ICT in primary education

A perspective study into the use and selection procedures of software designed to support the development of basic literacy skills for able and less able pupils (KS1).

A Thesis submitted for the Degree of Doctor of Philosophy

By

Evangelia Papadimitriou

Department of Education, Brunel University

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Ithaca

When you set out your journey to Ithaca
pray that the road is long,
full of adventure, full of knowledge.
The Lestrygonians and the Cyclops,
the angry Poseidon – do not fear them.
You will never find such as these on your path,
if your thoughts remain lofty, if a fine
emotion touches your spirit and your body.
The Lestrygonians and the Cyclops,
the fierce Poseidon you will never encounter,
if you do not carry them within your soul,
if your soul does not set them up before you.

Pray that the road is long.
That the summer mornings are many, when,
with such pleasure, with such joy
you will enter ports seen for the first time;
stop at Phoenician markets,
and purchase fine merchandise,
mother-of-pearl and coral, amber and ebony,
and sensual perfumes of all kinds,
as many sensual perfumes as you can;
visit many Egyptian cities,
to learn and learn from scholars.

Always keep Ithaca in your mind.
To arrive there is your ultimate goal.
But do not hurry the voyage at all.
It is better to let it last for many years;
and to anchor at the island when you are old,
rich with all you have gained on the way,
not expecting that Ithaca will offer you riches.

Ithaca has given you the beautiful voyage.
Without her you would have never set out on the road.
She has nothing more to give you.

And if you find her poor, Ithaca has not deceived you.
Wise as you have become, with so much experience,
you must already have understood who the Ithacans are.

Constantine P. Cavafy (1911)
Alexandria, Egypt

Available: http://users.hol.gr/~barbanis/cavafy/ithaca.html {6/9/03}

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Indeed it has been a long journey towards accomplishing the doctoral degree, Ithaca – to use Cavafy's metaphor. A long period full of experiences and knowledge accompanied by commitment, hard work and effort. But I feel that I would not be able to sail through this adventurous journey alone without the help of some important people who stood by me, believe in me, and supported me emotionally and actually.

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From the bottom of my heart,

I thank you all

Abstract

The British government is heavily committed to successfully applying technology in primary education through a series of expensive initiatives stressing the importance of technology in teaching across the curriculum and the belief that technology can contribute to pupils' academic achievement. One would assume that educators use it regularly in their classrooms in the subject of basic literacy. One of the factors that may impede the use of technology in teaching is the good quality software. There are numerous software available but of poor quality. Unfortunately, no criteria are available for teachers to select computer packages. Pupils' contribution to designing software is highly recommended but their views have been ignored in relation to what elements should be included in computer packages. This study was set:

a) To explore the use and selection procedure of initial literacy software in primary / nursery schools, and
b) To explore young pupils (KS1) thoughts on using basic literacy software and on the technical features and instructional characteristics in such programs.

This inquiry investigated the above aims involving the views of the three stakeholders - teachers, developers, and children. Namely, 112 primary school teachers, mostly mature in age and experience, of five LEAs in Southwest area of London, 98 KS1 (62 Yr1 and 36 Yr2), and 10 software companies. The constructivist paradigm by Cuba & Lincoln was employed to reach joint constructions by comparing and contrasting differences, but mostly to give weight to the perspectives of the less power – children – to "give voice".

The study has found that young pupils do not have frequent access to such programs, and to computers in general, though schools are equipped with computers and literacy software. The ratio of computers to pupils is large, 1:13. Schools opt for the ICT suite in order to secure equal access. Just over half of the teachers feel sufficiently trained in using ICT. The older in age and in teaching experience teachers feel less confident in using technology. Developers share the view that teachers' ICT skills are poor.

Half of the available software does not undergo any testing before reaching classrooms since only half of developers evaluate their products, and equally half of teachers preview it, but both without pupils involved. Young in the profession teachers and teachers who feel sufficiently trained tend to preview software more than the rest of their colleagues. No criteria are used in order to select computer packages and teachers feel that they need more skills for that reason. The older in the teaching profession educators find more influential software that has been tried out with children. The criteria found in this study are the same as the ones provided by the literature and the ones used by few teachers.

Pupils like to work on computers. They believe that computers contribute to their learning, and equally literacy games contribute to the development of pre-reading skills. They like to work in pairs and explain why. The views of pupils on the difficulties they encounter match the views of teachers and developers. Regarding the software elements the study has shown differences between the two age groups (Yr1 and Yr2). Similarly, differences are found between the three stakeholders in relation to technical features in software. The study provides a list of recommendations for classroom teachers.

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List of Abbreviations

ADD: Attention Deficit Disorder.
ADHD: Attention Deficit Hyperactivity Disorder.
ADI: Association for Direct Instruction.
AERA: The American Educational Research Association.
APD: Academic and Professional Development.
BECTA: British Educational Communications and Technology Agency.
BERA: British Educational Research Association.
BESA: British Educational Suppliers Association.
BETT: British Education Technology.
CAI: Computer-Assisted Instruction.
CEC: Council for Exceptional Children.
CCLD: The Coordinated Campaign for Learning Disabilities.
CD ROM: Compact Disk Read-Only Memory.
CCVC: Consonant-Consonant- Vowel-Consonant
CVC: Consonant-Vowel-Consonant.
CVCC: Consonant-Vowel-Consonant-Consonant.
CSU: Colorado State University.
DATEC: Developmentally Appropriate Technology in Early Childhood (The).
DES: Department of Education and Science.
DFE: Department For Education.
DfEE: Department for Education and Employment.
DI: Direct Instruction.
EAL: English as Additional Language.
ECE: Early Childhood Education.
EO: Equal Opportunities
EPIE: Educational Products Information Exchange
ESL: English as a Second Language.
ESPA: Educational Software Publishers Association.
ETS: Educational Testing Service
HMI: Her Majesty Inspectorate.
ICDD: Idaho Center on Developmental Disabilities (The).
ICT: Information and Communication Technology.
ICT Co-ordinator: Information and Communication Technology Co-ordinator.
ILS: Integrated Learning Systems.
IRA: International Reading Association (The).
IT: Information Technology.
KS1: Key Stage 1 (pupils aged 5-7).
KS2: Key Stage 2 (pupils aged 7-11).
LEA: Local Education Authority.
MECC: The Minnesota Educational Computing Consortium.
NAECS / SDE: National Association of Early Childhood Specialists in State Departments of Education.
NAEYC: The National Association for the Education of Young Children.
NASEN: National Association for Special Educational Needs.
NC: National Curriculum.
NCC: National Curriculum Council.
NETC: Northwest Educational Technology Consortium.

NFER: National Foundation of Educational Research.
NGfL: National Grid for Learning.
NICHD: National Institute of Child Health and Human Development (The).
NLS: National Literacy Strategy.
NOF: New Opportunities Fund.
OFSTED: Office for Standards in Education.
PI: Programmed Instruction
PMRS: Professional Marketing Research Society.
QCA: Qualification and Curriculum Agency.
QTS: Qualified Teachers Status.
RD: Reading Difficulties.
RR: Repeated Reading(s).
SCRE: Scottish Council for Research in Education.
SEN: Special Educational Needs.
SENCO: Special Educational Needs Co-ordinator.
SES: Socio-Economic Status.
SMT: Senior Management Team.
SPSS: Statistical Package for Social Sciences.
Sw: Software
TEEM: Teachers Evaluating Educational Multimedia.
TTA: Teachers Training Agency.
TV: Television.
UK: United Kingdom.
UN: United Nations.
USA: United States of America.
WoS: Working schemes
WPRIR: Wisconsin Policy Research Institute Report (The).
YR1: Year 1 (Pupils aged 5-6).
YR2: Year 2 (Pupils aged 6-7).
WWW: World Wide Web

"We know, purely and simply, that every single child must have access to a computer, must understand it, must have access to good software and good teachers and to the Internet, so that every person will have the opportunity to make the most of his or her own life."

President Clinton, 15 /02/ 1996
The 1996 National Educational Technology Plan. Available:
http://www.air.org/forum/goals.htm

Chapter 1. Introduction to the Study

The purpose of this chapter is to clarify the original issues and ideas that trigger my interest and formed the axis around which this research will evolve, namely basic literacy skills, and computer programs (software) used by primary / nursery teachers to support the pupils' development of basic literacy skills. A brief analysis of related themes will lead to the research aims and justification of the study. The chapter will end with a summary of the broad structure of the thesis.

My personal interest in the development of basic literacy skills, either using traditional or electronic print, originates from my fifteen-years career as a Kindergarten teacher and another five years as a special educator. Teaching reading is of great appeal to me for the following reasons:

- The amazing combination of the 24 letters (Greek alphabet) can be transformed and take the shape of words, sentences, speech, communication and knowledge.
- The puzzle that a rather significant portion of the school population "struggles" at some point in their school career to reach reading achievement levels proportionate to their classmates.
- We are in the course of the information age where the demand for high reading skills is only increasing. Pupils need not only to learn new skills (operating computers), but also to be able to read the heavily-text pages in the web in order to find information.

Besides, very few will dispute that literacy is the first chapter in education mainly because it is the corner stone of further academic and professional success. Literacy has direct impact on personal, socio-cultural, political and economic levels. The introduction of computers in early primary education settings has brought new ways of delivering teaching. Operating the machines though is not viewed as another subject that pupils have to be taught; rather as a pedagogical tool that can be used across the curriculum with different subjects.

Initial literacy software* or "games" in children's language, designed to support the development of pre-reading skills are mushrooming nowadays. This fact has sparked my interest in this domain, and consequently has formed the axis around which this study will evolve. Practicing the profession of teaching in Hellas, I have to confess at this point that I have no experience whatsoever of using computers, or initial literacy software in my classroom, since this novelty has not reached my country yet. I, also, stumbled upon scanty research on computers in early years, as well as on computer-assisted instruction in initial literacy. Every source of information (book or article) was found on the Internet, searching the ERIC database, and through snowballing, one source was leading me to others.

1.1. The concept of initial literacy skills

Literacy is a broad term and to seek a single definition, upon which most will agree, is rather futile mainly because the various writers disagree upon how do we define "*literate*". Is it the person who knows how to read and write, or does it mean the broad education of this person? Nevertheless, the most simple and straightforward definition of literacy is: "the ability to read and write" (Goody, 1999, p. 29). Similarly, the DfEE (1998) defines literacy as the ability to read, write and spell. Because literacy engulfs all the reading ability levels starting from the early years of childhood and progresses through one's life, it connotes that literacy has different skills at each stage in life. In early years, *initial* or *basic literacy* is a term that stems from the original one and is related to those activities that set the foundations of advanced reading, but this study put emphasis solely on the reading part of the definition. The terms *initial*, or *basic literacy*, or *pre-reading skills* are used interchangeably throughout this thesis.

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* By the term "initial literacy software" that is being used throughout this study, I mean any kind of software designed to support the development of pre-reading skills in KS1 pupils of all abilities.

Reading is the process whereby one decodes and comprehends words and makes sense of text. The specific skills (pre-reading skills) that young inexperienced readers must acquire, as well as learners with various reading problems, fall into four broad areas:

- Phonological word analysis.
- Rapid sight word recognition.
- Fluent word processing in text.
- Comprehension (Torgesen, 1985; Adams, 1990;Tan & Nicholson, 1997).

These skills are - to a considerable degree - independent of each other. A reader might rely on one particular skill without the simultaneous use of the other skills to the same extent. This is particularly true for beginning readers for whom the emphasis of instruction is to teach the *code*. Decoding skills take several years to learn, and even then most pupils will not have the speed and fluency of skilled adult readers. Some pupils face severe problems in acquiring these skills.

