A REVIEW OF THE RESEARCH LITERATURE ON BARRIERS TO THE UPTAKE OF ICT BY TEACHERS

British Educational Communications and Technology Agency

(Becta)

June 2004

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ACKNOWLEDGEMENTS

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EXECUTIVE SUMMARY

This report brings together evidence from a range of sources on the actual and perceived barriers to the uptake of ICT by teachers, as identified in a review of some of the available literature associated with teachers' use of ICT, and also by education practitioners who took part in a small scale survey, carried out by Becta. It is published in conjunction with a companion report looking at the factors which enable teachers to make successful use of ICT (Scrimshaw, 2004).

The key findings of this report are:

- A very significant determinant of teachers' levels of engagement in ICT is their level of confidence in using the technology. Teachers who have little or no confidence in using computers in their work will try to avoid them altogether. (Dawes, 2000; Larner and Timberlake, 1995; Russell and Bradley, 1997.)

- There is a close relationship between levels of confidence and many other issues which themselves can be considered as barriers to ICT. For example, levels of confidence and therefore levels of ICT use are directly affected by the amount of personal access to ICT that a teacher has (Ross *et al.*, 1999; Cox *et al.*, 1999; Guha, 2000), the amount of technical support available (Cuban, 1999; Bradley and Russell, 1997), and the amount and quality of training available (Pina and Harris, 1993; Lee, 1997).

- Levels of access to ICT are significant in determining levels of use of ICT by teachers (Mumtaz, 2000). However, it is not necessarily the case that a school with low access does not have enough equipment; it may be that the amount of equipment is adequate but inappropriately organised in the school. Equipment should be organised in such a way to ensure maximum access for all users (Pelgrum, 2000; Fabry and Higgs, 1997).

- Inappropriate training styles result in low levels of ICT use by teachers. Courses which lack pedagogical aspects are likely to be unsuccessful (Veen, 1993), but there also needs to be an element of ICT skills training (Preston *et al.*, 2000).

- Teachers are sometimes unable to make full use of technology because they lack the time needed to fully prepare and research materials for lessons, particularly where this involves online or multimedia content. Time is also needed for teachers to become better acquainted with hardware and software. (Fabry and Higgs, 1997; Manternach-Wigans *et al.*, 1999.)

- Technical faults with ICT equipment are likely to lead to lower levels of ICT use by teachers. Recurring faults, and the expectation of faults occurring during teaching sessions, are likely to reduce teacher confidence and cause teachers to avoid using the technology in future lessons (Bradley and Russell, 1997). The lack of available technical support is also likely to lead to teachers avoiding ICT, for fear of a fault occurring that

cannot be rectified and lessons being unsuccessful as a result (Cuban, 1999; Preston *et al..*, 1999).

- Resistance to change is a factor which prevents the full integration of ICT in the classroom. This resistance can be seen in terms of teachers' unwillingness to change their teaching practices, and also in terms of schools as institutions finding it difficult or being unable to re-organise in ways which facilitate innovative practices involving ICT. (Albaugh, 1997; Cuban *et al..*, 2001.)

- Teachers who do not realise the advantages of using technology in their teaching are less likely to make use of ICT. Any training programme needs to ensure that teachers are made aware of the benefits of using ICT. (Cox *et al..*, 1999.)

- Little evidence was found in the literature to support the view that age affects levels of teachers' ICT use. Younger teachers are no more likely to make use of ICT in their work than their more experienced colleagues (Bradley and Russell, 1997).

- There is some evidence to suggest that teachers' gender has an effect on the degree to which they use ICT, with male teachers making more use of ICT than female teachers, and with female teachers reporting greater levels of computer anxiety than male teachers. This may have a significant negative effect on the use of ICT in primary schools, where there are more female teachers than male teachers. (European Commission, 2003; Bradley and Russell, 1997.)

- There are close relationships between many of the identified barriers to ICT use; any factors influencing one barrier are likely also to influence several other barriers. For example teacher confidence is directly affected by levels of personal access to ICT, levels of available technical support and the amount and type of training available, all of which can be seen as barriers to ICT themselves. (Ertmer, 1999)

SUGGESTIONS FOR FURTHER RESEARCH

Suggestions for further research into ICT barriers include:

- Looking at sector specific and subject specific barriers. This could then lead to identifying the ICT enablers – those factors which motivate teachers into fully engaging with ICT in their work. Such work could be targeted at key areas of education where levels of ICT use need to be improved. For example, looking at the factors restricting the use of ICT in teaching primary music, and how these might be overcome.

- Researching the barriers and enablers specific to individual technologies, such as the internet, interactive whiteboards, or digital video. Such work could lead to developing targeted advice on increasing the use of these technologies in the classroom.

- Investigating some of the barriers in more detail to understand how they group together, and the specific actions that may be taken to overcome the main ICT barriers. This could then lead to the trialling of possible interventions that might help to increase ICT use in schools.

BARRIERS TO THE UPTAKE OF ICT BY TEACHERS

INTRODUCTION

Various documents recently produced by Becta report on the barriers that exist in schools that prevent teachers from making full use of ICT in their work. These include:

- literature review work looking at barriers to ICT, to inform specific publications, including a recent addition to the 'What the research says' series[1].
- a literature review carried out by the Centre for Guidance Studies on behalf of Becta which looked at the use of ICT in education within a careers education and guidance context (Bosley and Moon, 2003);
- a small survey of practising teachers investigating their own perceptions of the existing barriers to ICT use, carried out by Becta in 2003 (See Appendix B).

This report aims to bring together the findings and key points of each of the above documents, along with evidence from a literature review to include the more recent research that has been carried out in this area. Each identified barrier will be dealt with in turn, and research and survey evidence specific to each barrier will be considered.

METHODOLOGY AND RESEARCH DESIGN

Literature Review

The evidence utilised in this report is from research conducted by a variety of researchers, from several different countries, and covers a span of ten years, dating from 1993 to 2003. Pelgrum (2001) carried out research in 26 different countries, and the findings of this study in terms of comparisons between nations are considered later, as are studies carried out by other researchers in specific countries. Countries covered by the literature include:

- UK (Harrison *et al..* (2002), Somekh *et al..* (2002), Besa (2002), Cox *et al..* (1999), Kirkwood *et al..* (2000), Murphy and Greenwood (1998), Ofsted (2001,2002), Preston *et al..* (2000), PriceWaterhouseCoopers (2001), Simpson *et al..* (1997)).
- USA (Albaugh (1997), Butler and Sellbom (2002), Cuban *et al..* (2001), Ertmer (1999), Guha (2000), Larner and Timberlake (1995), Manternach-Wigans (1999), Snoeyink and Ertmer (2001), VanFossen (1999), Wild (1995));
- Australia (Russell and Bradley (1997), Bradley and Russell (1997));
- Canada (Granger (2002), Ross *et al..* (1999));
- Netherlands (Veen, 1993);
- Hong Kong (Yuen and Ma, 2002);

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[1] "What the Research Says…" is a series of briefing papers 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. Available at: http://www.becta.org.uk/research/research.cfm?section=1&id=546

It is important to note that the majority of the qualitative studies reviewed here are based on evidence given through interviews and questionnaires from classroom teachers; while this is likely to give a clear picture of the barriers to ICT as perceived by teachers, it will not help in giving an overview of the barriers as perceived by other groups of interested parties, such as head teachers and other managers and leaders. It is possible that these groups may have different opinions about the barriers which most affect teachers' uptake of ICT. The small number of the studies reviewed in this report which do consider the opinions of other groups of practitioners, include Murphy and Greenwood (1998) where questionnaires were distributed to teacher trainers and student teachers, and Yuen and Ma (2002), who also studied the opinions of pre-service teachers.

