Embracing ICT in a Second Level School:

Challenges and Implications for

Teacher Attitude, Role, and Development.

Diane Birnie

B. A. Mod., H. Dip. Ed.

A Dissertation submitted to the Education Department, National University of Ireland, Maynooth, in part fulfilment of the requirements for the Master of Education Degree.

Date: July 1999

Head of Department: Professor John Coolahan

Supervisor: Mr. Jim Callan

Contents

Figures and Tables

Figures

Tables

Declaration

I declare that this dissertation is my own work and has not been submitted as an exercise for a degree at this or any other University.

Signed: Diane M. Birnie Date: 17th July 1999

Diane M. Birnie

Acknowledgements

The experience of taking the Masters in Education Degree in NUI Maynooth was a fulfilling one. The Education Department lecturers, under the leadership of Professor John Coolahan were enthusiastic and encouraging. Brid and Lily were always available to answer my administrative queries.

My classmates were a great support as colleagues and friends. I wish them well in their future endeavours. My teaching colleagues supported my efforts. Thanks to those who, in a special way shared the experience with me. Good luck to those who follow.

My friends and family were understanding and patient as I took a two-year break from normal life.

I am indebted to Jim Callan, my supervisor who offered support, advice, clarity, praise, criticism, and conviction and always at the appropriate moment.

And to Declan, my partner and friend, who supported me in every conceivable way during my studies. Thanks for the hours of proof-reading, the continuous positive reinforcement and for being the wind beneath my wings – thanks for helping me to fly!

Diane.

Abstract

This study researches teachers' attitudes to Information and Communication Technologies (ICT) in a particular second level school in Dublin, Ireland. Within this context, it examines the challenges for teachers which are raised by the adoption of ICT in schools. The study also outlines the consequent implications for teacher development and for educational change support agencies.

Many of the key research writings in the areas of ICT in education, teacher attitude and implementing change are presented. Through a process of analysis of the data obtained by questionnaire and interview procedures, it was discovered that teachers' anxieties are a significant factor in contributing to positive or negative attitudes to computers.

Two kinds of anxiety are drawn from the data: computer use anxiety and computer pedagogical anxiety. Factors contributing to computer use anxiety are classified as "Hail to the computer!" factor; "it's beeping at me" factor; language or "buzz-words" factor; personality or 'that's just the way I am' factor; 'generation game' factor; and 'poor access and education' factor. In overcoming computer use anxiety the following issues were found to be of key importance: training/in-service/teacher development; the importance of significant events in teachers lives; the computer ethos in society and in the school; and the effect of "seeing other peoples' success" with computers. The value of supportive collaborative environments was also evident and time to familiarise and experiment with computers was vital.

Issues discovered within the computer pedagogical anxiety data can be grouped as follows: Education versus Economy; Knowledge versus Information; and the changing role of the teacher. The strategies proposed in this study for dealing with these anxieties are informal conversations, identifying entry points and weaving networks. While this is not an exhaustive list, these strategies were of particular relevance for the school under study.

This study does not enter into a comparison between schools but stays within the context and setting of a single school. Within this setting, some of the significant issues that arose from the data are discussed. While time constraints limited the depth of analysis and the range of issues examined, this researcher believes that the finished study presents an informative account of certain key factors that surround the issue of teachers' attitude to ICT in this school.

In an era of technological change, ICT has the potential to exert a growing influence on education and as a result to significantly challenge teacher attitudes, methods and role as we enter the next millennium. Having examined the data in the light of the literature in the area, this study concludes that this school is ready to face the challenges posed by the introduction of ICT.

Chapter 1: ICT - A Growing Force in Education, A Growing Challenge for Teachers

This study researches teachers' attitudes to Information and Communication Technologies (ICT) in a second level school. Within this context, it aims to examine the challenges for teachers which are raised by the adoption of ICT in schools. This chapter explains the setting within which this study takes place, gives an overview of the research undertaken, and outlines the chapters within the dissertation. In an era of technological change, ICT has the potential to exert a growing influence on education and as a result to significantly challenge teacher attitudes, methods and role as we enter the next millennium.

Growth of ICT

The growth of ICT in societal, industrial and educational spheres has been well documented in recent times. Collis reports

> Between July 1994 to July 1995, the number of registered hosts connected to the Internet rose from 3.2 million to 6.6 million; based on this the projection is made that by 1999 there will be 120,000,000 hosts and given a certain average number of persons with addresses per host, it is estimated that "**everyone on earth will be on the Internet by 2004**."[1]

Terms such as the Internet, tele-working and tele-learning are becoming part of everyday parlance. The home computer market has been steadily growing. An increasingly technically qualified workforce is required to meet the demands of an economy that is becoming reliant on ICT industries.[2] Researchers question how ICT

can be channelled to make a Learning Society, "a society committed at all levels to continuous learning."[3] Much of this growth has taken place in a very short time period and has required adjustment from society, industry and education.

ICT in Education

ICT includes information technologies (for example, CD-ROMs, databases, the World Wide Web) and communication technologies (for example, e-mail, tele-conferencing, video-conferencing, chat-rooms). The terms 'computer,' ICT, and Information Technology (IT) will be used in this study to refer to such forms of technology.

Internationally, and particularly in the United States and Canada, increased use of many of these forms of ICT in the classroom, has led to claims that computers can be put to the service of learning. Further claims now suggest that the adoption of ICT in education may change not just the resources available to educators and learners but may offer new ways to understand knowledge and learning.[4] These claims will be further investigated in chapter two.

Computers can be seen as a replacement for the teacher, as a neutral tool to carry out certain tasks or as a powerful cognitive tool which enables new kinds of learning tasks to be set.[5] Each view places different requirements on the teacher, regarding their attitude to computers, their computer skills competence, their role and their educational vision. These perspectives will also be investigated in this study.

The Irish Context

In the Irish context, recent investment by the government in promoting technology in the business and education sectors suggests that ICT will continue to become an integral part of Irish society and a feature of Irish schools. In particular the Schools IT 2000 project, launched in 1997, is currently investing in initiatives to improve the technology, skills and support infrastructures at all levels of the education system.[6]

For ICT to be used as an educational tool in Irish schools requires a significant level of computer skills training for teachers. For ICT to become part of the teaching and learning process will require significant change to current curricular and pedagogical practices.

Complexity of Change

The complexities of the change process are well documented[7] and should not be under estimated. The fact that educational change involves several agents (including, for example, government departments, curriculum boards, school boards, teachers, students, and parents) and has many systems to contend with (for example, curriculum and assessment systems), adds to the complexity of the change process. In particular the implementation of ICT structures and processes at school level pose significant challenges for teachers who, by in large, were themselves educated before the widespread use of computers. Several recent studies[8] have called for more research to investigate the challenges and opportunities that ICT poses for the Irish education system.

Importance of Teacher Attitude

Research has confirmed that the attitudes and beliefs of teachers are vital when dealing with educational change.[9] In this instance the attitudes of teachers to ICT will markedly influence the effectiveness of the implementation of ICT at school level and at the level of the classroom. Christensen and Knezek, among others, recognise that positive teacher attitudes are necessary for "effective use of information technology in the classroom."[10]

The Schools IT 2000 documentation states

> The professional development of teachers has been identified internationally as the primary factor in enabling effective ICT adoption by schools.[11]

This demonstrates a recognition of the central importance of teacher development in improving teacher attitude and skill.

Reasons for this Research

The researcher has a keen interest in computers and their educational function and has been involved in various initiatives which examine and promote the use of computers in education. The choice to pursue this subject area as a research project was guided by the topicality of the area under study as well as by the advice of Bogdan and Biklen:

> Without a touch of passion you may not have enough to sustain the effort to follow the work to the end, or to go beyond doing the ordinary... be sure it is of sufficient interest to you to maintain your spirit.[12]

For the purposes of this research, the researcher attempted to limit any bias she might have towards computers. The manner in which this was done will be explained in chapter three.

Research Content

This study sets out to research teachers' attitudes to ICT in an Irish second level school. Within this context, it also aims to explore the growing challenge to teacher attitude, which is raised by the adoption of ICT in schools. Through a process of analysis of the data obtained by questionnaire and interview procedures, it was discovered that teachers' anxieties are a significant factor in contributing to positive or negative attitudes to computers. For the purposes of this study, two classifications of anxiety have been identified: computer use anxiety and computer pedagogical anxiety.

In examining computer use anxiety, this study explores some of the causes of such anxiety, including for example a fear of damaging the machine or losing information. It also highlights some suggestions for improving teacher attitude to computers, for example, the need for particular modes of training.

In examining computer pedagogical anxiety, the study explores challenges to the nature of knowledge, to teacher role and to teacher development. For instance, it examines the evidence that the information explosion appears to be facilitating a change from teacher-as-expert to teacher-as-guide.

This study does not enter into a comparison between schools but stays within the context and setting of a single school. Within this setting, some of the significant issues that arose from the data are discussed. While time constraints limited the depth

of analysis and the range of issues examined, this researcher believes that the finished study presents an informative account of certain key factors that surround the issue of teachers' attitude to ICT in this school.

Overview of the Dissertation

This chapter has explained the context of this study in an era of growing reliance on technology in society. It highlighted the growing importance being placed on the use of ICT in education and explained the motivation, and content of the research.

Chapter two provides a summary of many of the key research writings in the area of change and ICT in education. While the review of literature is not exhaustive, particular efforts were made to include references to writings in the Irish context.

Chapter three presents a detailed explanation of the methodology engaged in for the gathering and analysis of data.

Chapter four engages in some initial analysis of the data, highlighting the significant factors surrounding teachers' attitudes to computers and, in particular, examines various forms of teacher anxiety.

Chapter five conducts a wider analysis of some of the key issues. A meta-analysis of some of the factors under study is undertaken by comparing and contrasting the research data with some of the key findings in the research literature.

The current orientation with respect to ICT in society presents technology as a growing force in education and consequently a growing challenge to teachers who must learn to put ICT to the service of teaching and learning. It is hoped that this

research will provide a useful contribution to the field of study concerned with teachers' attitudes to ICT in education.

Endnotes for Chapter 1

[1] Betty Collis, *Tele-learning in a Digital World: The Future of Distance Learning* (London: International Thomson Computer Press, 1996) p.27.
[2] Robert McGarvey, "High-tech Pot o' Gold" in *Upside Magazine* (Upside Media Inc., Feb. 1999) <http://www.upside.com/texis/mvm/story?id=3687f8af0>.
[3] Charles Desforges, Preface. *Using Information Technology Effectively in Teaching and Learning: Studies in pre-service and in-service teacher education* edited by Bridget Somekh and Niki Davis (London: Routledge, 1997) p.xi.
[4] See for example Bridget Somekh, Niki Davis, (Ed.) *Using Information Technology Effectively in Teaching and Learning: Studies in pre-service and in-service teacher education* (London: Routledge, 1997), and Betty Collis, *Tele-learning in a Digital World*, for some of the issues that will be dealt with in chapter two of this study.
[5] Bridget Somekh, "Classroom investigations: Exploring and evaluating how IT can support learning" in *Using Information Technology Effectively in Teaching and Learning* edited by Bridget Somekh and Niki Davis p.123.
[6] Department of Education and Science, *Schools IT2000: A Policy Framework for the New Millennium* (Dublin: Government Publications, 1997) p.3.
[7] See for example Michael G. Fullan with Suzanne Stiegelbauer, *The New Meaning of Educational Change* (London: Cassell, 1996).
[8] See for example Cyril J. Drury, *Implementing Change in Education: The Integration of Information Technology into Irish post-primary schools* (M. Sc. Thesis, University of Leicester, 1995). Also available at <http://indigo.ie/~cjdrury/thesis/contents.html>
[9] See for example A. Hargreaves and R. Evans, *Beyond Educational Reform* (Buckingham: Open University Press, 1997) p.107, for some of the issues that will be dealt with in chapter two of this study.
[10] Rhonda Christensen and Gerald Knezek, "Parallel forms for measuring teachers' attitudes toward computers" in *Society for Information Technology and Teacher Education (SITE 98): Proceedings of the 9th International Conference* (Charlottesville: Association for the Advancement of Computing on Education, 1998) <http://www.coe.uh.edu/insite/elec_pub/HTML1998/re_chri.htm>.
[11] Department of Education and Science, *Schools IT2000*, p.6.
[12] Robert C. Bogdan and Sari Knopp Biklen, *Qualitative Research for Education: An introduction to Theory and Methods* (Boston: Allyn and Bacon, 1982) p.57.

Chapter 2: ICT in Education - Challenging and Supporting Teachers

Introduction

This chapter provides an outline of many of the key research writings in the areas of ICT in education, teacher attitude and implementing change. In this way, it introduces many of the key areas under study in this research.

Hargreaves states:

> Teachers don't merely deliver the curriculum. They develop, define it and reinterpret it too. It's what teachers think, what teachers believe and what teachers do at the level of the classroom that ultimately shapes the kind of learning that young people get.[1]

This statement suggests that unless teachers believe that ICT is a useful educational instrument, and unless they are willing to learn how to integrate ICT into their teaching, then ICT will remain forever on the fringes of education as an interesting but expensive attempt at innovation and as the domain of a few ICT enthusiasts. The importance of teacher attitude (which is used as an encompassing term for teachers' thoughts, beliefs and behaviours reflecting these)[2] in the implementation of ICT is clear.

This chapter begins by examining the growing force of ICT in education by presenting rationales for adopting ICT into the Irish education system.

The next section discusses the growing challenge that ICT presents to schools, to traditional pedagogy and to teachers. First, this section clarifies some of the concerns

and reservations of using ICT in schools. Second, it explores how ICT can contribute to the pedagogy of the classroom by improving the learning environment. Third, it investigates how ICT significantly challenges the traditional role of the teacher, and how the implementation of ICT is influenced by teachers' attitudes to computers.

Finally, the chapter examines strategies for supporting teachers in these times of change. It presents an overview of some of the literature on the implementation of change, and mentions various approaches to teacher development in the area of technology. In particular it highlights the advantage of collaborative approaches to teacher development.

Rationales for ICT – A Growing Force in Education

The impact of ICT in the field of education to date is difficult to measure. This difficulty is compounded by unrealistic expectations and by the confusion that exists over what should be measured and how.[3] Yet despite this apparent lack of hard evidence for the value of computers in education, there remains a strong political will in Ireland to pump resources into educational projects and programmes which involve ICT.

This section summarises various rationales which have been put forward for the integration of ICT into schools, some based on economic considerations and others on pedagogic concerns. It draws on various reports on the state of technology in the Irish school system and in particular on the framework policy of the recently appointed government-sponsored initiative Schools IT 2000.

This project was initiated in April 1997 to

> ...support all 4,000 schools in the State in acquiring, by the end of the Year 2000, Information and Communications Technologies equipment, training and curriculum materials, as well as an Internet connection.[4]

Five compelling motives for ICT integration in schools are listed in its Policy Framework.[5] It identifies the social, economic, vocational, pedagogical and catalytic benefits that ICT can bring to the educational environment. Each rationale is now examined in turn.

Social Rationale

As ICT becomes "an ever more central feature of everyday living," the 1992 European Commission report on New Information Technology in Education in Ireland, suggests that schools have a role to play in educating our young people "to be selective and critical in the use of information resources."[6] It also stresses the importance of student awareness "of the social consequences of IT," and "the use (and possible misuse) of personal information stored on computers." The 1992 Irish Green Paper also stresses that

> ...a basic appreciation and understanding of the modern information and communication technologies is fostered in young people.[7]

This social aspect of ICT demands that people are not only comfortable with, but also critical of what ICT has to offer. It suggests that ICT is a vital part of life for every citizen in today's information and communication age.

Economic Rationale

Ireland's economy is fast becoming technologically dependent. In 1992 the software industry accounted for eleven per cent of all Irish exports. More recent estimates quoted in an American magazine (1998) confirm a massive boom in this area during the nineties:

> About 60 per cent of PC software and nearly one-third of PCs sold in Europe come from Ireland (exports account for 80 per cent of Ireland's GDP). More importantly, since 1980, one-fourth of new U.S. manufacturing investment in Europe has been in Ireland, whose population (about 3.6 million) is scarcely 1 per cent of the EU's.[8]

A workforce of highly trained technicians and engineers is needed to sustain such growth in the ICT industry.

Several reports in the nineties have advised expansion and change in the technical and vocational sector of education in order to cope with this rapid development. The Industrial Policy Review Group[9] in 1992 called for more emphasis on the acquisition of usable and marketable skills. The Government Green Paper[10] suggested the introduction of a new Enterprise and Technology Studies subject at second level. The European Commission White Paper on Education and Training issued in 1996 stated that it is now a priority for the Commission to "develop multimedia educational software by strengthening co-ordination of research conducted in this area."[11]

More recently, in 1998, the Expert Group on Future Skills Needs proposed that a study "...be carried out into the factors affecting student choices at second-level and especially their choice of technology careers"[12] in order to increase the interest and

awareness in such careers among second level students. The Minister for Education and Science responded in the foreword of this report as follows:

> An important role of the educators is to provide the type of skills that will enable both students and workers to fully participate in the knowledge economy on a scale sufficient to the changing needs of the economy.[13]

The economic value of ICT in education clearly informs the Education and Science Department, and will have an influence on the allocation of funding and hence the future priorities of our education system.

Vocational Rationale

Both the vocational and economic rationales for incorporating ICT in schools are founded in the commercial and business world. An ever-increasing number of students find employment in the ICT arena, and an expanding range of occupations requires some competence in technology. If students become competent users of technology in schools, they will be more prepared for the world of work. Schools IT 2000 and the 1992 European Commission Report stress the need to foster appropriate ICT skills in students in order to improve employability.[14]

Pedagogical Rationale

As part of the pedagogical rationale for including ICT in education, the 1992 European Commission Report provides a wide-ranging list of experiences that ICT can offer to the student. These include:

- Development of design skills and communication skills using various software packages;
- Opportunities to access, manipulate, interpret and present information of various types using databases and on-line resources;
- Experimentation in dangerous or costly domains by means of computer simulations;
- Provision of a rich new multimedia learning environment;
- Broadening of horizons and increase of awareness via opportunities for telecommunication with other students and teachers in Ireland and farther afield.[15]

The Schools IT 2000 document agrees that ICT

> ...can improve the quality of education by providing rich, exciting and motivating environments for learning.[16]

If ICT has something to offer the teaching and learning process of schools, as the literature suggests, then perhaps it should form an integral part of every subject. For some subjects it might be used as a multimedia presentation tool. For others, students might be engaged in collecting, analysing and presenting data. This rationale suggests that to confine ICT to the realms of "the computer classroom" would be to deprive every other subject area of a wonderful aid to learning.

Catalytic Rationale

The final category used by the Schools IT 2000 document discusses what it calls catalytic reasons for ICT integration.[17] It suggests that the use of ICT in schools can lead to improved collaborative environments for teachers and students, and can increase the emphasis on problem solving and information handling rather than on memory work. Loveless considers pedagogy as the

> ...transformation of consciousness that takes place in the intersection of three agencies - the teacher, the learner and the knowledge they together produce.[18]

Using this model, she considers ICT as "...a fourth agency, acting as a catalyst for the interaction between teacher, learner and knowledge."[19] Such a view suggests opportunities for every subject area and implies that adopting ICT across the curriculum would benefit and perhaps radically restructure the education process.

In the documents discussed, these rationales are presented as complementary reasons for including ICT in Irish schools and priority is not given to any one rationale over others. As ICT implementation continues in Irish schools, it remains to be seen how these rationales inform further development and how influential each educational agent (pupil, teacher, school management, school board, etc.) will be in adapting the national rationales to the needs of their school.

The literature confirms that ICT is a growing force in educational spheres. The next section examines how the increased importance of ICT in schools presents a challenge to teachers.

ICT – A Growing Challenge for Teachers

The implementation of ICT in schools has the potential to critically influence the learning process and environment. Technology is also open to abuse. The following section examines the concerns and reservations surrounding ICT in education. The next section considers a selection of research on the effect of ICT on the learning environment. This section concludes with a discussion of the challenges faced by teachers in this time of change.

Concerns and Reservations surrounding ICT in Education

A significant body of research warns of possible dangerous side effects of ICT and advises that technology should be used with care. There is evidence to suggest that ICT will cause us to turn our back on a world rich in oral culture. Some see technology in schools as nothing more than "a bandwagon, a frill, a fad, a hype."[20] Many warn of the dangers of information overload and the damage that fragmented knowledge can cause to the learning process. Others maintain that computers are in fact, rendering our schools, teachers and entire education system obsolete. This section examines some of these concerns and reservations in more detail.

Losing a Culture

For centuries, cultures have valued the spoken and written word. Hargreaves worries that

> ...the spectacle and superficiality of an instantaneous visual culture may supersede and obliterate the necessary moral discourse and studied reflection of a more oral one.[21]

There is disagreement on this issue in the literature. Some perceive the status of the letter as a mode of communication is fast being eroded by the advent of almost instantaneous electronic mail. Others believe that "the telephone may have wounded the art of writing letters, but the computer has resuscitated it."[22]

There is some evidence that many students seem to find the written and spoken word less stimulating than the multi-media experience that ICT can offer. Hargreaves suggests that this erosion of a culture can be retarded if teachers take on a new role. He suggests that

> Teachers must be both competent users of and innovators with technology, and moral guardians against its most superficial and trivializing effects.[23]

This suggests that teachers must be comfortable and confident with ICT. Furthermore they must learn to be proficient at using technology creatively in their subject area. They must also be aware of the dangers of the abuse of ICT and educate students to use technology wisely.

The increase in the appearance of media studies in the curriculum especially in Transition Year and more recently in the new English syllabus suggests that schools already feel the obligation to encourage students to question the mode of delivery of information. For example, students of English can now be asked to write a film review or a political discussion rather than the more traditional essay.

This concern of losing a valuable culture accentuates the need for the development of a pedagogy which incorporates ICT into education in a considered manner. The moral

element of the role of the teacher suggested by Hargreaves requires a different sort of teacher development than the mere acquisition of ICT user skills.

Information or Ideas?

A body of research postulates that computers can actually damage the learning process. Rosnak believes that technology has lost sight of the fact that "the mind thinks with ideas, not with information."[24] He warns that

> ... an excess of information may actually crowd out ideas, leaving the mind (young minds especially) distracted by sterile, disconnected facts, lost among shapeless heaps of data.[25]

Postman makes similar criticisms. He regards computer technology as "a new mode of transportation. It moves information – lots of it, fast and mostly in a calculating mode."[26] He argues that technology, in particular television, is eroding intelligence by presenting everything as entertainment.[27]

Harlow maintains that the dialogues of these *computer technology critics*, as he calls them, prompt us to question the meaning of learning and knowledge, and remind us that gathering information does not equate to thinking.[28]

These ideas are reflected in research by Worthington and Henry who coined the term 'existential anxiety' to describe student teachers' fears that the use of technology is at odds with the educational goals held by the teacher for their students.[29] Some respondents to their anxiety survey believed that technology would expose the students to a vast but often inaccurate and unverifiable source of information. These

teachers were also anxious that opportunities for interpersonal contact would be restricted by the use of ICT in the classroom.

As a safeguard, Collis recommends that "technology should only come into the picture when it is obvious that technology is needed to reach the goal" that has been agreed upon.[30] White also urges teachers to critically analyse technology and suggests that the "blind acceptance of technology in education is not only wrong, but disempowering for teachers and students."[31]

Distinguishing between information and ideas, and their different significance in the education of young people, challenges schools and teachers to develop a critical understanding of the purpose and role of ICT in the teaching and learning process.

Computer Use Anxiety

Several studies on teacher attitude towards ICT have found that teachers often have anxieties about actually working with the computer. Kelly mentions some of the following worries:

- feeling foolish at not being able to manage a keyboard or mouse;
- not understanding the jargon and the numerous three letter acronyms;
- nervousness at using something without knowing how it works;
- fear of causing damage to the computer;
- fear of feeling foolish in front of students who appear to have more knowledge, skills and confidence;

- fear of feeling foolish in front of colleagues who seem to have picked up new skills easily and appear to be light-years ahead.[32]

This attitude is recognised by Worthington and Henry,[33] Kelly,[34] and Somekh and Davis[35] among many others, as being a vital influence on the success or otherwise of implementing ICT in schools. Mastery of basic skills makes the computer "less frightening, more useful, and more integrated" into teachers' daily routine according to Berge and Collins.[36]

Overcoming such anxieties is a major challenge for teachers who were themselves largely educated in a time when computers were not in general use.

Re-placing (not replacing) the Teacher

Another fear on the part of some teachers is that computers will eventually replace them. Perlman claims that "not only will technology close the door on traditional schools, but it will also render obsolete schools, students, and teachers as we think of them today."[37] Peck and Dorricott disagree:

> Technology can re-place (not replace) the teacher. . . . many of the routine tasks done by teachers can be reassigned to technology, elevating the role of teacher.[38]

In listing their top ten reasons for technology use in education, they highlight teacher roles that cannot be fulfilled by technology:

> Some things only teachers can do. Teachers can build strong, productive relationships with students. Technologies can't. Teachers can motivate students to love learning. Technologies can't. Teachers can identify and meet students' emotional needs. Technologies can't. Technology-based solutions in education can, and must free the teacher to do the important work that requires human interaction, continuous evaluations and improvement of the learning environment.[39]

Somekh believes that teachers who worry that the computer will replace them are actually misunderstanding the role of the computer. She gives tells of a teacher who thought that the piece of software he had bought would allow him to load it and "stand back and watch while it 'taught' his pupils."[40] Teachers normally need to play a role when students use computers to aid learning: "in drawing out points for discussion, planning follow-up work and... providing lead-in activities to maximise its impact."[41]

ICT threatens traditional cultures and some believe it will replace knowledge and ideas with information and entertainment. These, and other challenges presented by the implementation of ICT in schools, require careful consideration. These concerns and reservations expressed in the literature suggest that ICT implementation will involve a significant personal cost to teachers in terms of time, energy, and threat to personal competency. David writes:

> ...the presence of technology complicates teachers' jobs enormously. They are learning not only how to use the technology but also how to teach differently, how to relate in new ways to their students, and how to assume new roles as learners, researchers and equipment technicians.[42]

Learning to use ICT to aid teaching and learning involves much more than attending a few in-service courses and learning to use a computer. The next section examines the

opportunities offered by ICT to improve learning and the subsequent challenges it poses to traditional pedagogy in order to make ICT effective.

Challenges to the Learning Environment

The rationales already examined suggest various reasons for introducing ICT into our schools. In particular, the pedagogic and catalytic rationales imply that ICT can contribute in a significant way to addressing certain key desirable educational student objectives such as: communication processes, data finding processes, processes of application of information, problem-solving processes, and creative processes. Using ICT in this way presents the teacher with significant potential for improving not only the standard and accuracy of *what* is taught, but it offers a chance to radically improve *how* it is taught. This merits its inclusion into the core activity of the teacher's work.

This section postulates on whether ICT should be seen as just another useful device or tool, or whether it has something more fundamentally educational to offer our schools. An examination of research demonstrating the potential that appropriate use of ICT in schools has for the teacher and the learner follows.

ICT: A Useful Tool or an Educational Instrument?

Many people who use a computer agree that as a tool, it can save time, improve organisation and presentation and assist in the speedier transfer of information via e-mail and the Internet. Somekh et. al. describes this as akin to using the computer like a pencil.

Teachers sometimes

> ...see the computer as a tool which is virtually neutral and can be used to carry out the same learning tasks their pupils would have undertaken previously with pen or pencil.[43]

This raises the question of whether ICT is just another useful tool, much like a calculator or a labour saving device, or whether it can offer something more to the process of education. Research on the effect of ICT on learning suggests that it can. However, Worthington and Henry note:

> ...there is no lack of rhetoric describing the potential for technology to improve the education [which] learners receive by enabling teachers to be more responsive to individual needs; helping learners develop a sense of connectedness to the world outside school; and providing access to the latest information, to name a few examples.[44]

In order to move beyond rhetoric, there is a need to look more closely at the research findings on the effect of ICT on the learning process.

Much of the initial research in this area involved technology companies and people who have a vested interest in technology. Gilster remarks "It's very hard to come up with the really impartial studies that show a huge increase in student learning."[45]

Much of the research referred to above concurs with Fisher et. al. who conclude that

> Technology alone cannot improve teaching and learning. It can only be effective if it is grounded firmly in curriculum goals, incorporated in sound instructional process, and deeply integrated with subject-matter content.[46]

Collis speaks of the possibilities that technology offers to provide both pedagogical enrichment (doing the same things, but perhaps better) and pedagogical re-engineering

(doing things differently).[47] Here the research on the benefits of ICT in improving student learning is divided into three categories: effect on lower order tasks, effect on higher order tasks and influence on the learning environment.