One of the main tasks that young pupils are taught is phonological word analysis, or else *phonological awareness*. It refers to the general appreciation of the sounds of speech as distinct from meaning (Snow et al, 1998), and typically involves tasks that require the pupil to isolate, or segment, one or more of the phonemes of a spoken word, to blend or combine a sequence of separate phonemes into a word, or to manipulate the phonemes within a word. Spoken words can be phonologically analysed at several levels. This is the *syllable*, the *onset and rime* within the syllable, and the individual *phoneme* (c/a/t/). This level of analysis is called *phonemic awareness*.

Such metalinguistic skills involving the manipulation of sounds in speech are found to be related to later literacy achievement (Adams, 1990; Maclean et al, 1987). There is already evidence that starting to teach phonemic awareness in kindergarten has good results; this is the children make better progress when reading instruction is introduced later on (Torgesen, 1997; Bond & Dykstra, 1997; Adams, 1990). Similarly, one important predictor of first year reading achievement is the pre-reader's knowledge of letter names (Chall, 1983, 1996;

Mason, 1980; Byrne & Fielding-Barnsley, 1989, 1990; Bond & Dykstra, 1997; Adams, 1990). In addition to accuracy, fluency, or else the ease of letter recognition, strongly predicts the acquisition of reading among beginning readers (Ehri & Wilce, 1979; Adams, 1990; Mason, 1980). In fact, children who are slow in recognising and naming letters, later have been found to encounter difficulties in learning letter sounds (Ehri & Wilce, 1979; Mason, 1980).

The above skills may well be taught by example, imitation, and practice (Sanders, 2001); the teacher models and through ample opportunities of practice according to the child's learning ability, the pupil acquires the skill. Learning the code through practice is found to work well for beginning readers, and pupils who show some difficulties (Torgesen, 1985; Sanders, 2001). Wild (2000) explains that those skills have to be taught either directly, or indirectly –that is through guidance – since it cannot be expected to arise by experience alone. For that reason the *phonics* method is suggested to be the most appropriate (Sanders, 2001).

Because of the two prevailing theories regarding how reading is acquired, and how it should be taught (*phonics* vs *whole-word* approach), phonics is still disputed among educators, but researchers such as Stahl et al. (1998) have tried to encompass principles from both theoretical campus and present thus phonics through the *balanced* approach to reading. Teachers swiftly choose material that best fits to the needs of the pupils using multiple methods, and not eclecticism (either / or). The report of Snow et al. (1998) on "Preventing Reading Difficulties" has been perceived in the literature as the end of the reading war, and if some continue this "war" it is due to poor channels of communication, or what I call "egocentric polarities". Basic literacy skills are taught either by tutorial instruction and practice (Reitsma, 1988). The teacher models and pupils learn through a lot of practice, or what seems to work best in teaching phonics is direct instruction (DI) (Sanders, 2001; Stahl et al., 1998; Chall, 1983). Direct instruction is a heavily structured method of teaching that involves a lot of modelling from the teacher's part, immediate correction and repetition until the pupil acquires the skill (mastery skills learning). It is a method that seems to work best with pupils who show some difficulties in acquiring basic skills either in reading, spelling or maths. It should be viewed as *one* of the methods of teaching basic literacy skills, and not the *only* method. For pupils who learn the skills easily, and do not need a lot of practice, then DI is not the appropriate method.

While most of the pupils will eventually acquire those initial literacy skills, twenty percent of them will encounter difficulties in learning the code. Most of them (15%) have *developmental* problems – constitutionally part of the child rather than *acquired*, as a consequence of disease or injury (Sanders, 2001). There are a host of factors that prevent pupils from developing reading skills at a normal rate that are due to biological, social, and psychological factors. Developmental problems will eventually outgrow with further development but not without some kind of intervention. An important issue here is that these children are entitled to every right that other pupils have, such as access to the National Curriculum (NC), access to ICT resources, and school provision. It is imperative that these pupils be taught alongside their classmates if at all possible.

In order for the UK Government to raise the literacy standards of all primary education pupils, and to support pupils with low academic achievement, the National Literacy Strategy (NLS) was introduced in autumn 1998. For one hour every day, every school in the country has a detailed framework in accordance with the NC objectives. What is worthwhile to notice here is that this framework is using *phonics* and *sight words* as methods of teaching these skills, which in turn are best taught through structured models of teaching.

In order for teachers to teach basic literacy skills they use materials from a vast array of reading books and schemes that have been developed in the market. The content of these books is closely matched to the NC objectives. Whatever had to be learned in school was in book, on the blackboard, or dictated by the teacher. But the herald of computers in primary educational settings brought new styles of teaching and learning, which have caused changes in the way instruction is delivered and in pupils' learning. ICT has much to offer in all areas of the curriculum including initial literacy. Teachers face the same challenge to use and select software that will contribute towards the implementation of NC / NLS objectives just like any other print material. Educational material is the material that assists the classroom teacher to achieve those objectives.

1.2. The concept of ICT in early primary classrooms

There is no simple definition of ICT (Information and Communication Technology) since multiple concepts are combined. It is formed by different components, such as computer hardware, a variety of software, information sources (such as CD-ROM and Internet), peripherals (such as printers, scanners, digital cameras, laptops), and expands to TV sets or even fax machines and tape recorders. The acronym ICT has replaced the previous term IT (Information Technology) in the 2000 National Curriculum mostly because IT was related to computer literacy skills like keyboards, mouse control and the like, where as ICT gives more emphasis to the "communications" aspect (e-mails, video-conferencing searching for information on the Web). The difference between the two terms is subtle for some authors like Smith (1999), and for others like Falmer & Falmer (2000) the two terms supplement each other.

As far as this thesis is concerned, the term ICT is identified with the use of computers by beginning readers loaded with programs (software) designed to support the development of basic literacy skills, such as learning the alphabet, letter recognition, rhymes, wordbanks, making sentences that enable pupils develop the phonological awareness skills mentioned previously (section 1.2.). But why ICT is essential in primary education?

1.2.1. Reasons to use ICT in early primary settings

The reasons why ICT is important are political, professional, educational, and personal (Leask & Meadows, 2000). President Clinton (p. XIII) showed a strong determination on the government's part that every child learns to use the computer so that s/he will be prepared for future work challenges. In the same vain, the British government advocates: "ICT prepares pupils to participate in a rapidly changing world in which work and other activities are increasingly transformed by access to varied and developing technology" (DfEEa, 1999, p. 99). ICT has become essential in everyday life since computers are increasingly necessary to all businesses and commercial fields. The UK policy for the development of ICT in education is shown through the following four perspectives:

- To promote vocational goals in preparing pupils for future work.
- To raise standards in pupils' achievement.
- To increase teacher effectiveness and sufficiency in professional preparation and presentation.
- To support, promote and extend learning (Loveless, 2002, p. 12).

The above indicate that the government is fully committed to ensuring that all schools and teachers are in a position to deploy ICT to raise educational standards, to enhance learning, and to prepare young pupils with the ICT skills they will need in society and at work in the future. It shows that the UK Government acknowledges the importance of ICT in the work force, the potentiality to help pupils raise their achievement standards and the versatile capacity of computers and ICT applications as *tools*. The use of ICT as a supplement to the traditional teacher-directed instruction is advocated by older and recent studies (McDermott & Watkins, 1983; Cotton, 2001). For the above reasons ICT became a core subject in the National Curriculum with explicit aims, purposes, and standards of achievement (see 3.2.), but at the same time because of its vast capacity, it is advised to be used "across the curriculum".

The introduction of computers in schools has caused a variety of changes (ICT policy, equipment, management of resources and teacher training) that are discussed further in chapter 3. The UK Government has invested astronomical sums in equipping primary schools with the new machines through the NOF scheme (see 3.4), and NGfL. Technology has also changed the way teaching is delivered, and the new term Computer-Assisted Instruction (CAI) has been coined.

1.3. Computer-Assisted Instruction (CAI)

Computer-Assisted Instruction (CAI) is an educational medium in which instructional content, or instructional activities, are delivered with the support of a computer (hardware and software). In this thesis CAI will be referred to the subject of basic literacy solely, and the term Computer-Assisted Reading (CAR) will be used interchangeably. The difference between CAI, or CAR, and traditional teaching is that pupils are sitting in front of the screen, they are in control, and a kind of interactivity develops between the learner and the text.In some way, computers take over the role of the classroom teacher. Reading electronic text though is quite different from reading a book in the way that are presented in table 3-1 (see 3.8). It, also, has different forms according to the program being used (see the various forms of CAI in 3.7.).

The field of computers and reading is not adequately researched (Terrell & Davidson, 1990; Soe, et al., 2000; Belajthy, 1987), but there are strong indications that such computer programs have a significant role to play in assisting the teaching of basic literacy skills to young beginning readers, or pupils who face reading difficulties especially with the recent technology of multimedia (see 3.10., Research on CAI and basic literacy skills). This research is particularly interested in the use of such programs in primary schools and intents to find out the extent to which such software is being used in primary education.

On the other hand, CAI is effective for classroom use especially when the content of electronic material is linked to the ongoing curriculum (Winkler et al., 1985; McDougall & Squires, 1995b; Jolicoeur & Berger, 1988a; Haugland, 1992; Taylor, 1987; Clements & Nastasi, 1992; HMI, 1991). On Kindergarten level, Haugland (1992) argues strongly that instruction assisted by computers brings best results when computers are integrated into the ongoing curriculum, this is computers are matched with the subject's / classroom's objectives.

Factors for the successful application of technology is the schools ICT policy (Kosakowski, 1998), teachers training, and sufficient up-to-date resources

(Cosden 1988; Poulter & Basford, 2003). But the most important factor that affects the successful use of computers, and which will justify the money invested, is good quality of software (Johnson, 1987; Scandura, 1981; Buckleitner, 1996). What the above arguments emphasise is that the common denominator of the successful application of ICT, and the effectiveness of CAI is good quality software.

1.3.1. Software

Software is a term used to describe programs and other applications, which run on a computer – hardware (Farmer & Farmer, 2000). It is the dynamic source that makes computers such versatile machines. It is the vehicle through which classrooms teachers and pupils interact with the machine, and it is responsible for any academic gains children might acquire. The value of the computer is a little more than plastic and electronic circuitry until software is loaded (Shade, 1996). A relative comparison is that of the television with television programs. Good TV programs are what make TV (set) a good medium, and not the other way around. It is them that support instruction, computers are their medium

There are different kinds of software (see 3.7.) and different classification systems the most recent adopted is: a) the *content-specific* and b) the *content-free* software. Content-specific is software designed to assist the teaching of a subject. It usually takes the role of the teacher and consists of some kind of tutorial, drill & practice (D&P) activities, and possibly an achievement record. On the contrary, content-free are word-processors, spreadsheets, adventure games and simulations. This thesis is interested in the first type (content-specific) software that "teaches" basic literacy skills. It has been argued that it is difficult to develop criteria for games, art packages, word-processors, and software of uncommitted material (Ingram, 1994). But what research indicates is that there are no criteria for selecting educational software of any kind. Without criteria, how do teachers select software for classroom use? This constitutes another area of interest in this thesis. How do teachers select initial literacy software?

But in order to develop criteria one has to know what elements in software attract pupils' attention, which will be used as standards of quality. Unfortunately, little research is available on young children using computers (Poulter & Basford, 2003), and even less on what makes software of educational value. Despite the initial reservations (Barnes & Hill, 1983; Cuffaro, 1984; Elkind, 1985, 1987, 1995), computers are found highly motivating, children enjoy working with them, they enhance social interactions, and can contribute to the development of basic literacy skills. But it has been argued that technology is appropriate for young users provided that:

- The quality of the overall preschool / kindergarten curriculum
- The software's match with the curriculum
- The quality of the computer software (Buckleitner, 1996).