The literature reviewed in this document includes work carried out by researchers who themselves evaluated and analysed the existing research into ICT barriers and related topics (Albaugh (1997), Bosley and Moon (2003), Fabry and Higgs (1997), Mumtaz (2000) and Wild (1996)). Many other researchers, in addition to carrying out their own literature reviews, undertook studies to obtain primary evidence of the barriers to teachers' use of ICT, using a range of qualitative and quantitative methods and instruments. For example, much of the literature is based on surveys of practitioners, with questionnaires being completed by varying numbers of individuals. Studies ranged in size, from those with samples of as few as 22 practitioners (Snoeyink and Ertmer, 2001) to surveys of as many as 350 teachers (Russell and Bradley (1997) and Bradley and Russell (1997)). Other studies used interviews of practitioners to gain information (Butler and Sellbom (2002), Granger *et al.*. (2002), Guha (2000)). Again, these studies ranged in size, from interviews with 10 teachers (Guha, 2000) to 350 teachers being interviewed by Bradley and Russell (1997). Some researchers made use of observation of teachers as well as interviews (Cuban *et al.*. 2001; Ertmer 1999; Veen 1993), although each of these studies were more small scale, focussing on 4 secondary teachers (Veen, 1993), 7 primary teachers (Ertmer, 1999) and teachers in 2 high schools (Cuban *et al.*., 2001). Manternach-Wigans (1999) and Cox *et al.*. (1999) made use of focus groups as well as questionnaires. These focus groups were made up of 6 to 8 teachers in each of 30 different schools (Manternach-Wigans, 1999), and a smaller sample of 20 teachers (Cox *et al.*., 1999).

Although sample sizes in the reviewed literature vary, the majority of studies here tend to focus on samples larger than 70 practitioners. It is important to note that those studies which used smaller samples (Guha (2000), Ertmer (1999), Veen (1993)) may not necessarily provide results which are representative of the teaching population as a whole. However, it could be argued that the larger, quantitative studies may not provide as rich detail as the smaller, qualitative studies. Both approaches therefore add value to this review.

Becta Teacher Survey

One difficulty with a study such as this, which aims to give a picture of the current situation in schools with regard to the barriers to ICT use, is that the most up to date evidence is needed. Relying on a literature review to provide this evidence is not always an ideal solution, because, even with the most recent studies, there is inevitably a considerable amount of time taken between the research being carried out in schools and the final publication of any results. It is only after publication that the results can be considered for a document such as this. This is a particularly important issue when considering the barriers to teachers' use of ICT, as in recent years several initiatives have been introduced which are likely to have had a considerable

impact on the extent to which teachers make use of ICT. These initiatives include the NOF training initiative, NGfL strategy, and Computers for Teachers schemes. Any literature based on research carried out prior to these strategies will not show any of the effects they might have had. It will also be shown later that teachers often require a significant amount of time to fully engage with new technologies after they have been introduced, making the need for up to date evidence even greater.

With this in mind, in order to support any conclusions made from the literature review, and to provide a means of obtaining more recent data on the topic, Becta carried out its own small scale survey of 170 teachers and other practitioners, regarding their perceived barriers to the use of ICT. Practitioners were asked to complete a questionnaire when attending the BETT Show and Education Show in early 2003, and also when visiting Becta's Teachers Online website, in which they were able to record their own thoughts and opinions regarding the most significant barriers. (For more details of the questionnaire and the survey results see Appendix B.) The sample of practitioners in this survey is not necessarily representative of the teaching population as a whole; it is important to recognise that those practitioners attending these events are likely to have had a higher than average interest in ICT, and are less likely to be affected by the barriers to ICT use, resulting in a possible bias in the results. However the results of the survey are still of value, as by surveying these teachers we were likely to find respondents who had had direct experience of barriers to ICT, either personally, or where they were directly involved with the management of ICT, through their involvement with helping colleagues in their attempts to overcome them. In this way, then, we were able to obtain first hand and very recent evidence of the factors which prevent teachers from making full use of ICT. The barriers identified by the practitioners in the survey are strikingly similar to those discussed in the literature reviewed here, and this has made it possible, for many of the barriers covered by this report, to state to what extent the practitioners' views support (or otherwise) the research findings in the literature.

REPORT FINDINGS

The findings of our research into the barriers to the uptake of ICT by teachers are presented here, divided into sub-sections for each of the barriers or groups of barriers we identified. Following the description of the barriers and the extent to which they are acknowledged by the literature and survey, there is an analysis of the relationships which appear to exist between the barriers, which, it is hoped, will help us to understand further the reasons why some teachers find it difficult to integrate ICT into their work.

LACK OF TEACHER CONFIDENCE AND TEACHERS' COMPUTER ANXIETY

Many teachers who do not consider themselves to be well skilled in using ICT feel anxious about using it in front of a class of children who perhaps know more than they do. Larner and Timberlake (1995) found that teachers were worried about showing their pupils that they did not know how to use the equipment, and that it was the teachers who experienced this kind of anxiety who were less willing and / or able to make use of computers in their teaching. In addition, pupils' attitudes and expectations of their teachers' competence in ICT are likely to contribute to this teacher anxiety. Guha (2000) states that students, who on the whole experience daily interaction with a wide range of technology, are increasingly placing demands on teachers, expecting them to be knowledgeable in the area of computer usage.

In the Becta survey of practitioners the issue of lack of confidence was the area that attracted most responses from those that took part, (21.2% of the total responses were related to confidence issues) and much of the research evidence suggests that this is indeed a major barrier to the uptake of ICT by teachers in the classroom. In a study by Bosley and Moon (2003), for example, inconsistencies were found between the amount of ICT training received by a teacher and the extent to which the teacher applied that training in the classroom. This, the authors felt, suggested that some staff did not have the confidence to put their learning into practice.

Many of the respondents to the Becta survey who identified their lack of confidence as a barrier particularly focussed on a fear of admitting to their pupils that they had limited knowledge in the area of ICT. As one respondent commented, *"Too many [teachers] are too afraid of public humiliation in front of knowledgeable pupils / parents."*

This notion of teachers experiencing a fear of ICT is also supported by Russell and Bradley (1997), who refer to a 'cyberphobia' that exists in some teachers which can be a genuine concern for them, and that these concerns deserve serious attention. In a separate study (Bradley and Russell, 1997) the authors reported that the most common causes of this computer anxiety were "getting stuck and not knowing what to do next", and "not understanding the computer jargon and the messages it gives." It is suggested by the authors that any strategies to reduce computer anxiety in teachers should aim to address these issues.

Fabry and Higgs (1997) also suggest that teachers' fear of computers stems from a fear of losing their professional status, as they see the increasing use of computers in teaching as removing, or downgrading, their traditional pedagogical skills.

The problem of lack of confidence as a barrier is closely related to several other key issues, which themselves alone can be viewed as barriers to teachers' use of ICT. For example, teachers' confidence in using ICT is directly affected by the amount of *personal access* to ICT they have, at home. (Ross *et al..*, 1999; Cox *et al..*, 1999; Guha, 2000). In school, the frequency of *technical problems* that occur can have a direct effect on a teacher's confidence in attempting to use that equipment, due to the fear of it breaking down during a lesson, or the fear of them breaking the equipment themselves (Cuban, 1999; Bradley and Russell, 1997). The *lack of teacher competence*, or teachers' perceptions of their competence and the quality of the training they receive, is also related to the degree of confidence they have about using ICT (Pina and Harris, 1993; Lee, 1997). Each of these are dealt with in detail, as specific barriers to teachers' ICT use, later in this document.