First, through appropriate use of software, certain lower order tasks and basic skills (such as reading, writing and mathematics) can improve at a faster pace. In her literature review on the status of technology in the Canadian education system, Wellburn gives some examples of quantitative research in computer aided learning, while stressing the need for further research to be done in this area. The CHILD[48] study, which involved students in self-paced computer interactions, demonstrated a "positive and statistically significant result across all grades, schools and subjects."[49] The ACOT[50] project used computers successfully to "raise student test scores in vocabulary, reading comprehension, language mechanics, math computation, and math concept/application" in one of its research sites.[51] In contrast Gardner et. al. (reporting on a portable computer project) concluded that "the impact of high access to computers on learning in mathematics, English and science was at best marginal."[52] It should be noted that in this case the researchers surmised that the length of the project (one school year) might have been too short for significant results to be displayed.

Second, certain higher order skills (such as information evaluation, problem-solving skills and analysis) can improve. Underwood and Underwood argue that computers "can act as a catalyst to cognitive development" when they are used as open-ended tools rather than as a means of drill-and-practice. Their research in this area demonstrates "improvements in problem-solving, hypothesis testing, and questioning, as well as in specific curriculum skills."[53] The ACOT project discovered that in

general, students used "inquiry, collaborative, technological, and problem-solving skills" more often when using computers. However, traditional assessment requirements were not perceived as assisting this kind of learning.[54]

Third, educational technology can enrich the learning environment by allowing learning to take place in a variety of settings and by improving opportunities for pupils to learn in more individualised, differentiated, and active conditions. In the Portable Computers in Schools project, some teachers reported "that the use of portables with mixed-ability groups provided greater scope for differentiated and individualised teaching and learning."[55] The conclusion of a Scottish initiative involving the use of personal portable computers by students in various curricular areas was reported in Gardner et. al.:

> ...the portable computers in the project settings resulted, though not universally, in high levels of pupil motivation, harmonious and purposeful learning environments and greatly accelerated information-technology literacy among pupils and teachers alike.[56]

In general, these projects involved the students in active learning, and appeared to positively influence the learning environment. Underwood and Underwood also stress the importance of the motivational factor of certain software:

> Classroom software that motivates children will therefore produce successful learning, and will involve children in learning.[57]

Other studies examined by Wellburn on the effectiveness of self-paced learning with suitable computer software found "that the use of technology as a learning tool can make a difference in student achievement, attitudes, and interaction with teachers and other students."[58]

It is important to note here that many studies highlight the central role played by the teacher in the effective use of technology. The SLANT[59] project suggests that "the way in which teachers organise their classrooms, the precise instructions they give and the relationships established" influence the quality of student talk in computer activities.[60] The ImpacT[61] project concluded that the use of ICT "increased the importance of the teachers role and their interaction with pupils."[62] In summary, the literature shows that ICT can positively influence the teaching and learning environment if used effectively by the teacher. Hence we return to the importance of teacher attitude to ICT. It is the teacher who will ultimately be responsible for incorporating ICT into the curriculum, for developing new instructional habits, and for integrating all that technology has to offer into the classroom. ICT challenges the teacher to make ICT an effective educational instrument. We now examine more closely the implications of ICT for the role of the teacher and the importance of teacher attitude in ICT implementation.

Challenge to teachers

The increased usage of ICT in schools and the potential benefits it offers the teaching and learning process, challenge teachers to re-evaluate their role in the classroom and to assess their range of teaching methodologies. In this section we look at the changing role of the teacher, and then consider the importance of teacher attitude in ICT implementation.

The Changing Role of the Teacher

Pre-computer teacher technologies such as the textbook, chalk and talk, questioning, testing, overhead projector, tape recorder, video recorder, typewriter and photocopier, each offer the teacher a mode of communication to students and in some cases a way of assessing student learning. Hargreaves comments on the challenges that these changing times pose to teachers and their current methods:

> Hi-tech visual images are a pervasive feature of young people's lives. Textbooks, worksheets and overheads are a poor match for these other, more complex, instantaneous and sometimes spectacular forms of experience and learning. In this context, the disengagement of many students from their curriculum and their teaching is not hard to understand. Teachers are having to compete more and more with this world and its surrounding culture of the image. This demands a lot of them in terms of technological awareness and pedagogical change.[63]

The U.S. National Education Commission on Time and Learning stress the importance of "...educators confronting their reluctance to supplement the techniques of the 19th century (textbooks, chalk and blackboards) with the technologies of the 21st (CD-ROMs, modems and fibre optics)."[64]

Traditional pedagogical values expected teachers to hold the role of expert in their field, and to communicate this expert knowledge to their students. With the vast quantities of information currently available to students on the Internet and the opportunities for international communication via e-mail and video-conferencing, teachers are being challenged to look beyond this expert role. A facilitative approach to enable students to interpret and evaluate the information and its medium is becoming more necessary.

O'Donnell speaks of the teacher helping the students to wade "through deep waters of the information flood."[65] Leslie highlights a consequence of this information deluge:

> ...teachers can't know everything of value to their students, but with the aid of telecommunications, they often can guide students to the information they seek.[66]

This idea of the teacher as a guide is reflected elsewhere in the literature. Tuckett et. al. propose that "...teachers must move from being 'sages on the stage' to 'guides on the side' with new roles such as 'learning facilitators and knowledge brokers'.[67]

The teacher must also create opportunities for the student to compare, contrast and analyse information if the warnings expressed by Rosnak and Postman[68] are not to go unheeded.

This appears to signify that ICT implementation will facilitate a move from the product-orientated approach to the process-orientated approach to learning. Callan, in his work on promoting active learning recognises that changing classroom learning formats requires the teacher to unlearn "conventional attitudes, practices and assumptions" and to learn new ones.[69]

Loveless recognises that

> The potential for ICT to enhance, extend and change the role of the teacher can be perceived as an exciting opportunity or a confidence-crushing threat.[70]

The fact that ICT implementation in schools offers to not merely supplement the teaching-learning process as it stands, but to actually alter its very structure, is what makes it both an opportunity and a threat. Teachers can be protective of their role in

society and anything that challenges the traditional image of teacher role or the traditional classroom environment may not be readily accepted. Teacher attitudes to ICT and their perception of technology as an opportunity or otherwise are key factors in the implementation of ICT in schools. The next section examines previous research on teacher attitudes to ICT.

Importance of Teacher Attitude

As one of his six principles of educational change, Hargreaves suggests that

> The struggle for positive educational change is one that must involve as many teachers as possible, and that must fully engage their hearts as well as their minds.[71]

He speaks of the emotional input that is required for good teaching, and recognises that change of any kind exerts an even greater overload on teachers. It follows that if the implementation of ICT in schools is to be worthwhile and effective, teachers must be committed to and engaged with the process.

Watson, in a British evaluation of information technology in schools, echoes this by concluding that

> The effective use of ICT in classrooms is... linked to teachers' theories, beliefs and understandings of the subject domain, as well as access to, and competence with, resources.[72]

Research in the United States also reflects the importance of teacher attitude.

Christensen and Knezek state that

> ...positive teacher attitudes toward computers are widely recognized as a necessary condition for effective use of information technology in the classroom.[73]

The implication is that a combination of teachers' attitude to and knowledge of their subject area, their practice of pedagogy in the classroom and their disposition towards and competence with ICT resources, will determine the level and success of ICT integration into the classroom.

A number of studies have investigated teachers' attitude toward use of technology and anxiety about technology.[74] Akbaba and Kurubacak compiled a list of salient teacher beliefs from research, which add to the picture of teacher attitude discussed here.[75] These are categorised as attitudes to computers and attitudes to changes in the working environment in Table 2.

Akbaba and Kurubacak state that teachers' attitudes can influence students' attitudes to technology, and that teachers need to feel comfortable with ICT before they will use it in the classroom.[76] This suggests that if teachers are to embrace technology and make it a part of their teaching culture, it is important to understand their feelings, beliefs, and attitudes to ICT.

In a recent Irish study, Dolly found that home ownership of a computer and a greater frequency of use of computers were both strongly related to more positive teacher attitude and in particular less computer use anxiety.[77] This quantitative study also suggested that males are more positive to ICT than females, and that teachers in the construction woodwork and graphics areas in particular, and in the science and

business areas to a lesser extent, demonstrated a more positive attitude to computers than teachers in other subject areas.[78]

Table 2: Teachers' attitudes towards technology, adapted from Akbaba and Kurubacak

Attitudes to Computers	Changes in Working Environment
Teachers • think they are too old to learn new technology; • are afraid of being unsuccessful using technology; • are afraid of addiction to the Internet; • think that technology brings alienation; • think that using technology creates uncertainty due to unknown results; • think that technology reduces the level of interaction among people; • think that learning new technology is a waste of time.	Teachers • think that they will lose their authority in the classroom; • see learning of technology as extra load for them; • are afraid of changing their roles in the classrooms and afraid of losing their status to be the first and unique sources of information; • think they will lose their jobs because do not want to attend training programs; • technology will replace them;

Research shows that teacher attitude towards change in general and ICT use in education in particular, is a vital component in successful ICT implementation in schools.

The literature has demonstrated that the growth of ICT in educational spheres raises certain challenges. There is sufficient evidence to suggest that ICT, when used effectively can improve student learning. However, the concerns and reservations

presented suggest that all those connected with schools, and in particular, teachers, need to be aware of the dangers of technology and guard against its abuse. This all points to a need for teachers to re-evaluate their methods, role and attitude in the light of what ICT has to offer. The question of how teachers are to be supported in this time of change is the subject of the next section.

Supporting Teachers in Times of Change

The literature reviewed so far reveals the significance of teacher attitudes to successful ICT implementation in the school. In addition, it highlights the kind of competency and the ability to innovate within their subject area, which teachers are expected to have in relation to ICT. The question of how one prepares and educates teachers to respond to this situation is a challenging one.

Issues that must be addressed by teacher development include improving teacher understanding and skill in the area of ICT, and learning new instructional habits which incorporate ICT. Training should also address teacher attitudes to their changing role and to ICT, and address how best to guide students in the moral aspects of using technology.

This section begins by examining some of the factors required for educational change to be considered worthwhile. It then explores some approaches taken in different countries when addressing teacher development in ICT, and in particular considers the significance of encouraging collaborative learning for teachers.

The Need for Change

Research suggests that teachers must be clear of the need for change before they will commit time and energy to its implementation. Teachers who find that their current teaching style and role generates good examination results and appears to keep the students interested may find it hard to perceive a need for integrating ICT into their teaching. Fullan explains the four criteria that teachers use in assessing whether or not a change is worthwhile:

1. *Need*: Does the change potentially address a need? Will the students be interested? Is there evidence that the change works?
2. *Clarity*: How clear is the change in terms of what the teacher will have to do?
3. *Practicality*: How will it affect the teacher personally in terms of time, energy, new skill, sense of excitement and competence, and interference with existing priorities?
4. *Reward*: How rewarding will the experience be for the teacher? [79]

Fullan refers to many examples of changes that have failed to address these questions and as a result were not successfully implemented. Often this is because the change was inappropriate and/or because of lack of resources to support the change process.

Somekh believes that if

> ... you begin by exciting the interest of a teacher or student in the educationally interesting things which a computer can do, they will learn the basic technical skills easily because they perceive a need for them.[80]

ICT implementation can suffer from what House refers to as the tendency to "oversell" its potential benefits.[81] A previous section in this chapter drew attention to the abundance of rhetoric around the positive effect of computers on learning. Teachers who are misled in this way, are likely to reject the implementation process if the 'gap' between benefits promised and received is perceived to be more of a 'chasm'. According to House, teachers perceive that with most innovations "personal costs are high, and benefits are unpredictable.[82] Innovations also fail due to lack of follow-up. Teachers "become disappointed and lose the conviction to continue their efforts to develop it further."[83]

Fullan believes that the need for change and growth in education is evident from looking, for example, at research on the proportion of students who are disaffected by the education system and at the abundance of teachers who are frustrated in their work.[84] Whether the implementation of ICT is a step towards a solution to these or other challenges is a different question and one which teacher have varying attitudes towards. As discussed in the next section, successful teacher development is a key factor if teachers are to be supported in the change process which is precipitated by increased ICT use in schools.

Approaches to teacher development in ICT

The question of how teachers are to cope with such changes in the context of their teaching conditions, is a vital one. Fullan challenges teacher education to gear teachers towards continuous learning.[85] He suggests that teachers do not know enough about their subject, how to teach and how to understand and influence surrounding

conditions. As a result they are ill equipped to handle change of any kind. This suggests that teachers who have a mastery of the teaching and learning process (a key element of which would be subject mastery content, its methodology, and its relevance to current issues), may be better equipped to successfully innovate with ICT in their subject.

According to research conducted by the Office of Technology Assessment in the United States, the majority of teachers who had successfully integrated technology into their teaching had done so as a result of extensive individual work rather than through any organised training programme.[86] This suggests that those who are already committed to the *why* of implementing ICT into schools will find ways to solve the question of *how* to learn the necessary skills.

However, if it is hoped that ICT will be integrated more widely across the curriculum, rather than remain in the realm of the ICT enthusiast, it is probable that some level of organised in-service is needed on a national level.

In an Irish context, Drury proposed that a large financial commitment to teacher development in ICT is important. He recognised that

> Of all the factors influencing the successful implementation of IT in schools the professional development of teachers is the most critical... Investment in IT hardware and software depreciates much more rapidly than investment in the IT training of teachers.[87]

Since then, the Teaching Skills Initiative (TSI), organised by the NCTE has made it a priority to address the need for computer skills for teachers. Eight hundred teachers (at primary and second level) have been trained as tutors to date.[88] The courses on offer

include learning to use a wide range of general software applications and enhancing computer maintenance skills. In addition, collaboration between the NCTE and certain subject teacher associations has resulted in the development of ICT courses relevant to specific subjects. Learning how to handle the technologies and learning new instructional habits must go hand in hand. As such the use of tutors, who are themselves competent classroom ICT users, is more likely to result in successful teacher involvement in the change process. No evaluation is yet available to discover the effectiveness of the courses in addressing the development of positive teacher attitudes to ICT or in increasing the level of comfort experienced by teachers when using computers.

Pelgrum and Plomp state the importance of time, for teachers to become familiar with technology. They say that it is unfair to expect teachers

> ...who are completely new in the field of computer use in education, [to] adopt this innovation and fully integrate it into their curriculum within only a few years.[89]

If teachers are expected to critically interact with technology and to guide their students to do likewise, they need time to reflect upon what is happening.[90]

In a study which spanned twenty-one education systems, Pelgrum and Plomp found that pedagogical and instructional aspects of ICT need to be included much more in teacher development programmes to improve the amount of computer integration in subjects.[91] Mulcahy concurs with the need to develop teachers' pedagogical skills using the medium of ICT rather than focusing exclusively on the acquisition of technical skills.[92]

In Frederiksborg County, Denmark, the teacher in-service scheme is based on "a principle of regional dissemination of knowledge through a network of ICT pioneers and experienced ICT teachers."[93]

Some countries have used a mentor or coach scheme to help guide teachers into effective teaching skills using technology. The British system initially used this approach by training advisory teachers to help in the provision of in-service training in ICT and in preparing support materials for the classroom.[94]

More recently, the New Opportunities Fund was launched. This will resource training throughout the United Kingdom which aims to address:

- when, when not, and how to use ICT to achieve teaching objectives and improve standards;
- the implications of the functions of ICT on teaching and learning;
- teachers' own competence in using ICT, so that they can access its potential not only for their teaching but also for their own professional development;
- understanding the different approach needed for the assessment of pupils' work when ICT has been used.[95]

Efforts are being made to ensure that pre-service teachers receive a high level of suitable ICT input as part of their training. Many of the in-service efforts speak of bringing in-service teachers to the level of their newly qualified colleagues.[96] Schuttloffel warns of the dangers of leaving teachers behind and considering them casualties of progress.[97] Teachers who entered the profession many years ago could not have envisioned the numerous and rapid changes that would occur. Some may balk at the thought of learning new ICT skills. The challenge to prepare our new teachers for technological change must go hand in hand with the renewal of our

current colleagues. The following section suggests that teacher development is most effective within collaborative cultures.

Collaborative Environments

A common thread running through the literature on teacher development is the notion of teacher collaboration. Fullan notes

> ...at the teacher level the degree of change was strongly related to the extent to which teacher *interact* with each other and others providing technical help.[98]

Callan's work on promoting active learning also suggests that teacher development can be best achieved "in a collegial context, that is, a context which allows and encourages teachers to learn from each other and from people they value."[99] Archer, in an external evaluation of this work noted that teachers were positive towards the workshop model of teacher in-service where teachers learn from each other. In fact this was seen by teacher participants as one of the main advantages of this initiative over other more traditional forms of in-service and teacher development.[100]

Somekh et. al. also stress the need for teachers to use technology in collaborative contexts so that

> ...they can both identify the problems and possibilities for themselves and find ways to model these activities in their own practice with learners.[101]

A number of writers also call for a recognition that the teacher's work is not done in isolation.

Hargreaves and Fullan state:

> ...the context of teachers' working environment provides conditions in which teacher development initiatives succeed or fail.[102]

In order to fully realise the educational potential of ICT, teacher development is a necessary but not sufficient condition. In addition, whole staff development and school development is required.

If teachers are to implement various ICT initiatives in the school, they must perceive a clear need for such change. Teachers will require support in their efforts to adapt to new techniques, new roles and new skills. The literature suggests that such support may best be given by teacher development strategies which are mindful of teacher attitudes to ICT and the underlying reasons for these attitudes, and which encourage collaborative cultures.

Conclusion

The literature reviewed in this chapter was chosen in order to better understand the underlying factors and reasons for teacher attitude to ICT. For example, a teacher who believes that computers enrich the learning process will be more likely to have a positive attitude to ICT in education.

The literature offers convincing rationales for the integration of ICT into schools. There is evidence to suggest that effectively used technology can improve the teaching and learning process. However, other research offers warnings against the use of technology without discourse and critical evaluation. If teachers are to implement

various ICT initiatives in school it appears vital to assess where they stand on such issues. For example, placing a high level of importance on the vocational and economic elements of the rationales may result in a different format of ICT integration than a placing a high priority on the pedagogical rationale. Likewise, for some teachers the adoption of ICT may involve such strong incentives as a sense of mastery, excitement, and accomplishment. For others, the personal benefit-cost ratio may not be so favourable. Teacher attitude is a key factor in understanding the complexity of implementing ICT in schools.

In this way this chapter has highlighted the positive and negative factors which the research literature suggests may contribute to various teacher attitudes towards ICT.

Endnotes for Chapter 2

[1] Andy Hargreaves and Michael Fullan, (eds.) *Understanding Teacher Development*, (London: Cassell, 1992) pp.ix-x.
[2] The Concise Oxford English Dictionary defines 'attitude' as a settled opinion or way of thinking, or behaviour reflecting this. R.E. Allen, *The Concise Oxford Dictionary of Current English* (Oxford: Clarendon Press, 1992) p.70.
[3] Betty Collis, "Implementing Innovative Teaching Across the Faculty via the WWW" in *Society for Information Technology and Teacher Education (SITE 98): Proceedings of the 9th International Conference* (Charlottesville: Association for the Advancement of Computing on Education, 1998) <http://www.coe.uh.edu/insite/elec_pub/HTML1998/keynote.htm>.
[4] Press release by Minister Niamh Breathneach of the Department of Education and Science on 9th April 1997. Full text can be found at <http://www.irlgov.ie/educ/25fa33a.htm>.
[5] Department of Education and Science, *Schools IT 2000: A Policy Framework for the New Millennium* (Dublin: Government Publications, 1997) p.15.

[6] Task Force Human Resources Education Training Youth Commission of the European Communities, *New Information Technology in Education in Ireland.* (Luxembourg: Office for Official Publications of the European Communities, 1993) pp.65-67. These rationales also appear in the Schools IT 2000 document.
[7] Department of Education, *Education for a Changing World: Green Paper on Education* (Dublin: The Stationery Office, 1992) p.134.
[8] Robert McGarvey, "High-tech Pot o' Gold" in *Upside Magazine* (Upside Media Inc., Feb. 1999) <http://www.upside.com/texis/mvm/story?id=3687f8af0>.
[9] Jim Culliton, *A Time for Change: industrial policy for the 1990s: report of the Industrial Policy Review Group, Ireland*, (Dublin: The Stationery Office, 1992).
[10] Department of Education, *Education for a Changing World.*
[11] Edith Cresson and Padraig Flynn, European Commission, *Teaching and Learning: Towards the learning Society*, (Luxembourg: Office for Official Publications of the European Communities, 1996). The full text of the white paper can be downloaded from at <http://europa.eu.int/en/comm/dg22/lb-en.wpd>.
[12] Forfás, *Responding to Ireland's growing skills needs: The First Report of the Expert Group on Future Skills Needs* (Dublin: Forfás, 1998) p.28.
[13] *Ibid.*, Micheal Martin T.D., Foreward. p.3.
[14] Task Force E.C., *New Information Technology in Education in Ireland*, p.69, and Department of Education and Science, *Schools IT 2000*, p.15.
[15] Task Force E.C., *New Information Technology in Education in Ireland*, pp.65-67.
[16] Department of Education and Science, *Schools IT 2000*, p.15.
[17] *Ibid.*, p.15.
[18] Avril Loveless, "Where do you stand to get a good view of pedagogy?" in SITE 98 <http://www.coe.uh.edu/insite/elec_pub/HTML1998/th_love.htm>.
[19] *Ibid.*
[20] Betty Collis, *Tele-learning in a Digital World: The Future of Distance Learning* (London: International Thomson Computer Press, 1996) p.5.
[21] A. Hargreaves, *Changing Teachers, Changing Times* (London: Cassell, 1994) p.75.
[22] Tom Maddox, "Report from the Electronic Frontier: Life on the Internet, Part I: Reading Mail, Reading News" Official Journal of the Macintosh Scientific and Technical Users Association Volume 3, No. 4, July 1993 <http://www.macscitech.org/stj/stj1993_jul.html>.
[23] A. Hargreaves, *Changing Teachers, Changing Times*, p.76.
[24] T. Roszak, *The cult of information* (New York: Pantheon Books, 1998) quoted in Steve Harlow, "Information Technology and the Search for Coherence" in SITE 98 <http://www.coe.uh.edu/insite/elec_pub/HTML1998/th_harl.htm>.
[25] *Ibid.*
[26] Neil Postman, *Technopoly* (New York: Vintage Books 1996) quoted in Steve Harlow, "Information Technology and the Search for Coherence."
[27] Neil Postman, *Conscientious Objections* (London: Heinemann, 1989) p.168.
[28] Steve Harlow, "Information Technology and the Search for Coherence" in SITE 98 <http://www.coe.uh.edu/insite/elec_pub/HTML1998/th_harl.htm>.

[29] Valerie L. Worthington and Andrew Henry, "Computer Anxiety: A Technical or an Existential Problem?" in SITE 98 <http://www.coe.uh.edu/insite/elec_pub/HTML1998/re_wort.htm>.
[30] Betty Collis, "Implementing Innovative Teaching Across the Faculty via the WWW."
[31] Cameron White, "The Role of Technology in Teacher Education: A Postmodern Critique" in SITE 98 <http://www.coe.uh.edu/insite/elec_pub/HTML1998/th_whit.htm>.
[32] Adapted and expanded from A.V. Kelly, *Microcomputers and the curriculum* (London: Harper and Row, 1984) p.25.
[33] Valerie L. Worthington et. al., "Computer Anxiety: A Technical or an Existential Problem?"
[34] A.V. Kelly, *Microcomputers and the curriculum*.
[35] Bridget Somekh and Niki Davis, "Getting teacher started with IT and transferable skills" in *Using Information Technology Effectively in Teaching and Learning* edited by Bridget Somekh and Niki Davis (London: Routledge, 1997) pp 138-149.
[36] Zane Berge and Mauri Collins, "We Teach as We Were Taught" in *Wired Together: Computer-mediated Communication in K-12: Teacher Education and Professional Development*, Vol. 3, (Hampton Press, 1998) <http://jan.ucc.nau.edu/~mpc3/mauri/books/k12bk3.html#anchor843152 >.
[37] L. J. Perlman, *School's Out: Hyperlearning, the New Technology, and the End of Education*. (New York: William Morrow, 1992) quoted in "How Computers Live in Schools" by Larry Miller and John Olson in *Educational Leadership* Oct. 1995, <http://odie.ascd.org/pubs/el/miller.html>.
[38] K. Peck, and D. Dorricott, "Why Use Technology?" in *Educational Leadership* 51(7), 1994 pp.11-14 quoted in, "Technology and Systemic Educational Reform" by Carla Lane in *Education and Technology* <http://www.tecweb.org/eddevel/reform10.html>.
[39] *Ibid.*
[40] Bridget Somekh, "Classroom investigations: Exploring and evaluating how IT can support learning" in *Using Information Technology Effectively in Teaching and Learning* edited by Bridget Somekh et. al. p.123.
[41] *Ibid.* p.123.
[42] Jane L. David, "Restructuring and Technology: Partners in Change" in *Phi Delta Kappan* 73, 1991 p.1 quoted in "Technology and Systemic Educational" by Carla Lane <http://www.tecweb.org/eddevel/reform10.html>.
[43] Bridget Somekh, "Classroom investigations: Exploring and evaluating how IT can support learning" p.123.
[44] Valerie L. Worthington et. al., "Computer Anxiety: A Technical or an Existential Problem?"
[45]Paul Gilster, in "A New Digital Literacy: A Conversation with Paul Gilster" by Carolyn R. Pool in *Educational Leadership* Vol. 55, No.3 Nov. 1997 <http://www.ascd.org/pubs/el/nov97/extgilst.html>.

[46] Charles Fisher, David C. Dwyer, and Keith Yocan, *Education and Technology: Reflections on Computing in Classrooms* (San Francisco: Jossey-Bass Inc., 1996).
[47] Betty Collis, *Tele-learning in a Digital World: The Future of Distance Learning*, p.17.
[48] CHILD stands for Computers Helping Instruction and Learning Development.
[49] E. Wellburn, "The Status of Technology in the Education System: A Literature Review" for Technology and Distance Education Branch, Ministry of Education, Canada, 1996 <http://www.cln.org/lists/nuggets/EdTech_report.html>.
[50] ACOT stands for Apple Classrooms of Tomorrow.
[51] E. Wellburn, "The Status of Technology in the Education System: A Literature Review."
[52] John Gardner, Hugh Morrison, and Ruth Jarman, "The impact of high access to computers on learning" in *Journal of Computer Assisted Learning*, Vol.9, no.1, 1993, pp.2-16.
[53] Jean D.M. Underwood and Geoffrey Underwood, *Computers and Learning* (Oxford: Blackwell Publishers, 1990) pp.169-193.
[54] E. Wellburn, "The Status of Technology in the Education System: A Literature Review."
[55] Bob Stradling, David Sims, and Jim Jamison, *Portable Computers Pilot Evaluation Report* (National Foundation for Educational Research, NCET, 1994) pp.20-23.
[56] John Gardner, Hugh Morrison, Ruth Jarman, Clare Reilly, and Helena McNally, *Personal Computers and the Curriculum*. (Scottish Council for Research in Education, 1993).
[57] Jean D.M. Underwood et. al., *Computers and Learning*, pp.169-193.
[58] E. Wellburn, "The Status of Technology in the Education System: A Literature Review" referring to SPA, "Report on the Effectiveness of Technology in Schools," 95-96: Executive Summary, 1996.
[59] SLANT stands for Spoken Language and New Technology.
[60] Roy Barton, "Does data logging change the nature of children's thinking in experimental work in science?" in *Using Information Technology Effectively in Teaching and Learning* edited by Bridget Somekh, et. al., p.68.
[61] ImpacT stands for Impact of Information Technology on Children's Achievements in Primary and Secondary Schools.
[62] Roy Barton, "Does data logging change..." in *Using Information Technology Effectively in Teaching and Learning* edited by Bridget Somekh, et. al., p.69.
[63] A. Hargreaves, *Changing Teachers, Changing Times*, p.74-81.
[64] National Education Commission on Time and Learning, "Prisoners of Time: Report of the National Education Commission on Time and Learning," (Washington, 1994) quoted in Carla Lane in *Education and Technology*, <http://www.tecweb.org/eddevel/reform10.html>.
[65] J. O'Donnell, "The digital challenge" in *Wilson Quarterly*, Vol. 20, 1996, quoted in E. Wellburn, "The Status of Technology in the Education System: A Literature Review."