The first factor does not fall within the realm of this study. What the ove writer (Buckleitner) argues for, and with whom I totally agree, is that information technology, in order to be appropriate for young children, has to match the school's ongoing curriculum, and also guarantee the quality of software. There is evidence in the literature that exactly the same factors serve as prerequisites of the ICT application in schools next to ICT policies, resources and their management, and teachers' training.

1.4. The research problem and its justification

I have discussed above the serious commitment of the UK government to support the ICT application in primary education for social, economical, and vocational reasons, and the astronomical amount of money spent for schools equipment, teachers training (NOF) and facilities to assist schools and teachers (NGfL). I have also mentioned the changes that technology has brought to school administrations and teaching (CAI), and the positive research findings on CAI in reading, but there is evidence that children do not have adequate access to computers. Watson (1997), and Loveless & Dore (2001) argue that primary schools have 15-30 minutes access per week. In USA, the studies of Marcinkiewicz (1993-94), and Norris et al. (2003) indicate that teachers do not actually use technology in classrooms. There are though serious considerations that this amount of time is not enough and that young ages should have a minimum of 10 minutes daily access (Haughland, 1992; Clements &

McLoughlin, 1986; Torgesen, 1984; Atkinson & Fletcher, 1972). I have stated above that this research will explore the extent to which UK primary educators use such programs to support the development of pre-reading skills.

I have mentioned that among the prerequisites of the successful implementation of ICT, and / or CAI, in schools is the good quality of software. The continuous production of micro-computing, and the introduction of computers in the primary classrooms resulted in software mushrooming in the market, and in an increasing demand of educational software. But most of the software designers were characterised "amateurs" who were trying to fill the vacuum producing a plethora of software at the cost of pedagogy, a situation described as "cottage industry" (Smith & Keeps, 1988). Indicative of the situation is the following statement:

"*...a credibility gap between the rapid increase in the amount of hardware in schools and the slow increase of easily available, non-trivial, educationally legitimate software packages*" (Preece &Squires, 1984, p.20).

The poor quality of software has been claimed by many researchers (Preece & Squires, 1984; Taylor, 1985; Cosden, 1988; Borton & Rossett, 1989). In USA, 10.000 instructional software packages have been published for elementary and secondary school – thousands in each discipline (Taylor, 1985; Borton & Rossett, 1989), but what is alarming is that only 5% of this amount receives favourable reviews (Borton & Rossett, 1989). There is anecdotal evidence that the number of software packages increases by 300 each year. Unfortunately, the problem continues to exist and the result is teachers' dissatisfaction concerning the existing software (Hague et al., 1987) that is escalating to a serious problem that could affect rather negatively the use of technology in schools (Cosden, 1988; Hague et al. 1987; Johnson, 1987).

Various studies have been conducted to find appropriate software evaluation methods, but to no avail. No sets of criteria have been developed and the literature calls for *specific criteria* for every subject (Komoski, 1987; Ridgeway et al., 1984). The nature of evaluation proved difficult and evaluating CAI requires more naturalistic approaches because of the idiosyncratic ways each school, and each teacher, applies it – this is what I call "situational vagaries". There are also suggestions that teachers should be the evaluators. Two questions that I raise here are: a) How do teachers select software for educational use after all this vast number of computer programs, and b) what are the criteria, if any, that teachers employ to select software?

One of the problems related to poor quality software and dissatisfaction on teachers part is that software is not being tried out with pupils (Patterson & Bloch, 1987; Jacobs, 1998; Dick, 1980), and that little empirical research is currently available on the specific factors that make educational software effective (Jolicoeur & Berger, 1986). Furthermore, the opinions of pupils – who, after all, are the reciprocates of the computer products – have been greatly ignored. In order to maximise the gains from technology in early childhood education, one has to explore the child's views of this technology, and how s/he feels about it (Klein, 1998). Robertson (1994) argues that if software is seen as boring, useless, unnatural, difficult to use, or generally inaccessible, it will probably be difficult to alter their impression in later years. In a nutshell, we cannot succeed to apply technology effectively and we will not ameliorate the poor quality of software unless we listen to what the pupils have to say about it, and we will not succeed in developing criteria unless we know what are the characteristics in software that pupils are satisfied with. Children do not have control over the content of educational material, print or electronic, but they have a lot to say of how this material should be delivered.

Of course the development of computer games belongs to companies who are not necessarily educators, therefore they need the collaboration with teachers and pupils. It is believed that there is a gap of communication between the three stakeholders –developers, teachers, and pupils (Ridgeway et al., 1984; Scaife, et al., 1997; Robertson, 1994) that enlarges the problem of dissatisfaction with the existing CAI applications. The best intentions of developers and members of school administration will have no effect if the teachers and the pupils are unable, or unwilling, to use systems as supplied. It has been argued that there is much to be gained from collaboration between software designers, teachers and children working in the classroom (Walker & Raynolds, 2000). Only recently the collaboration of the three stakeholders has been sought (Scaife, et al., 1997), but personally I have not come across any studies that involve the three stakeholders (teachers, developers, pupils), and any study that asks pupils opinions about elements in software. Another reason that makes this dialogue almost imperative to set up is that the use of computers in assisting teaching (CAI) is not likely to become widespread (Ridgeway et al., 1984). This study is the first to seek and find out what children have to say about elements in basic literacy software.

1.5. Aims

The above brief analysis of thoughts and arguments help the reader understand the problem and what initiated this thesis. Central themes of this study are basic literacy skills and technology (computer programs) to support the teaching of initial reading skills. Reflecting those themes, and the consequences that are implicated, the study has the following broad research aims:

A. To explore the use and selection procedure of initial literacy software in primary / nursery schools.
B. To explore young pupils' (KS1) thoughts on using basic literacy software and on the technical and instructional elements in such computer programs.

1.6. The structure of the study

The structure of this work closely follows the themes and research aims of this study, thus chapter 2 reviews the concept of initial / basic literacy. To clarify at this point that this concept (pre-reading skills) will not be investigated in any particular way; rather it will be used as a threshold to understand that the process of reading, as a cognitive process, is similar in traditional or computer-assisted modes of instruction. There are though certain differences in the way of delivering between the two kinds of instruction. Teachers have to select software the content of which matches their objectives. The process remains the same; it is the medium and its characteristics that change.

Chapter 2 starts with the nature of the reading process, it presents the prevailing reading theories, it proceeds with the initial literacy skills and how are they taught (methods of teaching reading). The pre-reading skills, of course, are not acquired easily by all learners, and the chapter explains what is the nature of reading difficulties and the causes. An indispensable part of teaching literacy is the National Curriculum (NC) objectives, and the National Literacy Strategy (NLS) that will be discussed at the end of the second chapter. Initial literacy skills can be taught of course through the traditional teaching mode, but the introduction of computers in education has caused some changes in school administration, but also it has alter the way teaching is delivered. I will deal with these themes in the following chapter.

The first part of Chapter 3 introduces issues related to ICT and its dual position, this is as a separate subject in the National Curriculum, and as an invaluable tool in teaching (ICT across the curriculum). It proceeds with the new responsibilities that has brought to schools namely, ICT policies, management of resources and teachers' training. The second part will explain what is CAI, its history, its types and characteristics, and it will conclude with research evidence in the use of computers and the subject to reading. But among the factors that will make CAI successful is the good quality of software. The next chapter will elaborate on issues related to evaluating educational computer programs.

Chapter 4 explores the construct of evaluation solely in relation to evaluation, the different approaches to it, the problematic issue of software, i.e. lack of criteria, and the outcome of poor quality. But in order to improve the quality of software designed to be used by young pupils and making it of pedagogical value requires the input not only from educators, but the input from young pupils in particular.

In Chapter 5, I will discuss issues of ICT and young children. At this stage, the literature review will have highlighted the research gaps that this study sought to address. The remainder of this thesis will concentrate on the empirical investigation undertaken, namely, the research methods employed, sampling and methods of data analysis will be covered and justified in Chapter 6 of this document. The results obtained as part of this inquiry, together with their associated statistical analyses, and the discussion with the conclusions will then be presented in Chapter 7 and 8 respectively.

Chapter 2. The development of basic literacy skills

Literacy is a complex cultural, psychological and linguistic activity (Strickland & Morrow, 1989). It is a broad term that can be defined in three levels: a) basic or initial literacy; b) required literacy and c) advanced literacy (Venezky, 1990, p. 11). This study puts aside issues and concerns that would belong to "required" and "advanced" literacy, and focuses on "basic" literacy. An essential aspect of basic literacy is the development of reading skills upon which further aspects of literacy develop and the learner becomes an independent reader irrespective of the medium that these skills are taught, these are traditional and electronic teaching methods.

The reading process remains the same whether it is taught through traditional or computer-assisted teaching. Therefore this chapter highlights issues relating to the reading process, the controversial reading theories and methods of teaching these basic skills and the current trend (phonics) to teaching those pre-reading skills. It moves then to the description of these skills, to reasons why some learners cannot acquire these skills and ends with a description of the National Literacy Strategy as the government initiative to raise all pupils reading standards in UK.

2.1. The nature of the reading process

It is acknowledged that reading is not a "natural" activity; rather it is intended and was invented by man over the years. Many researchers have attempted to define reading and their definitions are mainly influenced by the discipline they advocate. Initially authors emphasise primary the *decoding* ability in reading, this is the identification of graphic symbols. Progressively others emphasised the *encoding* ability - to understand written words. No matter how differently authors have tried to define reading the main point is that the reading process has a dual nature which involves both the above abilities decoding and encoding in order to accomplish its ultimate purpose, this is the reader understands written text. This makes reading a language and cultural process, and it is this writer's belief that among the various definitions the one given by Fryberg (1997) encapsulates more accurately the linguistic and cultural elements of the process:

"*Reading is communication between an author and a reader during which the reader accurately recognizes (word recognition) and interprets (comprehension) the graphic symbols which represent language and author's message*" (Fryberg, 1977, p. 32).

Reading is not simple a task. The abilities involved in reading - recognition of symbols (letters), sounds (spoken words), and grammatical rules (syntax) – do not function independently; rather they operate together to form a very complex form of communication (Gay, 1997). The development of reading presupposes the involvement of other cognitive skills, such as speaking, listening and writing, which constitute language, attention, memory and perception. This makes reading one of the most complex cerebral activities of human functioning that requires the involvement and coordination of multiple skills (Meyer & Rose, 1998). The same authors argue – based on brain PET scans – that the reading process is not only a complex but an individual process as well, meaning that each person learns to read in a different way, at different rates, and from different reading methods.

The reading process can be summarised by explaining the processes involved (Gay, 1997), such as a) perceptual processing, b) word recognition, c) syntactic processing, d) semantic processing, e) metalinguistic processing, and f) comprehension.

2.1.1. Perceptual processing

Smith (1973) claimed that reading is not primary a visual process; rather it depends on some information getting through the eyes to the brain, which he called *visual information*. In reading the eye receives waves of light energy that are transmitted to the brain as a series of neural impulses. Initially the written symbols may be perceived as sets of bars, slits, edges, curves, angles and breaks, but when reaching the brain these bars, angles or whatever are processed and words are identified (Weaver, 1980). By the time a word reaches the brain through the ocular and sensory processing, different mental activities take place in order to be recognised or identified. At this stage the memory systems play an essential role.

2.1.2. Word recognition

Fromkin & Rodman (1993) claim that words are recognised at two levels: a) the letter level and b) the word level. At the letter level, the child recognises the individual graphemes (letters) and their sounds (phonemic equivalent). The *beginning* reader (4-5 year old) uses only grapheme to phoneme correspondence, having to sound out words in order to string the individual sounds into a meaningful word, unable to recognise them automatically through their shape. Two skills precede this: knowledge of letters and knowledge that strings of letters (words) correspond to spoken words.

