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An Evaluation of the Impact of ICT in Teaching and Learning in two Primary Schools

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SUMMARY:
This research project set out to investigate the effectiveness of primary teachers' management, use and implementation of Information and Communication Technology (ICT), in two primary schools with a 'rich' ICT environment and to investigate a model of staff development with these teachers. Long-term observation, interviews and documentary analysis were the main data collection techniques employed. The research conducted over the course of two and a half years and outlines significant findings of the implementation of ICT in these two primary schools in England. Evidence from the findings suggested that teachers' use of NTCR was not integral part of their teaching and learning process and that teachers were not particularly motivated by the New Technology and Communication Resources (NTCR) available to drive and enhance their teaching and pupils' learning and many opportunities were missed. There is an apparent need for teachers to integrate the NTCR in teaching and learning and be continuously trained, supported and keep abreast with the ever changing developments of the NTCR.

KEYWORDS: *ICT teaching, primary schools, classroom practice, teacher training.*

INTRODUCTION

Over the past few years the 'intrusion' of Information and Communication Technology (ICT) in schooling and the increasing availability of New Technology and Communication Resources (NTCR) in classrooms has affected the method of instruction and the quality of teaching and learning. Between 1998 and 2000 (DfEE, 1998; 1999; 2000), the average expenditure on computers per school increased steadily in all school types. Since 1997, when the ambitious governmental initiative of the National Grid for Learning (NGfL) has been launched, the government has been providing funds (£230 million) in order to equip schools with modern ICT equipment and to support and expand teachers' ICT experiences, through the New Opportunities Fund (NOF) training scheme.

However, there is still considerable uncertainty over how ICT should be used effectively in the classroom and numerous studies have corroborated this view (Watson, 1993; Hargreaves *et al*., 1996; Chalkley and Nicholas, 1997). While its use across schools has been established, 'real' integration into the teaching and learning process has hardly commenced. Research evidence suggests that still the main bulk of the teaching force utilise technology only sporadically and it is often being urged under a sense of compulsion rather than persuasion of its merit as an educational means (Goldstein, 1997; Lynch, 1999). Not in only scant occasions, teachers have been left overwhelmed and perplexed when they were faced with far-reaching demands to integrate the new technologies into teaching and learning. Obtaining high levels of resourcing though, may not

always lead to successful results. In other words, although the increase in hardware and software can facilitate and provide more opportunities to teaching and learning, does not necessarily means that it can automatically guarantee effective ICT use (Watson, 1993; Chalkley and Nicholas, 1997).

Aim of the Study

The prime aim of this study was to provide valuable insights into teachers' abilities and attitudes towards technology and learning and to explore whether and/or how the new technologies are supporting teachers in their work. More precisely, the main aim was to look at the ways in which ICT was being used and to ascertain how does the NTCR affect teachers and their pupils in the ICT teaching and learning process.

Setting the Scene

A series of classroom observations was carried out over the course of two and a half school years in two well ICT-resourced primary schools, aiming to provide secure evidence of existing ICT practice. The children aged between 9 and 11 years (Key Stage 2, Years 5 & 6) and both teachers were experienced, playing key roles in their schools.

METHODOLOGICAL ISSUES

A decision was taken to observe the teaching and learning process over a long time, for once a week for approximately two and a half school years, in order to gain a better understanding of what has been taking place inside the classroom. Thus, three different approaches have been employed, in order to collect as much information as possible, within the limitations of resources, time and finance. Several *case studies* therefore, were based upon *participant observation, interviewing* and *documentary analysis*. More precisely, the *observational* procedure did enable me to probe deeply into what was actually occurring inside the classroom and scrutinise the evidence that emerged and formed the basis of descriptions upon which insights, interpretations and evaluations were made and developed. Although my research interest was mainly focused on the 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 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' Differrentiation 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

Interviews were also used in order to supplement the data of the research and provide more insight into teachers' and headteachers' personal beliefs, views and perceptions about the teaching and learning process. In addition interview data were utilised to examine whether the teachers' and headteachers' expressed views, were supported by the evidence of observation. *Documentary analysis* was used as a technique complementing the *triangulation* approach, in order to provide more information and enhance the validity of the findings.