[66] J. Leslie, "Kids Connecting" in *Wired Magazine,* 1994, quoted in E. Wellburn, "The Status of Technology in the Education System: A Literature Review."
[67] J. Tuckett, S.R. Jones, and P.J. Thomas, "The future of technology in higher education: A Delphi survey" in J. Hlavicka and K. Kveton, (eds.). *Proceedings of Rufis '97: Role of the university in the future information society* (Prague: UNESCO International Centre for Scientific Computing, 1997) pp. 43-48 quoted in Betty Collis, "Implementing Innovative Teaching Across the Faculty via the WWW."
[68] See section on *Information or Ideas?* earlier in this chapter.
[69] Jim Callan, *Schools for Active Learning: Final Report*. (Dublin: Department of Education, 1994) p.120.
[70] Avril Loveless, "Where do you stand to get a good view of pedagogy?"
[71] A. Hargreaves and R. Evans, *Beyond Educational Reform*, (Buckingham: Open University Press, 1997) p.107.
[72] D.M. Watson (ed.) *The ImpacT Report: an evaluation of the impact of information technology on children's achievements in primary and secondary schools* (London: Centre for Educational Studies, Kings College, 1993) referred to in Avril Loveless, "Where do you stand to get a good view of pedagogy?" in SITE 98, <http://www.coe.uh.edu/insite/elec_pub/HTML1998/th_love.htm>.
[73] Rhonda Christensen and Gerald Knezek, "Parallel forms for measuring teachers' attitudes toward computers" in SITE 98, <http://www.coe.uh.edu/insite/elec_pub/HTML1998/re_chri.htm> referring to J.E. Woodrow, "The influence of programming training on the computer literacy and attitudes of preservice teachers" in *Journal of Research on Computing in Education*, 25(2), 1992, pp.200-218.
[74] For example see American studies on teacher attitude to computers include P. H. Kay, "Gender differences in computer attitudes, literacy, focus of control and commitment" in *Journal Research on Computing in Education*, 21, 1989, pp.307-316; A.A. Koohang, "A study of the attitudes of preservice teachers towards the use of computers." *Educational Communications and Technology Journal*, 35, 1987, pp.145-149 and J. Marshall and S. Bannon "Computer attitudes and computer knowledge of students and educators." *AEDS Journal*, 19, 1986, pp.270-286.
[75] Sadegul Akbaba and Gulsun Kurubacak, "Teachers' attitudes towards technology," in SITE 98, <http://www.coe.uh.edu/insite/elec_pub/HTML1998/re_akba.htm>.
[76] *Ibid.*
[77] Caitriona Dolly, *A Survey of Teachers' Attitudes to Computers*, Masters in Computer Applications for Education, DCU, 1998, pp.67-87.
[78] *Ibid.*, p.91.
[79] adapted from Michael G. Fullan with Suzanne Stiegelbauer, *The New Meaning of Educational Change* (London: Cassell,1996 edition) p.127.
[80] Bridget Somekh and Niki Davis, "Getting teacher started with IT and transferable skills" in *Using Information Technology Effectively in Teaching and Learning* edited by B. Somekh et. al., p.141.
[81] Michael G. Fullan et. al., *The New Meaning of Educational Change*, p.129.

[82] *Ibid.*, p.129.
[83] Bridget Somekh, "Classroom investigations..." in *Using Information Technology Effectively in Teaching and Learning* edited by Bridget Somekh et. al. p.122.
[84] Michael G. Fullan et. al., *The New Meaning of Educational Change*, p.131.
[85] M. Fullan, *Change Forces: Probing the Depths of Educational Reform*, (London: The Falmer Press, 1993) pp.108-120.
[86] Office of Technology Assessment. *Teachers and Technology: Making the connection.* (OTA-EHR-616). (Washington: Government Printing Office, 1995).
[87] Cyril J. Drury, *Implementing Change in Education: The Integration of Information Technology into Irish post-primary schools*, (M. Sc. Thesis, University of Leicester, 1995) <http://indigo.ie/~cjdrury/thesis/contents.html>.
[88] Figure quoted at a tutor-briefing session organised by the NCTE in December 1998.
[89] Willem J. Pelgrum and Tjeerd Plomp (eds.) *The IEA Study of Computers in Education: Implementation of an Innovation in 21 Education Systems.* (Oxford: Pergamon Press, 1993) p.127.
[90] Peter Scrimshaw, "Computers and the teacher's role" in *Using Information Technology Effectively in Teaching and Learning* edited by Bridget Somekh et. al., p.112.
[91] Willem J. Pelgrum et. al., (ed.) *The IEA Study of Computers in Education*, p.135.
[92] John Mulcahy, "Information Technology in the Junior Cycle Curriculum" in *Issues in Education* (Dublin: ASTI, 1997) p.149.
[93] From an article on ICT in-service in Denmark on the Internet <http://www.globallearning.org/programme-conference/text-netdays.htm>.
[94] Ofsted, *Information Technology in Schools: The impact of the Information Technology in Schools Initiative 1990-1993*, 1994.
[95] Anthea Millett, "ICT and the Future of the Teaching Profession - The National Perspective," a lecture given at a conference of the TTA (teacher training agency) on 10 February 1999. <http://www.teach-tta.gov.uk/speech6.htm>.
[96] *Ibid.*
[97] M. J. "Mimi" Schuttloffel, "Engaging Educators in Asking the Right Questions about Technology Implementation," in SITE 98, <http://www.coe.uh.edu/insite/elec_pub/HTML1998/th_schu.htm>.
[98] Michael G. Fullan et. al., *The New Meaning of Educational Change*, p.131.
[99] Jim Callan, *Schools for Active Learning*, p.121.
[100] Peter Archer, *An External Evaluation of Schools for Active Learning* (Meath: Peter Archer, 1994) p.93.
[101] Peter Scrimshaw, "Computers and the teacher's role" in *Using Information Technology Effectively in Teaching and Learning* edited by Bridget Somekh et. al., p.112.
[102] A. Hargreaves et. al., *Understanding Teacher Development*, p.3.

Chapter 3: Design, Research Instruments and Methods of Analysis Employed

Introduction

This chapter elucidates the journey of this study from proposal stage to written report. It begins by reviewing the reasons why such research was considered timely and appropriate. It then details the methodologies used in gathering and analysing the data. In particular the questionnaire and interview processes are examined. Finally there is a discussion on the validity of this research and whether or the findings can be generalised to other contexts.

Figure 3.1 illustrates the various stages of the research process engaged in for this study. The diagram is in the form of a funnelling spiral. The process began with the research proposal and an initial period of reviewing current research findings in the area of study. This helped to generate potential research questions, which were deleted, edited and refocused as the work progressed. After the collection of questionnaire data, some initial analysis occurred and after a period of interaction with and reflection on the data, the researcher entered the inner, more focused cycle. A further stage of data gathering was undertaken with the focus on issues that had been identified as significant for the participants. The final process of analysis and the written report were then completed.

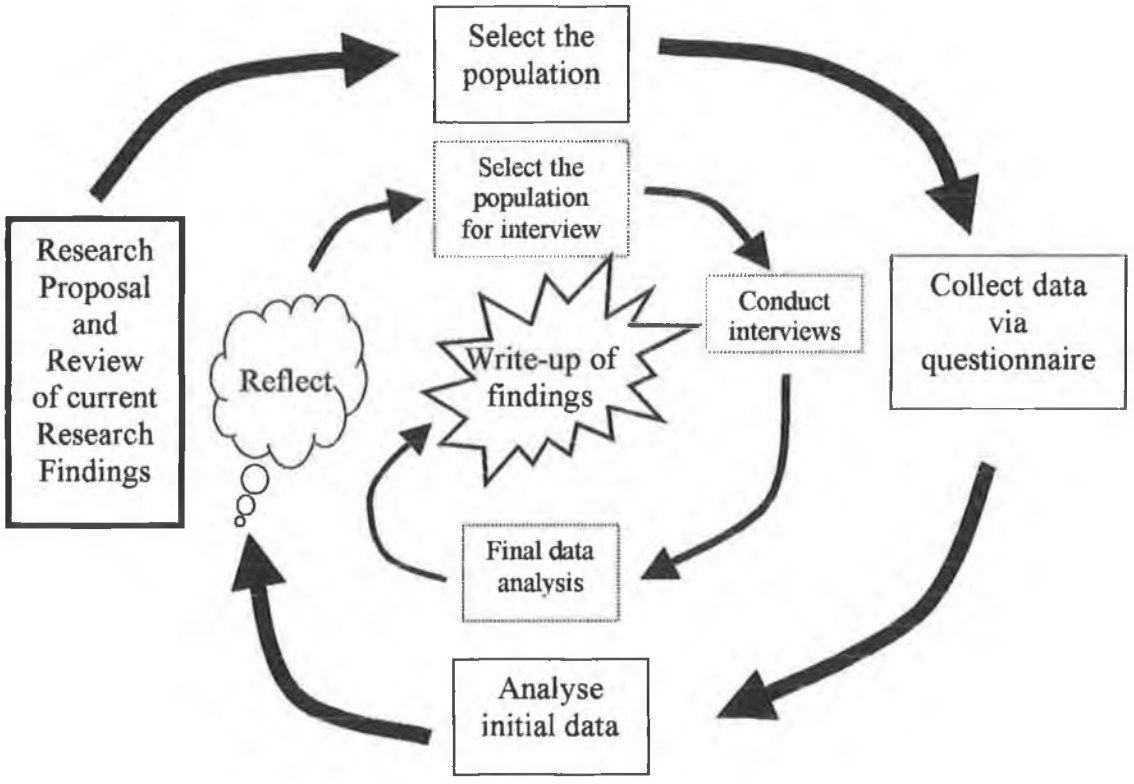

Figure 3.1: Model of research process as a funnelling spiral.

As an example of this cycle, consider the following. After reading much of the literature regarding computers in education in the Irish context, the researcher developed the following hypothesis:

> There appears to be at least four major rationales for computers in education in the IT 2000 documents. Perhaps teachers' opinions about the relevance of these rationales would be an important factor in determining whether or not they think computers have a role to play in schools.[1]

This hypothesis informed the first cycle of data collection by the inclusion of the final four questions in section one of the questionnaire. However, the responses to the questionnaire suggested that teachers were more focused on issues such as training and support and overcoming their fears about using computers. Through interaction

with the subjects, the researcher narrowed the focus of the research at interview and analysis stages.

This study shares some common elements with the concepts of interpretive or qualitative research. While certain questions were of interest to the researcher as she set out on this study, the actual categories and themes were arrived at through an inductive process of analysis of the data. The majority of the data is descriptive rather than numerical and efforts have been made to present the participants' perspectives of the issues. This is in keeping with the current developments in educational research as presented by Bogdan and Biklen:

> Educational research is changing. A field once dominated by measurement, operationalized definitions, variables, and empirical fact has had to make room for a research approach gaining in popularity, one that emphasizes inductive analysis, description, and the study of people's perceptions.[2]

However, the time available for completion of this study and the consequent constraints on time spent in the field interviewing participants leaves this piece of work far short of deserving the title of qualitative research. While many of the emerging themes were examined in depth, at no stage could it be said that the point of 'saturation of data' as explained by various qualitative proponents,[3] was reached. Several more cycles around the funnelling spiral would have been necessary to achieve this.

Nevertheless, this chapter will proceed to demonstrate that the rationale behind the research, the methodologies used, the data gathered, and the subsequent analysis were all conducted in a valid and objective manner within the context of this study.

Rationale for the study

Recent and current events have highlighted the growing importance of ICT in the field of education as outline in chapter two. Computers have become a part of everyday life for students, teachers and much of the wider community. Investment by individual schools in computer equipment is on the increase. Investment by the Department of Education and Science in the area of ICT in recent times has significantly increased. Reports by various government committees have stressed the economic need for improved training of personnel in the area of technology. In line with these developments and with this researcher's area of interest a dissertation in the area of ICT in education was considered appropriate.

In addition, chapter two has outlined the importance of teacher attitude in the process of change. It follows that teacher attitude to computers will have a significant influence on the manner and success of the integration of ICT into education. As far as this researcher can ascertain, little research has been done in Ireland on the topic of teacher attitude to computers. A quantitative study in this area has already been mentioned in chapter two.[4] However this only attempted to compare variables such as teacher gender, and years of teaching experience with computer attitude. In particular, Drury called for "more qualitative research methodologies" to examine issues which influence implementation strategies at the level of the school.[5]

These issues provided the rationale for the undertaking of a study on teacher attitude to computers, at this time, and using the research mode orientation outlined.

Aspects of the Study

This list from the original dissertation proposal demonstrates the broad range of themes that interested the researcher in the initial stages of her work:

- What were the fears and apprehensions of these teachers before they began to use ICT?
- What were the key factors in encouraging them to stick with it?
- Teacher training – what, if any, have they received and what are their needs?
- What factors affect ICT integration into the culture of school?
- Teacher role – what changes are needed if ICT is used in the classroom setting?
- Role of school leadership in implementing ICT change initiatives.
- What are the perceived effects on student learning?
- Other issues that emerge during research.[6]

It was initially proposed

> ...to work with the teachers in the school who currently use IT in order to learn what factors are involved in their decision to use IT, and what this involvement means, regarding interest in being trained, and in helping to train their colleagues, in developing their skills over time, in its use in their subject, and across subjects.[7]

After a review of previous research in the area, it was decided to gather data from a wider audience than originally planned and to focus the first cycle of data collection on the following areas:

(1) To identify patterns of attitudinal change over a period of approximately five years and to attempt to detect reasons for such change.

(2) To ascertain via a Likert-type attitude scale, the existing attitudes of a staff of second-level teachers in an Irish school under the sub-headings of anxiety level, productivity of computers, opportunities offered by computers to improve learning, challenges to teacher role and challenges to the social and moral aspects of society.

(3) To discover teachers' attitudes to the various rationales for the inclusion of ICT in Irish education as outlined in chapter two.

(4) To identify any patterns between current attitude and variables such as gender, age, subjects taught and home computer ownership.

(5) To discover the current level and variety of computer usage by the sample group, both personally and professionally.

(6) To discover the benefits and the limitations of ICT in education as perceived by these teachers.

This data was gathered through a questionnaire from the chosen population of forty-nine teachers. Analysis of the questionnaires identified certain patterns of response which led the researcher to conduct further more in-depth enquiries through interviews with a small number of teachers, into the examination of the transition of individuals

from negative to positive attitudes towards computers and the factors promoting such change.

While the preceding sections have given a brief overview of the research process, the remainder of this chapter considers the research methods employed in more detail.

Research Methods

Henerson et. al. acknowledge that "the task of measuring attitudes is not a simple one"[8] and they suggest proceeding with certain precautions in mind. They argue that attitudes are often not universally defined, cannot be directly measured and often rely on inference. In addition, behaviours, beliefs, and feelings may not always match, and attitudes may not "stand-still" for long enough to be documented or understood.[9]

Interviews were initially considered to be the most appropriate research instrument for conducting an enquiry into teacher attitude to computers, because

> Often it is the only way of finding out what the perspectives of people are, and collecting information on certain issues or events...[10]

However Woods argues that "...interviews need to be used in conjunction with other methods..."[11] With well-constructed attitude scales such as the Thurstone or Likert models, a measure of attitude within a specific context can be obtained.[12] However the purpose of this study was not merely to create an attitude score for each teacher. It was hoped to identify certain key factors which influence teachers' attitudes to computers. A questionnaire was judged to be a suitable instrument to begin the process of data collection. This sequencing and combination of methods contributed to the process of

inductive analysis as the categories and variables were allowed to emerge from the data rather than being generated a priori.

The remainder of this chapter looks at the design, piloting and implementation of the questionnaire, and the preparation and execution of interviews. It then explains the process of data analysis used for this study and defends the validity of the research study.

The Questionnaire

This section begins by explaining the rationale for the use of a questionnaire in the initial stages of data collection. It then explains the criteria which informed the design and content of the questionnaire, the reasons for the selection of the population and the alterations made as a result of the piloting process.

Rationale for use of a Questionnaire

The literature shows that much energy has been expended in an effort to develop accurate research instruments for assessing teachers' attitudes towards information technology. Silverman reminds us that

> Attitudes... do not simply attach to the inside of people's heads and researching them depends on making a whole series of analytical assumptions.[13]

In this case the entire questionnaire was "just one method in a package"[14] and served to:

1. collect data from a wider sample than could be reached by personal interview in the allotted time;
2. provide a starting point for interviews.[15]

A questionnaire approach was considered advantageous for the initial stages of this study for several reasons. Each respondent to a questionnaire or attitude scale answers the same questions and this provides comparative data across the survey population. While it may not offer the flexibility of interviews, a questionnaire permits anonymity, allows the administration of questions to many people simultaneously, and makes data analysis more manageable. Woods states that

> It gives time for thought, reflection, memory, and composition, and this suggests that for certain purposes and in certain instances the questionnaire is intrinsically a better instrument than interviews.[16]

However, such a self-reporting instrument presents certain weaknesses. First, it relies on the co-operation of the respondents to take the time to complete the questionnaire fully and accurately. Second, there is the danger that respondents will report what they think they ought to say or what they think the researcher would like to hear. Third, and particularly pertinent in the area of attitudinal studies, the respondent must know what they think in order to report it.[17]

This researcher personally distributed the questionnaire to all forty-nine teachers over a time period of two days, informed them that it would take approximately ten to fifteen minutes to complete, and followed up individuals who forgot to return it by the

due date. The questionnaire responses guided the researcher in her choice of teachers for interview and in her quest 'to learn what the important questions are,'[18] and to make informed choices in preparation for the interview stage of data gathering.

Design and Content

The questionnaire consists of three sections and can be viewed with the covering letter in Appendix A. Section 1 of the questionnaire asks teachers to respond to statements regarding their attitude to various aspects of computers. The second section consists of eleven open questions on a variety of issues and the final section gathers items of personal information from the respondents. The questionnaire was presented as three separate sections because of the different format and instructions needed for the three modes of questions.

Section 1 is a Likert-type attitudinal scale.

> A Likert scale is a five-point scale in which the interval between each point on the scale is assumed to be equal... [It] is used to register the extent of agreement or disagreement with a particular statement of an attitude, belief, or judgement.[19]

By inserting a tick on a scale from strongly agree to strongly disagree, teachers responded to statements about their attitudes towards computers. Certain subtopics were identified within the area of computer anxiety and these were:

1. computer use anxiety (e.g., item 3, "I do not feel I have control over what I do when I use a computer");
2. the usefulness or productivity of computers (e.g., item 6, "Computers are necessary tools in educational settings");

3. the effect of computers on student learning (e.g., item 11, "Computers are a distraction to student learning");
4. the effect of computers on teacher role (e.g., item 13, "I am worried that computers may eventually replace the teacher");
5. the effect of computers on society (e.g., item 19, "Computers are changing the world too rapidly");
6. the rationale for using computers in education (e.g., item 21, "Schools should teach computer skills to students to improve their employment prospects").

There were four questions on each theme, with a mixture of positive (e.g. item 6 above) and negative statements (e.g. item 19 above). This reversal of the direction of some items helps to protect against a bored or disinterested respondent who might simply mark the same response choice for each statement.[20] The inclusion of a 'no opinion' response, while offering the possibility of 'sitting on the fence' to respondents, was included to discourage respondents from leaving a section blank.

The construction of this section of the questionnaire was informed by the work of Christensen and Knezek, who compiled a compendium of attitude measuring instruments and formulated the Teachers' Attitude Toward Computers Questionnaire (TAC), which contains a total of 284 items falling on 32 Likert subscales.[21] They used this instrument to assess attitudinal change among groups of teachers before and after participating in various computer training courses.

Some items were taken unchanged from the TAC for example: *I hesitate to use a computer for fear of making mistakes I cannot correct.* This was judged to be relevant in the Irish context and to be an effective decider of computer use anxiety. Other items were changed slightly, and some items were invented to take of aspects from the literature that were judged relevant to this study. The four statements on rationale for computers in the Irish context (items 21 to 24) were devised due to the emphasis placed on the importance of rationale in the literature (see chapter two). Further discussion on the final items which were chosen for section one, can be found in the section on the pilot questionnaire which informed the reduction of the initial thirty items to twenty-four.

The limited value of the results of the Likert-type attitude scale in section 1 of the questionnaire is recognised by the researcher. If this study were based solely on the results of the responses to these items, the results would be neither reliable nor valid, since the items were not tested for these characteristics.[22] While many of the items were taken from the well-tested TAC, one cannot expect random items to yield accurate results. However this Likert-type section was only one of several data-gathering exercises engaged in for this study.

A twenty-four item Likert-type questionnaire requires very little time for respondents to complete and thus could be included in the questionnaire in this study without significantly altering the completion time needed. The questionnaire began with this section because it is easy to answer, and because it encouraged the teacher to begin to think about certain issues before being expected to answer the broader, open questions in section two.

Section 2 of the questionnaire asked open questions attempting to explore the following eleven items:

1. Respondents' professional uses of computers;
2. Respondents' personal uses of computers;
3. Frequency of use of computers;
4. Possible benefits of using computers for teachers and students;
5. Possible dangers or challenges of using computers for teachers and students;
6. Respondents' attitudes to computers five years ago;
7. Respondents' attitudes to computers now;
8. Reasons for any similarity in response to items 6 and 7;
9. Reasons for any differences in response to items 6 and 7;
10. Respondents' attendance at computer courses;
11. Invitation to make a statement related to the respondent's attitude to computers.

Items 1 through 3 were designed to discover how the teachers in the population are using computers. Items 4 and 5 reveal the benefits and dangers that respondents attributed to computers for teachers and their students. Items 6 to 9 concentrate on discovering if there has been any change in the respondent's attitude to computers in a five year period and to ascertain the reasons for such change. Item 10 provides information on the level of computer training of the respondent. Finally item 11 allows

the teacher to highlight some aspect of attitudes to computers which they feel is important.

While open questions can be notoriously difficult to code and are "not easily handled by statistical procedures,"[23] it was hoped that the data obtained from teachers' own words would reveal more than responses to closed questions. It also gave teachers the freedom to reveal information that might be significant and could be followed up at interview stage.

The third and final section asks for personal information including gender, age group, years of teaching experience, ownership of a computer in the home and subjects taught. This factual information would allow the comparison of reported attitudes with each of these variables. This researcher was aware that some teachers might find the request for their age to be too personal, but it was nonetheless included. As Babbie recommends, this factual section was left until the end of the questionnaire.[24]

The questionnaire layout was designed to be uncluttered, easy to read, and easy to answer. Efforts were made to ensure that the questions and instructions were as clear and unambiguous as possible. Appropriate emphasis helped to draw the respondent's attention to instructions and key words.

Choosing the Population

While probability sampling or random sampling is normally regarded as the most reliable method of choosing survey candidates in order to be able to draw inferences about the general population, Babbie acknowledges that

> Occasionally it might be appropriate for you to select your sample on the basis of your own knowledge of the population, its elements, and the nature of your research aims. This method of sampling is sometimes called **purposive** or **judgmental sampling**. (Original emphasis)[25]

The decision to confine the study to within one school rather than comparing data across a range of schools was informed by the following criteria:

1. The researcher's prior knowledge of the context and culture of the school in question was considered an advantage, and was used in the validation of data which shall be part of a later discussion in this chapter.

2. Teachers in one school have similar opportunities and constraints when it comes to using computers for professional reasons. For example, in the school researched, end-of-term reports are completed on computer and each teacher must enter a mark and a coded comment for every student. Also computers are available for teacher use in the staff room and in various offices. This is not necessarily the norm for other schools.

3. Confining the research to a single site improved the ease of access to the research participants for administration of the questionnaire and for follow-up interviews.[26]

4. Postal questionnaires have been known to produce small returns. It was perceived that the personal circulation of the questionnaire by the researcher and the personal follow-up after the return date had passed would increase the return rate. Literature suggests that such follow-up procedures improve the response rate.[27]

5. The school chosen for this research project is currently experiencing a relative *boom* in computers. This school recently purchased new equipment, and formed a school computer committee, which drafted and circulated a Computer Policy Document. A survey conducted by this committee indicated a very high demand for computer training for teachers. Therefore the topic being studied by this researcher was a current and relevant one for this staff and as such the teachers were more likely to co-operate with the researcher's attempts to gather data.

For these reasons, the decision to confine the research to this single school was taken. The entire staff, except for a small number of trainee teachers and casual part-time teachers, was requested to complete the questionnaire as this would produce a reasonably large data base from which to gather information to inform the next stage. It would also alert the researcher to issues that could have been omitted if a random sample was chosen instead. For example only one teacher in the population had retained a negative attitude over the reported five year period. This small but significant piece of information could have been lost if the entire staff had not been surveyed.

The school principal through informal discussion granted access to the research site. No formal permission was deemed necessary because of the researcher's prior knowledge of the school.

The Research Relationship

The research subjects in another form of relationship knew this researcher. As a result, the need for being particularly sensitive in how to pursue a research relationship was perceived. In particular it was known that the population regarded the researcher as someone who uses and is interested in computers. Bogdan and Biklen warn that

> Others in the setting in which you are doing your research, if they know you well, are not used to relating to you as a neutral observer... They may not feel free to relate to you as a researcher to whom they can speak freely.[28]

Certain sensitivities were therefore kept in mind for the duration of the research. For example, when distributing the questionnaire it was clarified that this was a confidential study and was not related to the ongoing work that was being undertaken by the school computer committee. When discussions regarding computers took place in her presence, this researcher attempted to adopt a facilitative rather than a directive role. Teachers who expressed a lack of knowledge or experience or a wariness of computers when handed the questionnaire, were reassured and encouraged to 'write everything down'. This was further emphasised in the letter which accompanied the questionnaire (Appendix A). The standard and variety of data received leads the researcher to believe that such precautions assisted in the promotion of a healthy researcher-client relationship for the duration of the study.

Piloting of Questionnaire

The questionnaire was piloted in March 1999, with thirteen (approximately one quarter of the size of the intended population) second-level teachers in three different

schools all of whom use computers to varying degrees. The range of uses included record-keeping, administrative tasks, class resource materials, video-conferencing, e-mail, the Internet and games. The pilot population varied in gender (five males, eight females), in age (from 20-24 to 45-49) and in subjects taught. The reported frequency of use of computers varied from 'very infrequently' to 'daily'. Thus the pilot population reflected the target population (the teachers of the school in this study) which has a similar spread over these variables.

Teachers were asked to complete the questionnaire and subsequently to fill in a short questionnaire evaluation form (see Appendix B). Feedback from the pilot questionnaire was generally positive with teachers estimating that it took between five and thirty minutes to complete. In particular one respondent felt that it was too long. As a result, it was decided to reduce the length of the questionnaire by amalgamating some of the open questions and reducing the number of Likert-type questions. The instructions were considered clear. The questions and statements were judged clear and easy to understand. Teachers in the pilot survey felt they had a sufficient range of responses in the Likert-type questions.

Various design and content improvements were suggested including:

(1) Increasing the font size for easier legibility – this was done and more space was left for answering the open questions to encourage longer responses.

(2) Using the term 'computer' throughout rather than a mixture of 'ICT' and 'computer'. All teachers are familiar with computers, but not all know what the acronym ICT stands for.

(3) Some criticised the use of the *No Opinion* option in the attitude survey, but the literature suggests there is a need for such a choice in attitude scales so this was retained.

(4) Several statements in the Likert section were criticised as being unclear for example the statement 'Computers are a distraction to student learning' had 'of what' written after it by one respondent. It was accepted that some of these questions were ambiguous and needed work.

(5) Two teachers asked for clarification on whether the question 'do you use computers in your work in the classroom?' meant that the students actually use the computers or that the teacher uses them as a resource. Consequently this question was amalgamated into the question on professional use of the computer (section 2, item 1).

(6) 'Subjects you teach' was amended to 'Subjects you teach or have taught in the past'.

The questions on attitude to computers five years ago, current attitudes, and on the reasons for any change in attitude, yielded informative responses and were retained with only cosmetic improvements.