The *young reader* (5-7) learns to blend sounds together, or segment whole words into their individual sounds. These are processes that the *phonics* reading methods use, and it is arguably the way early instruction should occur. It is believed that up to 90% of less skilled readers have deficits in phonemic processing, where as 10% of the poor readers have a deficit in learning words from their shape (ibid). In parallel, a child also learns the shape of the words. This process is introduced by the *whole word* reading method. Once phonemic awareness has sufficiently developed, whole word approaches should occur.

2.1.3. Syntactic processing

Syntactic processing involves the ability to identify clauses, noun phrases, verb phrases, prepositional phrases, adjectives, articles, nouns, and verbs, and assemble them in syntactically acceptable sentences. During the second year, children begin to distinguish between actors, objects and verbs. By the time children are ready to read they are quite adept with syntactic rules in spoken language and seem to have learned them without effort. They can easily string words into a grammatically correct sentence (Gay, 1997).

2.1.4. Semantic processing

Ashcraft (1989) reported that semantic processing is developing before an infant begins to use words. Words initially begin with a single meaning, after they become richer as the child is exposed to a wide range of words and experiences, some of which may be the same but used in different contexts, and some of which are related to each other. Meaning is assembled in semantic networks in which words are inserted in classes, which is referred as "spreading activation". In reading, this occurs when a particular word is encountered that is related to another and in order to derive meaning we have to use the context. Spreading activation helps readers predict the words that will follow based on what has already been read. Semantic networks develop relatively late as compared to the other aspects of language and continue to develop throughout life as new things are learned.

2.1.5. Metalinguistic processing

Children gain metalinguistic skills through language growth. They exhibit rudimentary metalinguistic skills by the age of 3. These involve the ability not just to use language but to think about it, play with it, talk about it, analyse it, and make judgments about acceptable versus incorrect forms. As far as reading is concerned this cognitive process is exhibited by the children's growing appreciation of what a word is, the idea that things have names, but they are unable to isolate single words. Instead, they break the sentence into phrases, gradually, nouns, then verbs and finally articles etc. Another aspect of metalinguistic development is the child's ability to attend to and analyse the internal phonological structure of spoken words. By the age of 4 to 5 years children gain insight about sentences, words, and speech sounds, before they enter school (Snow et al.,1998).

2.1.6. Comprehension

Comprehension involves the use of all of the above processes, especially the semantic. Comprehension is the linking of new knowledge to the old, adding new links and modifying the strength of connections between nodes. In the early stages of learning to read, comprehension is hampered by limited capacity of processing space, attention, prior knowledge, and automization of processes, which make up skilled reading (Gay, 1997).

While researchers have managed to describe the process and the various cognitive skills involved it is not as easy to explain how do we acquire these skills. Although we know that most children can and do read, we do not understand exactly how this learning comes about. Various theories have developed over the last century or so, they made an essential contribution to understanding the reading process, but none of them provided a complete and accurate explanation for all the behaviours that are observed among readers (Wong, 1998).

2.2. Theories of reading development

The philosophies of reading development fall into two main camps, these are the "Bottom-up" and "Top-down" theories. The table below depicts the principles of the above theories summarised by Zakaluk (1982/96):

Table 2-1 The contrasting views of the two prevailing reading theories

"Bottom-up" theory	**"Top-down" theory**
1. Letters are transformed into phonemic representations	**1.** The reader samples the print
2. Phonemic representations are transformed into word representations	**2.** S/he makes predictions as what the word might be based upon prior knowledge of the topic and syntax
3. Words are assigned meaning	**3.** S/he reads to confirm the hypothesis
4. Words are combined into meaning-bearing sentences	**4.** S/he constructs meaning
5. Meaningful associations are formed	**5.** S/he assimilates new knowledge
6. Information is finally stored	

2.2.1. "Bottom-up" or word recognition-based reading theories

The bottom-up theory, which is also known as data-driven model, comprises aspects of Behaviourism and Cognitive psychology on reading acquisition. It contends that the reading process begins with letters and their sounds (phonics). Reading starts with the fixation of the eyes upon the print, the reader recognises the letter(s), then the phoneme(s) or sound(s), and then creates the word lexicon (mental dictionary), which in turn produces meaning (Rude & Oehlkers, 1984). This emphasises the need to translate:

- Written symbols to sounds
- Sound to meaning (Reid, 1998, p. 16).

The implications for reading instruction are that students need to begin reading by learning the letter names, associating the letter names with their sounds, and then be shown how to blend these sounds together into words. Bottom up theorists argue that the brain attends to every bit of available information. This is we read letter-by-letter so quickly that it becomes automatic. This model portrays reading as a linear process proceeding in serial fashion, from letters to sounds, to words, to meaning.

It is evident though that to pronounce the word "read" correctly in the present and past tense for example, the reader draws upon world knowledge and meaning as well as grammatical sense to facilitate word identification. Hence it is obvious that cognitive processing at higher levels influence lower or surface level processing. Reading thus seems to be interactive, rather than a linear process based only on letter perception (Rummelhart, 1977).

2.2.2. "Top-down" or comprehension-based reading theories

The top-down theory of reading, also known as concept driven, or the Psycholinguistic model, originates in Gestalt psychology. In opposition, the reading authorities of the "top-down" model perceive reading as chiefly "externally guided" and subscribe to a "hypothesis-test" model of reading development (Zakaluk, 1982/96). For these experts reading does not result from the precise perception and identification of the elements in a word (letters), but from skill in selecting the fewest, most productive cues necessary (Goodman, 1970).

The reader attempts to absorb the meaning of the text from the cues that are available. These cues can include:

- The context of the passage being read: this relates to the syntactic context, i.e. the structure of the sentence, and semantic context, i.e. the anticipated meaning of the passage;

- The graphic information available i.e. what the word looks like, the reader anticipates the word or sentence from these descriptive cues (Reid, 1998, p. 16).

Goodman's model known as the "psycholinguistic guessing game" asserts that good readers make efficient use of hypothesis-formation and prediction in reading thus the reader makes use of the contextual cues available to him or her. In addition, the efficiency in prediction of text means that good readers will have less need to rely on graphic cues and therefore do not have to process every visual characteristic of text. Advocates of this theory like Neisser (1967) and Smith (1971) asserts that word identification is not necessarily based upon prior letter identification, rather distinctive features directly provide the basis for word identification. In their view, readers are not only confined to one source of information – letters – but there are two other kinds of information available at the same time: semantic cues (meaning), and syntactic cues (grammatical or sentence sense).

The top-down model has been subject to powerful criticism by a storm of authors, like Stanovich (1988), Adams (1990), and others. The central tenet of the model that good readers are dependent on context for word recognition is inaccurate. The counterargument suggests that it is poor readers who depend on the context. Good readers do not need to do so because they possess efficient word recognition skills and can recognise words effortlessly. The effort required for poor readers to recognise words reduces their cognitive capacity for comprehension. Moreover, there is considerable evidence (Adams, 1990) that good readers actually fixate nearly every word as they read.

2.2.3. Interactive compensatory model

As it has been discussed above, both top-down and bottom-up models have limitations in relation to understanding the reading process, and because clearly readers draw upon both these processes when reading (Reid, 1998).

The interactive model acknowledges that reading involves recognising words based on information provided simultaneously from both the text and the reader, and as proposed by Stanovich (1988) focuses on the following assumptions:

- Readers use information simultaneously from different levels and do not necessarily begin at either the graphic (bottom-up) or the contextual (top-down) level;
- During their development of reading skills, pupils may rely more heavily on some levels of processing than on others, e.g. they may use context to greater or lesser extents;
- The reader's weaknesses are compensated for by his / her strengths (Reid, 1998, p. 18).

The various theories of how we acquire the reading process have influenced the reading instruction and reading methods accordingly, so different competing instructional models have been developed.

2.3. Instructional models in reading

I have mentioned previously (see 2.1.) that reading involves two activities *decoding* and *encoding*, hence the various models of instruction influenced by the reading theories set out to teach these different but intertwined activities.

2.3.1. Basal reading programs

In the 1950s, there was basically one approach to teaching reading, this was the basal reader. Basal readers all used "directed reading activity", this is background building and vocabulary development prior to reading, guided silent reading followed by questions and oral rereading, and a series of post-reading questions (Stahl, 1997). Reading is viewed as a concatenation of skills dividing the reading process into a sequenced series of skills and sub-skills. These skills are taught and reviewed through direct teaching and workbook practice, every lesson bracketing each story. Comprehension was synonymous with question answering. In this perspective, "reading" was thought of accurate word recognition and the ability to answer questions about what it was read, and "instruction" was what was done to facilitate word recognition and question answering. The implicit assumption of these programs is that reading instruction involves the mastery of all the skills taught (often more than 300 or more):

- Through exposure to those skills practiced in isolation in workbooks, and
- Through their reading of stories in the book.

2.3.2. Direct instruction (DI)

These models were originally developed to teach decoding and did so through a task analysis. The same strategy was applied to comprehension and problem solving. Instruction begins with a task analysis of the target behaviour, which is then used to design the instruction. DI proponents view reading as a process composed of isolated sub-processes or identifiable sub-skills that when taught directly, will improve children's reading ability. It is a skills-oriented teaching approach to phonics based on a behavioural analysis of decoding (Kameenui, et al., 1997), and the teaching practice it implies is teacher-directed. The teacher is in control for two reasons: the first is that s/he has to proceed with the official agenda in order to cover the curriculum (Wells, 1998), and secondly the nature of the curriculum for teaching beginning readers is memorizing *facts*, the language codes, that children would be able to reproduce and generalise.

Reading instruction is seen as using a set of procedures to teach pupils each of these sub-processes. These views are rooted in behaviourist psychology in which complex tasks are broken down and each component is taught using contingency management until it is mastered. These components are chained together to get the larger behaviour. In short, direct instruction models:

- Break language down into components that are taught in isolation, not in meaningful context;
- Are highly teacher directed, allowing pupils little choice in what is to be learned and how it is to be learned, and
- View the acquisition of literacy as highly "unnatural", requiring systematic instruction, rather than absorption (Stahl, 1997, p.3).

In relation to teaching basic reading skills, the task of decoding is broken down into its component parts, and each of these parts is taught carefully and deliberately. Teachers model the desired behaviour, provide ample practice and feedback at each step, and assess whether further teaching is necessary.

Instruction proceeds from letter sounds to blending to reading words in context. The material is level and not age appropriate. The lessons consist primary of sequences of stimulus-response pairings and aim to teaching mastery –pupils do not move on until they understand the material. Learners are taught letter sounds – not letter names at least in the beginning – through highly structured instruction using cuing and reinforcement (immediate feedback and correction) procedures derived from behavioural analysis of instruction.

There is a substantial body of research supporting the use of DI for early childhood teaching in the websites of the Association for Direct Instruction and its associated University of Oregon ADI, as well as in the Wisconsin Policy Research Institute Report (2001). Additionally, the study of Schaudt (1987) concludes that the use of a direct instruction approach to the teaching of reading has produced greater gains on reading tests than less structured methods largely because it increases academic learning time, which has been shown to produce gains in achievement. Also, it is widely supported that DI is effective for pupils with reading difficulties (Wisconsin Policy Research Institute Report, 2001). Kammenui & Simmons (1990) wrote a book about how to use DI with pupils who face reading problems or pupils at risk, where they suggest instructional stategies. What is interesting is that DI is re-emerging in regular education and kindergarten classes as well (Stahl, 1997). Such an example is the Literacy hour, where phonics and sight words are the main features of instruction.