Progressive Focusing

In order to obtain an holistic view of the way that teachers implement ICT and interact with their pupils a great deal of time was regarded as necessary. Hence, the planning of the current study included three different stages, which approximately entailed in two and a half school years. At the outset, this progressive focusing was achieved through the focusing of the research questions, then the methods selected and also on the gradual focusing of the research interest during the three stages of the research. During the first stage, demonstration, in-service training, participant observation, documentary analysis and interviews took place; in the second stage more detailed participant observation, reactive feedback, documentary analysis and interviews; and in the third concluding detailed positive feedback, discussions and interviews with the teachers.

During the first stage, the teachers had ample opportunities to ask questions and try different skills and techniques, since the range of the NTCR was new to them. In spite the fact that solutions to any technical problems were provided, whenever this was possible, no attempts were made though, to promote pedagogical change as teachers and students adjusted to these NTCR and were in a steep learning curve.

During the second stage, by retaining the role of a *participant observer*, but by observing in more detail, I was aiming to be able to make secure judgements on the ICT teaching and learning process within a natural context. More precisely, to be able to look at the ways the teachers used, incorporated and implemented the NTCR in their classrooms, after a school year's of familiarisation, experience and significant help and support.

In the last stage of the research project, I offered my immediate constructive feedback - approximately for a term during the third school year (1999-2000) - as well as my personal suggestions. This included a reflection, with the teachers, on the ways that software and hardware had been used, during the previous school year.

RESULTS

Due to space constrictions only a few of the findings are cited and discussed here, regarding the impact of ICT in teaching and teachers' training. The research findings, derived from observational data, suggested that overall ICT teaching in both schools was '*unsatisfactory*'. There

was less evidence that teaching with ICT was effective, and that teachers provided themselves and their pupils with many opportunities to utilise and exploit the wealth and wide range of the NTCR available. Therefore, as the findings of the present study indicate, the addition of technology did not revolutionise classroom instruction 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. The effective use of technology involves much more than 'adding' computers to classrooms. 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.' In addition, observational data illustrate that in many cases the teachers, regardless of the choice of software, appeared to send children to use the resources alone, quite isolated in terms of teaching and learning, and away from a meaningful context. There were several occasions where the computer activities were external to the whole culture of the classroom. As Smith (1999, p. 2) underlines, 'many pupils experience ICT in isolation. Opportunities for greater challenge are missed, due to a lack of teacher intervention.'

Through the results of this study in respect of '*Teachers' ICT Knowledge and Understanding*' both teachers seemed to lack an understanding of these abilities. According to the teacher of the second school:

> *Yesterday, I was training every member of staff on the new PCs on Acorns on anything that we wanted to have more knowledge about, because they haven't all got the knowledge even about Word, you know simple things!*

Possible causes could be the lack of pre-service training and the nature of recent 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:

> *I've been on courses on certain aspects like data handling or communicating ideas or modelling but it is a general thing rather than specifically to use these machines.*

However, factors such as the lack of desire to experiment and exploit the opportunities that the technology generously offers, can deter teachers from extending their knowledge and understanding. Obviously, ample personal time needs to be devoted to practice and/or seeking help and advice from many electronic or 'conventional' type of ICT sources that already exist to provide assistance and support for teachers. Teachers' lack of knowledge and understanding prevents them from appreciating the potential of ICT and its tremendous effect that can have in teaching and learning. Without confidence, teachers are hesitant to embrace computers as a teaching and learning tool and appreciate its potential:

> *... 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 ...*

That is obvious, because how come can someone recognise the vast abilities and opportunities that can be offered by a means, when himself or herself is not competent and does not posses the knowledge? Thus, teachers' skills and knowledge is absolutely essential for the effective integration of ICT.

Through the findings, drawn from observation as well, teachers' reluctance to use non familiar technology equipment was obvious. Lack of skills and knowledge, along with common problems regarding time and curriculum restrictions, prevented teachers and consequently their pupils from

exploiting and experimenting with a part of technology that seemed very promising and equally exciting.

