



# An Evaluation of the Quality of ICT Teaching within an ICT-Rich Environment: The Case of Two Primary Schools

VASSILIS ZAKOPOULOS

*Athens School of Pedagogical and Technological Education*

*E-mail: vaszak@otenet.gr*

## *Abstract*

This longitudinal, empirical study was set out to evaluate the quality of Information and Communications Technology (ICT) teaching in two UK rural primary schools with ICT-rich environment. The research was carried out for approximately two and a half school years in order to obtain a holistic view of the way teachers implement ICT and of the ways they interact with their pupils. The main data collection techniques employed were participant observation, semi-structured interviews and documentary analysis. The data analysis, derived from the observation of several case studies, suggests that teachers were not sufficiently motivated to drive and enhance their teaching and pupils' learning by the available New Technology and Communication Resources (NTCR). The teachers involved did not in general integrate the NTCR in the teaching and learning process and their own role in the classroom has not yet been adapted to the NTCR. The most frequently identified problems, as also mentioned by the teachers themselves, were: lack of time to organise, prepare and implement computer activities due to pressures from everyday workload and time and curriculum restrictions. Teachers also complained about shortage of on-going training and technical support. The research's findings identified five main ways forward: adaptability, integration, sustainability, professional development and reflective thinking.

**Keywords:** long-term observation, ICT teaching and learning, evaluation, ICT-rich environment, primary schools

## **Introduction**

The potential for Information and Communication Technology (ICT) to transform education is well-documented (BECTa, 1998; Kleiman, 2000; Meadows and Leask, 2000). Computers are powerful and versatile tools because they can introduce either levels of simplicity or levels of complexity into the instructional process and can enhance teaching and reconceptualize learning in numerous ways. There is still, however, considerable uncertainty over how ICT should be used in the classroom, a view corroborated by a number of studies (Watson, 1993; Hargreaves *et al.*, 1996; Chalkley and Nicholas, 1997; OFSTED, 2001). While the use of ICT across schools has been established, integration into the teaching and learning process has hardly commenced (Harrison *et al.*, 2002). Research evidence suggests that the main bulk of the teaching force still utilise technology only sporadically and under a sense of compulsion rather than because they are persuaded of its merit as an educational means (Goldstein, 1997; Lynch, 1999). Teachers are often overwhelmed and

perplexed when faced with the demand to integrate the new technologies into teaching and learning.

The current study was set out to evaluate the quality of ICT teaching in two UK rural primary schools with ICT-rich environment. It is widely recognised that even limited ICT resources in a primary classroom can have considerable implications on the teaching and learning process. What happens though, in an ICT rich-environment? Is ICT being integrated within the curriculum subjects? Has the teacher's role undergone any changes in order to accommodate the New Technology and Communication Resources (NTCR)? Is there interaction between students, the teacher and NTCR? In other words, is ICT used effectively in the classroom? These are the questions this research seeks to answer.

### **Research Framework**

The present study lasted for two and a half school years and took place in two different schools, in order to obtain a holistic view of the way teachers implement ICT and of the ways they interact with their pupils. I designed the research project to include three different stages. During the first stage, participant observation, interviews and documentary analysis took place. The second stage included more detailed participant observation, reactive feedback and interviews with the teachers and pupils. In the third concluding stage discussions and interviews with the teachers took place and I was able to provide detailed positive feedback.

The schools selected, referred to in what follows, as 'First School' and 'Second School', were small, rural, but well resourced primary schools. Their selection was based on the fact that they were both given, by a 'local sponsor organisation', at the same time an almost similar, large amount and wide range of NTCR (mostly Macintosh computers, Internet connection and various peripherals). They were also provided with some introductory training on the use of the new hardware and software and technical support during those three years by the 'local sponsor organisation'. The children were aged between 9 and 11 (Key Stage 2, Years 5 & 6).

Three teachers were observed and interviewed during the two and a half school years. The teachers were experienced, having been at their schools for some time. All of them had basic computer skills while two of them—both from the 'Second School'—were acting as ICT co-ordinators. Both Headteachers were also interviewed.

During the first stage, which lasted for a whole school year, teachers and students adjusted to these NTCR and were on a steep learning curve. Teachers had ample opportunities to ask questions about the NTCR—since the hardware and the software were new to them—and to try different skills and techniques. All teachers attended introductory training on the use of the new hardware and software organised by the 'local sponsor organisation'. Help, advice and technical support was available to them—if needed and asked—during the three school years. Demonstration on the hardware and the software was also given by the researcher before the start of the lesson or during the intervals, when asked, and solutions to technical problems were provided, whenever possible. Given that teachers were still on the steep end of the learning curve no evaluation of the teachers' performance was carried out at this stage.

During the second stage, which lasted for one school year, by continuing to be a participant observer, my role was to focus on the ways teachers used the NTCR in their classrooms, after a school year's of familiarisation, experience and significant help and support. This "on site" evidence is particularly important in order to be able to evaluate the use and implementation of the NTCR.

In the last stage of the research project, which lasted for around a term during the third school year, I provided the teachers with feedback on the issues under investigation and with personal suggestions for improvement in the use of ICT.

This research therefore contains several case studies based upon participant observation, interviews and documentary analysis. The observational procedure enabled me to probe deeply into what was actually occurring inside the classroom. These observations formed the basis of descriptions upon which insights, interpretations and evaluations were made and developed.