Practice takes place in order for pupils to consolidate skills and increase fluency of their execution. Practice on component skills (decoding) in reading is particularly important. Actually the whole process of reading is based on an efficient amount of practice and is the most common way to increase reading fluency (Reitsma, 1988). Moreover reading comprehension depends critically upon the fluent execution of sub-skills "verbal efficiency", such as word decoding and identification of meaning of individual words (Perfetti & Lesgold, 1997) provided that it is done within small texts.

Unlike earlier versions, the current use of direct instruction includes also metacognitive explanation of the importance of the strategy; how, when and where it is to be used, and when its use is not appropriate. Direct instruction is but *one* way in which a teacher can assist pupils in extending what they understand and are able to do.

Similar to direct instruction is the *explicit explanation* model (Garcia & Pearson, 1991). Just like DI, it involves modelling and greater emphasis on practicing the *strategy* in the context of reading text, and greater concern with gradually releasing the responsibility for the execution of a strategy. The focus of instruction is on leading pupils to make this transfer. Initially, the responsibility of using a strategy lies largely with the teacher, and by the end the pupil executes the strategy independently.

Explicit explanation models of instruction focus on a single strategy at a time assuming that the strategy will be used along with other strategies when reading. Even when multiple strategies are taught, they are taught one at a time (Gaskins & Elliot, 1991). The assumption is that children need to learn the target strategy as an end in itself so that it can be evoked at an appropriate time during reading. This contrasts DI whose goal is that the strategy be overlearned so that it can be executed automatically.

But the problem with this model is that it is new, and it is difficult to draw conclusions about its effectiveness. We also notice that this model talks about *strategy* and not *skills*. Skills are cognitive process that are executed automatically without the reader's conscious effort (Paris et al., 1983). In contrast, strategies are deliberately chosen and applied to a reading situation. Since this thesis is interested in basic literacy skills, and because skills are best performed automatically, it is not clear from the research that explicit explanation models would be useful (Stahl, 1997).

2.3.3. Cognitive apprenticeship

The teacher's role in such models is to scaffold the learning, withdrawing support as pupils are able to proceed on their own. Just like an apprentice first watches the master doing a skilled craft, so does the pupil. Initially the pupil observes the teacher as s/he models the processes of comprehension and gradually gives more and more responsibility to the pupil until it is the teacher who watches the pupil.

Such teaching models emphasise the meaning of a text through social interactions. Interacting with the knowledgeable other, pupils learn how an expert orchestrates the processes involved in comprehension (Garcia & Pearson, 1991). Teacher and pupils may read a text together, with the teacher providing as much support as necessary for the pupils to successfully work through an increasing complex text, but do so using social interaction as a mediator. This is instead of a teacher-dominated class structure, such models usually involve small groups working together – cooperative learning, reciprocal teaching and collaborative problem solving. The importance of social mediation is rooted in a social constructivist view of knowledge relying on Vygotsky for theoretical support.

While explicit-explanation models focus on a single strategy at a time, cognitive models teach multiple strategies simultaneously (Palincsar & Brown, 1984), for example, groups of pupils are taught to summarize, question, predict, and clarify while reading. It is argued that isolating a strategy distorts it, making it difficult to use in "real" reading (Stahl, 1997). In contrast to direct instruction models, teaching is performed using authentic texts for authentic purposes.

Just like the explicit explanation models, cognitive apprenticeships are too recent to have been fully evaluated especially in terms of basic literacy skills. Rosenshine & Meister (1991) found that such models are most effective when combined with direct teaching. On the other hand, direct instruction programs are most effective when combined with wide reading in tradebooks (Meyer, 1983). While apprenticeship models are effective with the comprehension part of reading, there is no evidence yet to the effectiveness of using such models with teaching basic reading skills. What the above suggest is that effective instruction requires a melding of the different models. Because teaching involves multiple goals, different models are best to different goals. They should not be thought of as discrete approaches, but as points on that continuum.

2.3.4. Whole language

The whole language approach is difficult to define. Bergeron (1990) investigated articles that used the term to examined commonalities among definitions. She found that whole language was defined differently in each of the 64 articles she reviewed, and that little consistency was found among the provided definitions. Nevertheless, there are beliefs that are shared among the whole language practitioners. Among these are that children will learn language (oral or written) best if it is learned for *authentic purposes*. The postulation is that oral language is learnt without direct instruction because it serves a purpose for the learner. Young children learn to talk because they can see that talk fulfils a function for them. Children will learn to produce written language if they also see it as functional.

In the classroom this involves, using authentic reading and writing tasks, using whole texts, not looking at parts of language (e.g. sound-symbol correspondence) for their own sake, and not using artificial tasks, such as work sheets or specially adapted stories found in basal reading programs. Written language is a parallel form to oral language differing only in mode. Though learning starts from the whole, it may proceed to an analysis of the parts of language, but only if necessary (Stahl, 1997). Whole language advocates view reading as a problem-solving activity (Goodman, 1989) with a great deal of reference to discovery and risk taking. Pupils learn strategies that they feel they need to accomplish a desired literacy goal.

There is also the belief that child-centred learning is empowering children to direct their own learning. Instruction should occur not when the teacher plans it, but in response to pupils' needs as they are attempting to use language for communication. The whole language movement has had a pervasive influence in elementary classes, but whole-language theorists make it clear that whole language is not a collection of activities or "method", but it is a philosophy underlying all the teacher's instructional decisions. The difference between cognitive apprenticeships and whole language is that in the former there is a lot of teacher planning and control initially, where as in whole language the teacher's role is to "lead from behind" (Newman, 1985). In practice both models share the following:

- ➢ They both treat the task of reading holistically. They do not break it down into sub-skills, nor do they teach these sub-skills in isolation.
- ➢ They both stress the higher levels of thinking.
- ➢ They both use social interaction (Stahl, 1997, p. 11).

The discussion in the previous paragraphs shows the epistemology of the different instructional models that have been developed influenced by the various theories of learning and how reading is acquired. In relation to the instruction of basic literacy skills, we find that the most prevailing are direct instruction and whole-language models. These models in turn led to the development of various teaching methods / activities to reading, namely phonics and whole word that will be explored next.

2.4. Methods of teaching reading

Reading method is a set of teaching and learning materials and / or activities used by classroom teachers to teach reading. Each of the reading theories has developed different reading methods, which in turn have influenced teaching and the teaching materials (Fryberg, 1997). The most popular methods employed by classroom teachers are: phonics, whole-word, or the language experience approach (look-and-say).

2.4.1. Phonics method

Phonics, or the association of sounds and symbols, was popular from 1830 through 1920s. Advocates of phonics are concerned about helping beginners become independent readers as soon as possible by emphasising the importance of phonology and the sounds of letters and letter combinations, letter- sound correspondence in order to sound out words. The purpose of phonics is to teach pupils how to pronounce "unknown" words. If children are able to analyse words and segment them into parts, they should be able to recombine them into new units, transferring thus the knowledge of decoding unfamiliar words. Through this method pupils can get close to the sound of a word and, through that to its meaning.

Phonics gives pupils strategies to unlock or decode words and because of its structured nature it can help children who have an obvious difficulty with mastering and remembering sound blends. The disadvantage is that it could increase the burden on pupil's short and long-term memory by increasing what the child needs to remember (Reid, 1998; Wong, 1998) since such programmes teach children to distinguish the 44 phonemes or sound units of English. Chall & Popp (1996) emphasised that phonics is highly meaningful if taught well. Stahl et al. (1998), based on recent research and common sense, suggested principles that should be included in good phonics instruction through a balanced approach (pp 339-344) that will be discussed below. What seem to work best in phonics are two instructional activities: *tutorial instruction* and *practice* (Reitsma, 1988), and others strongly advocate the use of *direct instruction* (Chall, 1983; Stahl et al., 1998; Sanders, 2001; Hayes, 1991) discussed previously.

Phonics instruction can begin as early as kindergarten, as long as children have an appreciation of the functions of print and books, are familiar with printed letters, and understand that spoken words are composed of sounds (Houghton Mifflin, 1997). What research has shown is that pupils who learn to read in Kindergarten are found to be superior in reading skills and all other educational indicators measured as seniors in high school (Hanson & Farrell, 1995). The researchers concluded that no negatives effects are found from learning to read in the Kindergarten.

2.4.2. The whole-word approach

The method uses much of children's own talking and writing experiences as resources for reading. Advocates of this approach believe in helping beginners learn to bring their own knowledge and experience to bear in getting meaning from the printed word. To do this, teachers start with the language and experiences of the children, this is teachers have children tell them stories of their favourite activities. This approach engages the child in the process of going from thought to speech and then to encoding in print and from print to reading. Approaches to teaching whole word can include:

- Teaching reading and writing throughout the day in the context of the lesson topics, and
- Teachers emphasising storybooks rather than worksheets as well as multiple writing opportunities (CCLD, undated).

Another approach to whole word is the "Look-and-say" or "Sight words". This whole word method was popular from 1930 until 1960, and superseded the phonics approach. It is based on the understanding that reading is finding the meaning in the written language. The advocates of this approach stress helping children develop a stock of basic words, such as *I, and, the*, that children can easily recognise on sight (sight words). They argue that if children can begin with a stock of about one hundred basic sight words, they will be able to read about half the words in any text they might encounter. The emphasis is on meaningful units of language rather than sound of speech.

However, some of the same activities may occur in classrooms that use different "methods." For example, teachers in both code-emphasis and meaning-emphasis programs may use phonics lessons, read books aloud to children, and have children take home books to read. Whole language teaching methods are also concerned with helping children acquire an understanding of the relationships between sounds and letters – the difference lies in how this goal is to be achieved (Stokes, undated). Those responsible for reading instruction must realise that some children need this instruction, some need a little assistance in developing word identification strategies, and some seem to learn to read without instruction. However, even with children who seem to learn to read automatically at an early stage, it is suggested that they have opportunities to develop letter / sound / word concepts and had been encouraged to respond when stories were read to them (Burns, 1986). Whole language advocates, such as Church (1996), Goodman (1993), and Routman (1996), do not deny that the phonics approach has a distinguishable role to play in teaching early reading skills, and argued that whole language teachers should be teaching phonics and that decoding instruction has always been part of whole language teaching:

"*It would be irresponsible and inexcusable not to teach phonics.....but I do not know a knowledgeable teacher who does not teach phonics*" Routman (1996, p. 91).

The difference is that programmes that focus too much on the teaching of letter / sound relationships and not enough on putting them to use are unlikely to be very effective (Roller, 2000).

The advocates of the previously discussed reading theories, instructional models and methods of teaching reading reached polarised views mainly because they speak different languages and use poor channels of communication (Harrison & Coles, 1992) fact that initiated the "reading war". The debate has been going for a long time, since 1840 (Sanders, 2001). It continues to the present day with switching periods where phonics and whole word methods were used replacing each other. In the mid-1990s though the pendulum began to swing back toward phonics once again mainly because of:

- The contribution of Chall "Learning to read: the great debate" published first in 1967, reissued and revised in 1983 and 1996;
- The work of Marilyn Adams's work published in 1990 as "Beginning to read: thinking and learning about print", which actually is the continuation of Chall's work;
- The report of Snow, Burns & Griffin in 1998 "Preventing reading difficulties in young children" Finally, the congress legislation in 1985 that enabled the National Institute of Child Health and Human Development (NICHD) to improve the quality of reading research by conducting long-term prospective, longitudinal and multidisciplinary research.