Throughout the results drawn from the interviews the most frequently mentioned problems that teachers faced, when using computers in their classrooms, were of a *technical nature*, the *restrictions* and *lack of time to organise, prepare* and *implement computer activities* and in particular they referred to their *need for ICT training*. Finally, the teachers indicated their *need for assistance in the classroom*.

What also becomes apparent from teachers' interviews is the *need for on-going ICT training and support* :

> *I know that I have needs because as long as the technology develops I will need to develop my skills, anyway!*

As NCET/NAACE (1993, p. 5) note, 'since few teachers have been initially-trained in the use of IT, in-service training (INSET) is of particular importance in improving the quality of teaching'. However, INSET training does not occur frequently and systematically or even when it happens it raises questions about its appropriateness and effectiveness.

The findings of this study have many important implications concerning the content of training and the professional development that is necessary to help teachers integrate ICT more effectively into their teaching. Teachers expressed their need for training and more specifically for *on-going training* because of the rapidly changing nature of the technology. There is an increasing need for teachers to keep abreast of the developments of technology in order to make the most of it. The pace that hardware and software transforms and develops is exceptional and teachers need to be prepared to update their skills and knowledge on a regular basis. Teachers also expressed their *disappointment for the training courses attended* so far, emphasising the *inappropriateness* of the courses due to their 'general knowledge' content or due to their own higher knowledge from the one received:

> *Any course I have been on, my knowledge was higher than the course. And I just sat there in front of the machine!*

Teachers would favour ICT training providers to have some expertise and focus on their particular subject or the age group they teach. *On-line training* seems to be another thing to worry about for the non ICT capable teacher who cannot anticipate the benefits of such process. Teachers did not feel knowledgeable or confident enough to benefit from on-line training. Also, training during *twilight sessions* falls again into the *time restrictions* category and teachers arguing about the amount of time left to them. They stressed their preference though, to be trained regularly, in their own school environment and on their own familiar machines (hardware and software). It seems apparent that training on their own machines and in their own environment, focused on their particular subject or the age group they teach, can be very useful and effective since teachers can apply more conveniently what they have been taught.

More significantly, teacher training need to focus on how to implement and integrate the technology in teaching and learning, rather than merely demonstrate them how to use the hardware and software. If not, training will not be effective. Teachers need to be presented with 'real' teaching frameworks that incorporate ICT seamlessly into the curriculum subjects. As Somekh and Davis (1997, p. 5) pinpoint, 'real change (as opposed to the mere appearance of change) always

involves individuals exploring and experimenting so that their learning is integral with action and development.'

DISCUSSION

Despite the arduous effort of some teachers, who embraced the technology, to incorporate it effectively in the classroom and the enormous government investment in hardware and software, there are still vast number of teachers who are not familiar with ICT, therefore they do not feel competent to implement it successfully into the curriculum (Chalkley and Nicholas 1997; Stevenson 1997, OFSTED, 1999). The ever-changing nature of ICT demands teachers to be up to date with technological evolution and developments.

In order to take the appropriate, informed decisions as to how, when and when not to use the technology, teachers need to attain a secure command of ICT knowledge and understanding. Something that many of them lack, due to insufficient pre-service training, irrelevant INSET and unfamiliarity with the technology. Teachers may obtain the basic skills to operate the computer, but it is the acquisition of higher order skills that could enable them to incorporate and implement ICT effectively in teaching and learning. As Tyack and Cuban (1995, p. 125) point out, 'simply having access to computers and learning to use them as tools is only part of the story of the educational use of computers. To what degree, are they actually employed as sophisticated teachers' aides and integrated into instruction?'

Heppell (1993) delineated educational computing's evolution in four 'clear (not mutually exclusive), incremental stages':

- Stage One: Topicality
- Stage Two: Surrogacy
- Stage Three: Progression
- Stage Four: Pedagogic Evolution.

In the '*topicality*' stage the computer was the main focus and was used as a subject on its own, presenting 'computer awareness' learning outcomes and a few only children had experienced computer use. The '*surrogacy*' stage as Heppell (1993, p. 231) described it 'characterised the computer as a surrogate teacher, containing a discrete and relatively small body of expertise which could be trickle fed to the "empty vessel" learner.' In this stage, computers were viewed as the means to deliver parts of the curriculum. In the '*progression*' stage, the issue of 'What will I do next with the capability I have developed' was addressed. Despite the successful harnessing of computers this is still a transitional stage. According to Heppell, educational computing has not yet reached Stage Four. In '*pedagogic evolution*' change is suggested in identifying the new information capabilities of young learners and of recognising the computers' effect on learning. Finally, at this stage there should be an awareness of computer's important role to offer a new approach in learning and to the learner's transformation as well.