Although my research interest was mainly focused on ICT teaching as a process and the quality of interactions and understanding that were engendered between teachers and their pupils, it soon became inevitable that an evaluation and critical appraisal of these outcomes was needed. Thus, specific ICT Quality Indicators for teaching were also devised and developed in order to provide a standard set of observation data to supplement my personal judgements during the second stage of the study. These quality indicators set out the essential elements of good practice in ICT and represent the specific evidence to look for when making judgements. Since the research interest was based on the quality of ICT Teaching, the focus was mainly on the following categories:

### **ICT Quality Indicators for Teaching**

1. Long-term planning Aim
2. Lesson Plan and Organisation
3. Teacher's Knowledge and Understanding
4. Learning Objectives
5. Learning Outcomes
  - a. Pupils' Attainment
  - b. Pupils' Response
  - c. Pupils' Progress
6. Developing Pupils' ICT Capability
7. Developing other Capabilities through ICT
8. Teaching Style
9. Fulfilling of NC, ICT Requirements
10. Planning for Pupils' Differentiation in ICT
11. Encouraging Pupils' Autonomous Use of ICT
12. Access and Use of ICT Resources
13. Time Management
14. Management of Groups

## 15. Discipline

## 16. Teacher's Assessment

An individual scale was created to mark and assess the teaching process through the use of NTCR in the classroom. Each of these ICT Quality Indicators was marked by a grade ranging from 1 to 7, which stands for:

Scale: **1–7**:

- 1: Very poor
- 2: Poor
- 3: Unsatisfactory
- 4: Satisfactory
- 5: Good
- 6: Very good
- 7: Excellent

The marking scale has been designed in order to identify the level of the quality of ICT teaching, provided by the teachers. This was considered important and necessary in order to distinguish 'poor' from 'good' teaching. A seven-grade scale was thought to be appropriate to mark the lessons, as someone could indicate the difference within the quality of teaching, and provide more flexibility to evaluate the analysis of the data. The evidence was supplemented with detailed observation, personal notes and the staff's interviews—and was analysed and discussed with the aid of tables and graphs. In the specific research, observation was also focused on relevant documentation, the schools' ICT policy, schemes of work, and a sample of pupils' work, ensuring that these illustrate the range of ICT tasks in which they have been engaged.

It is obvious that there is no 'safe' way to distinguish a 'good' lesson from a 'poor' lesson, since the issues of bias and subjectivity can always be evident. However, in order to minimise subjectivity when I assessed the lessons, I tried to take into consideration all the important factors in advance. There are many indicators though, that can lead to safe and clear judgements. In general, very simply 'poor' teaching could be defined as teaching where the teacher does not give his/her pupils the opportunities to develop and apply their ICT capability in their study of National Curriculum subjects, as the statutory order states. Even more, poor teaching can be teaching where the teacher has no learning objective(s), has not organised and planned the lesson properly, has not provided access or allowed use of the ICT resources effectively and has not developed his/her pupils' ICT capabilities further and left them unsupervised and with no help. On the other hand, the opposite of all of these could exemplify 'good' teaching. According to OFSTED (2000) 'in determining their judgements inspectors should consider the extent to which teachers':

- show good subject knowledge and understanding in the way they present and discuss their subject,

- plan effectively, setting clear objectives that pupils understand,
- challenge and inspire pupils, expecting the most of them, so as to deepen their knowledge and understanding,
- use methods which enable all pupils to learn effectively,
- manage pupils well and insist on high standards of behaviour,
- use time, support staff and other resources, especially information and communication technology, effectively,
- assess pupils' work thoroughly and use assessments to help and encourage pupils to overcome difficulties,
- use homework effectively to reinforce and/or extend what is learned in school (OFSTED, 2000, BECTa—ICT Inspection web site).

In order to place the current study into a relevant context, a review of the results of some representative studies is presented next.

### **Review on the Implementation of ICT in UK Primary Schools**

There is already enough evidence, as the following discussion shows, to suggest that, despite heavy government funding and the profound interest and support from other parties (e.g. industry) in recent years, ICT's potential has not so far had a significant impact on teaching and learning.

The ImpaCT study (Watson, 1993) was the first longitudinal research (1989–92), which set out to investigate and evaluate the impact of IT<sup>1</sup> on children's achievements in primary and secondary schools in the UK. Although the research evidence shows that the use of IT has, in particular circumstances, a positive impact on children's achievement, the majority of teachers lack sufficient pedagogical skills in order to use IT effectively and were unaware of the essential benefits of IT on pupils' learning (Watson, 1993).

A study, unique in its long-term feature, is the Apple Classrooms of Tomorrow (ACOT) that commenced in 1985 in the United States and later extended to Europe and the UK. The initial idea of the study was to investigate the effects of a technologically rich environment on pupils and teachers. The project offers a perspective into how a technology—rich environment can change the nature of teaching and learning. As Sandholtz *et al.* (1997) emphasise, although the addition of technology radically transformed the physical environment during the first few years of the project, this failed to substantially change students' learning tasks. Only over time did teachers participating in the ACOT project '...move toward child-centred rather than textbook-centred instruction; toward collaborative rather than individual tasks; toward active rather than passive learning' (Sandholtz and Ringstaff, 1996, p. 284).

Chalkley and Nicholas (1997) also investigated teachers' use of ICT by observing 11 teachers and 253 pupils in different classes, in three London primary schools. Their results show that 'computers were not switched on for just over half of the available time. During the time when computers were switched on they were being used by children for 46% of this time' (Chalkley and Nicholas, 1997, p. 101).

Summarising the main inspection findings on IT in UK primary schools during the year 1995–96, Goldstein (1997) commented that overall IT is the least well taught of the subjects of the curriculum and standards of achievements continued to be lower than in any other National Curriculum subject, characterising the courses ‘mostly superficial and dull’. This finding coincides with the finding of the Qualifications and Curriculum Authority (QCA, 1997, p. 8) monitor of the school curriculum 1996–97 which reported that ‘many schools are unclear about the relationship between activities which use IT to support teaching in a subject and activities intended to develop pupils’ skills, knowledge and understanding of IT. The use of IT to support learning is underdeveloped in all subjects.’