Studies of the last decade or so (Bond et al., 1984; Lovett et al., 1994) have shown that there is no *one* best way to build pupils' literacy skills rather a combination of methods develops reading capabilities better than does any one method alone. Although there is controversy about how to teach children to read, there seems to be a growing consensus on the fact that the great majority of teachers use phonics at some point, even whole language advocates, provided that units (words) are taught within meaningful texts. The International Reading Association (IRA, 1999) posed a statement to clarify its stance on methods for teaching beginning reading claiming that there is no single method or single combination of methods that can successfully teach all children to read and suggests teachers to create the appropriate *balance* of methods needed for the children they teach.

2.4.3. A balanced approach

In recent years, a new philosophy of reading instruction has evolved proposing the need for a balanced approach to instruction. A balanced approach to teaching beginning reading means a swift choice on the teachers part to select and apply reading material that best fits to his/her classroom pupils using multiple methods and not eclecticism. Secondly, sound and effective beginning reading programmes must incorporate a variety of activities from different reading methods in order to give children positive attitudes towards literacy, as well as strategies and skills to become successful readers. This means that a number of important sub-skills that contribute to the reading process need to be acquired at an early stage. Finally, a balanced approach involves programmes that combine skills involving phonological awareness and decoding with language and literature-rich activities. The skills that beginning readers must acquire are discussed in the following paragraph.

Though there is a great deal of controversy on how reading takes place and what instruction or method to be used, there is less controversy about what are the pre-reading skills that young children need to learn. This will be elaborated next.

2.5. Basic / initial literacy skills

In order for pupils to become advanced readers they have to acquire certain basic skills. The principle task that they must acquire is word identification since words are the foundation for reading and the decoding of these printed symbols must be included in the reading instruction. The second major achievement is comprehension that is facilitated by decoding.

2.5.1. Decoding

For reading to develop proficiently, children need to become aware of the alphabetic principle, that there is a systematic relationship between letters and sounds (Snowling, 1996).

The alphabetical principle

Developing this principle children become aware that letters in words may stand for specific sounds. This awareness helps pupils learn more about letter and their sounds, as well as the form of each letter. The advantage of this skill is that it provides learners with a mental symbol system for representing and thinking specific phonemes (Hohn & Ehri, 1983), which enables pupils to acquire the phonemic segmentation or phonological analysis skills. Gradually this will help them learn more about complex orthographic elements such as consonant blends, consonant and vowel digraphs, diphthongs, and phonograms.

Beginning readers should perform these tasks without conscious effort (automatically) in order to recognise words fluently and analyse them (Adams, 1990). Knowing the names of the letters is one of the best predictors of reading (Chall, 1996; Adams, 1990; Reitsma, 1983). In fact children who are slow in recognising and naming letters, later have been found to have difficulty in learning letter sounds (Ehri & Robbins, 1992), and in recognising words (Mason, 1980). Moreover pre-readers letter knowledge was found to be the single best predictor of first-year reading achievement (Bond & Dykstra, 1997). The NAYEC guidelines and the IRA clearly state that learning the alphabet plays an important role in the development of literacy skills (Wasik, 2001).

Hohn & Ehri (1983) rebuffed the statement that teaching segmentation with alphabet letters confuses readers, on the contrary it helps learners distinguish the correct size of the sound units to be segmented, beginning readers exhibit less difficulty in learning to break blends up into phonemes, and it helps pupils to remember the sounds they are segmenting. There is no research to determine the best order for introducing letters. Some programmes start with easily pronounced letters (*m*, *n*, *s*) and proceed to teach consonant and then vowels, and others do not require the names of the letters. What it is emphasised is that when young children are taught the alphabet using rote memorisation, or other methods devoid of context, they do not benefit from this instruction. Though it is a necessary condition for full mastery of reading, it is not sufficient (Byrne & Fielding-Barnsley, 1989). It does contribute though to the development of phonemic awareness that is one side of the phonological awareness skills.

<u>Phonological awareness (or sensitivity)</u>

Phonological awareness refers to the use of phonological information, especially the sound structure of one's oral language, in processing written and oral information (Wagner & Torgesen, 1987). It is necessary for the pupil to know the phonological structure of words in order to discover that the print represents the sounds of the language. This shows the bi-directional relationship between learning to read and phonological awareness (Perfetti et al., 1987).

This knowledge of the segmental structure of a spoken word involves two distinctive skills: a) the *phonemic awareness*, or else *phonological analysis* or *phoneme segmentation*, and b) *phonological synthesis*. The first involves the ability to isolate individual phonemes (sounds) within words. In contrast phonological synthesis involves the ability to combine a sequence of isolated phonemes together in order to produce a recognizable word. Both of these skills enhance the decoding ability in young readers, which constitutes the basis of word recognition and reading (Snow et al., 1998).

Examples of such tasks in reading would be the identification of words with similar beginning (*mat* and *mow* start with the same sound), or ending sounds (*bus* and *house* end with the same phoneme), or indication of how many different phonemes are there in words of different lengths (*boot* has four letters *b/o/o/t*, but three sounds *b/u/t*). What is important to remember is that the ability to combine individually presented phonological segments into words (*phonological* *synthesis*) emerges earlier in development than the ability to identify the individual segments within words presented as wholes (*phoneme awareness*). This is documented by Torgesen & Morgan (1990), and the study of Torgesen, Morgan & Davis (1992). Phonemic awareness enables beginning readers to understand that:

- The phonemes the letters represent are separate segments in their respective words.
- The same phonemes also occur in other words.
- The particular association between the distinguishing letters and phonemes in the word (Byrne & Fielding-Barnsley, 1989, p. 320).

The first two insights are aspects of phonemic awareness, where as the latter is letter-sound association. The above authors suggest that both of the above insights are needed in order for children to develop the alphabetic principle. The alphabetic principle requires the development of phonemic awareness (Byrne & Fielding-Barnsley, 1989, 1990, 1993; Kirtley et al., 1989). This means that the alphabetic principle and phonemic awareness do not have separate identities and the implication for classroom instruction is that they have to be taught in parallel since it is a twofold process.

Another implication is that beginners learn to segment better when they are provided with visible models of the component sounds in the pronunciations of words. In other words, phonological skills should not be introduced as an oral analytic skill before children are introduced to print; rather children may learn much about the phonetic structure of words when they learn how to interpret spellings as maps for pronunciations (Ehri & Wilce (1979, 1980). The study of Byrne & Fielding-Barnsley (1993) showed that young readers who were trained in phonological awareness skills enhanced reading real words and pseudowords, and spelling by developing and understanding the phonological structure of words. The studies of Bryant & Bradley (1985) and Mclean et al. (1987) have shown a strong relationship between a child's phonological awareness and that child's progress in reading.

Onset and rimes

Phonological awareness skills help young readers become aware not only of phonemes, but also of the syllabic structure of language (rhymes, onset and rimes). Onset and rime were coined by Halle & Vergnaud (1980). The onset consists of the opening consonant or consonant cluster and the rime of the following vowel and end consonant, if there is one. So in the word *cat*, *c-* would be the onset and *-at* the rime. Or, *cr-* would be the onset and *-isp* would be the rime in the word *crisp*. It is supported that young children can segment a word on the onset and rime level, and that onset and rime play a considerable role in the development of children's phonological awareness, at least between the ages of 5-7 years (Kirtley, et al., 1989). Developing those skills pupils can perform rhyming tasks. Rhyming is a relatively easy skill for children and involves categorizing words by rime. These abilities enable beginners to identify the odd word(s) out of a list (*lip*, *tip*, *hop*), to detect rhymes (*brain-train-vain*), to count syllables, which make them sensitive to both regularities and irregularities in orthography (Stuart & Coltheart, 1988).

Goswami & Bryant (1990) proposed that rhyme awareness develops before learning to read and might be considered a precursor of reading development. Morais (1991) in contrast showed that phonemic awareness follows the acquisition of literacy and is required for spelling from the beginning. Both of the studies state that there is a specific link between rhyme awareness and reading. Later, Goswami & Meed (1992) demonstrated that children trained in onset-rime awareness at the very beginning of reading development could use *analogies* in their reading. Given a clue word *beak*, children could use this to read words sharing rime segments, (e.g. *peak*, *leak*) better than control words that were similar visually without orthographic analogies e.g. *bank*.

There is increasing evidence that skilled decoders do not sound out letter by letter when they encounter an unfamiliar word, but rather they recognize common letter chunks, such as the recurring blends (e.g, *sh*, *br*), prefixes, suffixes, Latin and Greek root words, and rimes (e.g. *–ight*, *–on*, *–ime*, *–ake*) of the language (Ehri, 1992). Fluent readers thus would not sound out the pseudoword, or else nonsense word *dight*, but they would recognise the *–ight* chunk automatically and blend its sound with the beginning *d* sound. The ability to recognise recurring word chunks, and use them to sound out words, is present to some extent even in 4-year-olds, or beginning readers who are just learning to decode (Goswami, 1998).

It is important to mention here that there is a link between analogies and phonemic awareness. Ehri & Robbins (1992) drew attention to the possibility that onset and rime strategies were dependent upon letter-sound decoding ability. Similarly, Walton (1995) reported that phoneme identification improves kindergarteners' ability to use rhyme analogies. Further more, analogy strategies depend on prior establishment of an adequately extensive sight vocabulary (Savage & Stuart, 1998). Children must be familiar with more than one word containing the appropriate rime unit.

The above findings lead one to conclude that onset and rime skills presuppose some phonemic awareness and a considerable sight vocabulary, therefore it can not be considered a beginning reading strategy. It may help to highlight regularities in English spelling. The critical examination of sixty-one experimental studies by Mcmillian (2002) showed interesting findings, and she views cautiously claims, such as rhyme is related to and determines reading ability, or rhyme awareness leads to phonemic awareness. She presents evidence that beginners are able to learn letter-sound correspondences at the same pace whether teaching is focused on phonemes in the onset position only, or on phonemes in all positions of a word. Since it is a relatively recent piece of information it is interesting to see the responses of the onset and rime advocates. The truth though is that Snowling (1996) found such evidence – that rime is in fact the optimal unit for teaching purposes, scanty. On logical grounds, she proposed that rimes are important for two reasons: a) decoding larger phonological chunks reduces the memory load involved; b) in the English language, there is greater orthographic regularity at the rime level than there is at the phoneme level.

Sight word recognition and fluency

Beginning readers do not only use the *decoding* and *analogy* strategy (see above) to read words. A different way is *by sight* (Ehri, 1997; 1995) especially when it contains letters that deviate from the conventional spelling system. The term "sight" indicates that sight of the word triggers that word in memory, including information about its spelling, pronunciation, and meaning. There are still words that need to be taught as sight vocabulary because they do not fall in any "sound blending" category, such as *one, and, many*. Children read these words as whole units within one second of seeing them, with no pauses between sounds. Irrespective of the way young readers approach printed word, they need to be able to read words quickly and effortlessly because gaining *fluency* entails rapid and automatic word identification (LaBerge & Samuels, 1974).

LaBerge & Samuel were the first authors to propose the model of *automatic information processing* in reading. They argue that to develop reading proficiency, cautious attention is first needed in order to recognise words. If word recognition consumes too much mental attention, then the extra effort taken in recognising words will detract from comprehension at sentence, paragraph, and text levels. This proposal has been further elaborated by Perfetti (1985) and Perfetti & Lesgold (1977) as "verbal efficiency theory", which emphasises rapid automatic decoding as a primary factor in reading comprehension. If pupils stumble over or decode slowly too many words, comprehension will suffer (Samuels et al., 1992).