LACK OF TEACHER COMPETENCE

A factor which is directly related to teacher confidence levels is that of teacher competence. In order to achieve high levels of teacher competence in ICT, there is a need to provide training, and perhaps unsurprisingly, there is a great deal of literature evidence to suggest that effective training is crucial if teachers are to implement ICT effectively in their teaching (Kirkwood *et al..*, 2000). If training is inadequate or inappropriate, then teachers will not be sufficiently prepared, and perhaps not sufficiently confident, to make full use of technology in

and out of the classroom. The lack of teacher competence, then, together with the associated lack of quality training for teachers, can be seen as a barrier to teachers' use of ICT.

Efforts have been made to address the need for ICT training through the recent NOF (New Opportunities Fund) initiative to provide training for all practising teachers in the UK. Kirkwood *et al.* (2000) made several observations regarding possible reasons why the uptake of NOF training was slow, acknowledging the fact that teachers who were "technophobic" would have been discouraged from seriously engaging into a training programme which involved addressing an "extensive" set of competencies. The authors suggest that some of these competencies were not of central importance, making it harder for such teachers to discern which areas they should concentrate on. It was also noted in the same report that the roll-out of equipment that should have closely followed the training had been too slow, resulting in limited access for teachers to make use of their newly acquired skills, and this view is supported by Manternach-Wigans *et al.* (1999) who found that teachers are frustrated by receiving training in certain technology applications, only to find they do not have access to that application once the training is complete.

Referring to the structure of the NOF programme in particular, Kirkwood *et al.* (2000) pointed out that using different approved training providers resulted in a considerable variation in the format, content and quality of the training offered, and due to funding arrangements the production of course materials from each of these providers was slow, having a negative effect on the speed of uptake of the training.

The issue of training is certainly a complex one, and many factors are considered to be important in ensuring that the training is effective. Each of these factors will be dealt with separately below:

Lack of time for training
In their evaluation of the NOF training scheme run by the Scottish Teacher Education Consortium,
Kirkwood *et al.* (2000) highlighted the fact that expecting teachers to train in their own time caused a slow uptake in the training. The authors noted that, *"it is difficult to reconcile a voluntary programme of training which may require teachers to study in their own time."*

This feeling is shared by a number of respondents to the Becta survey; many respondents who identified the lack of time causing problems for using ICT in general, also specifically mentioned that their training suffered as a result. As one respondent noted, *"[There is] not enough time to practise and receive meaningful training using ICT across the curriculum."* Snoeyink and Ertmer (2001) agree, noting the lack of time as a significant barrier, and suggesting that one way to overcome this would be to provide non-contact time for teachers to undertake ICT training during school hours.

Lack of pedagogical training
In a series of case studies carried out by Veen (1993) involving teachers with limited experience or training in the use of computers, the majority of those teachers' use of computers, *"did little that could be described as exploiting the overwhelming educational*

possibilities of information technology", and Veen suggested there was a need for them to have more control over the learning process of the students.

The issue of training teachers in how to use ICT to effectively manage children's learning, both during the lesson and also in the preparation of lessons before hand (pedagogical training), rather than simply training them in the skills of using ICT equipment, is an important one. In a study of IT programmes in initial teacher education in Australia, Wild (1996) identifies the need for individuals to blend the computer into their professional life, and to make the computer respond to the needs of the user, rather than the other way around. He sums this up by stating that before teachers need to know how to use computer technology, they need to ask why they need to know, and what they need to know. Equipping teachers with IT skills, Wild continues, will not necessarily influence the likelihood that they will use computers to extend or improve their teaching.

In a study of teacher education institutions in Scotland, Simpson *et al.* (1999) also found the lack of pedagogy in ICT training to be a problem for students undergoing initial teacher training: *"The trainee teachers clearly felt that their tutors had failed to deal extensively or as effectively as they would have wished with the key factors associated with the pedagogical use and management of [ICT]."*

Lack of skills training
Having expressed the need for pedagogical training, there is evidence to suggest that there still is an important need for training teachers in specific ICT skills. Lee (1997) points out that many teachers "of advanced age" will not have had any computer education when in college, and as a result are in need of computer skills training to allow them to make use of computers in their work. In Preston *et al.* (2000) teachers felt that they had not had adequate training, particularly in their ability to solve technical problems and in understanding the basic workings of the technology, and in the study by Manternach-Wigans *et al.* (1999), it was found that teachers were frustrated by the expectation that they learn technology skills and applications on their own, perhaps through reading a book. As a solution to this problem, Snoeyink and Ertmer (2001) suggest that the first stage of training should focus on the basic operations of technology and software applications, and once teachers have acquired the basic skills, only then should they move on to pedagogical training. Veen (1993) also suggests that training should be differentiated according to teachers' experience and skills in using computers. In this way differing amounts of skills training could be delivered according to individual teachers' needs.

Lack of ICT focus in initial teacher training
There is a suggestion that there has been in the past a lack of opportunity for student teachers to make use of ICT during their initial teacher training, which directly affects their uses of ICT once qualified (Murphy and Greenwood, 1998). Simpson *et al.* (1999) suggest that a reason for this lack of opportunity is the fact that tutors in the teacher training institutions themselves have little experience of using technology in the curriculum, and are therefore unable to pass on those skills as a result.

Cuckle and Clarke (2002) add that another barrier to student teachers' use of ICT in the classroom is the lack of ICT pedagogical training in teacher training institutions. They

found that although the student teachers in their study had good ICT skills in terms of their own personal use, they were unable to transfer these skills to using ICT in the classroom. In addition, after receiving pedagogical training in ICT, the students were still not able to make full use of that training as what they had been taught did not transfer easily to what was available in the classroom during teaching practice.

Murphy and Greenwood (1998) point out that the problem is exacerbated by a lack of encouragement for students to make use of ICT during teaching practices, but in a later study Cuckle and Clarke (2002) report that most teacher mentors are in fact supportive of student teachers using ICT during teaching practices, but that this enthusiasm is often hampered by the very barriers that affect their own use of ICT, most notably the issues concerning a lack of access to resources. This is dealt with as a separate barrier below.

<u>LACK OF ACCESS TO RESOURCES</u>

Mumtaz (2000) points out that evidence of very good practice in the use of ICT is invariably found in those schools that also have high quality ICT resources, and that a lack of computers and software can seriously limit what teachers can do in the classroom with regard to the implementation of ICT. The importance of schools being well resourced in ICT equipment is also highlighted by a recent Becta publication, "Primary Schools – ICT and Standards" (Becta, 2003). This study, which explored the relationship between schools' use of ICT and pupils' achievements in national tests, presented strong evidence to show that those schools which were well resourced in ICT tended to have better achievements than schools with unsatisfactory levels of ICT. The report was able to show that this relationship was not simply a result of the higher achieving schools having better socio-economic circumstances, and also that it was not as a result of those schools having better quality leadership. The lack of good ICT resources in a school, then, will not only prevent teachers from making good use of ICT in their teaching, but it is also likely to have a detrimental effect on pupils' achievement.

The issue of teachers' access to ICT resources is a complex area, and in order to understand this more, it is helpful to break it down into several 'sub-barriers'. The inability of a teacher to gain access to ICT resources may be the result of one of a number of factors, and is not always simply because the hardware or software is not present within the school. In the Becta survey of teachers, for example, when respondents identified access to resources as a problem, as a large number of them did (20.8% of responses were related to inadequate resources), they were actually referring to different kinds of access problems. Some respondents were indeed referring to a lack of resources physically available at the school, while others were referring to the poor quality of the resources that were available. In some cases teachers at schools with sufficient quantities of good quality resources were still experiencing problems, as a result of the organisation of those resources. Some respondents also highlighted the need for teachers to have better access to ICT for their own use, such as for the planning and preparation of lessons. Those survey responses that identified resources as a problem can therefore be further divided into five separate categories, which are also identified as barriers to ICT use by the literature:

Lack of hardware

In a worldwide study of the obstacles to the integration of ICT in education, Pelgrum (2001) found that the most frequently mentioned problem when teachers were asked about obstacles to their use of ICT was the insufficient number of computers available to them. Guha (2000) found similar results, with many teachers surveyed indicating that the number of computers in their classrooms was insufficient, and that if teachers were to continue to implement ICT into their work then they required the appropriate hardware and software to familiarise themselves with first, then guide their students accordingly. Interestingly, Guha also found that it was the teachers who used the technology most who were more likely to complain about a lack of equipment. This would suggest that as well as being a barrier to teachers' first use of ICT, it can also be a barrier to the further development of ICT in creative and innovative ways.