The Stevenson report (1997) revealed significant problems in terms of teachers’ confidence in the use of ICT and the availability of ICT equipment and mainly of (high-quality British educational) software directly related to the curriculum. The report suggested there was a low take up and quality of ICT in UK classrooms and one of the main reasons for this, also identified by a McKinsey & Co (1997) report, was that the majority of the computer equipment in the UK was obsolete. Even in schools with ICT—rich environment and Internet connectivity, the evidence shows that the computer was not fully or effectively integrated into the curriculum. According to the Office for Standards in Education (OFSTED, 1999, web site), ‘the major reasons for the greater incidence of unsatisfactory teaching of IT are teachers’ lack of knowledge of the subject and inadequate planning and organisation of lessons and tasks.’ The same report indicates that although an ICT teaching pedagogy is developing and some examples of good ICT practice have been emerging, ‘the vast majority of schools are still unaffected by these changes in pedagogy. Even where ICT tools are used to promote learning, the teaching of IT is mostly an adjunct activity rather than a systematic part of lesson planning’ (OFSTED, 1999, web site).

OFSTED (2001), in their interim report April 2001 ‘ICT in Schools: the impact of Government initiatives’ continued to be critical of the effect of ICT in teaching and learning in English schools. OFSTED comments that the full impact of Government’s ICT initiatives had not been achieved. Their criticism emanates from the fact that ‘one in five primary schools, half of secondary schools and most special schools do not still comply fully with the NC requirements for ICT’. Even in 2002 OFSTED inspectors recorded in their report that it is yet unclear, whether the government’s initiatives in terms of hardware provision and ICT training has had any positive impact on the quality of teaching and learning so far (OFSTED, 2002).

Finally, ImpaCT2, a major study carried out in UK schools between 1999 and 2002 and looking into the impact of ICT on educational attainment, found among other interesting findings that the proportions of lessons involving ICT was generally low over the period concerned, although they claim that this is likely to rise as teachers gain in knowledge and experience, as equipment is made available in more classrooms and as software improves (Harrison *et al.*, 2002, BECTa web site).

The results of the studies mentioned above could be juxtaposed with the findings of the current research, which are presented next.

## **Discussion of the Findings**

### *Findings drawn from observation*

Observations from both schools showed that the availability of NTCR did not seem to have a significant impact on the teaching and learning process. Teachers needed further training and familiarity in the use of communication resources such as the Internet, e-mail and video-conferencing and a variety of other advanced resources, like camcorders and digital cameras. Increased familiarity and knowledge of the resources could result in further willingness for exploration, risk-taking and experimentation with ICT. This knowledge would permit further integration of ICT in teaching and learning.

There was also lack of time to plan and implement ICT lessons, due to curriculum restrictions, as teachers also stressed in their interviews. As a result, opportunities to enthuse, inspire, motivate, stimulate and challenge pupils when using the technology were missed. There is, thus, an apparent need for teachers to increase their levels of adaptability, enthusiasm, creativity and imagination when working with ICT as well as to introduce interaction and regular communication with their pupils. Likewise, given the new resources available, there is need to reflect critically on their classroom practices.

### *Case studies*

The research was based on a number of case studies. These case studies illustrate specific examples of ICT teaching and learning provided in both schools underpinning and supporting the results discussed in this paper. Due to space restrictions, only two case studies are presented here—one for each school—accompanied by specific comments on any missed opportunities for teachers and pupils. They represent a small sample of the several case studies that were conducted as an integral part of this research. The comments reflect the author's personal opinions and do not constitute in any case 'ideal models' or 'perfect suggestions' for all schools to follow. They are stressed in order to pinpoint and highlight the opportunities that were available and could be seized in the future by the teachers and their pupils.

### **Case Study One from the 'First School'**

In the Literacy hour a group of four Year 6 boys were sent 'to use the Internet to review a web page'. The PC with access to the Internet is located in the library, virtually next door to the classroom. The teacher can have a visual contact with the pupils but cannot hear or see clearly what they are doing. The four boys were instructed to do a search on the Internet, choose a 'suitable' web page for their age, review it as they would normally do with book pages and then return with their results. The teacher instructed them on what to do, logged on to the Internet and then told them that they can easily use the search facility and then left. The pupils—apart from one—had no previous experience searching on the Internet and no previous detailed demonstration was given to them on the various facilities and features

of the program (Internet browser). The pupils showed a great response and motivation and were delighted to use the Internet for the first time in the classroom. Pupils' initial great enthusiasm and positive response was soon replaced by a big frustration and anxiety to accomplish their task and they felt very disappointed. They soon found themselves with a large amount of irrelevant pages and web addresses once they tried to put some words and use the 'search' facility, since they were not aware of ways of narrowing down their selections or using the search facility appropriately. Their interest gradually diminished and when they were accidentally presented with some of their favourite cartoon web pages—since their search was not specific—they lost their objective, and a significant amount of time while their motivation and discipline decreased. Then, they became very nervous once they could not decide which web page could have been a suitable one for review and more frustrated since the time was pressing and the web browsing became very slow. All this time they had been left unsupervised and at the end were called back to the classroom to join the rest of the session.

#### *Missed opportunities*

Despite the very important issue of developing pupils' information retrieving and handling skills, no introduction and demonstration was given to them on such an activity and on the main facilities and tools of the Internet. In which way can someone narrow down a search and be selective? No search examples were given and no discussion took place on potential difficulties. No interaction took place between the pupils and the teacher during the whole course of the activity and the children were not presented with challenges or any feedback. Children could have been encouraged to use their imagination and to think of more effective ways to accomplish their task. Due to time restrictions no discussion took place on the differences or similarities of a book page review and a web page review. Finally, no time was left for a discussion on the usefulness of the Internet as a medium and source of information and the possible pitfalls that could be faced when using it.