I have said previously that reading consists of decoding skills and linguistic comprehension what Gough & Tanmer (1986) have called the "simple view" of reading. In this view, decoding skill is independent of comprehension in that it involves the ability to read pseudowords. Likewise comprehension is independent in that it operates similar to listening. However, there is evidence to suggest that decoding is not independent of linguistic comprehension. Oaken et al. (1978) stated: "a high level of identification skills may not be a sufficient condition for adequate reading comprehension" (p. 72). They found no improvement in reading abilities of poor readers after they received word identification training independent of context. The studies of Fleisher et al. (1979) and Rayner & Pollatsek (1986) that training a child to say words quickly will not necessarily result in improved comprehension. But the most recent study of Tan & Nichloson (1997) that took up the study design of Fleisher et al. (1979) found a causal (not correlational) relationship between rapid and accurate decoding and reading comprehension and that training words in context is sometimes more effective than single-word training.

There is evidence that less skilled and beginning readers do not recognise words as efficiently as do skilled readers (Gough, 1993; Ton & Nicholson, 1997). This may be because the former have not developed efficient decoding skills yet and rely a lot on context cues to help with word recognition (Nicholson, 1991; Stanovich, 1986; Gough, 1993). The above provide some justification as to why sight word instruction has been seen as an ineffective technique. Sight words alone will not provide the basic skills required to become a good reader, although it is possible to improve speed and accuracy of specific word recognition (Lovett et al., 1990). Pupils must first acquire the ability to decode (Vellutino, 1990). Fluency, which is characterised as the intersection of accuracy and speed in reading, presupposes good phonological analysis skills, as well as sight word vocabulary (Rashotte & Torgesen, 1985). What sight words can do once decoding skills have developed is provide opportunities for practice and overlearning.

Practice and repetition

Sight word recognition skills and fluency in general involve practice that helps readers recognise individual words rapidly and effortlessly. Repeated reading (RR) can provide pupils with necessary practice in word recognition fluency and speed (Herman, 1985; Rashotte & Torgesen, 1985; Dowhower, 1987). Not also to omit that repetition and practice are the most effective interventions for poor readers (Sanders, 2001). In general, the repeated reading procedures have fallen into two categories: a) those in which reading of the passage or word is modelled either live by the teacher or assisted by the audiotape or the computer, and those in which there is no modelling. Pupils read independently. In order to build fluency, children read an easy, short passage three of four times or until a satisfactory level of fluency is reached before proceeding to a new passage.

The view that reading is a skill that will be learned mainly through actual reading is implicit in several theories of learning to read (Perffetti, 1985; Stanovich, 1986; Torgesen, 1986). Actually, reading instruction is often equated with providing opportunities for practice (Topping, 1995; Dowhower, 1987; Duffy & Roehler, 1982).

But the RR concept is not new in the field of reading education. In fact, William James realised the importance of practice on the development and execution of a skill (Herman, 1985). Similarly, Huey (1908 / 1968) described the procedure as a reading method:

"*...Practice, however, progressively frees the mind from attention to details and makes facile the total act, shortens the time, and reduces the extent to which consciousness must concern itself with the process* (Huey1908 / 1968, p. 104).

He contended that many children were learning to read by simply practicing text over and over until they could read it fluently. The method is based largely on the teaching implications of the theory of automatic information processing in reading (LaBerge & Samuels, 1974). There is little empirical research though as to how improved fluency obtained through RR of the same passage is transferred to a new passage. The study of Rashotte & Torgesen (1985) found that improved fluency and comprehension among non-fluent LD pupils depend on the degree of word overlap among passages. The word commonality among stories affected the gains in reading speed. Interestingly, LD pupils liked this one-month RR method and the general feedback format regardless of the degree of improvement.

Dowhower (1987) conducted a study with 52 second graders who were slow in word-to-word reading and accuracy, but adequate in decoding of words. She applied a RR experimental intervention program that included six basal reading stories for seven weeks. The result of this investigation is that repeated reading "worked". Pupils learned to read a passage faster, more accurate, and with more understanding. The findings substantiate claims that comprehension is positively affected by RR (Tan & Nicholson, 1997). Also, the study of Herman (1985) indicated that non-fluent intermediate pupils benefit from repeated readings, namely, rate of reading, number of speech pauses, and amount of accuracy. These factors would also transfer to new unpracticed stories.

The repeated readings (RR), as an extension of classroom reading experiences, allow children time to integrate the reading skills to which they have already been exposed and to recognise words with greater speed. Further, once pupils are familiar with the procedure, they can pursue it on their own with a tape recorder or a computer program. But what the above studies show is that the pupils involved were pupils who had some kind of word recognition problems that affected their accuracy and speed. The implication for teaching reading is that not all pupils require RR. Fluent readers would find it terribly boring. The key for the teacher is to identify which pupils need to engage in repeated readings: the less able readers, the less fluent.

2.5.2. Encoding or comprehension

Comprehension is the ultimate goal of reading and it involves a number of lower order (i.e. decoding and vocabulary) and higher order processes (word meaning and background knowledge) specific to reading. Thus far, I have explained the necessary skills that help beginning readers and readers who show difficulties with print to develop word recognition. Reading though, as it has been defined in this thesis, is the ability to understand words. Children are taught to read so that they can understand what is in text. What matters in reading instruction matters because it ultimately affects whether the pupil can comprehend what is in print.

In the above discussion, I have presented evidence of the importance for children to be taught graphemic-phonemic relationships and the blending of such cues to read words (decoding). Once sounded out, the child can recognise and understand the word. Thus researchers assume that if pupils can decode words they will understand them (Gough & Tunmer, 1986). An extension of this line of reasoning is that if the reader cannot decode a word, s/he cannot comprehend it (Adams, 1990; Metsala & Ehri, 1998).

I have also mentioned the importance of analogies. The work of Ehri (1992) and Goswami (1998) suggest that the development of skill in recognising word chunks should have a positive impact on understanding words. Both process (recognising and comprehending a word) occur within a short-term memory which is limited in its capacity (Miller, 1956). Thus the more effort required to decode a word, the less capacity is left over to comprehend it (LaBerge & Samuels, 1974). Similarly, the study of Breznitz (1997) gives support to this evidence for dyslexic children. Hence, the more automatic decoding is, the better is the understanding of the word. What is important is that learners should be encouraged to recognise word automatically. The study of Tan & Nicholson (1997) concluded that rapid recognition of words improves reading comprehension.

As far as vocabulary is concerned, there is experimental data making clear that a more extensive vocabulary promotes comprehension. The study of Beck et al. (1982) found the group of children (4^{th} grade) who were taught 104 new vocabulary words over a period of 5 months, at the end of the intervention their comprehension tended to be better than the control group. The intervention though included words that pupil often encounter and these words were used in multiple ways as part of the instruction. What is crucial in the link between vocabulary and comprehension is that pupils make deep and extensive connections between vocabulary words and their definitions, that is when teaching requires pupils to use the words in multiple ways over an extended period of time (Beck & McKeown, 1991).

Although vocabulary can be explicitly taught, most vocabulary words are learned incidentally as encounters in context (Sternberg, 1987). This is one reason why people who read a great deal have extensive vocabularies. This is also another reason why children who are exposed to reading stories develop their vocabulary (Dickinson & Smith, 1994; Robbins & Ehri, 1994). Another issue related to word comprehension is the pupils' background knowledge. Mature readers know much about the world and such prior knowledge (schemata) affects comprehension. Schematic processing affects comprehension from early life. Even young children develop schematic representations for recurring events in their lives

(Bauer & Fivush, 1992), and such knowledge permits them to draw inferences from stories that include information related to their schematic knowledge, such as bedtime, dinner, birthdays and the like. Thus the richer a child's world experiences, the richer the child's schematic knowledge base. When readers encounter words or ideas in text that relate to prior knowledge (schemata) there is the possibility of activating that prior knowledge, which is then used to comprehend the current text. One of the important findings is that skilled readers do not make inferences unless understanding of the text demands them (McKoon & Ratcliff, 1992). In contrast weak readers relate the text they are reading with prior knowledge that is not directly relevant to the most important ideas in the text, making unwarranted and unnecessary inferences (Williams, 1993). This is why it is important that words we teach in beginning readers should be familiar with their experiences.

The information about reading and its aspects is vast since it is the most researched field in education. It is impossible in this thesis to cover everything rather the focus was to describe the basic literacy skills that children must acquire in order to became proficient readers and to substantiate the benefits of those skills with indicative research. Some children seem to acquire basic reading skills independently, before they receive formal reading instruction at primary schools, although some may receive help from home. On the other hand some youngsters – at least 20% of the pupils' population according to the National Institute of Child Health & Human Development (NICHD, undated) – experience serious difficulties in learning to read. These children fail to acquire the above pre-reading skills, specifically at the level of phonology. The strength of the evidence is such that Stanovich (1988) has proposed that dyslexia can be considered a core phonological deficit. This thesis will adopt a broader term than dyslexia because in classrooms, teachers face learning difficulties that are not related solely to dyslexia. For this reason, I will adopt the term **reading difficulties** (RD) that will be explored briefly next.

2.6. Reading difficulties

2.6.1. Definition of reading difficulties

Reading difficulties have been described as a failure to reach grade specific reading level despite normal sensory abilities, educational and emotional background, and intelligence (Wise & Olsen, 1991). Thus, the inability to read is indicated by a substantial discrepancy between anticipated (intellectual level and /or chronological age) and actual achievement, despite reading instruction and the opportunity to learn (Fryberg, 1997).

2.6.2. Differences in reading development

Reading comes fairly easy to most people since they learn the mechanics of reading through school instruction during the early primary levels, but there is a broad range of variability among individuals. Some children manage to learn to read by kindergarten age and others, have a difficult time even with special instruction. Both poor and normal readers follow the same sequence and processes of learning to read with the difference that former are slower to reach fluency in reading (Sanders, 2001). They get stuck along at certain places along the way. The degree of difficulty will determine how easily these pupils will overcome their problems.

In the first grade (Yr2), every year teachers identify four different groups of teachers:

- Those who have already learned to read (5%);
- The large majority of pupils come with sufficient competencies to respond well to reading instruction (75%);
- Children who have reasonable understanding of basic reading skills but have difficulty with speed or memory and cannot progress at the pace of the larger group (15%), and
- The group of young readers who encounter serious difficulties in some skills (recalling whole words, have trouble learning the elements of the code) required for reading and need intensive help (5%) (Sanders, 2001, p. 49).

According to the above author, we have a group of skilled readers and a group of less skilled readers. The second that encompasses readers with *developmental* and *acquired* difficulties is less skilful in acquiring the pre-reading skills discussed in the previous paragraph, this is recognising the letters of the alphabet and discriminating the sounds in words on two levels:

- Accuracy and speed of their identification of strings of letters as words (decoding);
- Comprehension (meanings of words, basic meaning of text (Snow, et al. 1998, p. 60).

Though the characteristics of the pupils with developmental and acquired reading difficulties differ, there are many similarities in teaching these two sub-types:

- The labelling process has been criticised because it does not necessarily lead to a useful instructional or remedial program.
- The diagnostic procedures and techniques to analyse the reading problems are equally effective in determining the reading difficulties of both groups.
- The instructional methods overlap. There is no single set of teaching techniques for teaching reading to both groups (Kirk et al., 1978).

Taylor et al. (1988) doubt the importance of the two categories of poor readers when it comes to instruction wondering what would a classroom or remedial teacher do differently for a child classified as neurologically or educationally handicapped? The answer is not clear and the task remains to teach the child to read. Additionally, there is evidence that no single approach will be effective for all pupils within one category of special educational needs (NFER, 2000). This means that quite often pupils with special educational needs need differentiated intervention methods according to their needs.