It may be surprising to note that, despite the recent drive in the UK to increase the levels of ICT equipment in schools through schemes such as NGfL[2], a significant number of respondents to the Becta survey still identified a lack of hardware as a possible ICT barrier. This would support the findings of Pelgrum (1999) which show that even in those countries where schools' pupil:computer ratios were comparatively low (ratios of 10:1 and lower), as many as 40% of the teachers surveyed still complained of the lack of computers. This may well be a problem caused by poor organisation of resources, rather than a physical lack of computers present at the schools. This leads us to consider a second barrier to ICT concerned with resources:

Poor organisation of resources

Pelgrum (2000) makes the observation that if teachers at schools with low pupil:computer ratios are still complaining of a lack of computers, then it could be that those teachers and their school managers need to consider whether or not they are optimizing the use of the available equipment, suggesting that in some cases it is the organisation of resources, rather than the physical lack of them, which is creating a barrier to the use of ICT by teachers. Fabry and Higgs (1997) noted that numbers of computers alone do not necessarily ensure adequate access, and that it is important to locate the proper amount and right types of technology where teachers and students can effectively use them.

The apparently popular policy at present for schools to move towards dedicated computer suites is an important issue which may contribute to this barrier. Many respondents to the Becta survey explained that their schools' hardware is kept and used in ICT suites, and that this causes problems when so many members of staff have a wish to use those rooms at the same time. Two respondents noted: "*Meeting up with the ICT suite timetable* [can be a problem]; *usually they are double booked. I have 2 computers*

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[2] The National Grid for Learning (NGfL) programme was launched in 1998 and aimed to increase levels of ICT in schools, with target pupil to computer ratios for 2002 of 11:1 and 7:1 for primary and secondary schools respectively. By 31st March 2002, pupil to computer ratios had improved to 9.7:1 in primary and 6:1 in secondary schools. (Source: DfES. 2002. *Statistics of Education: Survey of ICT in Schools 2002*. London : TSO. Available at http://www.dfes.gov.uk/rsgateway/DB/SBU/b000360/sb07-2002.pdf).

in my lab (I teach science) but this is not enough to service a class of 24 – 28 pupils.'
And: *'Computers need to be in every teaching room, not just in some IT labs.'*

This is noted as a potential problem by Manternach-Wigans *et al.* (1999), who found that although computer labs allow teachers to use computers with the whole class, it is difficult for the teacher to integrate computer technology with other learning activities when the class is not scheduled to the computer lab, and a more useful approach would be to have computers in both labs and classrooms. Ofsted (2002) acknowledge that computer suites are an important factor in improving pupils' ICT capability, but at the same time suggest that for secondary schools it is important to organise ICT resources according to the needs of individual departments, using computer suites, clusters of machines and individual workstations as necessary.

Poor quality hardware

Another factor which may cloud the issue when considering schools' low pupil:computer ratios , is that of the quality of the hardware available. In a report by the British Educational Suppliers Association (BESA, 2002), the average UK school in 2000 reported that a third of its desktop computer stock was ineffective for teaching the curriculum. The report suggests that the effectiveness of computers is closely related to their age. There is evidence (Preston *et al.*, 2000) to suggest that teachers are less enthusiastic about using ICT where the equipment available is old and unreliable.

Preston *et al.* (2000) found this to be a particular problem for teachers, who complained about out of date resources, and the fact that hardware became obsolete very quickly. The authors note that this problem was exacerbated by the fact that many students had more up to date equipment at home, and that this caused further difficulties for teachers trying to use the older technology at school. One teacher's comment was that, *"poorly specified and maintained machines mean that they are unreliable and likely to cause disruption to even the best planned lessons."*

Fabry and Higgs (1997) point out that if teachers and their students are to have adequate access to computers which are to enhance learning, then not only do those computers need to be located in a position where all can access them, but they also need to be of a high enough specification to make their use worthwhile. This involves ensuring that they are internet connected, for example, to allow access to rich resources beyond the school, and also inter-connected, or networked, to allow teachers and students to communicate and collaborate. In their study Fabry and Higgs found that many of the schools claiming to have a low pupil:computer ratio had a large number of computers which were not capable of fulfilling these requirements.

Some respondents to the Becta survey confirmed this literature evidence by commenting on the older, poorly maintained hardware in use in their schools which often breaks down or develops technical faults, and the fact that this is a direct barrier to their use of ICT. One respondent pointed out that one of the problems, in his opinion is, *"The unreliability of school networks and equipment…"*

Inappropriate software

A number of respondents to the Becta survey suggested that although there might be an array of software now available for use in the classroom, much of this software is not appropriate or would not actually enhance a lesson in any way. As two respondents noted: *'Some software is inappropriate and covers too many areas rather than building on small skills first'*; and *'A reinforcement activity program either has plenty of graphics and so not enough maths is done OR it is just presented as sums and might as well be done with paper / whiteboard etc.'* This idea is supported by Guha (2000) who found that poorly designed software, and a lack of time for teachers to design their own software, often cause teachers to "give up" and choose not to make use of ICT.

Inappropriate software is also identified as a barrier in the research undertaken by the Centre for Guidance Studies (Bosley and Moon, 2003). Bosley and Moon's work was carried out with a focus on careers education and guidance, but their findings are worth considering when looking at ICT barriers in education as a whole. Bosley and Moon note that inappropriate software design can disengage the pupils from the intended learning processes, and as a result can create a barrier to ICT use. The authors also comment on other factors related to software which inhibit the use of ICT, such as the perceived high cost of software licences, and also the lack of time available for staff to evaluate software, which is dealt with as a separate barrier below.

Lack of personal access for teachers

When discussing the issue of access to resources, it is important not only to think of the access teachers need in order to teach with ICT, but also to consider the need for teachers to have their own personal access to ICT, to allow them to plan and prepare lessons, for example. One of the factors which contribute to the degree of a teacher's confidence in using ICT in school is the amount of personal access to ICT that the teacher has; Ross *et al.* (1999) make a direct link between teachers' use of ICT to accomplish their own personal goals and their confidence in making use of ICT in their teaching. Perhaps unsurprisingly, those teachers in their survey who made little or no personal use of ICT had a low level of confidence in using it in their lessons. Cox *et al.* (1999) also found this relationship. The results of their study showed that teachers who use ICT regularly are confident in using it and have a positive attitude towards it, perceiving it as a useful tool in both their personal and their teaching work, while Guha (2000) found similar responses from teachers interviewed, with one respondent commenting, *"…initially [there was a] lot of phobia, now that teachers have computers at home they have less fear in using them."*

The interim findings of the Teacher Workloads Study for the DfES (PriceWaterhouseCoopers, 2001) highlights the importance of teachers having access to ICT at home, to allow them to make use of the technology in their own work. Teachers appear to agree - in the Becta survey, a number of comments were made about the need to have more personal access to computers, at home and at school. Comments included: *"…teachers who have a laptop to take home end up making more use of ICT… it lets them develop confidence."; "Being given a laptop that works for personal use. Shared use of a computer when at school is not in the least convenient."; "Lack of instant access to resources – i.e. no computer / laptop on the teacher's desk."*

LACK OF TIME

A problem that exists for teachers in many aspects of their work is that of the lack of time available for them to complete given tasks, and teaching ICT is certainly an area that is affected by this. Fabry and Higgs (1997) point out that learning new skills in any profession requires time, but teachers have little time left after spending most of their day teaching, and with other commitments such as liaising with parents and attending staff meetings. Yet they do need that time to experiment with the technology, share their experiences with colleagues, and attend technology related in-service training programmes. According to Manternach-Wigans *et al.* (1999), teachers are very concerned about the lack of time for technology; they feel that they need more time to learn computer basics, plan how to integrate technology into their lessons, and actually use the technology in the classroom. In Preston *et al.* (2000), teachers pointed out that a great deal of work is required in preparing accurate ICT materials for use by children with a range of abilities, and complained of the lack of time restricting them from exploring materials for potential use with ICT.