#### **Case Study Two from the 'Second School'**

The teacher's aim was to teach data handling in the subject of Science. Due to the fact that the teacher wanted her pupils to use the graph facility, she decided not to use any available database programs and installed another program with the graph facility available. That resulted in some considerable delay and frustration both to the teacher and to the pupils. Then two pairs (Year 5) of boys and two pairs of girls were instructed to use the program and enter and handle information about 'children's pets'. The program, called SPA Survey database, is PC compatible only. For that reason only the two PCs available were used and the three Macintosh computers available remained idle. The teacher showed them the main features of the program and then went to work with the rest of the class. The program was fairly easy and quite familiar to the pupils from earlier years. So, it was easy for them to enter the information and use the sorting and graph facilities. At the end the pupils printed out their results and showed them to their teacher. No discussion or feedback followed.



*Missed opportunities*

The teacher's decision to install the software, just a few minutes after the session started, resulted in a big frustration to her and the pupils and considerable delay concerning the teaching and learning process. Valuable time was lost. Planning and organisation are very important for every single session and that concerns ICT resources as well as other issues. The pupils were invited to use a familiar program, which was very easy for them and did not challenge them at all. Other database programs and three computers (Macintosh) were available but were not used at all. Many opportunities were lost for more pupils to use the facilities and practice further. The pupils also lost opportunities to discuss and compare their results at the end of the session and to give their feedback to their teacher and to the rest of the class. The teacher's poor intervention left the pupils unchallenged and with less chances to make sense of the data collected.

The above findings highlight the fact that the addition of technology did not revolutionise classroom instruction in these two schools and even though the sheer number of computers and other technologies radically transformed the physical environment in both schools, it consequently failed to substantially alter students' learning tasks. As Sandholtz *et al.* (1997, p. 10) point out, 'meaningful use of technology in schools goes far beyond just dropping it into schools. Technology in and of itself will not change education; what matters is how it is used.' Consecutive government funded initiatives in recent years led to an increase in the availability of computer hardware and software in schools. It has however become clear that, having access to technology does not necessarily mean that this will be automatically integrated as a resource into everyday teaching and learning. Evidently, apart from other serious reasons, one of the explanations for this situation may lie in the lack of awareness or confidence on the part of teachers. If teachers are not convinced of the benefits of ICT as a means of providing access to a richer range of resources for themselves and their pupils, successful integration into the curriculum is hard to achieve.

The findings raise also the issues of lack of teachers' knowledge and understanding in ICT. This is quite evident, either when the teachers decide to use the technology or even when they seem reluctant to use it. Yet, many teachers are reluctant to embrace the technology and in Owen Lynch's words, in his TES Keynote speech at BETT '99:

... over the past ten years we have not achieved through the use of ICT that for which many of us had hoped or, indeed, expected. During the last decade we have invested significant energy, creativity and resource to implement ICT effectively to improve the quality of teaching and learning. Yet there has not been the expected systemic change. There are still few establishments where ICT has become indispensable to teaching and learning (Lynch, 1999, BECTA Web site).

Teachers seemed to lack a higher order ICT knowledge and understanding. Possible causes could be the lack of pre-service training and the nature of in-service training (INSET) or other modes of training attended, which probably deal with the acquisition of skills rather than looking at different ways of planning and implementing the NTCR. Teachers' lack of

knowledge and understanding prevents them from appreciating the potential of ICT and the tremendous effect it can have on teaching and learning.

The development of pupils' ICT capabilities followed the knowledge and understanding of their teachers. It was apparent through this study that pupils could still function reasonably under certain teacher instructions and directions. Interaction among pupils and their teacher though was limited. In some cases, children seemed bored with the activity they were engaged on the computer. There were far less opportunities for pupils to critically reflect upon their uses of the technology and upon their finished products and seek different ways of improvement. Pupils were not provided with ample opportunities to discuss the ways they use the technology, be critical about their work, provide and receive feedback or think of alternative ways to improve the quality of their end products and assess their capabilities and work as it progresses. As Guile (1998) points out:

Even though ICT may provide highly stimulating resources for students to develop particular skills, solve problems or become acquainted with particular ideas, they will not, by themselves, develop students' intellectual capacities; this will depend on the purposes teachers and students develop for the use of ICT as well as the demands that teachers make on students (Guile, 1998, p. 20).

Most times observed pupils were engaged in the mechanical application of computer tasks without gaining a deeper understanding of the incorporation of ICT in the teaching and learning process. Ager (2000, p. 7) also underlines that, 'it is amazing how often students are encouraged to use computerised "cut and paste" techniques, without adequate thought being given to what can be achieved by doing so.' Teachers need to spend and invest more time in discussing and reflecting with their pupils about the ways that ICT has been used and why and how these could be improved in the future.

#### *Findings drawn from interviews*

The interviews revealed that the problems most frequently faced by teachers in this research when using computers in their classrooms, were: technical problems, curriculum restrictions, lack of time to organise, prepare and implement computer activities, and their need for on-going ICT training. Finally, the teachers indicated need for assistance in the classroom.

Teachers and headteachers in this research expressed the view that technical problems were the most significant problems in the use of ICT:

- R<sup>2</sup>: Apart from training is there any other formal support that you need in your classroom?  
 T.2.2: Technical support for the school. Every school should have a technician! Whether it is a part time technician, we have, in this area we have, one, two, three, four schools within 10 or 15 minutes driving distance primary schools from each other. Two of them are in the same county, two of them are in different counties, but if we had for instance one technician between the four of us, it will be all sorts of things that you

could do, it's not just technical problems, it's software making sure that everything is up to date.

and:

T.1: I need technical support if the problem is hardware. [. . .] If the machines are broken or not function properly, I need technical support. So, I can do simple things but I can't fix computers!