Each Likert-type response was analysed and a graph was drawn for each item to discover whether it should be kept, modified or omitted. Figure 3.2 shows the response to item one: *I hesitate to use a computer for fear of making mistakes I cannot correct*. The graph shows a good variety of responses, no one chose the 'no opinion' option, and there was a high correlation between teachers' answers to open questions

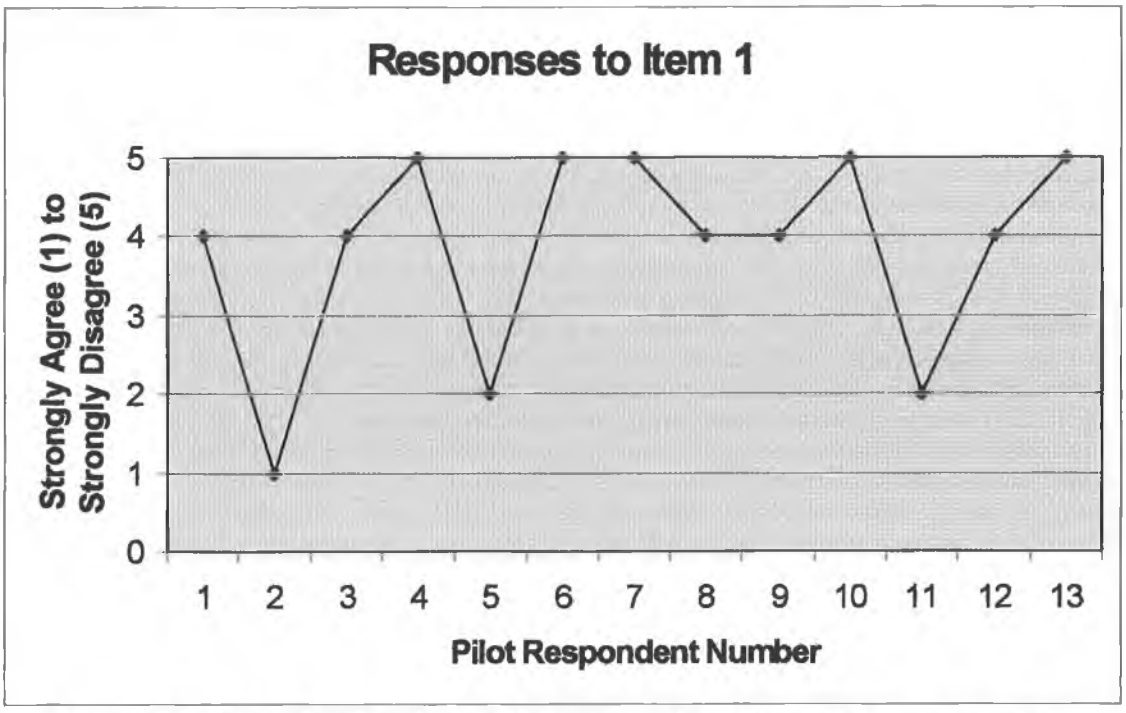

Figure 3.2: Example of analysis of Likert-questions from pilot questionnaire.

about attitude and their answers to this item. Item one was retained unchanged. Similar analysis of the other items resulted in the final twenty-four items.

Further restructuring of the layout of the questionnaire was informed by the literature. Lemon, for instance, summarises the principles for wording questions:

> ...questions should be as clear and unambiguous as possible, ...should not be biased or loaded in any particular direction, ...should not be vague or 'double-barrelled'... and ...should be relevant to the attitude in question.[29]

However "only instruments which fulfil... the purposes for which they were intended," he argues, can merit the title 'good'.

The pilot process was a useful exercise and significantly improved the final questionnaire.

Interviews

Interviews were used in this research to enable issues that arose in response to the questionnaire to be examined in more depth.

> In an interview, ...an idea or comment can be explored. This makes it possible to gauge how people are interpreting a question. ...people are generally better able to express their views orally than in writing.[30]

This is particularly important in attitudinal studies when a stated attitude can be probed and questioned and the factors contributing to it or to any change in attitude can be drawn out.

The interview, like the questionnaire is also a self-reporting instrument and therefore presents similar weaknesses. It relies on the co-operation of the respondents to give of their time and to articulate their views. The danger that respondents will report a projected viewpoint rather than their own view is still a danger as is the case with a questionnaire. However unlike a questionnaire, the interview affords the researcher the opportunity to follow up apparent inconsistencies there and then.[31] The relationship between the researcher and the interviewee and the character of the interaction is of utmost importance in the conduct of a successful interview.

Character of Interviews

The subject matter under research required that the interviewees felt free to talk about their anxieties and their lack of competence with computers. Because of the potentially sensitive nature of the discussion it was decided that an "open, democratic, two-way, informal, free-flowing"[32] type of interaction would be engaged in, as advocated by

Woods. This researcher attempted to keep the character of the interviews business-like, yet informal. To aid this, the interviews took place in the school, in a neutral office, for three of the four interviews and in the office used by the interviewee for the fourth. The teachers chose a time slot that suited them and the length of interview varied from forty minutes to an hour.

Throughout the interviews, this researcher attempted to ensure that the interviewees felt listened to and that their views were appreciated in a non-judgemental way.[33] This was considered to be especially important, as this researcher is known to the staff as being pro-computer. In researching attitude this can be a difficulty as Lemon notes:

> Attitude testing situations are social situations like any others. Because of this it is only reasonable to expect that behaviours in such situations will be influenced by as wide a range of variables as in any everyday social situation. Thus we should expect it to be influenced by... the respondent's expectations about the investigator's intentions and preferences and vice-versa....[34]

The steps taken by this researcher to ensure a successful researcher relationship was maintained have already been outlined earlier in this chapter.

Content of Interviews

At the start of each interview, the teacher's permission was requested for use of a tape recorder, a brief explanation as to the purpose of the research was offered, and teachers were allowed to read their questionnaire in order to familiarise themselves with the comments they had made. Some of the interviewees needed a period of 'settling in' in order to recover from a busy previous period, or a recent collegial confrontation.

The attributes of curiosity, "tact and discretion to decide when to press for further elaboration and when to pass on," naturalness and empathy as mentioned by Woods, were considered vital for successful interviews.[35] This researcher employed

> ...appropriate nods, shakes of the head, smiles, gasps of astonishment, grimaces, encouraging and knowing grunts, interjectory expressions[36]

in an attempt to show interest in the conversation and empathy with the interviewee. An analysis of the interview transcripts also revealed a number of phrases that were used by this researcher in an effort to assist the interviewee to give accurate and complete responses.[37] These include:

(1) Asking for elaboration ('Can you tell me a little bit more about that?', 'What sort of..?');

(2) Asking for explanation ('I wonder could you explain that?');

(3) Asking for examples ('Can you remember any particular incident?', 'Is it possible to isolate a certain time or event?');

(4) Asking for clarification ('What did you mean by that?', 'What difference did that make?');

(5) Summarising and asking for corroboration ('I think I hear you saying that...', 'Are you saying...', 'So, ...');

(6) Searching for connections ('Do you think there is a link here?', 'Does that have an influence on...');

(7) Searching for opinions ('What would you say are the main reasons why...?', 'What would have caused that?', 'Do you have ideas about...?');

(8) Asking for prioritisation ('Which would you put second?');

(9) Looking for comparisons ('Some people said... Would that be your experience?');

(10) Checking on contradictions, confusion ('So it *does*...?');

(11) Reassuring ('That's OK', 'No, it's interesting...');

(12) Aiming for comprehensiveness ('Do you have anything else to add?', 'Are there other elements...?', 'Are there any other things like that?').[38]

Successful interviewing is not solely about asking the right questions. Woods stresses the importance of trying to "cultivate the art of listening" through the use of "slightly exaggerated body language and attention to eye contact."[39] This can have the effect of encouraging people to be more open and to answer in more detail. Gentle probing was also used to good effect to ensure that the answers given were as complete as possible.

Babbie notes that

> Sometimes the best probe is *silence*; if the interviewer sits quietly with pencil poised, the respondent will probably fill the pause with additional comments.... (Original emphasis)[40]

While each interview followed a different route, the following themes were touched on in most cases:

1. Elaboration on the respondent's past negative attitude towards computers, including any anecdotal evidence of their fear or dislike of computers.
2. Elaboration of the respondent's reasons for their shift in attitude (whether judged by them to be slight or significant).
3. Attempt to list and perhaps prioritise factors that would assist teachers who are currently nervous of computers, to develop more positive attitudes to computers. This usually included a discussion on the benefits and dangers of using computers in education.
4. Attempt to list and perhaps prioritise factors that would assist already positively disposed teachers who want to further their knowledge of computers.
5. Rationale for computers in education, as seen by the respondent.

These five themes represent an over-simplification of the content of interviews. Bogdan and Biklen suggest avoiding the situation

> When the interviewer controls the content too rigidly, when the subject cannot tell his or her story personally, in his or her words...[41]

In short, the interview process was designed to ensure that as far as possible the qualities of a good interview, defined as follows, were satisfied:

> Good interviews are ones in which the subjects are at ease and talk freely about their points of view. Good interviews produce rich data filled with words that reveal the respondent's perspectives.[42]

Choosing the Population

Four teachers (eight per cent of the staff) were selected for interview. Originally it had been intended to conduct interviews with a larger number of questionnaire respondents. However the participant responses to the questionnaire were of a depth and breadth that enabled meaningful analysis of this data to be pursued. This, coupled with the time constraints experienced, encouraged the researcher to re-evaluate the proposed number of interviewees.

The criteria used in choosing the interviewees were informed by the responses to the questionnaire, and by certain issues which appear to be central to the issue of teacher attitude. For example, since one of the aspects of this study is to discover the reasons for teachers' change in attitude towards computers, only teachers who had displayed a change in attitude over the last five years (in responding to section 2, items 6 and 7) were considered for interview. An attempt was also made to obtain a mix of genders and age groups in the interview population. Thus the method of purposeful sampling was once again employed.

The researcher's personal knowledge of the population was used to avoid a small number of respondents that had previously indicated their preference not to be interviewed.

Use of Prompt cards

Prompt cards were written in preparation for each interview. Recorded on each card were the attitude scale scores for each candidate, their attitude to computers five years ago and now as recorded on the questionnaire from questions 6 and 7, and the reasons

for any change in this attitude as recorded in question 9. Other aspects of the candidates responses to the questionnaire that were considered relevant to the ongoing issues in this research project were recorded, and certain key words which suggested possible avenues of inquiry were also noted. During the interview, a brief note was occasionally made of points made by the interviewee that suggested follow-up questions. The prompt cards served as "a check, and a fall-back position"[43] rather than as a strict interview schedule.

Use of Tape-recorder

A tape-recorder was used for all interviews. Woods and others[44] promote the 'unobtrusive' use of a tape recorder:

> There is no other way of recapturing the fullness and faithfulness of words and idiom, and it does release the interviewer from one difficult task, allowing concentration on others.[45]

In previous work of this kind, this researcher favoured the use of a tape-recorder as this facilitated concentrating on listening to the interview candidate, rather than the taking of notes. As a result, it proved easier to pick up on issues to follow up, issues which may otherwise have been missed.

At the outset of each interview teachers were asked for permission to use a tape recorder. They were assured that they would not be personally identified in any way and that they would have the option of amending the transcript of the interview[46] at a later stage. This served the dual role of assuring the interviewee of confidentiality and of checking the transcript was an accurate reflection of the conversation and of the

views of the teacher. Field-notes were taken shortly after the interviews concluded, to record any conversation that happened before or after the tape recorder was switched on.

Data Analysis

> As a miner picks up a rock, turning it over to look for gold, so must a researcher look for the worth of information encountered in the research process. In one sense, then, ordinary events become data when approached from a particular frame of mind – that of a researcher.[47]

This figurative description of a researcher's approach to analysing data highlights the need to interpret carefully and to look for useful data in more than just the obvious places.

The initial coding and classification process is now examined and then the detailed analysis of the questionnaire responses and interviews is explained.

Coding and Categorising Data

The questionnaires were coded from number 1 to 50 (number 44 was lost by a respondent and replaced with another number). The interview transcripts were coded A, B, C and D with numbered pages.

In the process of trying to develop suitable codes and categories for the data to enable meaningful analysis, this researcher spent several long uninterrupted sessions reading through the returned questionnaires, the transcripts of the four interviews, and the literature review presented in chapter two. In addition, while reading through the transcripts, the original tape recording was played in order to listen for interviewee

reaction and emphasis. This process together with the field-notes helped to overcome the fact that:

> The tape recorder misses the sights, the smells, the impressions, and the extra remarks said before and after the interview.[48]

Notes were taken throughout this process to record recurrent themes and possible patterns.

Questionnaire Analysis

The initial analysis of the questionnaire data took place while the researcher was still in the field. The questionnaire was initially analysed using a spreadsheet package.[49] The data was divided into ten separate sheets:

1. Personal details (including gender, age, teaching experience, subject and home computer ownership);
2. Answers to the twenty-four questions on the attitude scale;
3. Respondents' professional uses of computers;
4. Respondents' personal uses of computers and frequency of use;
5. Possible benefits of using computers for teachers and students;
6. Possible dangers or challenges of using computers for teachers and students;
7. Respondents' past and present attitudes to computers;
8. Reasons for any similarity or change in attitude from past to present;
9. Respondents' attendance at computer courses;

10. Any other statement made by respondent.

Some basic analysis of the personal information from section three of the questionnaire was first undertaken. This yielded a description of the population under study using the variables of gender, age, number of years teaching experience, subject and home computer ownership. Some level of comparison of variables was also completed, for example, the number of female versus male teachers in each age group and proportion of people in each age group who have a computer in their home. The 'subject' category provided a challenge to the researcher as the questionnaire produced no fewer than seventy-three different subjects taught. By choosing the first subject mentioned as the primary subject, and by grouping certain subjects together, this was narrowed down to eleven categories thus making the analysis more manageable. For instance all science subjects were grouped with mathematics as one category. This allowed more meaningful analysis to take place.

The origin of the first twenty questions of section 1 of the questionnaire has been described earlier in this chapter. Each of the first four sub-headings were analysed individually in order to produce four scores for each respondent.

The first four questions were designed to measure computer-use anxiety and were scored as follows.

A pro-computer item (e.g., item 2, *I am very confident when using computers*) was scored using the following key:

Strongly Agree = 5, Agree = 4, No opinion = 3, Disagree = 2, Strongly Disagree = 1

A negative computer item (e.g., item 3, *I do not feel I have control over what I do when I use a computer*) was scored using the following key:

Strongly Agree = 1, Agree = 2, No opinion = 3, Disagree = 4, Strongly Disagree = 5.

Together these four questions yield a computer use anxiety score from 4 indicating a high level of computer-use anxiety when using computers to 20 indicating a low level of computer-use anxiety. Respondents who had omitted any answer out of the four or who gave multiple answers with comments could not be given scores in that area.

A similar method was used to create scores for teachers' attitudes on the effect of computers on productivity, on student learning, on the role of the teacher and on the impact of the computer on society.

Teachers' attitudes to the various rationales for computers were collated separately as these statements did not directly relate to teacher attitude to computers. This yielded a score of 20 for those who strongly agreed with all four rationales down to a possible 4 for those who strongly disagreed with all four statements.

The open questions in section 2 of the questionnaire were analysed differently. Teachers' replies to each question were categorised under headings. For instance the question asking teachers to describe how they have used computers for professional purposes (Section 2 item 1) yielded answers that were sorted into six categories. These were presentation, school administration, specific school programme, subject information, communication and storage/sorting of information. Each category contained certain sub-categories, for example school administration included accessing student files, entering results and comments, and accessing the timetable.

In this way the process of data reduction could be achieved without losing the quality of the information. The number of teachers recorded under each heading was calculated resulting in some indication of the level of priority of each category which helped to inform the interview process.

Interview Analysis

In the immediate days following each interview, this researcher transcribed the entire conversations from tape to print via a word-processing package.[50] Woods recognises this task as "a formidable one,"[51] but it was a useful process to engage in between interviews as it served to remind the researcher of the issues that were emerging from the data while preventing premature analysis of each interview.

When the process of categorising and coding was complete (or rather initially complete, as several categories were added at a later stage as new patterns were noted after further reading) quotes from each interview were gathered together under the various headings. These were collated with the questionnaire data and the writing up procedure began.

Accuracy, Bias, Reliability and Validity

This section attempts to demonstrate that this study was undertaken in a manner designed to, as far as was practicable, assure its accuracy, lack of bias, reliability and internal validity within the restrictions of limited resources and limited time.

Accuracy

Bogdan and Biklen state that accuracy can be improved by "showing draft articles or interview transcripts to key informants" and "verbally check[ing] out perspectives with subjects."[52] This researcher employed both of these procedures to a limited extent. Each interviewee received a copy of the interview transcript. Subsequently a conversation took place during which several interviewees confirmed or adjusted what they had said during interview.

Biases

As already stated, this researcher finds computers useful and is currently attempting to integrate them into her teaching. The participants in the study were aware of this and the efforts made to prevent this from biasing the collection of data have already been outlined. But what about the analysis stage? Is it not too easy:

> ...for the prejudices and attitudes of the researcher to bias the data. Particularly when the data must "go through" the researcher's mind before it is put on paper, the worry about subjectivity arises.[53]

In an effort to limit such bias, this researcher lets the data "bear the weight of any interpretation."[54] No statement of analysis is made in chapters four or five without the corroboration of data from interview, questionnaire, observation or a combination or these sources. As Bogdan and Biklen remark:

> The data that are collected provides a much more detailed rendering of events than even the most creatively prejudiced mind might have imagined prior to the study.[55]

Reliability

By reliability is meant that there a good fit between what is recorded here as data and "what actually occurs in the setting under study."[56] In other words, could another researcher on another occasion, "*replicate* the original piece of research and achieve comparable evidence or results."[57] While time constraints did not allow this researcher to engage in major observational work, results were being entered onto the school computers in preparation for the end-of-term reports, during the time period when the interviews were undertaken. Consequently, this researcher had the opportunity to observe the four teachers involved in some of the activities that they spoke about during interview. This served to confirm and concretise much of the spoken evidence offered by these teachers and is mentioned in the analysis chapter where appropriate. For example one teacher spoke of the importance of having a computer available in an office as this facilitated him "being able to 'fooster' around and make mistakes" in privacy. This teacher has never been observed using the computer in the staffroom and so observation corroborates the interview data in this case.

In addition the two main modes of data collection provided a means of checking the reliability of the data. In interview teachers were able to expand on ideas expressed in their written responses. The researcher could follow up on apparent inconsistencies and points that were unclear. For instance one teacher who stated that computers "will never provide the human medium between learning and the student that the teacher will" had the opportunity to concretise and further explain this idea during the interview stage.

Silver states that

> 'Authenticity' rather than reliability is often the issue... The aim is usually to gather an 'authentic' understanding of people's experiences and it is believed that 'open-ended' questions are the most effective route towards this end.[58]

The attempt at triangulation of data through the questionnaire, the interviews and some limited observation has assisted in achieving an authentic account of the data. As such, this researcher believes that similar data would have been collected by another researcher studying this population's attitudes to computers at this time.

External Validity or Generalisability

By external validity is meant "...whether the findings of a study stand up beyond the specific research subjects and the setting involved."[59] This research could be categorised as a case study in that the findings from the questionnaire apply to one school only and statements from the interviews apply to the individuals who expressed them. No attempt is made by this researcher to imply that the findings are valid for other teachers, in other schools. However, it may be true that the reader finds a certain familiarity among the issues addressed, even though they are working in a different context. Woods states that

> Generalizability is strengthened as the theory is strengthened, and this might be done in a number of ways – by more case-studies of schools, ...and, not least, in the readers' heads as they deploy their own knowledge and experience of such institutions.[60]

It is hoped that by undertaking this study, the researcher has added a further case study to the collection of research currently available in the area of teacher's attitudes to computers.

Internal Validity

By internal validity is meant "truth: interpreted as the extent to which an account accurately represents the social phenomena to which it refers."[61] The major difficulty that arises in this piece of research that attempts to focus on the teacher and computers in the context of a particular school is well expressed by Bogdan and Biklen:

> Picking a focus, be it a place in the school, a particular group, or some other aspect, is always an artificial act, for you break off a piece of the world that is normally integrated... Detaching a piece to study distorts, but the researcher attempts to choose a piece that is a naturally existing unit.[62]

It cannot be guaranteed that the findings of this research represent the 'truth'. However, this researcher is confident that by working to develop a professional researcher-participant relationship, by gathering data through a variety of means and engaging in limited respondent validation of that data, and by interpreting that data in a non-biased and transparent manner, that these pages contain a factual and reliable description from the perspectives of the subjects under study in the context of their particular school.

Summary

This chapter has described the methods used in the conduct of the research. It began with a general overview of the 'funnelling spiral' approach taken by this researcher and explained the rationale behind the study. The aspects of particular interest to the researcher were outlined. It then took a detailed look at the research methodologies used. The rationale for using a questionnaire was stated and the criteria, which informed the choice of design and content, the piloting process and the choice of

population, were discussed. The researcher-participant relationship was given particular attention because of its importance to the study. The use of interviews as a research instrument was then detailed, with particular emphasis on the character and content of the interviews. The chapter concludes with a look at procedures used for data analysis and a discussion on the accuracy, reliability and validity of this piece of research.

Endnotes for Chapter 3

[1] Taken from notes made at initial stages of reading the literature.
[2] Robert C. Bogdan and Sari Knopp Biklen, *Qualitative Research for Education: An introduction to Theory and Methods* (Boston: Allyn and Bacon, 1982) p.xiii.
[3] This concept is mentioned for example in Peter Woods, *Inside Schools: Ethnography in Educational Research* (London and New York: Routledge and Kegan Paul, 1986) pp.88, 147.
[4] Caitriona Dolly, *A Survey of Teachers' Attitudes to Computers*, Masters in Computer Applications for Education, DCU, 1998.
[5] Cyril J. Drury, *Implementing Change in Education: The Integration of Information Technology into Irish post-primary schools* (M. Sc. Thesis, University of Leicester, 1995) <http://indigo.ie/~cjdrury/thesis/contents.html>.
[6] Taken from dissertation proposal.
[7] Taken from dissertation proposal.
[8] Marlene E. Henerson, Lynn Lyons Morris, and Carol Taylor Fitz-Gibbon, *How to measure attitudes* (London: Sage publications, 1987) p.11.
[9] *Ibid.*, p.13.
[10] Peter Woods, *Inside Schools,* p.62.
[11] *Ibid.*, p.62.
[12] J.D. Nisbet and N.J. Entwistle, *Educational Research Methods* (London: Unibooks, University of London Press, 1970) pp.125-166.
[13] David Silverman, *Interpreting Qualitative Data* (London: Sage Publications, 1997) p.21.
[14] Peter Woods, *Inside Schools,* p.115
[15] *Ibid.*, p.115.
[16] *Ibid.*, p.119.
[17] Bruce W. Tuckman, *Conducting Educational Research* (Florida: Harcourt Brace College Publishers, 1972) p.216.
[18] Robert C. Bogdan, et. al., *Qualitative Research for Education*, p.29.

[19] Bruce W. Tuckman, *Conducting Educational Research,* p.197.
[20] *Ibid.*, p.233.
[21] Rhonda Christensen and Gerald Knezek, "Parallel forms for measuring teachers' attitudes toward computers" <http://www.coe.uh.edu/insite/elec_pub/HTML1998/re_chri.htm>; See also Christensen, R. and Knezek, G., *Constructing the Teachers' Attitudes toward Computers (TAC) Questionnaire*. Paper presented to the Southwest Educational Research Association Annual Conference, New Orleans, Louisiana, January, 1996.
[22] Details of testing items in attitude scales for reliability and validity are available in many sources including Bruce W. Tuckman, *Conducting Educational Research*, Chapter 9.
[23] Robert C. Bogdan, et. al., *Qualitative Research for Education,* p.2.
[24] Earl Babbie, *Survey Research Methods* (California: Wadsworth Publishing Company, 1990) p.141.
[25] *Ibid.*, p.97.
[26] Robert C. Bogdan, et. al., *Qualitative Research for Education*, p.57.
[27] Marlene E. Henerson, et. al., *How to measure attitudes*, p.81.
[28] Robert C. Bogdan, et. al., *Qualitative Research for Education*, p.57.
[29] Nigel Lemon, *Attitudes and Their Measurements*, (London: Batsford Ltd., 1973). p.76.
[30] Marlene E. Henerson, et. al., *How to measure attitudes*, p.29.
[31] Bruce W. Tuckman, *Conducting Educational Research*, p.216.
[32] Peter Woods, *Inside Schools,* p.67
[33] *Ibid.*, p.63
[34] Nigel Lemon, *Attitudes and Their Measurements* (London: Batsford Ltd., 1973) p.57.
[35] Peter Woods, *Inside Schools,* pp.64-65, 77.
[36] *Ibid.*, p.77.
[37] *Ibid.*, pp.79-80.
[38] This list of questions is taken from the transcripts of the four interviews conducted by this researcher as part of this study, and classified with the help of Peter Woods, *Inside Schools,* p.79-80.
[39] Peter Woods, *Inside Schools,* p.79.
[40] Earl Babbie, *Survey Research Methods*, p.192.
[41] Robert C. Bogdan, et. al., *Qualitative Research for Education*, p.136.
[42] *Ibid.*, p.136.
[43] Peter Woods, *Inside Schools,* p.78.
[44] Robert Bogdan and Steven J. Taylor, *Introduction to Qualitative Research Methods: A Phenomenological Approach to the Social Sciences* (London and New York: John Wiley and Sons, 1975) p.109.
[45] Peter Woods, *Inside Schools,* p.81.
[46] This is suggested by Peter Woods, *Inside Schools*, p.70, as a way of negotiating the use of a tape-recorder.

[47] Robert C. Bogdan, et. al., *Qualitative Research for Education*, p.73.
[48] *Ibid.*, p.74.
[49] The spreadsheet package used to analyse this thesis was Microsoft Excel 97.
[50] The word-processing package used to type this thesis was Microsoft Word 97.
[51] Peter Woods, *Inside Schools,* p.82
[52] Robert C. Bogdan, et. al., *Qualitative Research for Education*, p.30.
[53] *Ibid.*, p.42.
[54] *Ibid.*, p.42.
[55] *Ibid.*, p.42.
[56] *Ibid.*, p.44.
[57] David Hopkins, *Evaluation for school development* (Milton Keynes: Open University Press, 1989) p.81.
[58] David Silverman, *Interpreting Qualitative Data,* p.10.
[59] Robert C. Bogdan, et. al., *Qualitative Research for Education*, p.41.
[60] Peter Woods, *Inside Schools,* p.50
[61] David Silverman, *Interpreting Qualitative Data,* p.49, quoting Hammersley, *Reading Ethnographic Research: A Critical Research* (London: Longmans, 1990) p.57.
[62] Robert C. Bogdan, et. al., *Qualitative Research for Education*, p.60.

Chapter 4: Teachers' Attitudes to Computers in a Second Level School

Introduction

This chapter concentrates on presenting the factors influencing certain teacher attitude to computers which appear most significant in the data. The data on teacher attitude was collected through teachers' written contributions in response to the questionnaire and through taped interviews. In order to remain true to this data an attempt has been made to "analyze it with all its richness as closely as possible to the form in which it was recorded...."[1] This process of analysis led to a discovery that teachers' anxieties are a significant factor in contributing to a positive or negative attitude to computers. This chapter also explores two kinds of computer anxiety amongst the teachers surveyed and how they have managed to overcome some of their worries.

The questionnaire responses provided data across a number of areas from the forty-nine respondents. The interviews sought to explore, with four teachers, some key emerging issues from the questionnaire responses. This analysis draws on both sources in identifying the issues (questionnaire data) and seeking further clarification of these issues (interview data). In this way the two data sources serve to support, confirm and illustrate the emerging issues.

The methodology employed in analysing the data is described in more detail in chapter three. In what follows, data from questionnaires is referenced as R1 to R50 for respondents one to fifty (one questionnaire was mislaid and replaced) and data from

interviews is presented under the four pseudo-names of *Audrey*, *Barbara*, *Carmel* and *Denis*. *Audrey* and *Barbara* are in the 30-34 age group and *Carmel* and *Denis* are in the 50-54 age group.

Two forms of anxieties were prevalent in questionnaire and interview responses. The first is referred to as *computer use anxiety*. Teachers expressed various levels of discomfort when using a computer. The second kind of anxiety will be referred to as *pedagogical computer anxiety*. This refers to teachers' worries around various educational issues for example, how will computers affect the role of the teacher.

The chapter begins with a short profile of the school under study. Following on, Section A begins to unpack the two forms of anxiety discovered and compares their relationship to other variables. Section B then presents the analysis of the factors which appear to influence these anxieties and in particular examines possibilities for promoting more positive teacher attitudes towards computers, which have arisen from the data.

Profile of school and related ICT activity

The school in this study is a community college and is multi-denominational and co-educational. There are over 800 pupils and approximately 50 teaching staff. While it appears to have two 'computer rooms' one set of computers is out of date and almost defunct. A number of separate stand-alone computers[2] are distributed around the staff room, in teachers' offices, the library and in the main administrative office. Most computers are linked through a network system which facilitates the use of the machines for accessing and inputting data such as students' reports and personal

information. A small number of teachers have contributed significant time and effort in installing and maintaining the computer network and considerable resources have been invested in updating the school equipment.

All teachers enter student results directly onto computer. Class tutors, often with secretarial assistance, enter final report comments onto computers. Apart from teachers of subjects which involve the use of computers, this is the only use of ICT that is *expected* of teachers. Certain teachers in the school have worked to develop links with several computer companies and third level colleges and as a result some students are involved in computer skills tuition projects and video-conferencing initiatives. A computer policy committee was set up and recently completed and circulated an ICT Policy for the school. There appears to be general approval among the management and teaching staff that computers are of benefit to the school and the students.