Cuban *et al.* (2001) provide evidence to support this. In their survey of teachers at two American high schools, it was found that there was not enough time for computers to be incorporated fully into daily teaching. Teachers explained that they would need hours to preview web sites, prepare multimedia materials for lessons, and to undertake training. In the same study it was found that this problem did not only apply to those teachers who made little use of ICT; similar complaints were made by teachers who were attempting to make full use of the technology in their lessons, as they were having to work longer hours in order to make their ICT use successful, paying the price in exhaustion for this kind of dedication. The authors also note that these dedicated computer-using teachers often eventually leave the teaching profession or move on to other technical or teaching positions that provide them with more time, and this teacher turnover itself undermines the implementation of technological innovations in teaching.

A significant number of respondents to the Becta survey also identified time as a barrier to their use of ICT, some of them specifically stating which aspects of ICT require more time. These included the time needed to locate internet advice, for preparation of lessons and resources, to explore and practise using the technology, to deal with technical problems, and to receive adequate training.

TECHNICAL PROBLEMS

The barriers to teachers' ICT use caused by technical problems can be broadly split into two main areas.

Fear of things going wrong
A real concern for teachers when considering making use of ICT is the fear of equipment breaking down in a lesson, or that if they use the equipment they will do something wrong and cause damage to it themselves. In fact there are strong links between the barrier caused by a fear of doing damage to equipment, and the barrier caused by a lack of teacher confidence. This is highlighted by Bradley and Russell (1997), who note that a

primary source of computer anxiety is the concern teachers have about damaging a computer's hardware or information base. This anxiety is therefore likely to prevent such teachers from attempting to use the technology at all, even before there is a chance for any potential technical problems to occur. Cuban *et al.* (2001) explain that if technical glitches occur weekly or a few times a month, then confidence in the technology's worth erodes, and this has a negative impact on the rate of teachers' take-up of ICT.

Many of the Becta survey respondents also expressed concern over potential technical faults, which might prevent them from using ICT. Comments from these practitioners included: "*problems with getting it to work, glitches which are 'unexplained', not always reliable"; "computers that freeze while in the middle of a lesson"; "technology that doesn't work!".*

Lack of technical support
We have so far dealt with teachers' perceptions of how computers and technology can break down, and how this causes barriers to prevent them from considering using ICT, even before the potential faults could occur. Another barrier originates from actual breakdowns of equipment, and the subsequent disruption that these can cause. If there is a lack of technical support available in a school, then it is likely that preventative technical maintenance will not be carried out regularly, resulting in a higher risk of technical breakdowns. Cuban (1999) supports this by pointing out that in the schools that cannot afford technicians, there are often, *"software glitches and servers that crash, torpedoing lessons again and again."* Once the breakdowns do occur, a lack of technical support may mean that the equipment remains out of use for a longer period of time. An example of this is highlighted in Butler and Sellbom (2002), where a burnt out projector bulb took three weeks to be replaced. This, the authors state, is clearly unacceptable.

Preston *et al.* (1999) provide evidence of the fact that the breakdown of equipment inhibits the use of ICT in schools. The authors report on comments made about technical problems resulting in the *"demotivation of students"* and the removal of *"time/resources from other important curriculum areas".*

Many respondents to the Becta survey certainly agree that technical support is needed in schools. Comments from these include: *"Lack of technical back-up / expertise when things go wrong"; "[we need an] on-site ICT manager to support teachers in lessons".*

Clearly, there is a close relationship between these two 'technical' barriers; the more frequently that actual breakdowns occur (perhaps due to the lack of preventative technical maintenance), the more likely teachers are to avoid using the technology in the first place. Snoeyink and Ertmer (2001) found that teachers who tried to carry out a task on a computer, but who were unsuccessful due to technical problems, would then avoid using the computer for several days. This, then, further highlights the need for adequate technical support in schools.

RESISTANCE TO CHANGE & NEGATIVE ATTITUDES

Much of the literature looking at barriers to ICT use in schools suggests that in the teaching profession generally there is an inherent resistance to change, and that this is another barrier to some teachers' use of new technologies in education. Albaugh (1997) explains that: *"teachers are often suspicious of new claims and the implementation of new ideas without proof of effectiveness [and] teachers tend to adopt a new technology when that technology helps them to do what they are currently doing better."* Veen (1993) describes this as the 'persistence of beliefs'; teachers hold views that persist during the introduction of new innovations, and as a result educational change is a slow process, with teachers needing time to gain experience with computers. An example of this is found in Snoeyink and Ertmer (2001), where a teacher explained that she wished to remain comfortable with her teaching, and although this may have kept her from adopting the best teaching methods, being comfortable was important to her. The same teacher was not highly skilled in using computers, and so using them would have resulted in her having to leave her 'comfort zone', which she did not feel able to do.

Ertmer (1999) discusses the importance of attempting to overcome problems caused by teachers' beliefs and attitudes concerning ICT, referred to as second-order barriers, before other external factors, or first-order barriers, are tackled. First-order barriers, such as the lack of access or training, it is claimed, are more readily observed and more easily tackled, whereas second-order barriers may require major changes in daily routines and underlying beliefs about effective practice. Mumtaz (2000) agrees, suggesting that "*teachers' beliefs about teaching and learning with ICT are central to integration*".

Dawes (2000), however, is critical of the belief that teachers resist change in their professional practices merely as a result of their personal beliefs. She states that the reported attitude of teachers towards ICT tells us more about what equipment the teacher has access to, what training they have had, and what sort of community they are part of, than it does about the willingness of the teacher to use ICT. The suggestion here then, is that the perceived resistance to change as a barrier is actually only a symptom of other barriers to the use of ICT. This again highlights the close links that exist between all of the barriers discussed in this document.

The idea of resistance to change as a barrier to ICT need not only be attributed to teachers' own attitudes, however. According to Cuban *et al.* (2001), the school as an institution may in itself be resistant to the kinds of change needed for the successful integration of ICT. The cellular organisation of the school, the authors argue, with its strict time schedules and departmental boundaries, considerably reduces the cross-fertilisation of ideas within and between departments. In their study, the authors found that it was in the few classes where teachers did share ideas, plan together, and observe each other's teaching, that innovations which encouraged diversified teaching, including the use of computers, actually occurred.

NO PERCEPTION OF BENEFITS

One key area of teachers' attitudes towards ICT is their understanding of how it will benefit their work and their pupils' learning. Snoeyink and Ertmer (2001) noted the importance of teachers seeing purpose in using computers in their teaching, and suggest that this is

achieved through focussed training which specifically shows teachers how technology can help them in their own individual situations; simply watching other teachers use technology, they explain, will not show them how they can use it to their benefit in their own work. Cox *et al.* (1999) found that if teachers see no need to question or change their professional practice, then they are unlikely to make use of ICT. They concluded that the perceived usefulness of computers to teaching is an important factor for teachers, and as such should be included in any ICT training programme, to ensure teachers are convinced of the value of using ICT in their teaching.

