher level from those at the school or policy level (Mumtaz 2000).

Attitudes

Attitudes towards ICT, therefore, can be barriers in themselves and can influence or be influenced by other barriers. One study (Fabry & Higgs 1997) divided attitudes into three groups: self-confidence with ICT, perceived relevance of ICT, and innovativeness. Although attitudes partly depend on personality (Guha 2000), the importance of previous computer experience is widely recognised (Snoeyink & Ertmer 2001). Negative experiences affect perceptions of the ease of use and

relevance of ICT, reducing confidence and increasing anxiety.

Computer anxiety and anxiety about change are key factors limiting teachers' use of technology (Larner & Timberlake 1995). Underlying these anxieties are fear of embarrassment when using computers (Russell & Bradley 1997) and fear of losing professional status through a downgrading of traditional pedagogical skills (Fabry & Higgs 1997).

Training

ICT training can help overcome barriers, yet many authors argue that it often fails to do so. While a lack of time and training are major obstacles (Guha 2000; Cox *et al.* 1999), research suggests there are weaknesses in the design and delivery of many courses. By focusing on basic ICT skills, training fails to prepare teachers to integrate ICT in their pedagogy (VanFossen 1999; Wild 1996). One study (Snoeyink & Ertmer 2001), on the other hand, found that computer novices preferred to be taught basic skills before addressing pedagogical integration of technology. This illustrates the need for differentiated training, taking into account teachers' varying levels of computer experience and learning styles (Veen 1993).

Initial teacher training receives particular attention in the literature. Within institutions offering initial teacher training, access to ICT can be problematic (Murphy & Greenwood 1998), but a perhaps more serious barrier lies in the fact that tutors often have little experience of using technology to deliver the curriculum (Simpson *et al.* 1999). As a result, pre-service teachers lack practical models of integration, leading to a disparity between their expectations of ICT use and their actual use (Whetstone & Carr-Chellman 2001). A lack of encouragement to use ICT during teaching practice and varying resources in schools exacerbate this problem (Murphy & Greenwood 1998); for new teachers as much as experienced ones, integration requires both access to ICT in the classroom and the motivation to use it.

Key areas for further research

While the research on the barriers to effective use of ICT in general is undoubtedly important, more focused research on the barriers relating to the use of specific technologies is increasingly necessary.

The reasons behind teachers' attitudes and anxieties also warrant further investigation, as does the relation between barriers to teachers' use of ICT and barriers to pupils' use of ICT.

As technology advances and becomes ever more pervasive, it seems likely that the barriers to its use will change. Research will need to track and reflect how technological and cultural developments affect teachers' use of ICT.

About the research literature

The research literature on factors which prevent teachers from using ICT has a relatively long history and is international in nature. As reflected in this report, a great deal of the research has been conducted in the USA. Of the UK literature, a considerable amount relates to the barriers that pre-service and newly qualified teachers encounter during and immediately after initial teacher training.

A significant amount of research also exists on the barriers that prevent people in general from engaging with ICT. While it is beyond the scope of this report to consider such research, it may nonetheless be relevant to the issue of ICT in education. In particular, there is a body of literature on the effects of age on the ability to acquire ICT skills, which may be of relevance to the teaching population.

Much of the research on barriers also considers what factors enable or encourage people to use ICT. Again, it is beyond the scope of this document to report fully on this, but it is important to recognise that a number of factors have been identified which encourage and enable teachers to integrate ICT into their teaching. Becta intends to conduct further work on this topic soon.

Key questions for schools

- What barriers do teachers in your school think affect their use of ICT?
- Is the whole school involved in, and supportive of, the process of integrating ICT?
- Are ICT resources deployed so as to enable teachers to access them easily and integrate them effectively?
- Is your ICT training provision focused on pedagogy, differentiated by skill level, and arranged with sensitivity to teachers' workloads?

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Becta's ICT Research Network

If you're interested in research on the use of ICT in education, you can join Becta's ICT Research Network.

The ICT Research Network seeks to encourage the exchange of information in order to inform the national agenda and professional practice.

Membership is free and is open to:

- teachers
- ICT co-ordinators
- ICT advisers
- school managers
- researchers
- policy makers
- research sponsors
- industry.

The Network provides an opportunity to:

- exchange information on current research
- develop partnerships
- discuss priorities for further investigation
- focus research on issues of importance to practitioners and policy-makers.

They can do this via:

- an email discussion list
- publications
- conferences and events.

More information on Becta's ICT Research Network can be found at: <http://www.becta.org.uk/research/ictrn/>

Alternatively, send an email to: ictrn@becta.org.uk or write to: Michael Harris, ICT Research Network, Becta, Millburn Hill Road, Science Park, Coventry CV4 7JJ.

www.becta.org.uk/research

About Becta

Becta is the Government's lead agency for information and communications technology (ICT) in education and supports UK Government, national organisations, schools and colleges in the use and development of ICT in education to raise standards, widen access, improve skills and encourage effective management.

About the ICT in Schools Programme

The ICT in Schools Programme is the Government's key initiative to stimulate and support the use of information and communications technology (ICT) to improve standards and to encourage new ways of teaching and learning. The enormous potential of ICT means that for the first time it is becoming possible for each child to be educated in a way and at a pace which suits them, recognising that each is different, with different abilities, interests and needs. The challenge over the next four years will be to successfully embed ICT in every facet of teaching and learning where it can directly impact on raising standards of attainment. A vision for the future of ICT in schools is provided in the paper *Transforming the way we learn*, available at: <http://www.dfes.gov.uk/ictfutures>

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 **Becta**
ICT Research

British Educational Communications and Technology Agency (Becta)

Millburn Hill Road, Science Park,
Coventry CV4 7JJ
Tel: 024 7641 6994
Fax: 024 7641 1418

Research email: research@becta.org.uk
Becta main email: becta@becta.org.uk
URL: <http://www.becta.org.uk>