Section A: Preliminary Discussion on Teachers' Anxieties towards Computers

The difficulties in measuring computer attitude have already been discussed in chapter three, and as such the attempt to measure teachers' attitudes to computers on a Likert type scale cannot be regarded as precise. However when these results are collated with the remarks from the open questions, and compared with other variables, a clearer picture emerges. Responses to questions 6 and 7 in section 2 of the questionnaire indicate that five years ago seventeen teachers were positive towards computers, twelve were neutral and eighteen were negative. In describing their current attitude, this had changed to forty-one positive respondents, four who were neutral and one

who expressed a negative attitude. (Not all respondents replied to these questions) This accounts for a positive shift in attitude towards computers by over half of the sample population, and as such was judged to be worthy of further study.

Chapter three details the method used for calculating the Likert scores for various facets of computer attitude. A low score indicates a negative computer attitude, for example a high level of anxiety about using computers. A high score indicates a positive attitude towards computers.

Computer Use Anxiety

The first four questions in Section 1 of the questionnaire were designed to measure anxiety towards using computers. This will be referred to as 'computer use anxiety'. Together these four questions yield a computer use anxiety score from 4, indicating a high level of anxiety when using computers to 20 indicating a low level of anxiety and consequently a high confidence level. The actual scores obtained by the population ranged from 6 to 20, with a mean score of 13.6 and a standard deviation[3] of 3.5. This was the lowest mean and highest deviation of all calculated scores. This indicates that it is this factor, above all others included on the questionnaire, which seems to negatively affect teachers' attitudes, and that there is a broad range of computer use anxiety among teachers in the population.

Examining this in more detail reveals that six people (12% of the population) scored less than ten on this scale. This score, when compared with their open comments, more clearly explains the nature of computer use anxiety. R9 never uses the computer "because I'm afraid of making mistakes, causing the system to crash."[4] R15 said he

was "a bit fearful." R33 used to be terrified of computers and now feels more positive. But she agrees that she hesitates *to use a computer for fear of making mistakes* (section 1, item 1) and strongly disagrees that she is *very confident when using computers* (section 1, item 2). R2 stated that five years ago, computers were "something outside my experience." Now she feels "it is an urgent priority that I become computer literate." She does not feel she has *control when using a computer* (section 1, item 3). R21 uses it but needs "assistance from other members of staff". R41 "knew nothing about them."

These teachers are trying to function in a situation where they are expected to use computers, and yet they feel very anxious about using computers. Factors which have contributed to this anxiety and factors which may help to reduce it are issues for Section B of this chapter.

A brief comparison of computer use anxiety scores to gender (see figure 4.1) shows that a much higher proportion of males (53%) than females (19%) place themselves in the low anxiety, or high level of confidence bracket (score 16-20).

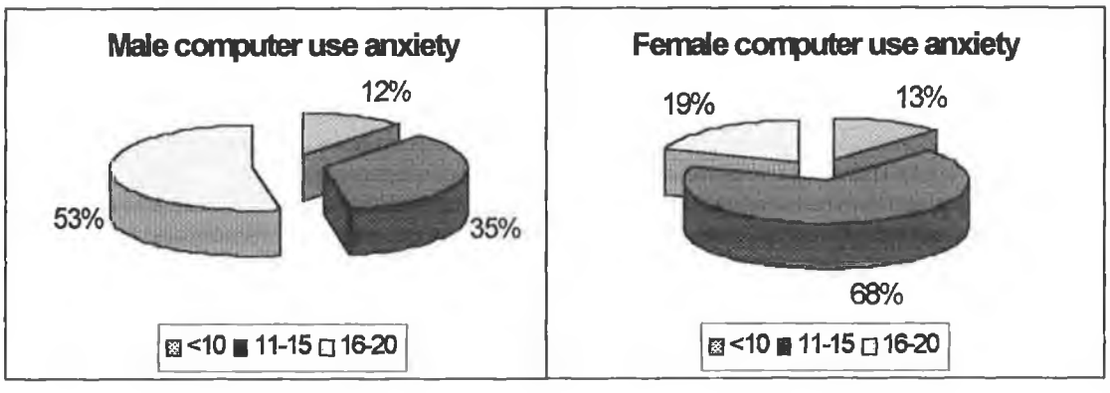

Figure 4.1: Computer use anxiety compared to gender

While there is no significant trend in computer ownership for teachers with high and mid anxiety ratings, of those scoring a low anxiety score (16-20), a very high percentage (87%) have a computer in the home.

Figure 4.2 demonstrates the relationship between frequency of computer use and computer use anxiety. It shows that those who are anxious do not use a computer very often, and those that are confident use computers more frequently. No attempt at establishing a direction of causality was made.

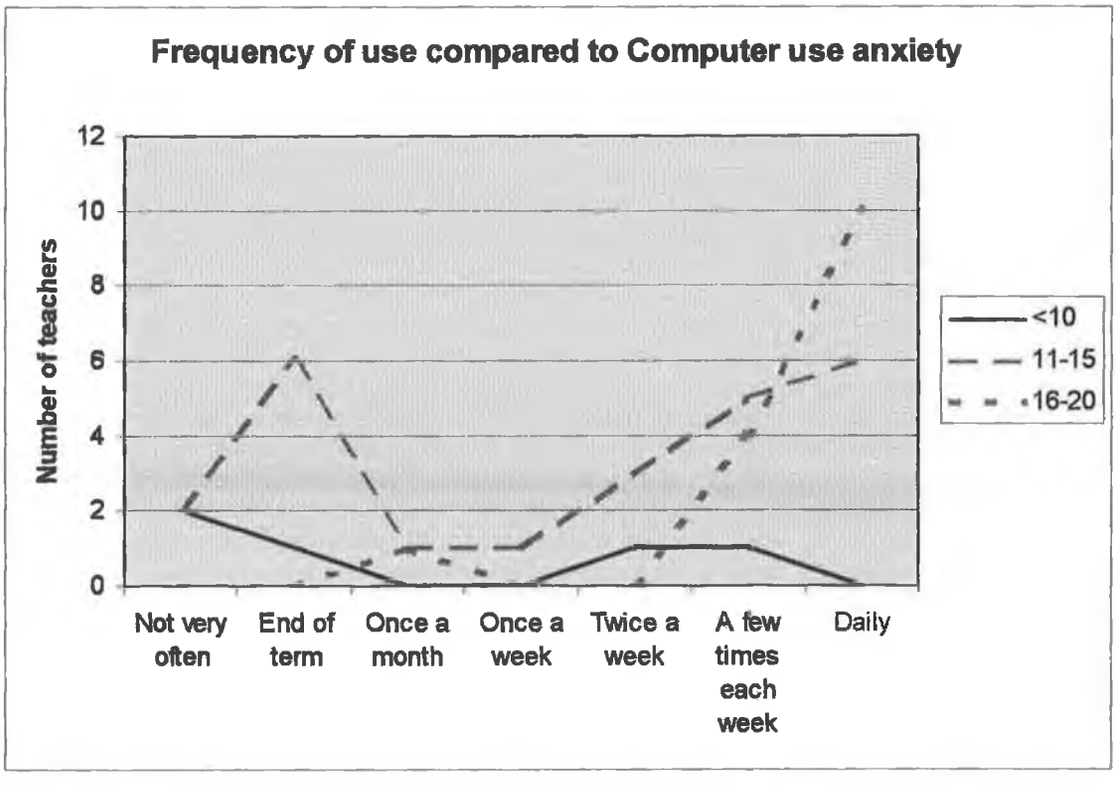

Figure 4.2: Comparing frequency of use with computer use anxiety.

Comparing computer use anxiety to primary teaching subject, indicates that the highest occurrence of computer use anxiety occurs amongst teachers of English and the lowest amongst teachers of Science and Maths (Figure 4.3). Teachers of Applied

Sciences, whose subjects usually involve some level of computer usage, also showed little computer use anxiety.

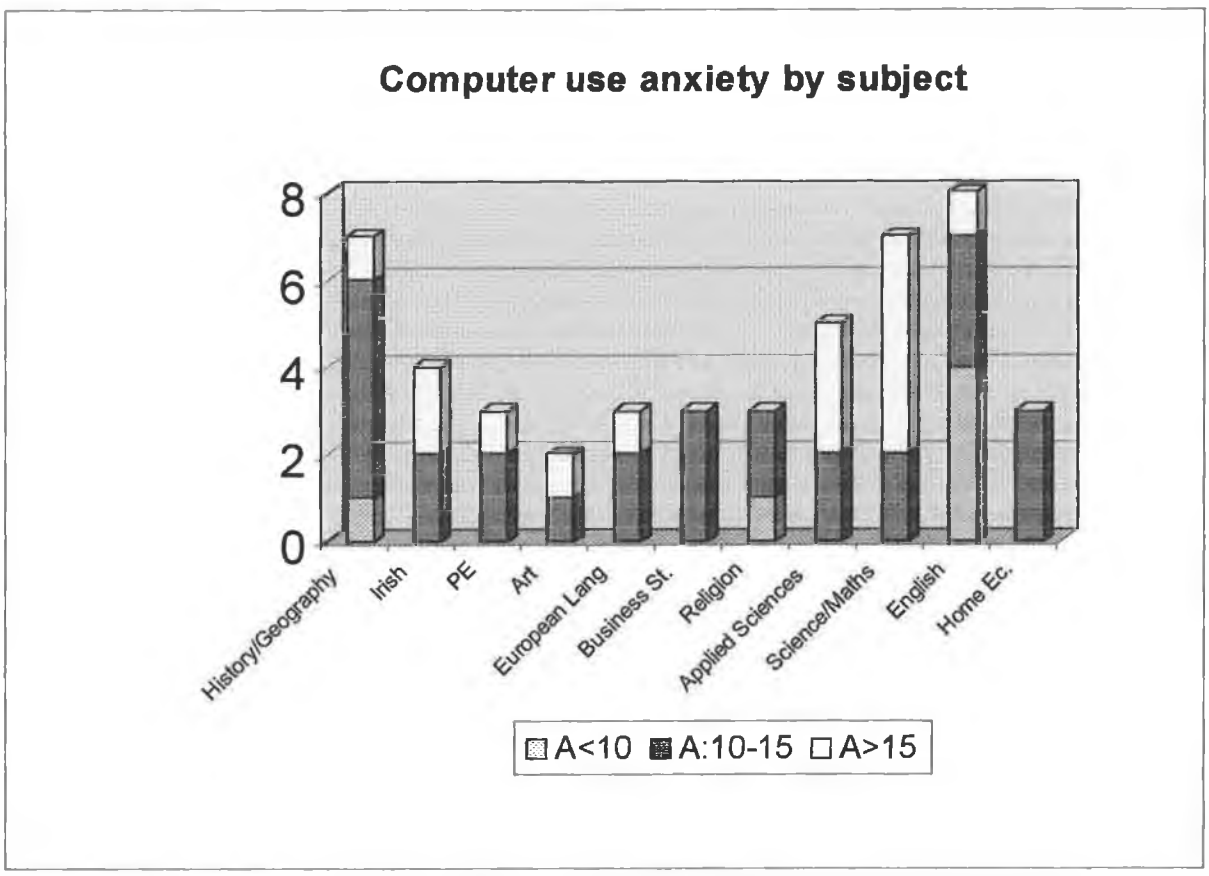

Figure 4.3: Comparing computer use anxiety to primary teaching subject

Comparison of this variable to teacher age or years of service produced no significant trends.

In summary, in this school, one of the major barriers to positive computer attitudes seems to be in the area of computer use anxiety. Teachers' anxieties regarding their lack of skill and competence with computers are palpable. This observation served as a guide to the researcher when choosing teachers for interview and when selecting interview themes. Section B will further unpack the key factors surrounding this issue.

Pedagogical Computer Anxiety

Responses to the questionnaire uncovered that teachers were also anxious about various aspects of computer usage in education. This will be referred to as 'pedagogical computer anxiety'. A brief examination of the remainder of the Likert-type responses suggests that there is general consensus that computers help teachers to be more productive, with teachers largely agreeing for example that *computers are necessary tools in educational settings*.[5] A belief that computers can aid the actual teaching and learning process seems to be more prevalent amongst younger teachers. However, the responses to the open questions in section two revealed more about teachers' worries regarding the influx of computers in education than the Likert scores suggested.

Table 4.1 summarises the benefits and dangers that respondents believe that using computers holds for teachers and students. While the table demonstrates some level of balance between the positive and negative aspects of computers in education, it also signposts some of the issues that cause teachers to question the influence of computers in education.

Examining two of these benefits versus dangers will help to highlight the difficulties that some teachers are having in believing that computer will necessarily improve the quality of education and will set the scene for further analysis in section B.

Teachers report of using computers to improve presentation of work by typing notes, letters, tests and solutions, presenting reports of various kinds, preparing notices and

posters, and encouraging students to present word-processed projects. Apart from overcoming bad-handwriting, word-processing has other perceived advantages.

Table 4.1: Benefits versus dangers of computers in education, drawn from questionnaire responses

Benefits	***Dangers/Limitations***
1. Improved presentation of work	1a. Presentation becomes more important than subject matter 1b. Students dis-improve at certain basic skills e.g. handwriting
2. Increased access to information	2a. Students confuse information with knowledge 2b. Students gain access to 'unsuitable' information
3. Students with computer skills are more employable	3. Economic need for ICT literate students may over-influence educational policy
4. Opportunities for more student-centred, self-directed learning	4. Threatens 'traditional' teacher role as subject expert
5. Possibilities of communication with teacher/student peers, in Ireland and in other countries	
6. Improved and speedier administration e.g. reports	

In some cases teachers felt that presenting typed material offers "a more professional service for students in keeping with the quality of presentation they've come to expect in this multi-media age" (R50). Teachers explained how using a computer "cut down on my workload" (R42), how "newly available research can be inserted in appropriate places in notes without having to rewrite" (R27) and how computers would help to banish the "ocean of paper" (R20) that surrounds them. Many teachers encourage students to present typed projects. Some teachers reported that when "presenting something in printed form they [students] are more conscious of spelling, grammatical

mistakes, general presentation, much more so than when presenting in hand-written form" (R36). So by simply using a word-processing package and saving their work, some teachers believe that students get a more professional service and benefit from presentation skills and that teachers become more efficient and organised.

However some respondents were anxious that using computers in this way could cause negative side effects. One teacher worried about "an increasing belief in order and the importance of form or presentation rather than content" (R41). Many teachers believe that students will become lazy and that computers will decrease "students' ability to express themselves in writing" (R2) by causing a disimprovement in skills such as hand-writing, grammar, punctuation, spellings and range of vocabulary (R31, R4, R34).

Similar arguments exist regarding the use of computers to access a greater range of information and resources. While fifty per cent of respondents use computers to access subject information, the use and abuse of information by students appeared frequently as an issue. Comments such as "information retrieved on the Internet, needs to be personalised and understood by pupils" (R45) were typical. While some teachers saw it as their role to help students to learn how to gather, analyse and critically use information, others believed that students would increasingly 'print off' information rather than digest and learn knowledge (R33). A worry that students would favour the multimedia world of computers over the world of books was also prevalent (R34).

This anxiety surrounding the pedagogical aspects of computers challenges teachers to examine the influence that computers exert on the nature of knowledge in their subject

area, on the role of the educator in the classroom, and on the role of the student in the learning. This pattern in the questionnaire responses also informed the interview process. A selection of these issues is further examined in Section B.

Section B: Factors Influencing Teachers' Computer-use Anxiety and Pedagogical Anxiety

Based on trends in the questionnaire responses, Section A introduced the areas that seemed important from the respondents' perspectives. Four teachers were invited to elaborate on their past and present anxieties in interviews. The combined data produced a range of factors which contributed to computer use anxiety. This section begins by examining some of these factors and proceeds with suggestions made by respondents for contributing to a shift towards a more positive teacher attitude to computers. Pedagogical computer anxiety is then examined in some detail.

Factors which contribute to computer use anxiety

This section examines some of the causal factors for computer use anxiety as reported in the data. During the interviews, teachers were asked to "move back in time" by approximately five years, and to elaborate on their feelings towards computers and on any underlying reasons for those feelings. The interviewees varied with age, gender, variety of job experience (other than teaching), computer training and other factors. In analysing the transcripts, certain common elements began to emerge across the four very different individual experiences.

These factors are classified as follows:

- "Hail to the computer!" factor;
- "it's beeping at me" factor;
- language or "buzz-words" factor;
- personality or 'that's just the way I am' factor;
- 'generation game' factor;
- 'poor access and education' factor.

It would be incorrect to imply that these are the sole elements that contribute to teachers' negative feelings towards computers. Other issues that arose in this research included the relationship which certain subjects seem to have with computers (dealt with briefly in section A). For example one teacher felt that her background in humanities was partly to blame for her "irrational fear of these machines" (*Barbara*). However this research will confine itself to the factors which appeared to be dominant in the school under observation as indicated by the data.

"Hail to the computer!"

Several (7) respondents from this school recall a time when computers were regarded as very special machines. Because of their delicate nature and tendency to break down a lot these computers received special treatment and non-trained personnel were told to stay away. One respondent introduced the connotation of 'worship' as she described that "Computers were regarded as a God and few people could use them" (R6). Another "felt they were only for experts" (R41).

In interview one teacher's voice became more hushed while describing her first dealings with *the computer* in a previous non-teaching role:

> ...when they were bringing in computers, this was in the late 1960's, the computer was in a special room, right? Nobody could go in or out except the people who were operating it, it was like a sort of operating theatre. The people who were there wore light clothes even in the middle of Winter because there was special heat for this computer and there was a whole air of mystique, danger and everything else attached to it... So for that reason, you sort of were in awe of it and terrified of it at the same time... That's the way it was. (*Carmel*)

This respondent seemed to take on the attributes of a story-teller while giving this information and when the tape-recorder was switched off at the end of the interview she repeated it as if to emphasise its importance and to impress on this researcher that "That's the way it was."

Other questionnaire responses demonstrated that one teacher was "A little bit in awe of them" (R10) and another was "reluctant to even approach a computer" (R7). This idea of the computer of the past needing to be "humoured, pampered and heated in order to operate," (*Carmel*) and therefore as a non-approachable machine in a place apart from the normal workplace, appears to have added to or perhaps even initiated certain teachers' fears of using the computer.

It is important to note here that the time-scale of five years was treated very approximately by certain teachers, who interpreted it to mean *sometime in the past*. The teacher who spoke about computers being accommodated in a separate room referred to the 1960s. It would have been interesting to see if using a retrospective period of ten or fifteen years would have uncovered more of the "Hail to the computer" factor.

Some of those who remember the days when computers were inaccessible seem to have carried this 'user-unfriendliness' view through to the present day. Using a computer, while they still feel uncomfortable or anxious, appears to rekindle these memories.

"It's beeping at me!"

Computers are machines. They have wires and buttons and you need to follow certain instructions if you want the computer to perform a certain task. The cryptic error messages of the past have to a large extent been replaced by a generic beep, which lets you know if you are trying to do something incorrect. Error messages still come on screen to tell you for example that "The selected floppy disk drive is not in use". Responses to section 1 item 3 of the questionnaire indicated that over one quarter (26.5%) of the surveyed population *do not feel they have control over what they do when they use a computer*. Considering the aspirations that are held for ICT in education, this is a significantly high number among the sampled teacher population.

A number of respondents recalled their reaction when faced with an error message:

> ...when I initially had contact with computers, something would flash at me or beep at me and I didn't know what to do and my tendency was to panic... my reaction was to go 'Ooooh, what have I done?'(*Barbara*)

In interview, anecdotal evidence was presented of things that can go wrong with computers and of the effect that such disasters can have on computer users. Things 'disappeared', files moved and computers seemed to have a mind of their own.

As a consequence of seeing computers as delicate and fragile machines, there is a fear of breaking something. One questionnaire respondent remembers being

> ...afraid of causing untold damage by pressing the wrong buttons or wiping off important files unwittingly. (R10)

Audrey remembers their college days when "I was more cautious of breaking the system or damaging the package...." The same interviewee spoke of her experience in college where

> ...the computers were always shutting down or blanking out and people losing their work... if something disappeared, where was it? Have I broken everything? Have I broken the computer? (*Audrey*)

This fear of losing work was mentioned by three of the four interviewees, with each teacher having a story to tell of a colleague or friend who had suffered in this way at the hand of computers. One spoke of this situation as it is parodied on television:

> I'd say where it [an attitude of terror] came from was watching television programmes, especially comedies and seeing some idiot pressing the wrong button and wiping everything off that other people had done before and so on. And I was terrified that if I went to the computer, that as sure as God I would press the wrong button and I would delete what everybody had worked on before or else break the whole thing down. (*Carmel*)

These worries appear to be very real for the teachers involved. While many teachers report improved attitudes, there are still strong remnants of a fear of the beeping noise and the flashing screen. Teachers do not like to appear incompetent and, as becomes clearer when we examine the interview data, some prefer to avoid using the computer at all, or only in a private office rather than expose their fears or incompetence.

"Buzz-words"

Questionnaire responses indicated that some teachers found that with computers "the language was different" (R6) and they "didn't understand the buzz- words or vocabulary" (R10). This sense of needing to speak a 'foreign language' in order to learn about computers was clarified by *Denis*:

> I just found the whole language... from hearing my own kids talking about it and so on, ... was just a bit above my head, and I just didn't find it attractive, you know. I'd hear them talking about CD-ROMs and all that kind of stuff – it just didn't attract me.... They'd be talking all this computer stuff and I just found it a foreign language, I found it... certainly boring, but almost annoying to hear.... (*Denis*)

This seems to have the effect of promoting some teachers' sense of computers as inaccessible. The notion of computer jargon as being equivalent to a foreign language added to teachers' feelings of incompetence with computers. Sometimes when things went wrong, someone else stepped in and solved the problem, but because of the language barrier the teacher was often none the wiser for this intervention:

> I think part of it is the language, because it's a whole language. And I mean when you hear people talking about computers they are really talking a different language to the rest of us.... I mean sometimes if you ask somebody, do you know when the screen is black and the white things come up on the left hand side? And then somebody shouts across some few words, and somebody else presses a button and so on, and we don't, we haven't a clue, you know? (*Carmel*)

It is clear that much work needs to be done to make the language of computers more accessible to teachers. It might be informative for teachers familiar with computer terms to be aware of the effect that computer jargon has on those who do not understand it. What *Carmel* describes as "when the screen is black and the white

things come up on the left hand side", her colleague might refer to as 'a screen-saver'. In this instance language appears to be a barrier rather than an aid to communication.

"That's just the way I am"

This category relates to aspects about the person that they regard as integral to their personality and consequently effects their attitude to computers either positively or negatively.

For example, eighty per cent of the population agreed with the statement: *I find it easy to ask for help if I have a problem when working on a computer* (Questionnaire, section 1, item 4). Seven people disagreed with this. An analysis of the average computer use anxiety score for these two categories indicates a significant increase in anxiety for those who find it difficult to ask for help.[6] Those who can ask for help when things go wrong appear, on average, to be less anxious when using computers. In interview, *Denis* found it "a little bit embarrassing to be asking people" for help, and preferred "to 'fooster' around and make mistakes" in the privacy of an office when trying to use the computer, rather than use the more public computer in the staff room.

A separate personality issue raised was that of self-motivation. Some teachers found it difficult to be interested in learning computer skills: "I would like to be computer literate but am too intellectually lazy to use it" (R13). Others attributed their consistency or change in attitude to their liking for the challenge of something new: "it is always exciting to try out new ideas" (R31) or "I enjoy the opportunity to try out, fail and learn from failure" (R50). *Audrey* expressed her motivation for learning thus:

> ...if something interests me, if my curiosity is arisen, I want to go and I want to do it, I want to be able to do as much as possible about it – so I would do all in my power to learn as much as possible.... (*Audrey*)

A teacher's self-esteem, openness to new things, level of motivation, ability to ask for help and to learn from mistakes appear to be aspects of a personality that influence an individual's anxiety level with respect to computers.

The Generation Game

There appeared to be a belief on the part of some teachers that belonging to a certain generation was either an advantage or a disadvantage when it came to computers. One of the more experienced teachers (aged 50-54) found that

> ...it was hard enough to see a lot of young people coming up, teachers and so on, and they all seemed to be able to do what they like with it, and I was never able to. (*Denis*)

This same teacher, while proposing certain structures for computer training for teachers, went on to group "the older generation" of teachers together in their judgement of teacher competence with computers. This respondent expressed the need for a very basic course to be offered to:

> ...the likes of us, and there would be a good lot of us, I'd say the older generation. I don't think there is any of us that have really mastered this thing. And I'd say a lot of those people would welcome lessons. (*Denis*)

Another teacher in the same age group explained why there would be a certain reluctance on her part, because of her age, to attend a NCTE computer course:

> That would be more for younger people, who are familiar with the language and know what they are doing. (*Carmel*)

One younger teacher (age 30-34) expressed a belief that teachers who were "used to a certain way of life" would find it harder to accept changes, and would therefore be intimidated by computers also:

> But there are others who were a little bit older in life and were intimidated by new experiences full stop. And I think that no matter what you introduce them to, because they have been used to a certain way of life for ten, fifteen years, nothing is going to change that– a lot of that would go down to the age they were at... (*Audrey*)

This same teacher felt that being younger was a definite advantage when it came to attitudes to computers:

> I was at an age when computers were coming in, ...there was intimidation at first but I was at an age when computer technology was just another fact of life. And I was open enough to that. (*Audrey*)

Another teacher in the same age group felt that their generation had fallen "in between two stools, we were given no technical training in school" (*Barbara*).

All four interviewees mentioned the generation (or age) factor. The general trend of thinking among the interviewees seems to expect older teachers to have more negative attitudes towards computers. The questionnaire data shows several exceptions to this, for example R43, who is over 50, scored 19 out of 20 on the computer use anxiety scale and states "I enjoy working with computers" because he sees "a need to keep abreast with society and industry." It should be noted that R43 is a teacher of Applied Sciences. A subject colleague confirms that "Five years ago computers were central to my subject" (R47). In this case the subject factor appears to outweigh the generation factor.

Access and education

Overall it could be said that five years ago many teachers had "no interest, [or] no information" (R14) regarding computers, and that computers were "something outside my experience" (R2). Because of poor access and lack of training at that time, computers did not impinge on the professional and personal activities of many of the teachers in this study. As one teacher put it, "Computers had no part in my life" (R26).

The fact that information technology was not part of her own home or school life appeared to contribute to *Audrey*'s initial discomfort in using computers:

> ...people didn't have computers in their houses, there wasn't an awful lot of IT in schools at the time – certainly not while I was in secondary school – it was a very limited experience we had – they were only being introduced. (*Audrey*)

Other teachers also spoke about their own lack of computer education at second level.

> ...we were given no technical training in school – what I mean by technical training, we were not given an option to study any type of information technology. So that was the first barrier.... I did have some typing skills, but I literally came out of school without having seen a computer. (*Barbara*)

The effect of having no information technology input during teacher training was also felt to be a significant factor in poor teacher attitudes to computers in education.

> When I think back to my training in teaching ...I'm only teaching about six years ...there was no information technology input into our training. ...if your subject wasn't specifically computer related or science related you had no information technology input whatsoever. (*Barbara*)

There seems to be some implication here that teachers of certain subjects are at an advantage with computers because of their training. The findings of this research on the link between computer anxiety and subject have already been briefly mentioned in Section A. They appear to corroborate *Barbara*'s opinion.

Several teachers expressed the need for more computers for teacher use to be made available. One teacher in particular was very strong on this and stated that "Apart from the grudgingly conceded appliance in the staff-room, teacher access (in a positive and welcoming way) is woeful..." (R37). Others commented on the need for all classrooms or subjects to be "furnished with computers and printers" (R6). There is some level of tension regarding where computers are located and who has priority in using them.

Another source of annoyance for certain teachers, was the promotion of in-school courses that never happened. Some teachers noted the lack of "follow through" in the school. For example, *Audrey* recalled

> Suggestions and leaflets are put out about what you would like, for example the timetable, and those interested in doing a course, and neither of those has happened. (*Audrey*)

Negative experiences on previous computer courses also added to some teachers' discomfort with computers. *Carmel* recalled a short course run in the school:

> ...we had a few afternoons before with some guy, but I didn't really learn anything at that. ...The only thing I remember from it was that he said that the computer has no brain, I remember that. ...And then he was showing us how to open a file or something like that, but I've forgotten, I don't know now how to open a file, so it was a waste of time for me. ...I think he didn't really know what we needed it for. (*Carmel*)

The memory of these and other experiences helped to inform teachers' recommendations for the structure of future courses. This is discussed later in this chapter in the section that deals with training and teacher development.