Yuen and Ma (2002) also discuss the importance of perceived usefulness, stating that this factor influences computer acceptance to a much greater extent than perceived ease of use. They add that a computer system is useful only if it is applied to a context, and that without understanding how computers can be integrated into teaching, teachers may not perceive computers as useful at all. A study by Robertson *et al.* (1996), discussed in Mumtaz (2000), found that some teachers who were given palmtop computers to use remained unconvinced about the computer's potential, and concluded that training should ensure that teachers are made aware of the range of uses and possible benefits of ICT.

IMPACT OF PUBLIC EXAMINATIONS

There is some evidence to suggest that teachers avoid making use of ICT during periods in which their pupils are studying for or sitting public examinations. In Becta's ImpaCT2 reports (Harrison *et al..* (2002), Somekh *et al..* (2002)), Key Stage 4 English teachers felt that they had no time to use ICT. Some teachers explained that in their schools very little use was made of ICT in Key Stage 3 English, because of the need for examination preparation (Harrison *et al..*, 2002).

Not only do examinations create difficulties with regard to time, but there is also the suggestion that ICT is not used at the time of examinations because ICT is not relevant to the examination syllabuses. One teacher explained that exam regulations sometimes do not allow coursework to be ICT generated, for example (Somekh *et al..*, 2002).

AGE DIFFERENCES

A small number of respondents to the Becta survey suggested in passing that the age of teachers was a factor which created barriers to the use of ICT (1.8% of responses mentioned age), in that older teachers are less likely to engage with the technology, simply due to their advanced age. A report by the EC (European Commission, 2002) found that age is a factor contributing to the use of computers and the internet, showing that the percentages of teachers using computers falls as their age increases, but the report acknowledged that the importance of this factor is falling. Much of the remaining literature would suggest little or no correlation between age and ICT use by teachers. In the study by Bradley and Russell (1997), it was found that levels of computer competence or anxiety did not vary significantly with respondent age: *"Suggestions that computer anxiety increases with age (and therefore, that younger teachers are unlikely to need professional development) were not supported by the current findings."* The fact that older teachers do not necessarily become more anxious about using computers, then, would suggest that age is not in itself a significant barrier to the use of ICT by teachers.

GENDER DIFFERENCES

In the literature review carried out for this document a small amount of evidence was found that points to the correlation between teachers' gender and their usage levels of ICT: The EC report (European Commission, 2003), for example, notes that gender is an issue which determines the use of ICT by teachers, stating that 77% of male teachers use a computer off-line, compared with 66% of female teachers, and points out that the gap is wider when looking at the use of the internet; 56% of male teachers compared with 38% of females. Bradley and Russell (1997) also reported a correlation between gender and levels of computer anxiety, with females reporting a greater degree of anxiety than males. Particularly in primary schools, where the ratio of female to male teachers is much greater[3], this issue as a barrier to the use of ICT may be much more significant. There could be several reasons for the differences illustrated by these figures, however. For example, until recently, there were many primary schools that did not have internet connections available. As the majority of teachers in primary schools are female, this could perhaps explain why less female teachers used a computer online.

ANALYSIS OF THE FINDINGS

This report has drawn together evidence from a range of sources to present the most significant barriers which prevent teachers from making full use of ICT in their teaching. In collecting this information it has become apparent that there are close relationships between each of the barriers. Further evidence of the way in which the barriers interlink, and therefore the potential enabling factors which can help teachers and schools to overcome these barriers, are inferred from the findings of the analysis of national data (Becta, 2003). It was found that there were five ICT enablers : ICT resourcing, ICT leadership, ICT teaching, School leadership and General teaching. No one factor in itself is sufficient to provide good ICT learning. However, the presence of all five factors increases the possibility of good ICT learning opportunities.

Relationships between barriers

Several authors refer to two types of barrier; the external, or first-order barriers, such as limited resources or lack of technical support, and the internal, or second-order barriers, which include teachers' attitudes to ICT (Snoeyink and Ertmer, 2001). The barriers discussed in this document can therefore be categorised as follows:

External barriers	Internal barriers
• Lack of access to resources • Lack of time • Lack of effective training • Technical problems	• Lack of confidence • Resistance to change & negative attitudes • No perception of benefits

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[3] 142 700 female teachers compared to 26 900 male teachers in nursery or primary schools in March 2001. (DfES, 2002)

Research suggests that there are complex inter-relations between these two levels, and between the barriers within those levels. For example, Ertmer (1999) suggests that teachers attach levels of importance to first-order barriers which in turn affect their own second-order barriers. Similarly, teachers' beliefs about the importance of ICT to their subject can magnify or reduce the effect of any practical difficulties they may encounter. In fact, Ertmer continues by suggesting that the issue of low uptake of ICT by teachers can only be addressed when the second order barriers are tackled; there is little point in providing large quantities of equipment if teachers do not have the confidence and attitudes necessary to change their classroom practices.

Another way of grouping the barriers is to consider whether they relate to the individual (teacher level barriers) or to the institution (school level barriers). The barriers identified in this document could therefore be grouped in the following way:

School level barriers	Teacher level barriers
- Lack of time - Lack of access to resources (lack of hardware, inappropriate organisation, poor quality software) - Lack of effective training - Technical problems	- Lack of time - Lack of confidence - Resistance to change & negative attitudes - No perception of benefits - Lack of access to resources (personal / home access)

Understanding the extent to which these barriers affect individuals and institutions may help in deciding how they are to be tackled. The lack of time has been included in both sections of the table, as it can fall under both categories; a teacher's lack of time may be due to the systems put in place by the school, making it therefore a school level barrier, but the lack of time might also be caused by the teacher's own organisation and preferences, which would make it a teacher level barrier. It is important, however, to remember that there are complex relationships between the barriers at each level, and also between barriers within each level; it is not possible to only think of them as existing in entirely separate groups.

It is worth noting here that where policy makers continue to introduce strategies for ICT with the intention of increasing its use in schools, such as improving hardware provision or providing training, such strategies are only likely to have an effect on the school level barriers. The teacher level barriers are more difficult for policy makers to tackle, as it is the teachers themselves who need to bring about the required changes in their own attitude and approach to ICT, if such barriers are to be brought under control. They therefore need to be given support and guidance to help them bring about these changes, and if all ICT barriers are to be tackled, they need to be given this support along side the implementation of national strategies aimed at reducing the school level barriers.