According to Somekh (1997, p. 122) there are three broad approaches, which teachers can take to computer use to support learning:

- the computer as tutor;
- the computer as neutral tool;
- the computer as cognitive tool.

Some teachers keeping a non-active role, view the computer as a *tutor*, where the pupils are taught by it, without any intervention by them. Pupils may have some control over the software, but without teachers' participation in the process this approach is not proving to enhance teaching and learning. Some other teachers view the computer as a *neutral* tool. Here, the computer activity is shaped on familiar tasks, which remain virtually 'untouched' by the use of technology. Teachers adopting this approach favour mainly the computer's presentation power. Finally, the computer is

viewed as a *cognitive* tool that can be used to enhance children's learning by providing them with the opportunity to achieve things that would be impossible to be done without the help of the computer. Pupils' activities include inquiry-based learning, use of generic software, problem-solving and decision-making and extensive use of communications such as e-mail. In order to be able to use computers this way, there is need for teachers to change their pedagogy and appreciate computers' potential as powerful cognitive tools. These different approaches have considerable implications to ICT teaching and pupils' learning, but as in any other useful model of classification, 'it would be wrong to assume that any one view is the one and only correct approach' (Ager, 2000, pp. 9-10).

The use of ICT in the classroom can affect the teaching and learning process in a variety of ways. It affects not only the way in which the lessons are planned and organised, but also the detailed structure of the events that take place within the session. It is globally recognised that the conventional approach of teaching, such as the teaching of facts and figures, is the predominant teaching style amongst serving teachers and solidly embedded and ingrained in educational establishments. In teacher-centred classrooms teachers impart facts to students and the use of technology is complementary and external to teaching and learning. In student-centred classrooms, teachers encourage their students to work in an active way and to construct their own knowledge. In order for teachers to embrace the new technologies and adapt student-centred approaches that accommodate them, plenty of time is needed for consolidation and reflection of these practices, time to think of implementation and integration in terms of gradual steps in order to see change as a more feasible process. Therefore, Dexter *et al*., (1999, p. 237) suggest that in order for teachers to acquire the knowledge to include the use of computers in their classrooms, 'teachers must have opportunities with computers, models of how computers work in instruction, and opportunities to reflect on their and the computer's roles in the learning process.' Thus, a teacher supportive context with professional-development opportunities and time to reflect on new approaches could bring results in teacher's decision making.

CONCLUSION

Although improvements have been made in all levels, there are still teachers who are not competent users or who cannot see the real benefits of ICT within the classroom. Some others, even though they have acquired basic computer skills, they lack the pedagogical understanding and the ability to integrate ICT into their teaching within various curriculum subjects. The way that leads to effective ICT teaching cannot be moulded through particular steps or 'recipes'. It is a long and on-going process due to the ever-changing and constantly evolving nature of ICT and thus, teachers need to be equipped with willingness and perseverance along with the essential acquisition of a wide range of skills. In addition, teachers need to be able to reflect on their practices and question successful or unsuccessful methods. But teachers should not be left alone, to strive in isolation, whether they are using computers effectively or less effectively.

Nowadays, there is an imperative for teachers to move from teacher-centred learning to student-centred learning, from isolated work to collaborative work, and from factual, knowledge-based instruction to critical thinking and informed decision making. Teaching should cease to be information-fed oriented and should become more interactive, whereas teachers should encourage active, exploratory and inquiry-based learning. NTCR enables new modes of teaching and learning to be adopted. In respect to teaching, ICT empowers teachers to become managers of learning than providers of information. ICT has opened up new ways of learning. From passive learning to a learning model that emphasises a more active, and more constructivist approach. Teachers need to be able to develop a metacognitive awareness to reflect on their own teaching and learning, in order to be able to develop these skills in their own pupils and to assess their own professional needs.

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