The lack of access to computers and the poor or non-existent computer content in their own education appeared to be a significant factor for teachers in this study. While almost two-thirds of the cohort currently have a computer in the home, five years ago there would have been very few computer owners among this group. It is significant that several teachers implied that they intended buying a home computer in the near future.

These were the main categories that arose in the data that appeared to contribute to teacher anxiety. Words used in questionnaires to describe teachers' attitude both in the past and in some cases in the present included "terror", "technophobic", "hostile", "reluctant to use them" and "fear". Such debilitating feelings were present for over a quarter of the teachers in the population, most of whom have now begun to overcome them to some extent. We now examine the reasons behind this change under two headings: overcoming computer use anxiety, which looks at steps which can be taken to help teachers feel more confident when using computers, and pedagogical

challenges which explores how computers challenge teachers to look afresh at certain aspects of their profession.

Overcoming Computer-Use Anxiety

It has already been stated that over half of the population demonstrated a shift in attitude towards a more positive view of computers in education, over a period of approximately five years. Teachers responded to questions 8 and 9 in the questionnaire and tried to account for the consistency or the change in their attitude over the last five years. Certain factors were seen to be common across the population.

At interview stage, teachers were encouraged to expand on any factors they had mentioned. Interviewees were invited to personalise the issues by describing their own situation, and then to depersonalise by trying to extrapolate factors which could help other teachers to effect such change. This section concentrates on factors that would help to tackle teachers' anxieties regarding using computers. These factors were chosen either because a high frequency of participants mentioned them in the questionnaire or because a small number of respondents laid great emphasis on their importance. The factors in overcoming teachers' computer use anxiety include:

- training/in-service/teacher development;
- the importance of significant events in teachers lives;
- the computer ethos in society and in the school;
- the effect of "seeing other peoples' success" with computers.

Each of these factors is now examined.

Training/In-service/Teacher Development

In response to question 11 on the questionnaire, which invited the teacher to *make a statement related to your attitude to computers*, there were ten comments (20% of the population) on the issue of training or in-service of some kind. One respondent wrote:

> I feel that computers are becoming an everyday part of teaching in classroom and administration, and I feel that teachers are crying out for in-service in same. In other areas e.g. hospitals where computers are introduced, training courses are given. I feel there is a huge lack of professional development here. (R45)

Teachers referred to the immediate need for computers skills training for teachers and also for continuous ongoing in-service in the information technology area. There was also a request for some small group courses to be run in the school for teachers and some general calls for "help, time and practice" (R10).

These comments demonstrate the general willingness to learn about computers that exists amongst the staff in this study. Teachers stated that they were "keen to learn but... need help" (R5). One teacher who is "still both reluctant and afraid to use" computers felt that "this difficulty will only be overcome when I attend a suitable computer course" (R21). Many of these comments suggest that teachers' attitudes to computers are intrinsically linked with their level of competence.

Over half of the teachers in this survey have already taken a course in computers. Teachers' experiences of courses in the past may have helped to inform them of the criteria for a good course. It should also be recalled that some initial groundwork, to determine staff interest in a computer course, had already been undertaken by the school computer committee. Therefore the issue of computer training for the staff in

this study may have been more to the fore than would have been the case at another period of time. However, the importance of training from the perspectives of the respondents was deemed significant and when all four interviewees mentioned training as a significant factor in attitudinal change, they were encouraged to give more detail regarding the possible content and format of the course. The qualities of the course presenter were seen as an important factor and issues such as time and finance were also discussed.

Course content should initially be geared towards beginners, should not "presume anything" and be "very, very basic lessons, done very slowly, in... as non-threatening an atmosphere as possible" *(Denis)*. Such a course would improve a person's attitude:

> ...if... you start with 'this is where you plug it in, this is where you turn it on, this is a keyboard and this is a screen' and you start at those very basic things, I think the negative attitude would become less in most people. Because I think that much of the negative attitude arise out of fear. (*Barbara*)

This school uses an administration package to enter and view the timetable, students' results, and personal details. Many of the teachers wanted to know how to do more than just enter results, and hoped that a course would include this. Learning how to type, do word processing, use e-mail and the Internet and accessing various subject software was also mentioned as worthwhile content for courses. The key here was to

> ...identify what people might use computers for – and within a school situation people might use computers to write up tests, make out certificates, things like that and it's to show them just how simple it is. (*Audrey*)

The preferred *course format* was "formal", "structured" and "systematic". While many teachers have found that they pick up knowledge from friends and colleagues, that is not how they would prefer to learn computer skills. They wanted "...systematic lessons, where we do one thing, ...and we practice and we come back next week and she asks us to do it all" (*Denis*). A hands-on approach was considered vital. Attending lectures would not contribute to teachers' computer skills. *Barbara* compared learning computer skills with changing a car tyre:

> I mean, theoretically I know how to change... a tyre... I've watched other people doing it but because I have never actually done it, ...if I... had to ...change my tyre, I imagine I would be anxious, because I've never actually physically done it myself. And it's the same with e-mailing. I know theoretically how to send an e-mail, but I have never actually done it. (*Barbara*)

The course format should also encourage teachers to practice between sessions. This was considered vital by *Carmel* who felt that "the main thing then is to practice it" in order to have the skills "at the tips of your fingers."

The *course presenter* would ideally be someone "who knows us quite well, and probably knows our needs" (*Denis*) and who can present it simply and in a structured manner. Several teachers mentioned the school secretary, who has since left the school, as an ideal person for the job and stated how much they rely on her help.

Possible *incentives* suggested by respondents to encourage teachers to learn computer skills include a financial bonus, courses sanctioned by the Department, certification of courses, and allocation of time rather than expecting teachers to use their free time. This would offer teachers a transferable skill and there would be "value in it itself for the teacher" (*Barbara*).

> I think teachers are under enough pressure already. If you were to ask people to try and do this training in their own time, that would only contribute to a more negative attitude, you'd have people saying: 'ah bloody computers again and now they want me to give up my free time'. But if you went to a body of teachers and said this will be formal training, it will be timetabled into your timetable, if people have to travel, their expenses are paid.... If you make it as easy as possible, I think people would not have a negative attitude. (*Barbara*)

Mention was made by several teachers of the importance of including ICT as part of teacher training courses. While the situation has improved, *Barbara* told of a friend who qualified as a teacher this year. The ICT element of the course was given entirely in a lecture room with absolutely no hands-on element at all.

The teachers on this staff appear to have a strong preference for in-school courses. As indicated in chapter two, the National Centre for Technology in Education (NCTE) has engaged in a significant way in the area of computer in-service for teachers. One teacher from the sample had taken such a course. Another tried to book a place but found the course was already booked out. *Carmel* felt that the NCTE courses would be "far too technical" for her. *Audrey* thought that if teachers attended an outside course, they "would be intimidated by a group of outsiders that are going to see how much [they] don't know." Teachers were reluctant to get involved in outside courses because of a worry of being very far behind in their knowledge:

> ...if at a very basic level, time was given to the computer illiterates on the staff,... to kind of ease us into it. To a certain extent it's been a galloping horse. I think we found ourselves in the middle of it. Now it's very hard when a thing has gone so far, to kind of catch up with it, or to admit that you're so far behind (*Denis*)

It was clear from the volume of comment on the issue, that training in computers is a burning issue for this staff, and that teachers are very open to learning. Through

training, respondents suggested that teachers would "master the skill of using a computer" and "become proficient and confident" (R49). A course that met their needs, was aimed at the right level and offered at the right time, would help to overcome the barriers of teachers' anxieties around damaging the computer, of not understanding the language of computers and of a lack of confidence in their ability to learn new skills, especially for more mature teachers. As one respondent wrote

> If we are to stay in tune with the need of our students we must stay in step with technological advances and computers are the way to go! (R10)

The Importance of Significant Events in Attitude

As interviewees described their change from negative computer attitudes to more positive attitudes, they were asked if they could remember a particular time or incident when they first felt such a change occurring. *Audrey* recalled:

> ...I had been asked to do a cert., just using publisher. ...I just sat down and figured it out: changing colours, changing the style of writing, using clip art. I was just fascinated with this, so I spent days... happily doing this. And the end product was so good I was very impressed with it. And then from there I was able to continue. (*Audrey*)

This recollection of this incident was animated and spirited. *Audrey's* facial expressions reflected the delight experienced at this success. A second teacher recalled the first time they felt that they had overcome a barrier with similarly expressive language and actions:

> ...I sat... for about thirty hours in front of this computer and it took me that time to word-process a paper that was maybe...about 10,000 words... It took me that time literally, to sit there and actually labour through word-processing... Sometimes I would press a button and the machine would say – error, error – and I would have to go back. That was an experience full of anxiety, it was an experience that exalted me. But by the end of it – the next time I went in to do a paper, this thing didn't frighten me and I learned by my mistakes. (*Barbara*)

This notion of key events effecting a teacher's life was echoed by *Carmel* in her description of the people in light clothing who operated the computer in a special room, as mentioned earlier. It was clear that these circumstances had contributed to the air of mystique surrounding this participant's negative attitude to computers.

A Computer Ethos

Twenty-two per cent of respondents disagreed with Section 1, item 23, which stated that *everyone needs to know how to use computers in order to live in today's world.* However, the fact that computers have pervaded many aspects of life featured highly among questionnaire respondents' reasons for a change in attitude.

One teacher stated that "computer literacy is vital in today's society" (R26). Another realised "that my lack of knowledge is holding me back from doing things" (R20). This growth in the everyday importance of computers has made computers seem more "user-friendly" (R17, R45), and has caused some teachers to "feel like a fool" (R30) when they cannot use a computer. It has increased many teachers desire and ability to "see the massive benefits which could come from being able to use one" (R20). These factors have encouraged many teachers to begin to become computer literate.

The fact that the school under study expects teachers to use a computer for entering student reports appears to have had a significant influence on teachers. This has

"forced" teachers "to use computers... for report filling" (R7). While one teacher's "growing hostility comes with the growing imposition of computer use" (R22), and *Denis* "deeply resents" that "it's beginning to be presumed that one is computer literate", this was not the norm. Several teachers expressed the attitude that until they "didn't have a choice" (*Barbara*) they would probably not make learning to use computers a priority. *Audrey* spoke of the "big effect" that having to do reports on computer had on her:

> ...at the time when I came into the school the reports were done by hand, and then gradually the computers were introduced.... I soon picked it up and how to get into it and what you could use it for, and other people would ask how do you get in and [I could] show them how to do it. (*Audrey*)

Carmel agreed that the main reason she started using the computer was "because it was just a case of having to do it." Otherwise she would "still be shying away from it." The school principal's attitude to computers may be a key factor here. Five years ago he "felt that they were extremely important and did my best to encourage their use." Overall it could be said that there is a level of ICT enthusiasm in this school, as can be seen from the brief overview given earlier in this chapter. This ethos of computers in society and in the school encourages teachers to become more positive in their attitudes to computers.

"Seeing other peoples' success"

In response to questions 8, 9 and 11 of the questionnaire, when explaining reasons for a change in attitude towards computers, eighteen per cent of the population mentioned the positive influence of family members, friends, colleagues and students. For some,

this served to increase their awareness of computers by seeing "students using computers more" (R38). Others received support in the form of "help/encouragement from colleagues who know what they are doing" (R45). This provided a demonstration of possible uses of computers by "seeing people using computers for a variety of different things" (R11). By "seeing other people's success with computers" (R45), teachers were more open to trying things out for themselves. In particular, teachers with family "at college and working and using computers in their daily lives" (R14) found this a great influence on their attitude.

One teacher stressed how important "staff members and a close friend introducing me to the wonders of the technology" (R32) had been for her improved attitude. This teacher is *Audrey*. She continued in interview to explain how this personal "backup" had assisted her overcoming her anxiety towards computers

> ...my boyfriend was doing a computer course ... and I saw how simple it was to do it, ...he was the one who was saying that if you put in rubbish you get rubbish out ...so it made me more open minded. ... 'OK, so if I do this, I am not going to break the computer, it might close down but there is ways of getting it back and there are ways of retrieving information.' (*Audrey*)

Carmel found the support of the school secretary vital when she first learned how to fill in reports:

> [The school secretary] stood over me the first time and showed me how to do it and then I was fine after that. It's just because somebody else was there and I knew I wouldn't throw the whole thing out. And I also knew that I couldn't do much damage, that all I had to do was put in figures or numbers or whatever. (*Carmel*)

This personal support can have interesting effects. The phenomenon referred to here as the 'teacher bypass' was evident from the data. This is where events requiring some level of computer skills can go ahead despite the lack of knowledge of the teacher. In some cases, this was viewed as a positive occurrence by the respondents for example when "kids generally know more than I do and can bomb ahead themselves completing tasks required" (R45). *Barbara* spoke of a technology project that had linked her students with students from Northern Ireland. She felt "quite obsolete" in the computer skills area, because a trainee teacher acted as technical support and completed most of the technological tasks. At the completion of the project her students wanted to keep in touch with the other students in the project

> ... and would like to invite them down. I was saying we have to contact these people and ask them if that would be possible and one of the students said why don't we just e-mail them – which of course is a completely reasonable answer, and we can do that because *they* can do it, not because *I* can do it. (*Barbara*)

Other teachers felt that the "teacher-bypass" can have negative effects if the supporter completes the task and the 'supportee' has learned nothing. *Denis* admitted taking "the easy way out" when getting help from the school secretary:

> ... I suppose because I'm not hugely interested... I don't concentrate. [The secretary] has shown me loads of times how to... access stuff and so on and I tend not to concentrate... (*Denis*)

He also explained that such support normally happens "in a hurry" and the opportunity for real learning is not present.

The importance of a colleague or friend who offers advice, who shares tricks-of-the-trade and who provides support and back-up cannot be overstated.

The data demonstrates that teachers in this school are experiencing various levels of computer use anxiety, and that different factors contributed to their anxiety when using a computer. The majority of teachers are eager to address their computer use anxiety. Several parallel means have been suggested for overcoming computer use anxiety. Some of these areas will be examined at a broader level in chapter five. The second kind of anxiety that arose from the data is discussed in the next section.

Pedagogical Computer Anxieties

Many teachers expressed certain beliefs and attitudes in their questionnaire responses, about the role of education, the nature of the student and the nature of the teacher's role, in relation to computers in education. These issues can be termed as pedagogical concerns in the broadest meaning of the word. In other words, pedagogy, defined as "the science of teaching,"[7] is taken here to include not just the methodology of teaching, but a wider definition as expressed by Ritter:

> ...pedagogy refers to the integration of a deliberate curriculum content and design (a system of information or subjects that are organized for students), educational materials, instructional strategies and techniques, teaching and learning styles, design of the physical environment, and evaluation procedures which provide focus and purpose for students and teachers to engage in learning together. In short, pedagogy is everything needed for the learner to learn and the teacher to teach.[8]

The data shows that while teachers are moving towards a more positive view of computers in education, the use of computers raises questions regarding the nature of knowledge, and of education. ICT also challenges teacher role and the nature of the

pupil-teacher relationship. These concerns influence teachers' attitudes regarding computers and are now examined further.

Education or training?

The difference between education, and training for employment first arose in the questionnaire. One teacher (R15) ticked the strongly disagree box several times, in section 1 item 24 which stated: *It is part of the role of the schools to provide the country with more young people with computer skills to keep the economy healthy.* Another respondent explained her views on the issue:

> I do accept that computers are part of the present culture. I accept they have advantages as a teaching aid. However, I think the importance of IT to our economy has an inordinate influence over educational policy in our country. (R34)

These respondents (R15 and R34) are *Denis* and *Barbara* in the interview data presented here.

While proportionally the number of teachers expressing this view may not appear significant, this researcher felt that in the light of the European Commission White paper on Education and Training,[9] the statements by the Department of Education and Science[10] regarding the importance of ICT in schools for the economy, and some of the issues raised in the literature review, these arguments were worthy of inclusion. Some of the following quotes are quite lengthy, but the researcher felt that this was necessary in order to convey the strength of feeling of the interviewees on this issue.

To offer balance, other views on the importance of students having computer skills for vocational reasons are first quoted. Teaching pupils computer skills "makes them

more employable" and gives them a "better chance in the working world" (R2), as there is an "increased importance placed on computer knowledge by employers" (R46). *Audrey* concurred that "every student must have computer experience – when they leave school, basically no matter what they do they will use computers."

While many teachers seemed to be of the view that students should learn certain basic computer skills in school, *Barbara* was not so sure. While she criticised her own lack of education in computer skills, and saw the need for information technology in today's world, she felt that

> ...education is a much broader thing – it's not just about educating people so they can get a job, and contribute to our economy, of course that is a dimension, but I think education is... a wider thing.... For me education is much more than just training people – it's a dimension of education, but it's much more. (*Barbara*)

This was echoed even more strongly by *Denis* who felt that education should "help people to think, think creatively, to appreciate life..." He worried about the ramifications of an excess of industry related activities in education.

> ...if we let industry dictate the pace, industry all the time will want us to row back on spending time on creative, intellectual, spiritual things and force us into churning out kind of operatives... people who turn the machinery, people who'll make money at the other end. Where as I think if we concentrate on educating people, if we concentrate on helping them think, and read literature and sing songs and do music and dance and do all sorts of things like that, they will learn how to think for themselves and they can bring that to bear on industry.... (*Denis*)

As more links with industry are forged and schools engage in joint projects, many of which are European funded, how can schools ensure that they are not letting "industry dictate the pace?" *Denis* suggests that in each case, when considering any new

initiative the school community should ask itself "in which way does this contribute to the well-being of the school, to the spiritual and intellectual development of the kids?" This school has formed various partnerships with industry in recent times, many of them in the ICT area. *Denis* and *Barbara* offer words of warning for the continuation of this practice without sufficient thought and consideration.

Knowledge or Information?

The nature of knowledge arose as an issue in questionnaires when teachers highlighted the benefits and dangers offered by ICT. One teacher recalled a newspaper article to express her anxiety:

> 'The ancients had wisdom, during the age of enlightenment we had knowledge, modern man has information.' [The article] was in reference to technology and its growth. It indicates shallower waters! (R22)[11]

Teachers were divided on this issue. Some concurred that there is a danger of students "using websites without analysing and criticising material" (R49). *Carmel* reported that some students believe that information accessed by computer is "gospel true." She explains to the students that it is "only somebody else's opinion" and that "this is the way I suggest to you that it should be done." Several teachers had experience of students "collecting information and not reading it, just printing it out and then presenting it as a project, no learning having taken place" (R38).

A worry that students will stop reading books altogether in favour of multi-media presentations was expressed. For example, *Carmel*, from her experience of teaching

English, expressed a worry that students only get "an immediate answer" or partial knowledge from a computer compared to the "overall picture" from reading a book.

On the other hand some teachers said that increased access to information can offer an opportunity for students to "learn more from criticism of sources," and from the "need to double check or verify information" (R27). This respondent experienced that the use of information which students gather from computer sources "often presents very interesting classroom discussion and comparison of material" (R27). Information becomes knowledge when it is "not just retrieved" but is "personalised and understood by pupils" (R45).

One teacher succinctly expressed the formidable task for the student:

> The challenge for students is to ensure that they use computers and not vice-versa. (R36)

How teachers view the onset of increased student access to information appears to depend on how they view their students, and what they see as their role as a teacher. In other words, the quality of the underlying relationship between the teacher and the pupil may underpin the resolution of this information versus knowledge conflict.

ICT and the Currency of the Classroom

A small number of respondents worry that computers will make students "lazy" (R2) and will decrease the "concentration span of students" (R12). Other responses suggest that several teachers believe that ICT has the potential to change the currency of the classroom, that is, to influence the everyday exchanges between teacher and student. Students "enjoy learning if it involves use of computers" (R25) and this implies that

computers "are a very valuable aid to learning" (R27) according to some respondents. This motivational element of computers could be because of the "novelty of using computers" (R29), or there may be other reasons.

For instance, *Audrey* is convinced of the pedagogical benefits of computers for students with learning difficulties. She spoke of teaching students to use a Thesaurus and a spell-checker and how using the computer gives students "another means of getting around... problems associated with bad handwriting and spelling." In particular she had noted positive effects on her students' self-esteem:

> The material they produce is far above what they could do in a normal class situation. Their self-esteem is being developed there. Those kids are coming in – 'see what I did, miss, look at this'... In the beginning when they would write something, it wouldn't even look good and people weren't interested in reading it. (*Audrey*)

Other respondents also believe that ICT "makes learning more interesting/exciting" by allowing "an element of independent learning / discovery / using initiative for pupil" (R45). Computers can make

> ...learning more pupil centred rather than teacher centred... more related to daily life, more practical, not just talk and chalk... [Computers] encourage students to become more confident in their own learning – proactive rather than reactive. (R10)

The success of these activities is not guaranteed as "Classes need to be planned with specific tasks for pupils to focus their work" (R45). Once again the role of the teacher in applying the technology to the classroom appears to be vital.

Teacher-Student Relationship and Teacher Role

In response to the Likert statement that *computers isolate people by inhibiting normal social interactions among users,* thirty-seven per cent of respondents agreed. Some worried that an overuse of computers would be "to the detriment of [students'] overall development, i.e. communication, social and cognitive skills" (R47). *Carmel* spoke of students who believe that in the future they will learn from computers while sitting at home. She expressed her belief in the importance of human relationships in education and stated that the computer "will never provide the human medium between learning and the student that the teacher will." Another respondent expressed that

> Teaching involves communicating personality, enthusiasm, attitudes and other human dimensions as well as information. This should not be forgotten. (R36)

In other words, the relationship in which learning is occurring is as important as what is being learned.

Teachers react to some of the dangers of student access to computers in different ways. Some respondents spoke of the need for teachers "to police the use of the Internet and make sure that pupils are not exposed to inappropriate images" (R39). Others worried about the addictiveness of computer activities (R39, R50) and the role of the educator in this. One respondent stated that teachers should know how to access computers in order "to see if research projects by students have simply been copied from some computer programme" (R17). These views seem to be based on a 'teacher-as-controller' view of the teacher-student relationship.

In contrast, some teachers see it as their role to encourage "education for 'wise' use of computers on the internet/information side" (R16). One respondent believes that ICT

> Encourages students to analyse info they have researched, be more critical, cast away excess material and use what they need, rather than slavishly regurgitating teachers' notes. (R10)

These teachers appear to see their role as one of 'guide' in helping the students to use the information to further their skills and knowledge. They view computers as offering another resource to teachers and students and believe that this opportunity could be used to improve the standard of teaching and learning in the classroom. It is the role of the teacher, some respondents expressed, to make the best use of the technology.

Several teachers expressed discomfort with some of these new roles. One respondent questioned the

> Time demands of ever-relearning of new skills, new information and their knock-on effects on teaching/educating role proper – am I and others becoming too caught up in technique rather than application? (R50)

Others who have been using computers for some time remembered "all the hours spent many years ago trying to master stuff that has no use or relevance" today (R17). While teachers expressed a desire to learn computer skills and to pick up on ways to use computers to broaden their range of resources and teaching methods, many were unsure as to how they could manage this within an already busy schedule. The challenges which ICT poses to teacher role are significant.

These factors represent some of the anxieties that teachers expressed regarding the influence of ICT on the educational process. While the data does not highlight the manner in which these pedagogical anxieties can be overcome, as it does for computer use anxiety, some suggestions are made for dealing with these issues in chapter five.

Summary

This chapter has focused on significant factors that emerged from the questionnaire and interview data. Teachers' anxieties were unpacked and examined under two categories: computer use anxiety and computer pedagogical anxiety. In addition the perceived benefits that ICT offers the education process, and equally the limitations and the possible abuses of technology as understood by the teacher were identified. Teacher development was highlighted as having a key role to play in overcoming computer use anxiety, as was the importance of support from colleagues. In addition, teachers expressed anxieties around the training of students for technology-based employment, the conflict between information and knowledge, and their changing role in the classroom. Chapter five engages in further discussion of some of these issues.

Endnotes for Chapter 4

[1] Robert C. Bogdan and Sari Knopp Biklen, *Qualitative Research for Education: An introduction to Theory and Methods* (Boston: Allyn and Bacon, 1982) p.28.
[2] Some of these computers are actually connected to the network in the one functional computer room, which resides in the library.
[3] Standard deviation measures the spread of values on either side of the mean. The formula used in this case was the STDEVP formula from the Excel package, which uses $\sqrt{\frac{n\sum x^2 - \left(\sum x\right)^2}{n^2}}$ to calculate the standard deviation.
[4] Later she stated that she does use it for entering reports.
[5] 88% agreed or strongly agreed with this statement.
[6] An analysis of the computer use anxiety score for these two categories indicates an average score of 10.4 for those who find it difficult to ask for help compared to an average of 14.9 for those who can ask for help. (The mean computer use anxiety rating for the population was 13.6).
[7] R.E. Allen, *The Concise Oxford Dictionary of current English* (London: Oxford University Press, 1990) p.877.
[8] Stephanie L. Ritter, "A Study of the Transformation of Regular Education: Are Inclusionary practices benefiting a diverse population of Children?" in *Lockhaven International Review*, Issue 10, 1996 <http://www.lhup.edu/library/InternationalReview/ritter.htm>.
[9] Edith Cresson and Padraig Flynn, European Commission, *Teaching and Learning: Towards the learning Society*, (Luxembourg: Office for Official Publications of the European Communities, 1996). The full text of the white paper can be downloaded from <http://europa.eu.int/en/comm/dg22/lb-en.wpd>.
[10] Forfás, *Responding to Ireland's growing skills needs: The First Report of the Expert Group on Future Skills Needs* (Dublin: Forfás, 1998). See in particular the Forward by Micheal Martin T.D.
[11] Reported by the respondent to be quoted from the Irish Times, Winter 1998.

Chapter 5: Teachers' Attitudes and Implications for ICT Implementation Strategies

Introduction

Computers are here to stay, or at least until something better comes along to replace them! To a large extent teachers in the school under study have accepted the potential benefits that computers offer the education process. Many teachers have overcome initial anxieties surrounding computer use. Others are still experiencing anxiety of this kind. Almost all teachers want to improve their computer skills in order to use it as a tool for themselves to improve their presentation and organisation skills, and with a view to using it for teaching resources and as a teaching aid. The challenges to pedagogy experienced by teachers require continuous discourse and dialogue, in an educational forum. Such dialogue is a key factor if the opportunities that ICT offers education are not to be missed and if the limitations of ICT are to be fully recognised and dealt with.

Some teachers in this school believe that the computer can bring added value to the teaching/learning process, that it can motivate students, encourage active and self-directed learning and improve creativity and analysis skills. These teachers want on-going training, collegial support and improved resources to assist them to overcome their computer use anxiety and to learn how to use ICT effectively.

In the light of the literature review presented in chapter two, certain issues that arose from the data presented in chapter four merit further discussion. This chapter engages in a meta-analysis of some of these factors.

First, teachers in the surveyed population expressed anxiety when using a computer. The existence of computer use anxiety was also reflected in the literature. This study highlights certain key factors that can influence this anxiety. These factors are further examined in the following section.

Second, there appears to be a need for some level of discourse amongst teachers regarding the benefits that computers bring to the teaching and learning environment on one hand, and the dangers and challenges they pose on the other hand. In the second section, some of these issues are further examined in the light of the literature.

Third, the existence of various kinds of teacher anxiety towards computers, in an era of ICT integration into education, has implications for the agencies promoting this change. Certain strategies are suggested based on the research data in the section entitled *Possible Strategies to Aid Change and Implications for Support*.

Throughout this chapter, reference will be made to Fullan's[1] criteria for educational change, mentioned in chapter two, in an effort to examine this school's readiness for embracing ICT.

Finally, the conclusion section refocuses on teacher attitude and revisits some of the findings of this study, while addressing the issue of responsibility for change.

Computer Use Anxiety – Challenges and Implications

This study confirms the research literature's assertion that teachers have various kinds of anxieties towards computers. Computer use anxiety, as recognised by Worthington et. al.[2] and Kelly,[3] has been experienced in the past or present, by most of the teachers in this study. This section begins by examining certain factors of computer use anxiety from the data which are also reflected in the literature. It then explores whether teachers perceive there is a need for the change necessary to adopt ICT in the school under study. Factors which have the potential to assist teachers in overcoming computer use anxiety are then addressed. The section ends with a discussion on the perceived level of clarity which surrounds the change process.

Factors of Computer Use Anxiety

It is interesting to note that many of the same factors mentioned by Kelly[4] in 1984, the era of the microcomputer, are still present fifteen years later. These common anxieties include:

- not understanding the jargon;
- fear of causing damage to the computer;
- fear of feeling foolish in front of students and colleagues.