As mentioned earlier in this document, there are close relationships between the barrier caused by a lack of teacher confidence and several other barriers. Figure 1 aims to illustrate these relationships.
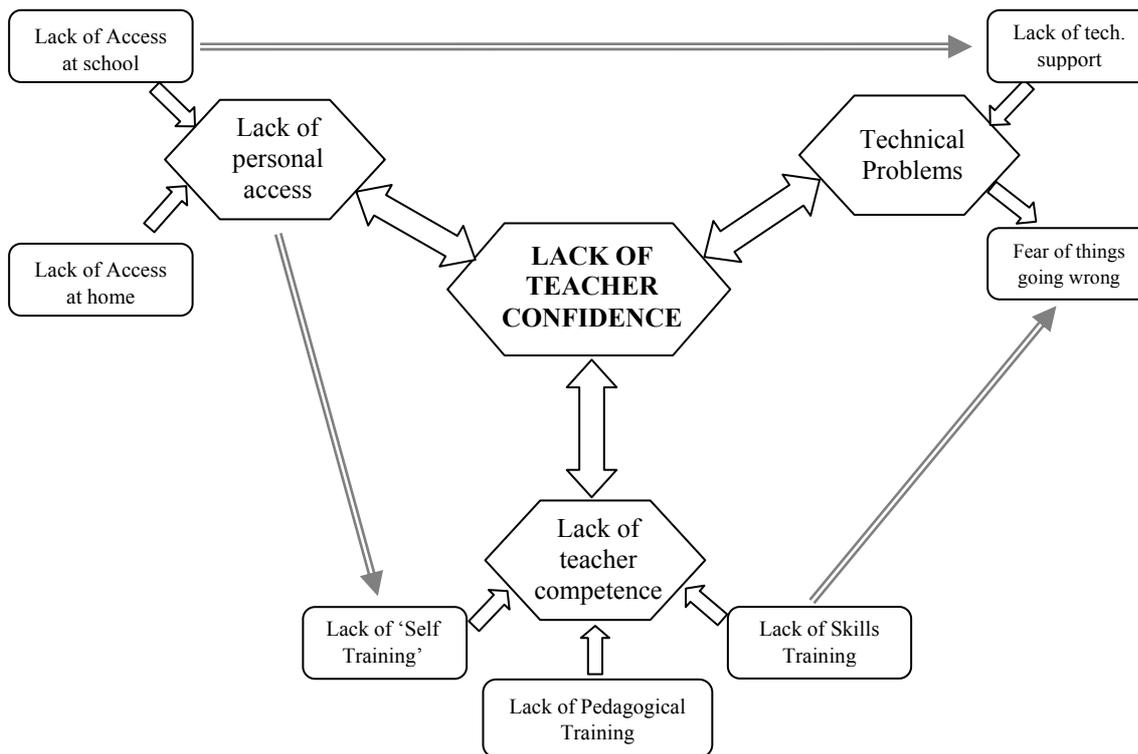
Figure 1 : Relationships between Confidence barrier and other barriers.

In figure 1, the direction of the arrows represents the phrase '*can lead to*'. For example, a lack of technical support can lead to technical problems, which can in turn lead to a lack of teacher confidence. The double headed arrows show that confidence can be affected by the three related barriers, but in turn, a lack of confidence could itself magnify the effects of these three barriers. For example, teachers with low confidence may have a higher expectation of technical faults occurring if they were to use ICT, and as a result may avoid using it. Secondly, a teacher with low ICT confidence may choose not to take part in any optional training, perhaps through fear of embarrassment in front of colleagues, and as a result their competence in using ICT will not improve. Thirdly, a teacher with low confidence may avoid seeking out facilities for personal access to ICT, which would as a result magnify the effects of this barrier.

In addition, some of the factors relating to these barriers can be inter-related, and these are indicated by the darker arrows on the diagram. For example, a relationship exists between the lack of technical support and teachers' personal access to ICT at school. Even when hardware is available, if technical support is not immediately to hand, any technical problems will reduce that access until the problems are fixed. Another relationship represented by the diagram is where the fear of things going wrong could be magnified by teachers' lack of skills training. With a lack of skills training teachers may experience a greater degree of anxiety about possible technical problems, as they would have less of an understanding of how to avoid or solve such problems independently.

Training can also be seen in terms of teachers training themselves, through experimenting and becoming more familiar with hardware and software. There is a relationship between

this 'self training' and teachers' personal access to ICT. Having limited personal access, either at home or at school, will result in a teacher being unable to spend time investigating the available resources, and in turn the teacher's confidence in using ICT may suffer.

It has been demonstrated in this document that the issue of access to ICT is also a complex barrier, and can be broken down into separate types of access barrier. To gain an additional perspective on these contributing factors, and to illustrate the relationships between them, the following diagram can be considered.
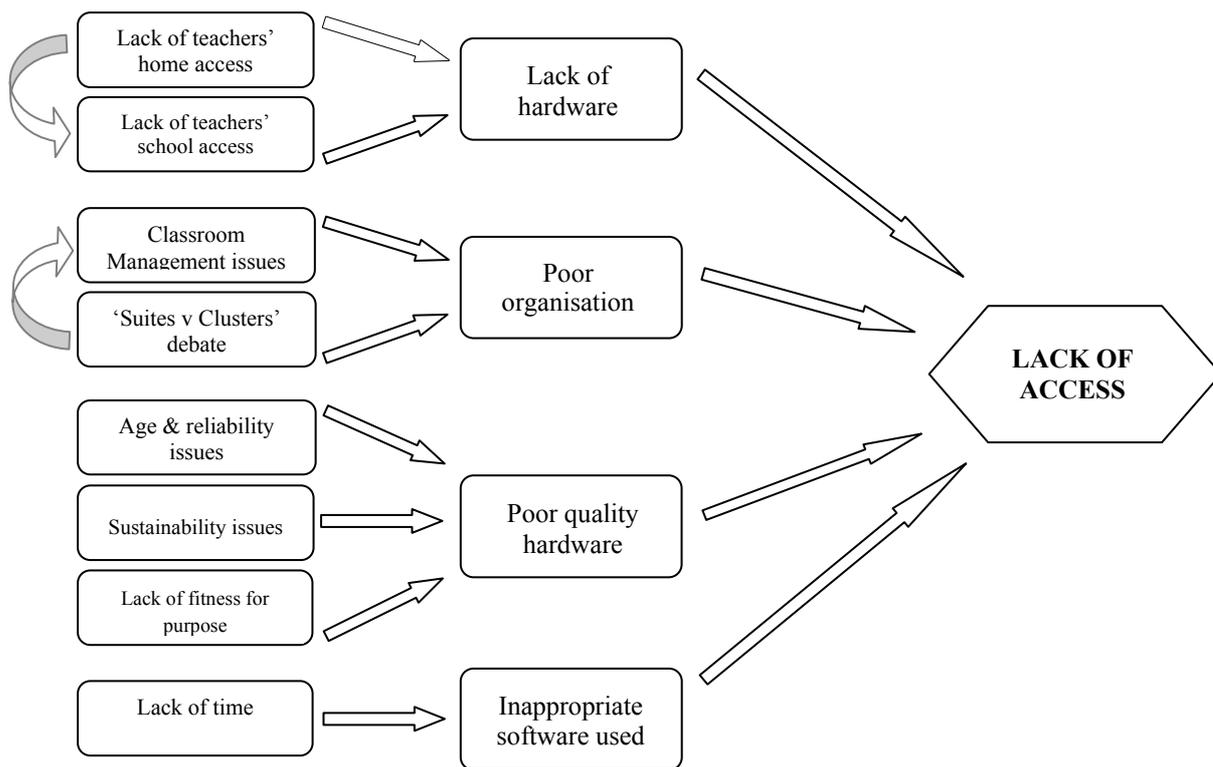
Figure 2 : Issues relating to Access to resources barrier

Figure 2 shows the three main factors contributing to the access barrier, and also identifies the issues related to those three factors. Again, the direction of the arrows represent the phrase '*can lead to*'. The lack of time is linked to inappropriate software to illustrate the point made in Bosley and Moon (2003) that teachers do not have time to carefully evaluate software and therefore choose the most appropriate programs to use in their teaching. Other relationships are indicated by the curved arrows. For example, the lack of hardware at school as an issue is closely related to the lack of home access for teachers; if staff had resources available at home to prepare their work then this would ease the demand for limited resources in school. When considering the organisation of resources, the debate over whether to use computer suites or smaller clusters of computers is important, but either approach can only be successful if effective classroom management is used.

Comparisons between countries

In order to identify the factors which create or reduce the barriers to ICT use, and therefore help teachers to make more widespread use of ICT, it would seem useful to seek a comparison between different countries, in order to identify the differences in approaches to ICT in each country, and to draw correlations between these approaches and the barriers that have been identified there. It might then be possible to identify which approaches are most successful in reducing the barriers. However in practice this is not easy to achieve, as individual studies taking place in different countries have different methodologies and approaches to collecting data, making such a comparison difficult.