According to the headteacher of the 'Second school' teachers ought to move beyond the acquisition of the 'basic skills' in operating the computer and develop a deeper knowledge and better understanding of incorporating ICT effectively into the classroom. Headteachers' lack of skills, knowledge and understanding can be summarised by his words, which reflect the situation in the 'Second school':

H.2: You've got a headteacher who set himself a target. I am enthusiastic but my ignorance tempers my enthusiasm so I've really got to get into it, no excuses, O.K. I am getting into Windows, I can put in a CD-ROM to work with children, I can interrogate it, I can produce a letter and print it, underline things, it's O.K., that's pretty basic stuff, but I need to do more than that!

Teachers often encounter, and are sometimes 'terrified', by dilemmas of making the appropriate choice of a particular hardware and software in order to achieve a specific learning objective, embedded in a subject context or are even hesitant to use it:

T.1: What I find some times is you are thinking I've got to use IT, but some times you look at the computer, oh how am I going to put IT into that topic. . . and I know a lot of staff because they are not very familiar with IT, just see it as another thing to worry about rather than see it as a brilliant resource to use. . .

Lack of time to organise and to prepare things and implement computer activities is another big issue for teachers:

T.2.2: I think the major problem is the timetabling and having enough time for the children to actually do what you want to do throughout the week because of timetable restrictions.

ICT training is always an interesting, but burning and problematic issue. What kind of training is needed, how often, how and where it can be conducted are only a few questions that instantly arose. Undoubtedly, there is need for on-going training and support if teachers want to be up to date and follow the tremendous speed of the technology evolution:

T.2.2: I know that I have needs because as long as the technology develops I will need to develop my skills, anyway!

The way that teachers approach the technology is of paramount importance in that it reflects their perceptions and attitudes towards teaching and learning and accordingly can significantly influence pupils' attitudes in their learning as well. According to Preston *et al.* (2000) the motivational factors that were found to be relevant to the majority of the teachers were their strong belief in ICT's usefulness for them and for their pupils, computer access outside school, use of a wide range of ICT programs, as well as getting the most of useful training courses and not experiencing many hindrances with using ICT. However, still in present days, a considerable high amount of teachers continue to lie negatively towards the implementation of the ICT into the teaching and the learning process, due to their lack of confidence and familiarity with ICT. This is a serious inhibiting factor which deprives teachers from embracing the technology with enthusiasm and motivation and furthermore from becoming creative and imaginative when using it in the classroom. There are of course certain factors on a typical teacher's day that could deter them from their initial plans:

R: How do you feel working with the whole class including groups using the computers?

T.1: It depends on what type of day you are having. Some days it is perfectly all right, some times it depends on the activity you set the class. That is going to have a pitch on what you are doing so you are going to have to spend a ridiculous amount of time with them and therefore you are not giving the attention to the people that are using the computer. Other times you only need them to crash a couple of times or someone could stop them and you've lost the entire days work, but generally it's O.K. But there are days when you just think I wish I've never turned them on! You know it's just more trouble than it's worth! Then you just have to gauge, when you have a day like that, you think fine O.K just forget it!

### Concluding Remarks

The findings thus suggest that the availability and increase in ICT resources did not appear to have a significant impact on the way teachers teach and pupils learn in either school.<sup>3</sup> Regarding the ways teachers used the technology certain similarities could be identified in the current findings with the results reached in the PALM project (Somekh, 1997) where no radical changes in teaching pedagogy and pupils' learning were found. Other reports have also indicated a rather disappointing picture in teachers' computer use (Chalkley and Nicholas, 1997; Stevenson, 1997; DfEE, 1997; Harrison *et al.*, 2002). The results should be juxtaposed with the DfEE's statistical findings—from the mid 1990s till the year 2000—which show a significant growth of NTCR along with an increased use of ICT by teachers in primary schools. The figures from the DfEE findings however, should be perceived with caution and scepticism, since they indicate nothing about the quality of use of the NTCR. And as the findings of the current research suggest high levels of resourcing do not necessarily guarantee effective use of ICT.

Given the ICT resources available in these two schools the levels of interaction and communication between teachers and their pupils were limited. To improve the levels of interaction and communication students could be challenged and motivated further as

suggested by, *inter alia*, Sandholtz *et al.* (1997). Integration of ICT in teaching and learning is not an easy process. Teachers require the skills, knowledge and understanding as well as time in order to achieve the integration. Drenoyianni and Selwood (1998) stressed the necessity for teachers' acquisition of skills, knowledge and understanding in the use of ICT:

The educational value of using computers, and many other tools in education can only be justified through educational psychology principles and ideas. Teachers' lack of educational technology skills and knowledge regarding the psychology of learning may have the effect of them not understanding the value of computer use, which for other tools is obvious because they are established. This lack of awareness encourages teachers to justify computer use through the adoption of a computer awareness approach (Drenoyianni and Selwood, 1998, pp. 97–98).

The lack of knowledge and understanding by some teachers may have contributed to a conceptual confusion as to what integration of ICT into the teaching and learning process demands. More specifically, teachers' perceptions of the role and the educational use of the computer drive their lesson planning, management and implementation of ICT in the classroom. Evidently, when teachers lack these high order ICT skills and knowledge, their vision and perception of computer use is fairly blurred and doesn't meet the educationalists' dominant theories and perception of ICT as a teaching and learning tool. Teachers' practices in the two schools, reflecting their views about the role of the computer, indicated that for them the computer mainly functioned as a source of information secluded from a meaningful learning context and they paid limited attention to their pupils' cognitive development.