The full list of factors drawn from the data in this study was wider than that provided in Kelly.[5] They were classified as the "Hail to the computer!" factor; "it's beeping at me" factor; language or "buzz-words" factor; personality or 'that's just the way I am'

factor; 'generation game' factor; and 'poor access and education' factor. This study found that these kinds of anxieties have a significant influence on teachers' overall attitude to ICT. Teachers feel they need to overcome the fear of using computers before they will feel comfortable embracing them into their day-to-day work.

Computer Use, Gender and Subjects Taught

Certain data shows similarities between the work of Dolly[6] and the results of this study. In particular, Dolly found a strong relationship between frequency of computer use and positive teacher attitudes. This study also recorded that those who have a low computer use anxiety tend to use computers more frequently (as illustrated by figure 4.2 in chapter four). Rosen and Weil[7] confirm these findings in their study on computer experience and technophobia.

This study also confirms Dolly's findings of a gender difference in computer attitude.[8] In particular, this researcher found that male teachers from the surveyed population reported less computer use anxiety than females. However the fact that half of the males surveyed are teachers of the applied sciences, maths or science makes it difficult to examine whether gender or subject was the key variable in this case. Teachers of these subjects demonstrated significantly less computer use anxiety than did teachers of other subjects.[9]

This study did not set out to gather much quantitative data on teacher attitude. However, it was considered worthwhile to note the similarities with previous research in this area.

The Need for Change

Despite the anxiety experienced by many of the surveyed population, chapter four has shown that in general, teachers in this study demonstrate a strong desire to learn more about ICT. They want to make use of computers to improve the presentation of their work, to add to their subject knowledge, to encourage students to engage in more self-directed learning and to open up channels of communication to reach beyond the walls of the classroom. They have therefore taken the first step towards embracing ICT into the school by accepting the need for change and demonstrating a willingness to change.

Accepting the need for change is Fullan's first criteria for educational change.[10] This study confirms that teachers in this school believe that the proliferate use of computers in everyday life makes it incumbent on teachers to become familiar with ICT, and on schools to educate students in the intelligent use of technology. This belief is echoed in the 1995 White Paper on Education which states that on completion of the junior cycle, all students will have achieved "competence and understanding in practical skills, including computer literature and information technology."[11]

Embracing ICT in schools meets the need for teachers and students to become computer literate. Many teachers perceive that computers have other educational benefits to offer, for example, improving weaker students' belief in the value of their written work, as reported by *Audrey*. Others see the computer as merely a tool, and one which teachers must police carefully to ensure that students use it wisely.

The educational benefits of ICT are accompanied by educational challenges. Increased use of computers in schools may well address perceived needs, but some teachers are asking 'at what cost?'

While the literature mirrors the data in the existence and nature of computer use anxiety, this study more clearly highlights the factors contributing to this form of anxiety. Furthermore, these factors provide glimpses as to how this anxiety can be overcome.

Overcoming Computer Use Anxiety

Of the reported barriers to teachers' desire to embrace ICT in the data, some are internal, for example a worry that they are too old to learn new skills (*Denis*), or a reluctance to ask questions when having difficulty (R3, R5, R19). Others are external to the teacher, such as a lack of access and education (*Barbara*), and the barrier of computer 'buzz-words' (*Denis*, R10). Similar barriers are recognised by Collis who acknowledges that the limited flexibility in the timing of instruction and the traditional nature of curriculum and modes of assessment do not assist certain kinds of learning. She states:

> It can be difficult to integrate technology into a lesson; this integration generally brings demands on the teacher's time and energy, no matter how much s/he wants to innovate and enrich.[12]

The research data gave rise to various suggestions for overcoming computer use anxiety. Figure 5.1 attempts to summarise these suggestions. In the remainder of this section, various parts of the diagram are examined in more detail under the headings:

- Training;
- Support from colleagues;
- Improved access;
- Importance of significant events;
- Time;
- Further improving teacher attitude.

Since these recommendations come from teachers currently experiencing computer use anxiety, they have important implications for ICT implementation strategies. These challenges are highlighted where relevant throughout the section.

Training

The diagram reflects teachers' desire for a basic course as an initial step to promoting more positive attitudes. The data suggests that such courses should be based on teachers' needs, and be aimed at a suitable level. They should be run by a competent and understanding presenter (*Denis*), preferably in the school, and have a hands-on approach (*Audrey*, *Barbara*, *Carmel*). Incentives could be an advantage, although a well-run course would be considered an incentive in itself (*Audrey*, *Barbara*).

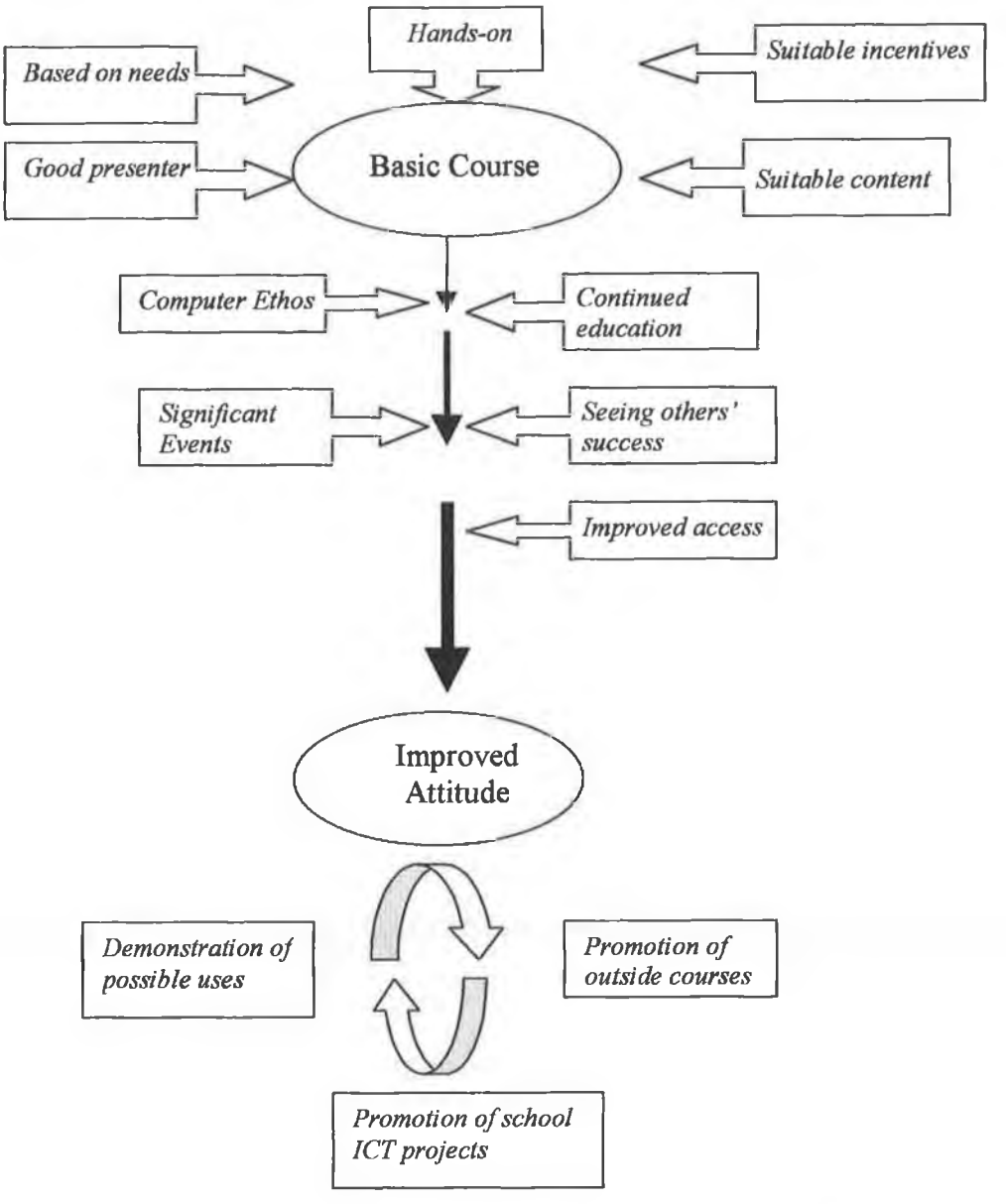

Figure 5.1: Overcoming computer use anxiety – factors drawn from the data.

The reviewed literature outlines various international approaches to teacher development in the area of ICT. Denmark runs 'netdays' in geographical clusters where experienced ICT teachers share their knowledge with others through collegial

networks. This format would address the need of teachers in the surveyed population who want to "see what you can do with resources" (*Audrey*), and to learn from the successes of others (R45, *Audrey, Carmel*). The IT 2000 Schools Integration Project (SIP)[13] gave priority to school clusters when selecting it's first round of projects for funding.

Referring to characteristics of effective professional development programmes, Fullan states

> The greatest effects are achieved when explanation of new practices is combined with demonstrations, opportunity to practice in non-threatening contexts, and individual feedback (i.e. 'coaching') back in the classroom.[14]

Much of this is reflected by the data. Teachers want a good presenter, who understands their needs and can present the material in a "non-threatening atmosphere" (*Denis*). Time to practice was also a priority. A hands-on approach would help to "reinforce" (*Carmel*) skills learned at a course.

The initial approach in Ireland has been to train teachers as ICT tutors and to empower teacher education centres to advertise and run courses. The IT 2000 framework document states that the Teaching Skills Initiative (TSI) will involve

> The development of a complete ICT skills development programme to ensure teacher progression from novice to expert. Skill development will be provided to at least 20,000 teachers nationally (and to at least one teacher per school).[15]

It is promising to see that the SIP initiative promises to address many of the criteria recommended in the literature and called for by the surveyed population. Unfortunately available funding currently restricts the number of schools accepted into SIP.

The data shows that teachers in this school have not yet been significantly affected by this national approach to ICT training, and would prefer in-school initiatives.

Support from colleagues

The data indicates that a supportive, collegial environment, where teachers can see the computer successes of their peers, will promote movement towards an improved attitude towards ICT. This is reflected in much of the literature about effecting change. According to Fullan

> New meanings, new behaviours, new skills and new beliefs depend significantly on whether teachers are working as isolated individuals or are exchanging ideas, support and positive feelings about their work.[16]

Teachers in this study also cite the importance of colleagues and friends in helping to overcome computer use anxiety. Some called for time to share computer resources for their subject (R10, R25, R50). *Audrey* suggested the allocation of more posts of responsibility in the area of ICT to better support teachers. In a review of a subject-based workshop initiative, Callan also reports the value of collegial collaboration.

Teachers place a high value on

> ...meeting with subject colleagues for purposes of sharing ideas, exchanging materials, discussing teaching methods, acknowledging commons problems....[17]

Callan suggests that the success of this and similar initiatives is due to the "seamless way" it combines pressure and support for change.[18] This approach is echoed by Fullan:

> Constant communication and joint work provide the continuous pressure and support necessary for getting things done.[19]

It appears that a school with a supportive collaborative culture is at an advantage. The challenge is to harness the willingness to support and assist colleagues that is already present among this staff in a constructive and systematic way.

Improved Access

Issues of improved access were also highlighted by the data. Some respondents perceive that teacher access to computers for exploration and preparation is poor in this school:

> Apart from the grudgingly conceded appliance in the staff-room, teacher access (in a positive and welcoming way) is woeful (R37).

When a teacher wants to do research or prepare work, either she waits in line for one of the two computers in the staff-room, "a not-very conducive area for reflection as it typically also serves as a communal area for lunch and relaxing"[20] or she does it at home (if she has access to a computer). The issue of access is well expressed by Collis

who states that "the access the teacher himself has for exploration and preparation"[21] is critical.

Importance of Significant Events

Several teachers told of significant events in their lives that had influenced their attitude to ICT. For example *Audrey* and *Barbara* recalled their first experience of producing a certificate and an essay respectively. *Carmel* recalled seeing the computer in "a special room." Somekh et. al. state:

> The most challenging and memorable episode for teachers is often in the first stages of their acquaintance with a computer.[22]

Sikes, Measor and Woods note that the progress of teacher careers often shows "sharp discontinuities and enormous leaps"[23] and that critical incidents can cause a turn-about in teachers beliefs and actions. While it may not be possible to fabricate such key events, this research suggests how important a few initial successful experiences with computers may be for the further development of teachers.

Time

Pelgrum and Plomp note the importance of time for teachers to learn new skills.[24] This need is reflected in the statement: "if one could only find the time to spend constructively in computer usage" (R17). Teachers' working lives are busy and respondents suggest that if they are to learn about computers in a confidence-giving, structured and hands-on environment, time needs to be allocated during their teaching day. Fullan advocates "release time for staff development and individual planning"[25]

especially at the early stages of implementation of change. SIP anticipates funding release time for teachers involved in the project.[26] This provides challenges to the agencies that control the educational resources of time and finance. Increased investment of such resources would be welcomed by the teachers in the school under study.

Further improving teacher attitude

The cycle at the end of the diagram reflects suggestions drawn from the data which may progress teachers' interest in computers in education. Those who require more advanced skills could be encouraged to attend outside courses. *Audrey* proposed a more overt method of promotion and advertising of these courses. Teachers already involved in school ICT projects could encourage other teachers to observe and perhaps take part (*Audrey*). Above all teachers will need to be made aware of the possible uses that they can make of computers. Collegial support and specific subject-based courses were suggested as possible means of accomplishing this (*Audrey, Carmel*).

Carmel drew an analogy between a computer and a car: "I don't want to know how the engine works, I just want to know how to drive and stop it." Somekh et. al. draw on the same analogy:

> There is no need to become a car mechanic, but routines are often emphasised in order to help the new driver... 'Mirror, indicate, mirror, slowly pull out!'[27]

They emphasis the need for a set of routine exploratory procedures for tackling new tasks on computers. *Denis* echoed this need in his request for a simple "chart" of instructions for various computer tasks.

In short, teachers need to spend time practising computer skills in order for them to feel comfortable and confident.

The cycle illustrated in figure 5.1 gathers some of the key factors from this research in an effort to demonstrate how computer use anxiety can be overcome. Promoting positive teacher attitudes to computers will involve time, money and commitment from change agents at every level, but in particular from teachers.

Clarity of Change

At this stage in the discussion, we recall Fullan's[28] second criteria for change as seen in chapter two. The issue of clarity is not black or white. It may be more accurate to speak about phases of clarity. Within this school, some teachers easily visualise the potential of ICT (R50, R43). Others feel that they must first become intelligent computer users themselves before they can be expected to visualise, let alone realise, the potential of computers in the classroom (R20, R2). A clear vision of the potential of ICT will help to clarify the path of the change process.

The school computer committee has drawn up a computer use policy, which concentrates almost completely on organisational and procedural issues. This may help to clarify other aspects of the change process.

No work has yet been done within this school on how computers can contribute to the pedagogy of the classroom and how teacher development can encompass this. Teachers are having some glimpses of the future as students use (and sometimes abuse) computers to aid with the research and presentation of projects, but the main demands that ICT will make on teachers are still emerging. For example, how teachers can best deal with increased student access to information is not clear. It is fair to say that for the teachers in this study, certain pedagogical aspects of the change process lack clarity.

Certain pedagogical anxieties, which were identified in chapter four, are the subject of the next section.

Pedagogical Anxieties - Challenges and Implications

The British teacher training agency is currently organising training which improves teachers' basic ICT competence and also addresses certain pedagogical concerns of ICT integration.[29] Teachers in this study identified several major pedagogical anxieties. To some extent these are similar to the 'existential anxiety' identified by Worthington and Henry among pre-service teachers who worried about the increased access to information and the possibility of ICT restricting interpersonal contact.[30]

This section examines three of the pedagogical computer anxieties that arose from the data. The issues are presented in the form of a debate between two respondents in the study. Fullan's final two criteria for change are then discussed.

Education versus Economy

Two perspectives inform this debate. Firstly, some believe that computer skills are a vital part of the education system because

> *Computers increase students' skills and make them more employable (R2).*

Others express a worry that

> *Our economy has an inordinate influence over educational policy (R34).*

The literature review demonstrates the importance placed by the IT2000 initiative on the vocational and economic rationales for the integration of ICT into education. Chapter two quoted several recent reports that promoted the teaching of computer skills in schools and that investigated ways to encourage more students to follow careers in the technology industry.

In contrast, Oakeshott argues that 'school' should involve

> ...detachment from the immediate, local world of the learner, its current concerns... 'school' is monastic in respect of being a place apart where excellences may be heard because the din of worldly laxities and partialities is silenced or abated.[31]

Oakeshott's idea of the school as 'a place apart' was echoed by some teachers in the study. These teachers called for schools to question the manner in which technology initiatives contribute to "the spiritual and intellectual development" (*Denis*) of the students. On this issue, this study expresses some worry on behalf of teachers that the trend to encourage partnerships between industries and school[32] may result in the weakening of certain educational ideals. The challenge to the school is to harness the benefits of links with industry while remaining true to its educational vision.

Knowledge versus Information

This issue is informed by two views. Some teachers believe that

Computers open up a whole new realm of resources and information (R10).

The other side of the debate argues that

Students have no digestion of the knowledge. They just have a print-out (Carmel).

This debate appears to hinge on how the "new realm of resources and information" (R10) offered by computers is used by students and teachers. One body of teachers surveyed hold what will be referred to as the pro-computer (PC) view. They argue that technology opens up new sources of information to students and teachers. Pupils can learn how to critique different sources, to analyse and use information intelligently (R10, R16). Video-conferencing, e-mail and other communication tools afford the opportunity for students to venture beyond the walls of the classroom and to broaden their perspective on the meaning of education (R29, R45).

PC teachers look on this as a chance to go beyond the text-book, to encourage self-directed learning, and to promote discourse and discussion in the classroom. The PC view reflects the literature findings that computers can encourage creativity and higher order thinking and analysis skills when used as open-ended instruments.[33]

The other body of thinking, which will be termed the anti-computer (AC) school of thought worries that students are merely amassing information. They are not thinking or learning. They are content to have a print-out from the Internet, but have no curiosity to see where the information comes from or to question its source or context (R29, R38, R45, R49). Students no longer want to read books (R2, R34, R50). They expect that all information should be presented in a multi-media format. This reflects the arguments of Postman and Rosnak in the research literature, of the danger of an excess of information in place of ideas. It also suggests that AC teachers worry that apart from Hargreaves' fear of losing the oral culture of society, there is a danger of losing the culture of books and the love of reading.

It is simplistic to imagine that all teachers in this school belong to either the PC or AC school of thought. The data suggests that many teachers can see both sides of the argument and reside in a position somewhere between the two extremes. There is a need for more dialogue between the AC and PC schools of thought in order to ensure that these anxieties on the part of educators help to inform the balanced use of technology in schools. As Postman remarks:

> Man cannot live by electric wiring alone, and this obvious fact must be part of any plans we make for the future.[34]

The challenge is to provide an educational forum for teachers to engage in dialogue which will inform such plans.

The changing role of the teacher

Some teachers view computers as an opportunity to re-evaluate their role:

> *ICT helps students be more proactive rather than reactive in their learning (R10).*

Others state that

> *Computers must not supercede the good old-fashioned methods (R19).*

The move from the teacher as 'sage on the stage' to 'guide on the side' suggested by Tuckett et. al.[35] and discussed in chapter two is not an easy role shift for teachers to make. Few teachers (eight percent) in this study expressed a worry that *computers may eventually replace the teacher*. Computers "will never provide the human medium between learning and the student" (R33) said one respondent. Lee echoes this belief:

> We are told that new technology, especially computers, may reduce the demand for teachers. But even if technology helps revolutionise teaching techniques, it is difficult to envisage any substitute for the human role teachers have to increasingly perform.[36]

But teacher expectation in this study suggests that if the potential of ICT in education is to be fully realised, teachers must "reorganise [their] approach to teaching" (R47) in order to cope with new resources, information and methodologies. Hargreaves et. al. suggest that ICT may prove to be a useful catalyst in refocusing on the nature of communities of learning:

> Communities of learning need no longer be confined to the classroom but can now also be constituted through the virtual space of technology... Technology is an accepted part of students' worlds that captures their imagination and frightens them far less than it does their teachers.[37]

Many teachers in this study agree that students find computer aided learning to be motivating and enjoyable (R25, R27).

Schuttloffel writes of the difficulties experienced by teachers in dealing with on-line materials. Teachers

> ...are not prepared to integrate on-line materials into their coursework, ... are often at a loss at how to best make use of this new resource. Teachers also have the problem of trying to prevent students from accessing inappropriate areas of cyberspace.[38]

The previous chapter presented evidence of the teacher-as-guide approach to using ICT. Such an approach appears to facilitate the most appropriate use of ICT resources. A teacher-as-controller approach may be more suitable for guarding students from inappropriate information.

Teachers are under pressure from the pace of technological change. They balk at the notion of learning new skills to add to their professional repertoire, when they may be out of vogue in the near future. For instance, even the *language* of computers has undergone rapid change. 'Computers' have become 'information technologies' (IT) which have in turn metamorphosed to 'information and communication technologies' (ICT) over the life-time of this piece of research.

The challenge is for teachers in this school to experiment with different teacher roles in order to find a balance between their roles as teacher-as-expert and teacher-as-guide, while maintaining the importance of the human interaction between teacher and student.

Engaging in critical dialogue around these issues will help to ensure that ICT is used to its full potential in the educational sphere without industry encroaching on educational ideals, without knowledge and learning being reduced to information and entertainment and without the role of the teacher being diminished.

The next two sections complete the picture of this schools' readiness for the implementation of ICT by considering Fullan's final criteria.

Practical Effect on Teachers' Workload

Issues that effect teacher workload have arisen from the previous sections. Fullan[39] mentions this as a third criteria for judging worthwhile educational change. Some teachers have already invested significant time into intensive individual work with computers. These teachers teach a computer-related subject (R43), have found ICT a useful aid for an administrative post (R50) or have some personal reason for finding computers useful (*Audrey*, R18). These teachers have made computer literacy a priority for themselves and a few of them are experimenting with using computers in the classroom.

There is evidence that ICT may change the nature of teachers' work as well as the volume of their work. It may encourage the sharing of resources (R10, R27), and increase communication between teachers in different institutions and countries (R29, R45). Fullan recognises that computers "increase teachers' workload in the short run."[40] While many teachers believe that computers will eventually save them work and time, for example, by avoiding an ocean of paper (R20, *Carmel*), they too are aware that the learning process will initially increase their workload.

Level of reward for teachers

The perceived rewards of educational change is the final criteria listed by Fullan.[41] The implementation of change may be difficult and unsettling for many teachers who are reluctant to rethink their current methods and beliefs in the light of what ICT has to offer. At the current rate of change there is a real danger that such teachers will be left behind. Some teachers in this study expressed frustration at the time and effort they had spent learning computer languages that are now virtually useless. On the positive side, many teachers see real benefits for themselves if they become computer literate. These include

- the benefit of succeeding at learning a new skill;
- a chance to improve the quality of presentation of their work;
- a chance to widen their subject resources;

- the opportunity to engage in communication with other teachers using technology;
- the possibility of an improved variety of activities for students in the classroom.

Audrey further suggested that if teachers "experience and overcome one form of intimidation [they] are more open to try out other things". She suggests that teachers who engage in this change process, may find it easier to adapt to other changes. In the long-term, the experience should be rewarding for the teacher. Certification and financial reward were two of the suggestions made in this study for extrinsic incentives. In the short term there may be a need for such extrinsic incentives in this school to encourage those reluctant to change.

Possible Strategies to Aid Change and Implications for Support

Previous sections have discussed Fullan's criteria for educational change (need, clarity, practicality of workload, and reward) in the light of the data available for the school under study. This shows that the teachers and the school have begun the change process. Fullan notes that "beginning implementation is characterized by frustration and difficulty organizing and managing use of the innovation... no matter how much initial assistance is provided."[42] The data suggests that the teachers under study echo Fullan's remarks and are in need of continued support.

There is a high level of expectation that ICT will benefit the educational process. In the recently published NCCA progress report of the Junior Cycle Review,[43] eight key skills are mentioned for students to attain at this level, including information technology skills. The report states:

> These skills are not developed in isolation by means of special modules or courses. They are developed across the whole curriculum, in context and to the best of each student's ability.[44]

Given the expectations for student education in ICT and for ICT use across subject areas, the level of teacher computer-use anxiety expressed in this school (fourteen percent demonstrated a high level of anxiety, and fifty-five percent demonstrated a medium level of anxiety) poses a serious challenge to policy makers and support agencies. The challenges which teachers confront in effecting a shift in teaching practice from didactic modes to active/experimentative modes, the challenges which embrace issues relating to knowledge values and societal expectations, in addition to the presence of computer use anxiety present a formidable task to teachers. Such change demands a high level of support in order to be successful.

This section highlights possible strategies for support agencies in the light of the research data.

Informal Conversations

Opportunities for discourse and dialogue would help to address many of the pedagogical anxieties discussed. These may occur at school level, though the forum of subject department meetings, staff development days or in the context of specific

programmes which promote active learning methods and use of ICT, such as the Transition Year programme or the Leaving Certificate Applied programme. They may also occur at subject teacher associations, at union meetings and other inter-school forum. Such an approach is vital in making teachers agents of change. This strategy of 'informal discussions and conversations' is mentioned by Davis[45] and benefits from the presence of ICT teacher experts to provide suggestions and ideas.

Identifying Entry Points

Open dialogue of pedagogical issues, will help to create a suitable environment for teachers who wish to try out ICT in their subject area. The data has indicated that teachers who discover a useful piece of software which has a definite application of use to them, or their subject area, tend to use this as an entry point into further exploration. Teachers who discover a use for technology tend to use computers more frequently. A suitable forum for the discovery and discussion of such applications may be a workshop format. Callan's research on workshop based teacher in-service demonstrates that such a forum encourages participants to try out ideas in the classroom. He notes that

> ... the practical and relevant nature of the workshops were effective in promoting actions at the level of teachers' work in the classroom.[46]

Such a forum demands a high level of openness on the part of participant teachers to suggest and experiment with ideas. It also requires the availability of resource teachers who are examples of good practice with ICT in their subject area.

Weaving networks

Basic courses in ICT skills are necessary for overcoming computer use anxiety. In-school courses may address some teachers' anxiety over others seeing their lack of skill. Not all schools have the necessary infrastructure to facilitate such courses. This suggests that some form of networking between schools in a geographical area may be useful. Perhaps such an initiative would be similar to the Denmark 'netdays' discussed in chapter two.[47] One school in an area could host computer courses, another could host lectures or discussions. Master classes could be run to demonstrate how to successfully integrate ICT into a subject. It may be useful for ICT expert teachers to be seconded for a time in order to visit schools and help to set up such networks and demonstrate such practice. Not every network may have such experts locally. Such a structure would facilitate teacher collaboration and provide a forum for experimentation and discussion.

If such strategies are taken on board, they need to occur in meaningful cooperation with agencies responsible for the allocation of resources. In this case, such agencies would include the Department of Education and Science, the National Council for Curriculum and Assessment, the National Centre for Technology in Education and the local education centres.

Individual teachers in schools need to have a constructive input into the change process of ICT implementation. The strategies outlined here would help teachers to:

- balance the benefits of ICT with its dangers, through educational dialogue;
- find ways of integrating technology into their subject, through supportive workshops;
- continue to learn how best to realise the potential of ICT, through active networks.

Conclusion

This study has researched how teachers' attitudes are growing and changing to accommodate the influx of ICT into a particular second level school. It has attempted to discover the factors that influence them and how these factors can be brought to bear on assisting other teachers to develop more positive attitudes to ICT.

This final section identifies certain patterns in the data on teacher attitude. While no attempt is made by this researcher to imply that the findings of the research for this school are valid for other teachers, in other schools, there may certain familiar elements which teachers in other contexts can recognise.

It can be seen that teachers' attitudes have already shown a significant shift towards computers, over the last five years. There is nothing to suggest that this positive shift will not continue into the future. However it is also clear that many teachers still feel isolated, left-behind, stupid, and unable to learn when it comes to computers. In a sphere where the main purpose is to educate, it seems hypocritical to bypass the very

people who are expected to pass on a love of life-long learning. Just like each teacher should be taught how to use the photocopier and the overhead projector in comfort, they should also be aided to grasp the skills that would give them the computer as another teaching aid. Suitable in-school computer skills training is the first requirement for the teachers in this school.

As each teacher is expected to be familiar with the textbooks and other resources of their subject, so too should each teacher be aware of the resources available on computer, on CD-ROM and on the Internet. After all, students will continue to use this information more frequently. In this school, teachers are currently choosing to either discount the validity of information obtained through ICT sources, or to use it to encourage classroom discussion with yet another source of information at their fingertips. This range of teacher attitude challenges the subject teacher associations, the curriculum agencies and school subject departments to address the issue of a changing approach to subject knowledge and to provide a forum for teacher development in this area. Some subject teacher associations have already organised workshops and hands-on training. Others may be encouraged to follow.