Pelgrum (2001), however, does provide us with international evidence, where the same data collection methods were used for each of the nations studied. It is interesting that in this study there was a substantial variation between countries of the most significant barriers to ICT perceived by teachers. The fact that the same barriers do not exist for all schools in all countries suggests that the contextual factors within each country do have an important influence on the extent to which ICT is used. But even in Pelgrum's study, although some correlations between contextual factors and perceived barriers were found, there still remained some striking exceptions, such as countries with low pupil:computer ratios which still had high percentages of teachers complaining of a lack of hardware. This reinforces the argument that the factors contributing to ICT barriers are very complex, and that any one barrier is likely to be caused by a wide range of inter-related factors. Comparisons between the general approaches to ICT in different countries, or even individual schools, will not necessarily provide us with easy solutions to reducing ICT barriers. Further research into ICT barriers, and in addition the factors which enable the more widespread use of ICT, are therefore needed if such solutions are to be found.

RECOMMENDATIONS FOR FURTHER RESEARCH

Subject and sector specific ICT barriers

Although a fair amount of literature providing evidence of the barriers to ICT in general is available, there is little evidence that looks at barriers which exist in specific areas, such as in specific phases of education, or in specific subject areas. In order to tackle the barriers to ICT use, it may be helpful to focus on those barriers that particularly affect practitioners in specific roles. It is therefore suggested that further research be carried out into the barriers to ICT use which are specific to primary teachers and to secondary teachers, and if possible the specific barriers which exist for each of the subject areas within those sectors.

Technology specific barriers

Almost all of the available literature looks at barriers to the general uses of ICT, with some emphasis on the use of computers. There is little evidence which looks at other specific ICT equipment and the barriers which prevent its widespread use. Further research could investigate barriers, and enablers, specific to, for example, use of the internet, interactive whiteboards, or digital video. Again, this would enable targeted advice to be given to allow for the increased integration of each of these technologies in teaching.

Effective ICT enablers

At the same time, it may be possible to seek out examples of ways in which the barriers can be overcome by teachers, perhaps by looking at examples of best practice in schools which have successfully integrated ICT across the curriculum, as well as through a review of the available literature on the subject. A set of 'ICT enablers' could then be drawn up which could help other teachers to make more use of ICT in their work. Again, any work looking at ICT enablers should be specific to subject areas and primary or secondary sectors wherever possible, in order to ensure that identified enablers are targeted to meet specific needs. Similarly, it may be possible to identify those enablers which have particular relevance to teachers, and those which have more relevance to educational institutions.

Effective use of ICT

Throughout the literature on this topic, including in this particular document, reference is made in very general terms to increasing the amount of 'ICT use'. It could be argued, however, that there is little point in increasing levels of ICT use if that use of the technology is not of any real value. It may be helpful, therefore, to look at the kinds of use that teachers are making of ICT, in order to ensure that any advice given to teachers about ICT enablers will allow them to make *effective* use of ICT in their teaching. With this in mind any further research into ICT barriers and enablers should attempt to categorise the kinds of ICT use observed. It may then be possible to see which factors allow teachers to make valuable use of technology, and as a result can be deemed true ICT enablers.

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APPENDIX B:
Information on Becta survey of practitioners

The survey data was collected through the use of a questionnaire (see below), which practitioners completed when visiting Becta's Teachers Online website, and when visiting Becta's stands at the BETT Show and Education Show in early 2003. A bottle of champagne was offered in a prize draw at each of these, in order to encourage people to take part in the survey. This is therefore only an opportunistic survey; the respondents who took part do not necessarily represent exactly the views of the teaching population as a whole, although the survey does give a general picture of the views of teachers regarding the barriers to ICT use.

In total, 170 practitioners responded to the questionnaire, many of them suggesting more than one barrier to teachers' use of ICT, so the total number of individual suggestions was 226. The number of survey responses for each of the barriers identified were as follows:

Barrier	Number of responses	% of total responses
Lack of confidence	48	21.2
Lack of access to resources	47	20.8
Lack of time	37	16.4
Lack of effective training	34	15.0
Technical problems	30	13.3
Lack of personal access	11	4.9
Age	4	1.8

Barriers to ICT : Becta survey of practitioners
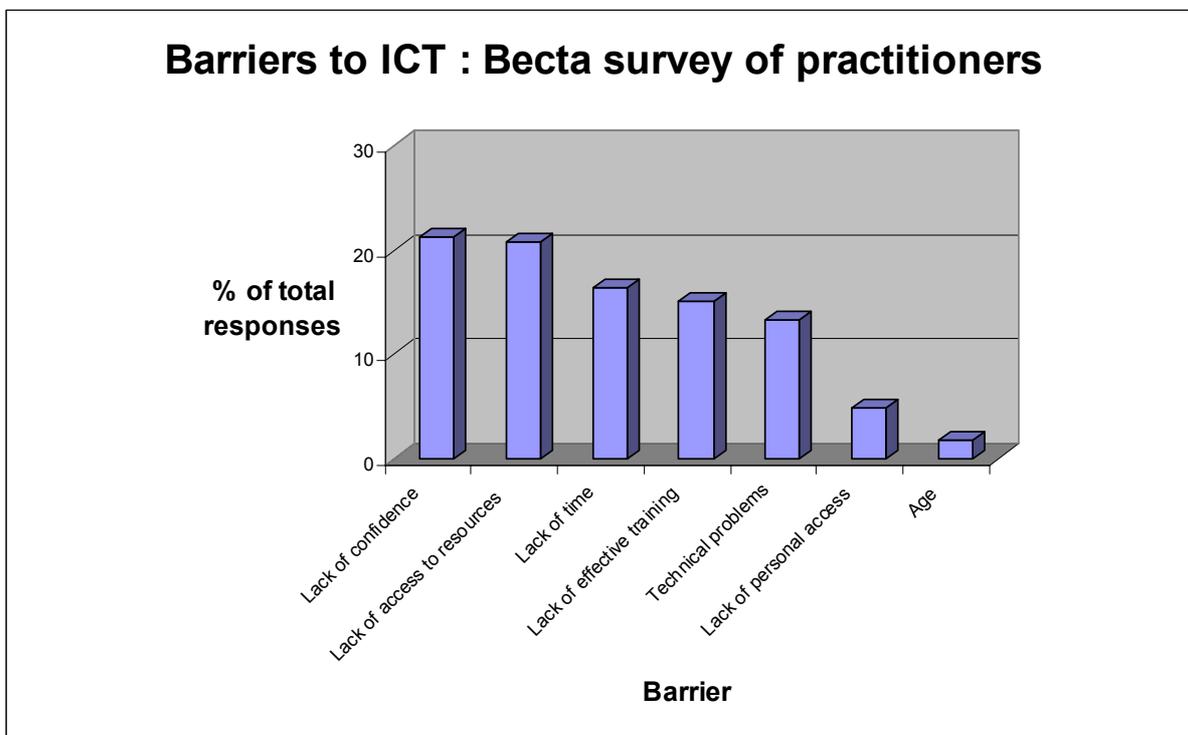
QUESTIONNAIRE USED TO COLLECT DATA FROM EDUCATION PRACTIONERS

Champagne Prize Draw Questionnaire

"What prevents teachers using ICT?"

We are all aware of the stock answers to this!

• Too little time!
• Insufficient hardware/ software/ internet provision/ training
• Lock of confidence/ competence
• Etc, etc, etc.

However, some teachers use ICT a great deal - they too must suffer from some of the same problems common to all - so what makes the difference?

If you think you have the answer please jot it down below. We would be interested in your informal feedback. To encourage you to take part, a bottle of champagne will be sent to a lucky draw entrant at the conclusion of BETT - so give it a go!

Response:

Name:
Email address:
Role / responsibility:

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