The key to effective ICT teaching and learning does not lie in the mere availability of technology, but rather on the way it is used and manipulated. Faster or more powerful and advanced computers cannot alone bring the desired results or substitute for human thinking. ICT alone does not constitute the panacea to the problems of education, but can prove a valuable tool for teachers and learners if used effectively. Human intervention is the most essential and indispensable constituent to all this. As Chalkley and Nicholas (1997) stress:

It is now well understood that the challenge of integrating technology into schools and classrooms is much more human than it is technological. What's more, it is not fundamentally about helping people to operate machines. Rather, it is about helping teachers integrate these technologies into their teaching as tools of a profession that is being redefined through the incorporation process (Chalkley and Nicholas, 1997, p. 99).

There are various reasons—as mentioned earlier—that can hinder teachers' ICT use within the classroom. However according to the findings of this study, the most important, fundamental factor for teachers' effective use of ICT in teaching and learning is related to their adaptability, along with their integration, professional development, sustainability and reflective thinking and practice. In other words, the extent to which teachers adapt in order to integrate NTCR effectively in the teaching and learning process.

**Adaptability.** This encompasses the demands of the teacher's new role. There is an apparent need for the teachers who still resist, to adopt new perceptions, attitudes and beliefs towards ICT use. Reflecting the findings of Sandholtz *et al.* (1997) and Sandholtz and Ringstaff (1996) teachers could become more adaptable in order to adopt and implement new teaching and learning styles by placing emphasis on more student-centred and open-ended approaches to learning. Pupils can take control of their own learning by becoming more active and by constructing knowledge. Teachers, on the other hand, can become facilitators, advisers and co-learners using their pupils' expertise along with 'sensitive intervention' and guidance (Lai, 1993; Scrimshaw, 1997; Dooley, 1999). When pupils are challenged, stimulated, motivated, enthused and inspired to implement ICT creatively and imaginatively they can then make sense of its uses in subject contexts and in life beyond school. The new technology requires teachers to be more flexible, creative, enthusiastic, imaginative, adventurous and inventive by taking on board innovation and risks, willing to explore and experiment and by dismissing traditional methods (Offir and Katz, 1990; Newcastle University *et al.*, 1999). Adaptability and flexibility is not only a prerequisite for teachers, but for schools as a whole and for the curriculum as well. A flexible and comprehensive curriculum would assist teachers and provide them with more opportunities for the curricular use of ICT.

**Integration.** There is a fundamental difference between 'just using ICT' and 'incorporating ICT for a purpose'. The integration of ICT into the classroom presents a personal challenge to teachers since it demands, from some, a change on their established beliefs and practices. ICT can be more useful when used as an integral part of teaching and learning and not as an 'extra'. Integration becomes all the more possible when teachers have a positive attitude towards ICT, a strong belief about the educational value of ICT use, are competent and knowledgeable users of technology (Drenoyianni and Selwood, 1998; Preston *et al.*, 2000) and also provide their pupils with responsibilities. Computer integration requires a shift from the traditional approach to teaching, which wants individual students working in an isolated manner, secluded from a meaningful learning context to one that involves the triptych of computer, teacher and students in interactive teaching and learning. As Fisher *et al.* (1996) stress in this respect, teachers shouldn't be left to strive in isolation, but should be given relevant training and support in order to achieve this goal.

**Professional development.** Teachers can fully exploit the power of technology, if offered support and relevant and effective training, focusing more on how to integrate ICT into the curriculum. More significantly, this kind of support needs to be on-going so that teachers can sustain the knowledge and skills obtained and keep abreast with the new developments in software and hardware. This in-service training could be run by ICT specialist advisory teachers, who could be visiting schools (once a week or once every fortnight, if possible) and provide personal encouragement, on-going technical and curriculum support on a regular basis. The advisors could then reflect with teachers about the ways that ICT was used or discuss, share and exchange information about the ways that ICT could be incorporated in the future and used as an integral tool in the curriculum (Yocam, 1996). Advisory teachers

could also assist teachers in seeking additional help from other sources, either conventional, like relevant ICT booklets (DfEE, BECTa, NAACE, QCA, etc.) or electronic via the Internet (educational websites, resources for teachers, etc.).

There is also an increasing need for an awareness of the pedagogical frameworks and/or models underpinning the curricular use of ICT in the teaching and learning process and indicating its integrative character (Dexter *et al.*, 1999). During their training teachers would benefit greatly from the demonstration of effective teaching frameworks and classroom practices that move away from traditional methods and stress the constructivist approach which they can adopt. These practices can act as exemplars that will enable them to think of implementing ICT in similar ways. As Fisher *et al.* (1996) indicate in the ACOT project, teachers were more apt to embrace new ICT teaching approaches and ideas mainly when those ideas became tangible examples in real classroom situations. In addition, rather than being provided with training courses that focus simply on the technology and its use, teachers' training should be centred on altering pedagogical beliefs and practices, with the technology being integrated and not being used as supplementary. Teachers would also profit from on-going assistance and support in pedagogical, curriculum and technical aspects of ICT.

Teachers' training, as the teachers in the current study indicated in their interviews, should be on-going, 'hands on' with familiar software and hardware and face to face, if possible. The teachers asked for the training to be pitched to their personal skill level and to place emphasis on how ICT can enhance the teaching and learning process by providing real or appropriate teaching and learning frameworks. Notwithstanding that teachers should attain a holistic familiarity and broadening awareness of a vast amount of NTCR, their training needs should primarily relate to the technologies which they have available to them on an every day basis. Having accomplished this, they could then become aware of a wide range of ICT resources and gain familiarity and experience in the use of more 'advanced' resources, like digital cameras and camcorders, which are currently underutilised (Williams *et al.*, 1998).

Therefore, effective training should be provided to teachers in order for them to obtain a secure command and knowledge of the incorporation of ICT in the curriculum, along with the acquisition of computer and technical skills that would help them become autonomous and get involved in the decision making process concerning the educational use of ICT. For this reason, it might be advisable that teachers' training and support is continuous and is accompanied by personal encouragement and constructive feedback regarding ICT's classroom practices and learning experiences. As Harrison *et al.* (2002) claim teachers' use of ICT in teaching and learning is positively affected by, among other things, teachers' knowledge and experience.