The question of who has responsibility for teacher development in the area of ICT, has been found in this study to be a vital one in the promotion of positive attitude among the teachers. If it is the teacher's own responsibility to seek out and attend courses to increase their skills, then this approach will result in certain casualties. Teachers who are 'bored' or unmotivated may chose to survive without these skills. Also, an improvement in the advertising of such courses would be necessary. A notice on a

notice board may not be the most effective approach. While individual posting of such advertisements may be costly, sending information through pay packets at least ensures that all teachers see it.

If the responsibility lies with individual schools, then someone within this school must have the ultimate responsibility to survey the staff to determine the needs, and to follow through on those needs with suitable courses, whether internal or external, depending on needs and availability of equipment. Issues such as time and certification and above all relevance and suitability will have to be dealt with. Teachers who attend courses that are too advanced, will come away feeling worse than before. Teachers already complain of pressure on their time. Many teachers in this study questioned how they could learn to be comfortable with computers and overcome their anxieties without investing a significant amount of their time in using ICT. How can teachers begin to use a computer when they feel unfamiliar with it, and how can teacher become familiar with ICT unless they use a computer? The issues of responsibility and time in relation to teacher development with respect to ICT are key issues for this staff.

Finally, more school case studies in the area of ICT and teacher attitude will help to build up a clearer picture of the national situation, and assist in comparing the Irish situation to that of other countries who have more fully integrated ICT into schools. A clearer picture of the national situation, reflected in appropriate consultative policy will in turn influence the individual school.

This study has been undertaken with enthusiasm and commitment. The methods used were rigorously conducted within the available time. The researcher engaged in data analysis which unearthed significant computer anxieties. Finally, in the light of the data this study has highlighted implications and strategies for overcoming these anxieties. It is hoped that this research will provide a useful contribution to the field of study concerned with teachers' attitudes to ICT in education.

Huberman uses a Jazz Group as a metaphor for change. Rather than being a methodical rehearsal where we can see that everything is ready for the performance, he suggests that change involves the group members improvising continuously within their common understanding of what tune they are playing.[48] As information and communication technology continues to accelerate communication and to stretch the boundaries of information access, it falls to the education community to continue to rehearse the optimal conditions for schools to fully embrace the educational opportunities offered by technology. Only then can each teacher in this school play their own individual but harmonious tune with ICT.

Endnotes for Chapter 5

[1] Michael G. Fullan with Suzanne Stiegelbauer, *The New Meaning of Educational Change* (London: Cassell, 1996) p.127.
[2] Valerie L. Worthington and Andrew Henry, "Computer Anxiety: A Technical or an Existential Problem?" in *Society for Information Technology and Teacher Education (SITE 98): Proceedings of the 9th International Conference* (Charlottesville: Association for the Advancement of Computing on Education, 1998) <http://www.coe.uh.edu/insite/elec_pub/HTML1998/re_wort.htm>.
[3] A.V. Kelly, *Microcomputers and the curriculum* (London: Harper and Row, 1984) p.25.
[4] *Ibid.*, p.25.
[5] *Ibid.*, p.25.
[6] Caitriona Dolly, *A Survey of Teachers' Attitudes to Computers*, Thesis, Masters in Computer Applications for Education, DCU, 1998, pp.67-87.
[7] L.D. Rosen and M.M. Weil, "Computer Availability, Computer Experience and Technophobia Among Public School Teachers" in *Computers in Human Behaviour*, Vol.11 No.1, 1995, pp.9-31, as quoted in Caitriona Dolly, *A Survey of Teachers' Attitudes to Computers*, Masters in Computer Applications for Education, DCU, 1998, p.73.
[8] Caitriona Dolly, *A Survey of Teachers' Attitudes to Computers*, p.81.
[9] Dolly also reported a higher level of confidence amongst teachers of these subjects, but gave no comparison between gender and subject variables. Caitriona Dolly, *A Survey of Teachers' Attitudes to Computers*, p.91.
[10] Michael G. Fullan with Suzanne Stiegelbauer, *The New Meaning of Educational Change* (London: Cassell, 1996 edition) p. 127.
[11] Department of Education, *Charting our Education Future, White Paper on Education* (Dublin: Stationery Office, 1995) p.47-48.
[12] Betty Collis, *Tele-learning in a Digital World: The Future of Distance Learning* (London: International Thomson Computer Press, 1996) p.209.
[13] Department of Education and Science, *Schools IT 2000: A Policy Framework for the New Millennium* (Dublin: Government Publications, 1997) p.45.
[14] Michael G. Fullan, *Successful School Improvement: the implementation perspective and beyond*, (England: Open University Press, 1992) p.43.
[15] Department of Education and Science, *Schools IT 2000*, p.6.
[16] Michael G. Fullan et. al. *The New Meaning of Educational Change*, p.77.
[17] Jim Callan, *Jesuit-Maynooth Initiative: Reports on Subject-Based Workshops* (Maynooth: Education Department NUI Maynooth, 1999) p.2.
[18] *Ibid.*, p.5.
[19] Michael G. Fullan et. al. *The New Meaning of Educational Change*, p. 84.
[20] Betty Collis, *Tele-learning in a Digital World*, p.211.

[21] *Ibid.*, p.211.
[22] Bridget Somekh and Niki Davis, "Getting teacher started with IT and transferable skills" in *Using Information Technology Effectively in Teaching and Learning* edited by Bridget Somekh and Niki Davis (London: Routledge, 1997) p.138.
[23] Patricia J. Sikes, Lynda Measor, and Peter Woods, *Teacher Careers: Crises and Continuities* (London: The Falmer Press, 1985) p.57.
[24] Willem J. Pelgrum and Tjeerd Plomp, (eds.) *The IEA Study of Computers in Education: Implementation of an Innovation in 21 Education Systems*. (Oxford: Pergamon Press, 1993) p.127.
[25] Michael G. Fullan, *Successful School Improvement: the implementation perspective and beyond*, p.43.
[26] Department of Education and Science, *Schools IT 2000*, p.46.
[27] Bridget Somekh and Niki Davis, "Getting teacher started with IT and transferable skills," p.146.
[28] Michael G. Fullan et. al. *The New Meaning of Educational Change*, p.127.
[29] Anthea Millett, "ICT and the Future of the Teaching Profession - The National Perspective," a lecture given at a conference of the TTA (teacher training agency) on 10 February 1999. For full text see <http://www.teach-tta.gov.uk/speech6.htm>.
[30] Valerie L. Worthington and Andrew Henry, "Computer Anxiety: A Technical or an Existential Problem?" in SITE 98 <http://www.coe.uh.edu/insite/elec_pub/HTML1998/re_wort.htm>.
[31] Michael Oakeshott, *The Voice of Liberal Learning: Michael Oakeshott on Education*. (London: Yale University Press, 1989) p.69.
[32] For example, the NCTE encouraged partnerships between schools and local technology industries when inviting proposals for the Schools Integration Project. Department of Education and Science, *Schools IT 2000*, pp.45-48.
[33] Jean D.M. Underwood and Geoffrey Underwood, *Computers and Learning* (Oxford: Blackwell Publishers, 1990) pp.169-193.
[34] Neil Postman, *Conscientious Objections: Stirring Up Trouble About Language, Technology, and Education* (London: Heinemann, 1989) p.xiii.
[35] J. Tuckett, S.R. Jones, and P.J. Thomas, "The future of technology in higher education: A Delphi survey" in J. Hlavicka and K. Kveton, (eds.) *Proceedings of Rufis '97: Role of the university in the future information society* (Prague: UNESCO International Centre for Scientific Computing, 1997) pp.43-48 quoted in Betty Collis, "Implementing Innovative Teaching Across the Faculty via the WWW."
[36] Joe Lee, writing in the Sunday Tribune dated 30th March 1997.
[37] Andy Hargreaves, Lorna Earl, and Jim Ryan, *Schooling for Change: Reinventing Education for Early Adolescents* (London: The Falmer Press, 1996) p.155.
[38] M. J. "Mimi" Schuttloffel, "Engaging Educators in Asking the Right Questions about Technology Implementation," in SITE 98, <http://www.coe.uh.edu/insite/elec_pub/HTML1998/th_schu.htm>.
[39] Michael G. Fullan et. al., *The New Meaning of Educational Change*, p.127.

[40] Michael Fullan, *Successful School Improvement: the implementation perspective and beyond* (England: Open University Press, 1992) p.37.
[41] Michael G. Fullan et. al., *The New Meaning of Educational Change*, p.127.
[42] Michael Fullan, *Successful School Improvement*, p.34.
[43] National Council for Curriculum and Assessment, *The Junior Cycle Review, Progress Report: Issues and Options for Development*, (Dublin: NCCA, 1999) p.16.
[44] *Ibid.*, p.15.
[45] Niki Davis, "Strategies for staff and institutional development for IT in education" in *Using Information Technology Effectively in Teaching and Learning* edited by Bridget Somekh et. al., p.256.
[46] Jim Callan, *Jesuit-Maynooth Initiative*, p.5.
[47] From an article on ICT in-service in Denmark on the Internet <http://www.globallearning.org/programme-conference/text-netdays.htm>.
[48] Michael Huberman, "Critical Introduction" in *Successful School Improvement* by M. Fullan, p.9.

Bibliography

Akbaba, S. and G. Kurubacak, "Teachers' attitudes towards technology," in *Society for Information Technology and Teacher Education (SITE 98): Proceedings of the 9th International Conference* (Charlottesville: Association for the Advancement of Computing on Education, 1998) <http://www.coe.uh.edu/insite/elec_pub/HTML1998/re_akba.htm>.

Allen, R.E. *The Concise Oxford Dictionary of Current English* (Oxford: Clarendon Press, 1992).

Archer, P. *An External Evaluation of Schools for Active Learning* (Meath: Peter Archer, 1994).

Babbie, E. *Survey Research Methods* (California: Wadsworth Publishing Company, 1990).

Barton, R. "Does data logging change the nature of children's thinking in experimental work in science?" in *Using Information Technology Effectively in Teaching and Learning* edited by Bridget Somekh and Niki Davis (London: Routledge, 1997).

Berge Z. and M. Collins, "We Teach as We Were Taught" in *Wired Together: Computer-mediated Communication in K-12: Teacher Education and Professional Development*, Vol. 3, (Hampton Press, 1998) <http://jan.ucc.nau.edu/~mpc3/mauri/books/k12bk3.html#anchor843152 >.

Bogdan R.C. and S.K. Biklen, *Qualitative Research for Education: An introduction to Theory and Methods* (Boston: Allyn and Bacon, 1982).

Bogdan R.C. and S.J. Taylor, *Introduction to Qualitative Research Methods: A Phenomenological Approach to the Social Sciences* (London and New York: John Wiley and Sons, 1975).

Callan, J. *Schools for Active Learning: Final Report*. (Dublin: Department of Education, 1994).

Callan, J. *Jesuit-Maynooth Initiative: Reports on Subject-Based Workshops* (Maynooth: Education Department NUI Maynooth, 1999).

Christensen, R. and G. Knezek, "Parallel forms for measuring teachers' attitudes toward computers" in *Society for Information Technology and Teacher Education (SITE 98): Proceedings of the 9th International Conference* (Charlottesville: Association for the Advancement of Computing on Education, 1998) <http://www.coe.uh.edu/insite/elec_pub/HTML1998/re_chri.htm>.

Collis, B. *Tele-learning in a Digital World: The Future of Distance Learning* (London: International Thomson Computer Press, 1996).

Collis, B. "Implementing Innovative Teaching Across the Faculty via the WWW" in *Society for Information Technology and Teacher Education (SITE 98): Proceedings of the 9th International Conference* (Charlottesville: Association for the Advancement of Computing on Education, 1998) <http://www.coe.uh.edu/insite/elec_pub/HTML1998/keynote.htm>.

Cresson, E. and P. Flynn, European Commission, *Teaching and Learning: Towards the learning Society* (Luxembourg: Office for Official Publications of the European Communities, 1996) <http://europa.eu.int/en/comm/dg22/lb-en.wpd>.

Culliton, J. *A Time for Change: industrial policy for the 1990s: report of the Industrial Policy Review Group, Ireland*, (Dublin: The Stationery Office, 1992).

David, J.L. "Restructuring and Technology: Partners in Change" in *Phi Delta Kappan* 73, 1991.

Davis, N. "Strategies for staff and institutional development for IT in education" in *Using Information Technology Effectively in Teaching and Learning* edited by Bridget Somekh and Niki Davis (London: Routledge, 1997).

Department of Education, *Education for a Changing World: Green Paper on Education* (Dublin: The Stationery Office, 1992).

Department of Education, *Charting our Education Future, White Paper on Education* (Dublin: Stationery Office, 1995).

Department of Education and Science, *Schools IT2000: A Policy Framework for the New Millennium* (Dublin: Government Publications, 1997).

Dolly, C. *A Survey of Teachers' Attitudes to Computers*, Thesis, Masters in Computer Applications for Education, DCU, 1998.

Drury, C.J. *Implementing Change in Education: The Integration of Information Technology into Irish post-primary schools*, Thesis, M.Sc., University of Leicester, 1995. <http://indigo.ie/~cjdrury/thesis/contents.html>.

Fisher, C., D.C. Dwyer, and K. Yocan, *Education and Technology: Reflections on Computing in Classrooms* (San Francisco: Jossey-Bass Inc., 1996).

Forfás, *Responding to Ireland's growing skills needs: The First Report of the Expert Group on Future Skills Needs* (Dublin: Forfás, 1998).

Fullan, M. *Successful School Improvement: the implementation perspective and beyond*. (England: Open University Press, 1992).

Fullan, M. *Change Forces: Probing the Depths of Educational Reform*, (London: The Falmer Press, 1993).

Fullan, M.G. with S. Stiegelbauer, *The New Meaning of Educational Change* (London: Cassell, 1996).

Gardner, J., H. Morrison, and R. Jarman, "The impact of high access to computers on learning" in *Journal of Computer Assisted Learning*, Vol.9, no.1, 1993.

Gardner, J., H. Morrison, R. Jarman, C. Reilly, and H. McNally, *Personal Computers and the Curriculum* (Scottish Council for Research in Education, 1993).

Hammersley, *Reading Ethnographic Research: A Critical Research* (London: Longmans, 1990).

Hargreaves, A. *Changing Teachers, Changing Times* (London: Cassell, 1994).

Hargreaves, A., Lorna Earl, and Jim Ryan, *Schooling for Change: Reinventing Education for Early Adolescents* (London: The Falmer Press, 1996).

Hargreaves, A. and R. Evans, *Beyond Educational Reform* (Buckingham: Open University Press, 1997).

Hargreaves, A. and M. Fullan, (eds.) *Understanding Teacher Development*, (London: Cassell, 1992).

Harlow, S. "Information Technology and the Search for Coherence" in *Society for Information Technology and Teacher Education (SITE 98): Proceedings of the 9th International Conference* (Charlottesville: Association for the Advancement of Computing on Education, 1998) <http://www.coe.uh.edu/insite/elec_pub/HTML1998/th_harl.htm>.

Henerson, M.E., L. Lyons Morris, and C. Taylor Fitz-Gibbon, *How to measure attitudes* (London: Sage publications, 1987).

Hopkins, D. *Evaluation for school development* (Milton Keynes: Open University Press, 1989).

Kay, P.H. "Gender differences in computer attitudes, literacy, focus of control and commitment" in *Journal Research on Computing in Education*, 21, 1989.

Kelly, A.V. *Microcomputers and the curriculum* (London: Harper and Row, 1984).

Koohang, A.A. "A study of the attitudes of preservice teachers towards the use of computers." *Educational Communications and Technology Journal*, 35, 1987.

Lane C. "Technology and Systemic Educational Reform" in *Education and Technology* <http://www.tecweb.org/eddevel/reform10.html>.

Lemon, N. *Attitudes and Their Measurements*, (London: Batsford Ltd., 1973).

Leslie, J. "Kids Connecting" in *Wired Magazine*, 1994.

Loveless, A. "Where do you stand to get a good view of pedagogy?" in *Society for Information Technology and Teacher Education (SITE 98): Proceedings of the 9th International Conference* (Charlottesville: Association for the Advancement of Computing on Education, 1998) <http://www.coe.uh.edu/insite/elec_pub/HTML1998/th_love.htm>.

Maddox, T. "Report from the Electronic Frontier: Life on the Internet, Part I: Reading Mail, Reading News" Official Journal of the Macintosh Scientific and Technical Users Association Volume 3, No. 4, July 1993 <http://www.macscitech.org/stj/stj1993_jul.html>.

Marshall J. and S. Bannon "Computer attitudes and computer knowledge of students and educators." *AEDS Journal*, 19, 1986.

McGarvey, R. "High-tech Pot o' Gold" in *Upside Magazine* (Upside Media Inc., Feb. 1999) <http://www.upside.com/texis/mvm/story?id=3687f8af0>.

Miller, L. and J. Olson "How Computers Live in Schools" in *Educational Leadership* Oct. 1995 <http://odie.ascd.org/pubs/el/miller.html>.

Millett, A. "ICT and the Future of the Teaching Profession - The National Perspective," Lecture given at a conference of the TTA (teacher training agency) on 10 Feb. 1999, <http://www.teach-tta.gov.uk/speech6.htm>.

Mulcahy, J. "Information Technology in the Junior Cycle Curriculum" in *Issues in Education* (Dublin: ASTI, 1997).

National Education Commission on Time and Learning, "Prisoners of Time: Report of the National Education Commission on Time and Learning," (Washington, 1994).

Nisbet, J.D. and N.J. Entwistle, *Educational Research Methods* (London: Unibooks, University of London Press, 1970).

Oakeshott, M., *The Voice of Liberal Learning: Michael Oakeshott on Education*. (London: Yale University Press, 1989).

O'Donnell, J. "The digital challenge" in *Wilson Quarterly*, Vol. 20, 1996.

Office of Technology Assessment, *Teachers and Technology: Making the connection*. (OTA-EHR-616). (Washington: Government Printing Office, 1995).

Ofsted, *Information Technology in Schools: The impact of the Information Technology in Schools Initiative 1990-1993*, 1994.

Peck, K. and D. Dorricott, "Why Use Technology?" in *Educational Leadership* Vol. 51, No.7, 1994.

Pelgrum, W.J. and T. Plomp (eds.) *The IEA Study of Computers in Education: Implementation of an Innovation in 21 Education Systems*. (Oxford: Pergamon Press, 1993).

Perlman, L. J. *School's Out: Hyperlearning, the New Technology, and the End of Education*. (New York: William Morrow, 1992).

Pool, C.R. "A New Digital Literacy: A Conversation with Paul Gilster" in *Educational Leadership* Vol. 55, No.3 Nov. 1997 <http://www.ascd.org/pubs/el/nov97/extgilst.html>.

Postman, N. *Conscientious Objections: Stirring Up Trouble About Language, Technology, and Education* (London: Heinemann, 1989).

Postman, N. *Technopoly* (New York: Vintage Books 1996).

Ritter, S.L. "A Study of the Transformation of Regular Education: Are Inclusionary practices benefiting a diverse population of Children?" in *Lockhaven International Review*, Issue 10, 1996. <http://www.lhup.edu/library/InternationalReview/ritter.htm>.

Rosen, L.D. and M.M. Weil, "Computer Availability, Computer Experience and Technophobia Among Public School Teachers" in *Computers in Human Behaviour*, Vol.11 No.1, 1995.

Roszak, T. *The cult of information* (New York: Pantheon Books, 1998).

Schuttloffel, M. J. "Mimi" "Engaging Educators in Asking the Right Questions about Technology Implementation," in *Society for Information Technology and Teacher Education (SITE 98): Proceedings of the 9th International Conference* (Charlottesville: Association for the Advancement of Computing on Education, 1998) <http://www.coe.uh.edu/insite/elec_pub/HTML1998/th_schu.htm>.

Scrimshaw, P. "Computers and the teacher's role" in *Using Information Technology Effectively in Teaching and Learning* edited by B. Somekh and N. Davis, (Ed.) *education* (London: Routledge, 1997).

Sikes, P.J., Lynda Measor, and Peter Woods, *Teacher Careers: Crises and Continuities* (London: The Falmer Press, 1985).

Silverman, D. *Interpreting Qualitative Data* (London: Sage Publications, 1997).

Society for Information Technology and Teacher Education (SITE 98): Proceedings of the 9th International Conference (Charlottesville: Association for the Advancement of Computing on Education, 1998).

Somekh, B. "Classroom investigations: Exploring and evaluating how IT can support learning" in *Using Information Technology Effectively in Teaching and Learning* edited by Bridget Somekh and Niki Davis (London: Routledge, 1997).

Somekh, B. and N. Davis, (Ed.) *Using Information Technology Effectively in Teaching and Learning: Studies in pre-service and in-service teacher education* (London: Routledge, 1997).

Somekh, B. and N. Davis, "Getting teacher started with IT and transferable skills" in *Using Information Technology Effectively in Teaching and Learning* edited by B. Somekh and N. Davis, (Eds.) (London: Routledge, 1997).

Stradling, B., D. Sims, and J. Jamison, *Portable Computers Pilot Evaluation Report* (National Foundation for Educational Research, NCET, 1994).

Task Force Human Resources Education Training Youth Commission of the European Communities, *New Information Technology in Education in Ireland.* (Luxembourg: Office for Official Publications of the European Communities, 1993).

Tuckett, J., S.R. Jones, and P.J. Thomas, "The future of technology in higher education: A Delphi survey" in J. Hlavicka and K. Kveton, (eds.). *Proceedings of Rufis '97: Role of the university in the future information society* (Prague: UNESCO International Centre for Scientific Computing,1997).

Tuckman, B.W. *Conducting Educational Research* (Florida: Harcourt Brace College Publishers, 1972).

Underwood, J.D.M. and G. Underwood, *Computers and Learning* (Oxford: Blackwell Publishers, 1990).

Watson D.M. (ed.) *The ImpacT Report: an evaluation of the impact of information technology on children's achievements in primary and secondary schools* (London: Centre for Educational Studies, Kings College, 1993).

Wellburn, E. "The Status of Technology in the Education System: A Literature Review" for Technology and Distance Education Branch, Ministry of Education, Canada, 1996 <http://www.cln.org/lists/nuggets/EdTech_report.html>.

White, C. "The Role of Technology in Teacher Education: A Postmodern Critique" in *Society for Information Technology and Teacher Education (SITE 98): Proceedings of the 9th International Conference* (Charlottesville: Association for the Advancement of Computing on Education, 1998) <http://www.coe.uh.edu/insite/elec_pub/HTML1998/th_whit.htm>.

Woodrow, J.E. "The influence of programming training on the computer literacy and attitudes of preservice teachers" in *Journal of Research on Computing in Education*, 25(2), 1992.

Woods, P. *Inside Schools: Ethnography in Educational Research* (London and New York: Routledge and Kegan Paul, 1986).

Worthington, V.L. and Henry, A. "Computer Anxiety: A Technical or an Existential Problem?" in *Society for Information Technology and Teacher Education (SITE 98): Proceedings of the 9th International Conference* (Charlottesville: Association for the Advancement of Computing on Education, 1998) <http://www.coe.uh.edu/insite/elec_pub/HTML1998/re_wort.htm>.

Appendix A: Covering Letter and Questionnaire

School Address
25th March 1999

Dear Colleague,

I am currently engaged in research as part of a postgraduate degree, in NUI Maynooth. I am trying to find out more about teachers' attitudes to computers. As a first stage, I am asking each member of staff to help me in my work by completing the attached questionnaire as accurately as possible. I would be very interested in *your own* views to the questions that follow.

Depending on the patterns of responses, in some cases I will be following up your comments with a request for an interview (hence the code at the top of the first page). The good news is that I will not need to bother most of you again! Confidentiality of your individual answers and of the school is assured and the primary audience of the research findings will be the academic staff in NUI Maynooth.

Could you please return the completed questionnaire to me on **Monday 29th March**.

Thank you for your help. Your cooperation is very much appreciated.

Diane Birnie.

Section 1:

This section asks you about your attitude to computers.

Please tick the box under *one* of the numbers in each row to show whether you

1. **strongly agree**
2. **agree**
3. **have no opinion on this issue**
4. **disagree**
5. **strongly disagree**

with *each* statement given below.

		Strongly agree	Agree	No opinion on this issue	Disagree	Strongly disagree
		1	2	3	4	5
1	I hesitate to use a computer for fear of making mistakes I cannot correct.					
2	I am very confident when using computers.					
3	I do not feel I have control over what I do when I use a computer.					
4	I find it easy to ask for help if I have a problem when working on a computer.					
5	Computers slow down administrative tasks.					
6	Computers are necessary tools in educational settings.					
7	Computers provide us with uncensored and inaccurate information.					
8	Computers encourage creativity in those that use them.					
9	I am suspicious of statements claiming that computers improve students' learning.					
10	Computers can be a useful instructional aid in almost all subject areas.					
11	Computers are a distraction to student learning.					
12	Computers should be used in the classroom to complement the more traditional methods of teaching.					

		Strongly agree	Agree	No opinion on this issue	Disagree	Strongly disagree
		1	2	3	4	5
13	I am worried that computers may eventually replace the teacher.					
14	Teachers need to re-examine their role in the classroom in the light of what computers have to offer.					
15	I do not need to use computers in order to do a good job as a teacher.					
16	Computers isolate people by inhibiting normal social interactions among users.					
17	Computers are having a negative effect on our culture.					
18	Computers increase information access and improve communication.					
19	Computers are changing the world too rapidly.					
20	Instruction in computers should be included as part of every teacher training course.					
21	Schools should teach computer skills to students to improve their employment prospects.					
22	Using computers in the classroom can improve the standard of student learning.					
23	Everyone needs to know how to use computers in order to live in today's world.					
24	It is part of the role of the schools to provide the country with more young people with computer skills to keep the economy healthy.					

Section 2:

This section asks mainly about your use of computers. This includes any use you have made of computers, such as filling in reports, word processing, video-conferencing, Internet, e-mail, CD-Roms, games, etc.

Please give as much detail in your answers as possible. Feel free to use extra paper for your answers if required.

1. Describe how you have used computers for *professional* purposes? (By that I mean in your job as a teacher, both in and out of the classroom.)

2. Do you use a computer for *personal* purposes? If so briefly describe how you use it.

3. Approximately how often do you use computers (for any purpose)?

4. Identify any ***benefits*** you believe that using computers has offered (a) you as a teacher, (b) your students.

(a)

(b)

5. Identify any ***dangers*** or ***challenges*** you believe that using computers can cause for (a) you as a teacher, (b) your students.

(a) _____

_____

_____

(b) _____

_____

_____

Now you are asked to reflect back to approximately 5 years ago, and try to recall your attitude to computers then. Please try to explain your feelings as clearly as possible.

6. Describe your attitude to computers 5 years ago.

_____

_____

_____

_____

7. Describe your attitude to computers now.

_____

_____

_____

_____

8. If your answers to 6 and 7 were ***similar***, what do you think has caused your attitude to be consistent?

_____

_____

_____

OR

9. If your answers to 6 and 7 were ***different***, what do you think has caused your attitude to change?

_____

_____

_____

10. Have you attended any courses in computers? If so, give brief details below.

_____

_____

_____

11. If you would like to make a statement related to your attitude to computers, as a teacher, please mention it here.

_____

_____

_____

_____

Section 3:

This section asks for some factual information which will help me to group your responses to the previous sections.

Please tick the relevant boxes:

A. *Gender*: Male ❑ Female ❑

B. *Age group*: 20-24 ❑ 25-29 ❑ 30-34 ❑ 35-39 ❑
40-44 ❑ 45-49 ❑ 50-54 ❑ 55-59 ❑ 60+ ❑

C. *Number of years of teaching experience including this year.* (Please include years when you were part-time or temporary whole time or permanent):
0-4 ❑ 5-9 ❑ 10-14 ❑ 15-19 ❑
20-24 ❑ 25-29 ❑ 30-34 ❑ 35-39 ❑ 40+ ❑

D. Do you have a computer in your home?

Yes ❑ No ❑

E. *Subjects taught*: (Please list all subjects that you teach or have taught, whether an exam subject or not, including any Transition Year modules.)

_____

_____

_____

_____

Once again, thank you for your time and your help.

Appendix B: Pilot Questionnaire Evaluation Form

Comments on the Pilot Questionnaire

Please comment on your experience of filling out this questionnaire under the following headings. Feel free to give specific examples where relevant.

1. How long did it take you to complete the questionnaire?

2. How clear were the instructions?

3. Were the questions and statements clear and easy to understand? (Please list any sections and numbers which where unclear.)

4. In the section that required you to tick a box, did you have a sufficient range of responses?

5. Do you have any other suggestions for improving this questionnaire?

Once again, thank you for your time and your help.

Diane Birnie.