Teachers could also be encouraged to contact other teachers, communicate, exchange and share ideas through conventional or on-line forms. Computer ownership would also help in this direction, since access to a computer at home will drive those who are motivated towards using ICT to enhance their skills and make greater use in school.

**Sustainability.** The inevitable question that arises is 'can teachers sustain the skills and knowledge obtained? Can they develop them further?' As the findings of the present

study suggest, there are obvious difficulties, which are hard to be surmounted by teachers alone given the ever-changing nature of ICT. In this context, continuity and sustainability emerges to be of salient importance. Teachers should be assisted in maintaining their interest of seeking evidence of best practice, welcoming innovative ideas and constantly updating their skills and knowledge. Therefore, they should be given support, personal encouragement and plenty of opportunities for constant professional development (Lynch, 1999).

**Reflective thinking.** When time and curriculum restrictions permit it could be to the teachers own benefit to critically reflect on their classroom practices (Dexter *et al.*, 1999). In doing so, they could identify what went well or what went wrong and thus inform future teaching. They could also share and exchange information, ideas and experiences with other colleagues, either in person or via communication means, like the Internet and email. This implies updating their skills and knowledge as well as new approaches to teaching, which entails fostering a learners' role as well. Future training should encourage teachers in reflective thinking and self-assessment and make decisions about their own ICT development needs.

ICT can offer boundless opportunities for creative and imaginative teaching and learning and teachers are asked to adapt to a new role in order to implement ICT effectively and enhance their pupils' learning. Pupils' attainment and progress are dependent on having access to a broader range of resources and activities and an increasing awareness and control of their use of ICT. Therefore, the implementation of ICT in education could lead to the introduction of new methods, concepts and beliefs that will help teachers to better meet teaching and learning needs. These methods must take full account of the evolution of the role of the teacher, offer learners a more active and participative role, personalise learning, encourage a cross-curricular and integrative approach and foster collaboration and reflective thinking. ICT could be viewed as a means that deliberates thinking and eases and enhances teaching and learning and provides a more enjoyable dimension in the schooling world.

Well, [...] despite the many tasks that fill a teacher's day, you might just be thinking you'll give the computer another chance in your learning environment. Please do. Computers are not perfect, but they really don't bite and the rewards, despite all the difficulties, might just be to see real delight on the faces of your children as they rush ahead with their learning thanks to your wisdom, to the computer's power and to their own personal hunger for learning (Heppell, 1998, Ultralab web site).

Getting the chance to teach and learn in a technologically (ICT) rich environment is not a matter of merely using the technology, but rather it is about maximising and optimising teachers' and learners' opportunities, discovering their abilities and exploiting and expanding their potential.



### Acknowledgment

This is a revised version of a chapter of my Ph.D. thesis submitted to the University of Reading in December 2001. I would like to express my gratitude to my supervisor Colin Wells for his guidance and on-going support, to my examiners Professor Stephen Heppell and Dr. Patrick Carmichael for their constructive comments, and to two anonymous referees of this journal for their helpful comments.

### Notes

1. Please note that IT used in this context is synonymous to ICT as currently used.
2. R stands for researcher, T.1 for the teacher of the 'First school, H.2 for the Headteacher of the 'second school' and T.2.2 for the teacher of the 'Second school'.
3. It has to be stressed at the outset of this section, that the case studies described earlier were not exposed in any way to devalue the work of teachers, but were simply intended to present an illustration of the ICT use in both schools. Where limitations in classroom work were described, that was done so in full recognition that they have not been perceived as teachers' or pupils' personal shortcomings.

### References

- Ager, R. (2000) *The Art of Information and Communications Technology for Teachers*. London: David Fulton Publishers.
- BECTa (1998) *Connecting Schools, Networking People. ICT Planning, Purchasing and Good Practice for the National Grid for Learning*. Coventry: BECTa.
- Blease, D. and Cohen, L. (1990) *Coping with Computers. An Ethnographic Study in Primary Classroom*. London: Paul Chapman Publishing Ltd.
- Chalkley, T. W. and Nicholas, D. (1997) Teachers' use of information technology: Observations of primary school classroom practice. *Aslib Proceedings*, **49**(4), 97–107.
- Dexter, S. L., Anderson, R. E. and Becker, H. J. (1999) Teachers' views of computers as catalysts for changes in their teaching practice. *Journal of Research on Computing in Education*, **31**(3), 221–239.
- DfEE (1997) *Survey of Information Technology in Schools 1996—Statistical Bulletin*. London: The Stationery Office.
- Dooley, K. E. (1999) Towards a holistic model for the diffusion of educational technologies: An integrative review of educational innovation studies. *Educational Technology & Society*, **2**(4), 35–45.
- Drenoyianni, H. and Selwood, I. D. (1998) Conceptions or misconceptions? Primary teachers' perceptions and use of computers in the classroom. *Education and Information Technologies*, **3**, 87–99.
- Fisher, C., Dwyer, D. C. and Yocam, K. (1996) The Apple Classrooms of Tomorrow. An Overview. In *Education and Technology. Reflections on Computing in Classrooms*, C. Fisher, D.C. Dwyer, and K. Yocam (eds.), San Francisco: Jossey—Bass Publishers. Apple Press.
- Goldstein, G. (1997) *Information Technology in English Schools: A Commentary on Inspection Findings 1995–6*. Coventry/London: NCET/OFSTED.
- Guile, D. (1998) *Information and Communication Technology and Education*. London: Institute of Education, University of London.
- Hargreaves, L., Comber, C., and Galton, M. (1996) The national curriculum: Can small schools deliver? Confidence and competence levels of teachers in small rural primary schools. *British Educational Research Journal*, **22**(1), 89–99.
- Harrison, C., Comber, C., Fisher, T., Haw, K., Lewin, C., Lunzer, E., McFarlane, A., Mavers, D., Scrimshaw, P., Somekh, B., and Watling, R. (2002) *Impact2: The Impact of Information and Communication Technologies on Pupil Learning and Attainment*. ICT in Schools Research and Evaluation Series, No. 7. London: DfES/BECTa. Available at: [http://www.becta.org.uk/page\\_documents/research/ImpaCT2\\_strand2\\_report.pdf](http://www.becta.org.uk/page_documents/research/ImpaCT2_strand2_report.pdf)

- Heppell, S. (1998) *Teacher and Computers. Computers don't bite teachers*. Accessed 11/12/00, at: [http://www.ultralab.ac.uk/papers/teachers\\_and\\_computers/](http://www.ultralab.ac.uk/papers/teachers_and_computers/).
- Kleiman, G.M. (2000) Myths and realities about technology in K-12 Schools. In *The Digital Classroom. How Technology is Changing the Way We Teach and Learn*. D.T. Gordon (ed.), Cambridge, MA: The Harvard Education Letter.
- Lai, K.-W. (1993) Teachers as facilitators in a computer-supported learning environment. *Journal of Information Technology for Teacher Education*, 2(2), 127–136.
- Lynch, O. (1999) *Teaching and Learning for the next decade. Is ICT indispensable? Is it sustainable?* (TES Keynote Speech, BETT '99, Thursday 14 January 1999). Accessed 20/05/99, at: [http://www.becta.org.uk/information/bett99\\_speech/bett99\\_speech1.html](http://www.becta.org.uk/information/bett99_speech/bett99_speech1.html)
- McKinsey & Company (1997) *The Future of Information Technology in UK Schools*. London: McKinsey & Company.
- Meadows, J. and Leask, M. (2000) Why use ICT? In *Teaching and Learning with ICT in the Primary School*. M. Leask, and J. Meadows (eds.), London: RoutledgeFalmer.
- Newcastle University et al. (1999) *Ways forward with ICT: Effective Pedagogy using Information and Communications Technology for Literacy and Numeracy in Primary Schools*. Newcastle: University of Newcastle.
- Offir, B. and Katz, Y. J. (1990) Computer orientated attitudes as a function of risk-taking among Israeli elementary school teachers. *Journal of Computer Assisted Learning*, 6(1–2), 168–173.
- OFSTED (1999) *OFSTED Primary Education: A Review of Primary Schools in England, 1994–1998*. London: The Stationery Office. Accessed 16/05/01, at: <http://www.official-documents.co.uk/document/ofsted/ped/ped.htm>
- OFSTED (2000) *Teaching. Primary Schools. Indicators*. Becta—ICT Inspection Web site. Accessed: 05/12/00. Available at: [http://www.becta.org.uk/supportproviders/section/ict\\_sub/primary/t\\_indicators.html](http://www.becta.org.uk/supportproviders/section/ict_sub/primary/t_indicators.html)
- OFSTED (2001) *ICT in Schools. The Impact of Government Initiatives: An Interim Report April 2001*. London: OFSTED. Accessed 20/05/01, at: <http://www.ofsted.gov.uk>
- OFSTED (2002) *ICT in Schools: The Effect of Government Initiatives. Progress report, April 2002*. London: OFSTED. Accessed 12/09/02, at: <http://www.ofsted.gov.uk/publications/docs/19.pdf>
- Preston, C., Cox, M., and Cox, K. (2000) *Teachers As Innovators. An Evaluation of the Motivation of Teachers to use Information and Communications Technologies*. South Croydon: MirandaNet.
- QCA (1997) *Monitoring the School Curriculum: Reporting to Schools*. 1996/7. London: QCA.
- Sandholtz, J.H. and Ringstaff, C. (1996) Teacher change in technology-rich classrooms, In *Education and Technology. Reflections on Computing in Classrooms*. C. Fisher, D.C. Dwyer, and Yocam, K. (eds.), San Francisco: Jossey—Bass Publishers. Apple Press.
- Sandholtz, J. H., Ringstaff, C., and Dwyer, D. C (1997) *Teaching with Technology. Creating Student-Centered Classrooms*. New York: Teachers College Press.
- Scrimshaw, P. (1997) Computers and the teacher's role. In *Using Information Technology Effectively in Teaching and Learning. Studies in Pre-Service and In-Service Education*. B. Somekh and N. Davis (eds.), London: Routledge.
- Somekh, B. (1997) Classroom investigations: Exploring and evaluating how IT can support learning. In *Using Information Technology Effectively in Teaching and Learning. Studies in Pre-Service and In-Service Education*. B. Somekh and N. Davis (eds.), London: Routledge.
- Stevenson, D. (1997) *Information and Communications Technology in UK Schools: An Independent Inquiry*. London: The Independent ICT in Schools Commission.
- Tyack, D. and Cuban, L. (1995) *Tinkering toward Utopia: A Century of Public School Reform*. Cambridge, MA: Harvard University Press.
- Watson, D. (ed.) (1993) *The Impact Report. An Evaluation of the Impact of Information Technology on Children's Achievements in Primary and Secondary Schools*. London: Department for Education and King's College London, Centre for Educational Studies.
- Williams, D., Wilson, K., Richardson, A., Tuson, J., and Coles, L. (1998) *Teachers' ICT skills and knowledge needs. Final Report to SOEID*. Accessed at: 03/04/00, <http://www.scotland.gov.uk/library/ict/append-title.htm>.
- Yocam, K. (1996) Conversation: An essential element of teacher development. In *Education and Technology. Reflections on Computing in Classrooms*. C. Fisher, D. C. Dwyer, and K. Yocam (eds.), San Francisco: Jossey—Bass Publishers. Apple Press.