Further more, there is evidence from the National Foundation of Educational Research claiming that teaching methods designed to teach pupils with SEN to acquire literacy skills are not qualitatively or significantly different from those used for all pupils (NFER, undated). What this means is that classroom teachers may use the same material (print or electronic) for beginning readers, as well as for pupils who are found to be at the same reading level with KS1 pupils since no cogent evidence exists to support the opposite. However, the same source claims that there is evidence that pupils' effective learning in literacy depends on appropriate differentiation, which means that the structure of the literacy teaching either has to be more explicit or balanced differently. But what causes this condition that affects almost 20% of our school population? The correlates (aetiology) of the reading failure will be discussed in short in the following section.

2.6.3. The aetiology of reading difficulties

Though there is a tendency to look at a single cause of a particular problem, in reality we know that life is more complex than that. There are a number of determinants that interfere with successful reading (and learning in general, which could turn a mild disability into a severe academic problem. These determinants are presented below according to Erickson's (1963) bio-social-psycho framework:

Biological factors

The biological factors are generally presented at birth and there are strong indications that children with such difficulties have inherited them from their parents, or from other members of the extended family.

Most common and prominent among these are *temperament* and *attention.* Temperament has to do with the child's response to both external and internal stimulation arising from thoughts, feelings and bodily needs. Children need to filter out disturbing stimuli in order to retain concentration and to regulate their response patterns (self- regulation). Also, many individuals have an overriding emotional tone that characterises them as irritable, worried, or sad.

Attending refers to the ability to concentrate on a task for a prolonged period. Attention problems are usually diagnosed as attention deficit disorder (ADD) and attention deficit/hyperactivity disorder (ADHD). Attention deficits are viewed as the most critical defect of children with reading or learning difficulties in general (Kirk et al., 1978; Fijalkow, 1998; Sanders, 2001).

Attention plays an important role in *memory* problems. This has been indicated by many writers (Johnson & Myklebust, 1967; Adams, 1990). Inability to attend leads to distractibility in poor readers, which interferes with their memory abilities, as well as their ability to follow directions. Some have suggested that due to attention deficits students fail on many tasks, and not to the disability itself (Harris & Sipay, 1990).

<u>Social factors</u>

Social factors develop early from within the *family*, and sooner or later from the wider community (in this study the *school*).

Children need emotional support and intellectual stimulation in a direct way. Though love can be defined in numerous ways, in relation to learning to read (and learning in general) the term is identified with support, encouragement and confidence building for children. Providing *intellectual stimulation* (Sanders, 2001, p. 61) is a form of love that makes a significant contribution to the child's learning. Exposing the child to early reading activities, such as listening to stories, looking at pictures, playing with letters (learning the alphabet), all help in discovering the intrinsic pleasure of intellectual mastery and in building banks of information and knowledge that make the classroom and its activities more familiar and welcoming (Sanders, 2001). It is documented that reading stories before school has a strong relationship with later reading success (Wells, 1988). Also family factors that influence a child's progress in reading are the language environment of the home and the types of values that a child extracts from the home environment.

Among the most important school factors that impede reading according to Bond et al. (1984) are the *materials* available and the *methods* of teaching reading. Ineffective teaching is when the teacher fails to match the material to the individual needs of the students. Too difficult materials exhort pupils' strengths and discourage them from learning. Also, the inappropriate persistence on a specific method of reading can prevent effective reading. There is the broad belief that no single method or single combination of methods can successfully teach all children to read (Bond et al., 1984; Farstrup, 2000).

Psychological factors

These factors evolve from the child's personality. They are shaped by the interaction of the particular set of biological and social forces at work over the years. The most common psychological factor that interferes with learning, including full mastery of reading, is poor *motivation*.

Besides the severely emotionally disturbed pupils, who are truly incapable of focusing on their work, there are others – they constitute the larger group – who lack motivation, because of temperamental, family and situational variables (Sanders, 2001). Most of the motivation problems around schoolwork result from children's discouragement about their ability to do well enough, and from parental disposition towards reading. The combination of weak skills and lack of understanding and support from parents and school is detrimental on pupil's performance and motivation. Material and teacher's attitude is also linked to motivation.

English as a second language (EAL)

Because the study views "difficulties" encountered in ordinary classrooms broadly, it is imperative at this point to mention briefly children who attend English classes but have a different home language. Those pupils face the dual dilemma of coping with the school's academic requirements, and learning the English language to a satisfactory level that will not interfere with their school achievement. Until they achieve it, these pupils present "reading difficulties" which are not constitutional in nature rather temporal and with appropriate intensive teaching of initial reading skills eventually they will reach the desired goal and attend regular education classes.

According to the Warncok report, all the above factors affect learning at different levels mild, moderate and severe (DES, 1978). While pupils with moderate / severe difficulties are educated in special schools, pupils with mild difficulties are expected to manage a mainstreamed curriculum with support (Gulliford, 1992). In most occasions, mild / moderate difficulties are not identified until children enter primary school (Montgomery, 1990) and *reading* and *writing* are the areas where these problems are noticed. Teachers observe that low achievers exhibit difficulties in a) memory, b) language, and c) thinking (Montgomery, 1990). Specifically, these pupils have problems reading words and speed in reading.

The 1994 Education Act introduced the Code of Practice where it is emphasised that children with SEN (including those with statements) should be educated in ordinary schools and have the greatest possible access to a broad and balanced education within the National Curriculum. David Blunkett patently stated that integration is still a governmental priority for the education of pupils with SEN:

"*While recognising the paramount importance of meeting the needs of individual children, and the necessity of specialist provision for some, we shall promote the inclusion of children with SEN within mainstream schooling wherever possible*". (DfEE, 1997, p. 5).

In order to raise the reading standards of diverse learners and to help poor readers within regular settings to the greatest possible degree, the UK government and the Literacy Task Force in particular has introduced the National Literacy Strategy (NLS). This is one of the most ambitious nation initiatives for change that primary education has seen.

2.7. The National Literacy Strategy (NLS)

The implementation of the National Literacy Strategy (NLS) began in UK primary schools in autumn of 1998. The purpose of the strategy is to bring about a dramatic improvement in literacy standards, so that by 2002 eighty percent of 11-year-olds should reach the standard expected for their age in English in the KS2 National Curriculum tests. Another purpose is that this extra hour will assist pupils who have literacy difficulties.

The literacy hour is now taught each day for one hour in the vast majority of schools, and teachers have a detailed framework to guide their planning and to determine their teaching methods. It is applied to all pupils and also encompasses pupils with special educational needs and pupils with EAL (English as Additional Language) who are expected to benefit from it. The overall structure of the framework is to teach literacy in three strands.This is word level work (phonics, spelling and vocabulary), sentence level work (grammar and punctuation), and text level work comprehension and composition) (DfEE, 1998). Within the strategy there are objectives that cover the National Curriculum requirements and these objectives are organised to be reached in three terms. In keeping with the "early learning goals" of the N.C. in line with the objectives in the NLS Framework, by the end of the Foundation stage, most pupils are expected to be able to:

- Hear and say initial and final sounds in words, and short vowel sounds within words.
- Link sounds to letters, naming and sounding the letters of the alphabet.
- Use their phonic knowledge to write simple regular words and make phonetically plausible attempts at more complex words.

The NLS Framework objectives for the Foundation year also require that pupils should be taught knowledge of grapheme / phoneme correspondences through:

- Reading letter(s) that represent(s) the sounds: *a - z, ch, sh, th*
- Writing each letter in response to each sound: *a - z, ch, sh, th*

Teaching to secure these objectives by the end of the Foundation year, combined with the key skills of segmenting and blending, provides pupils with a firm grounding for reading and spelling, not just consonant-vowel-consonant (CVC) words, but also CCVC and CVCC words (OFSTED, 2003).

Additionally, the NLS provides a list of 45 high frequency words to be taught as sight-words through the Foundation Year and 113 ones for KS1 level (Yr1 and Yr2), plus the days of the week, the months of the year, numbers to twenty, common colour words, pupil's name and address, and name and address of the school. The above list of words is listed in Appendix 1. Literally, the framework provides details of what should be taught and the literacy hour is the means of teaching it. What also is noticed in the application of this strategy is that *phonics*, and focus on developing rhyme and analogy skills (Macmillan, 2002) play an important role and receive now a much greater priority in most schools. For many teachers the implementation of the NLS has meant a considerable change to their approach to the teaching of reading. There has been a considerable move away from the practice of "hearing readers" to one in which pupils are taught to read directly by their teacher (OFSTED, 2003). Teachers now are called to choose activities from a variety of scheme or non-scheme books, and try to make reading as easy as possible for all pupils.

2.8. Summary

The core of this chapter is the description of the basic reading skills that young learners need to acquire in order to become fluent readers that would enable them to succeed in further academic years, and professional life, and how these are taught in traditional settings. It is very important to stress again what I have attenuated in the introduction chapter (p. 13) that the concept of reading will not be empirically investigated in this study in any sense. The chapter on reading serves only as a facilitator for the reader to understand the theories of reading that influence the various teaching instructional models and methods, and in turn the design of books and literacy computer programs. It will also enable us to see similarities and difficulties between the two materials (print and electronic), and the differences between how teaching reading is delivered by computers (CAI).

Irrespective of the teaching medium, traditional or computer-assisted teaching, the reading process develops in similar patterns having as a major precondition the integrity of the child's health, and sensory organs. Various sensory deficits and psychological and environmental factors can impede seriously the development of the skills in concern. Equally, irrespective of the kind of the medium, books or computer programs, the design of both educational materials is influenced by the same prevailing reading theories. The design of initial literacy material, in the form of book or software, is basically influenced by two major reading philosophies, this is bottom-up and top-down. Consequently, the available electronic materials support either phonics, or a holistic approach to teaching basic literacy skills.

The literature clearly indicates the reading skills that young pupils, as well as pupils who face reading problems, must acquire in order to become fluent readers. These are the alphabetical principle, phonological awareness skills that presuppose knowledge of the letters, the syllabic structure of words (onset and rimes) that helps beginning readers to use analogies and presupposes phonological awareness skills, and adequate sight vocabulary. Sight vocabulary is another skill that beginning readers must acquire. All the previous skills, when possessed, will lead to accuracy and fluency after a lot of practice and repetition depending on each child's needs, and further more to comprehension, which is the ultimate goal of reading. Textbooks, or software, include a variety of such activities that aim at helping young readers to develop their reading ability.

In traditional teaching, the medium that conveys teaching is the teacher. S/he decides the textbooks that will be used, the worksheets, and the skills pupils need to acquire at each developmental phase, and how s/he will perform the teaching of those skills. Educators can adopt both: skills-oriented, or whole-word approaches to teaching basic literacy skills. The research indicates that phonics is the best way to teach the code, but not in the form of segmented chunks rather within a context that makes sense to children. Direct instruction is suggested, but for a short period for able pupils. As soon as children acquire the decoding skill, direct instruction becomes redundant and boring.

But what is essential is that the teaching methods designed for SEN pupils do not significantly differ from those used for all pupils (NFER, undated). These pupils do not need different approaches to learning to read, but the appropriate methods. Direct instruction is more appropriate for those children, which provides immediate corrections, and ample opportunities for practice until the pupil has acquired the skill. But what works best in preventing early reading failure is the *one-to-one tutoring* (Wasik & Slavin, 1993), which can be done by the computer, as I will discuss in the next chapter. Teachers have to discriminate *what*, *how* and *when* to teach each of the skills, and what method to employ.

The choice of what instruction to follow, and what textbook, or activity to use is determined by the classroom teacher based on what s/he wants to teach, on the academic ability of his / her pupils, and the classroom objectives that the teacher has to cover. In UK, educators have to follow the NC guidelines and in relation to literacy, they have to select material that covers the NLS objectives (to remind once again that the basis of the literacy hour is to teach phonics, and sight words). In this way, they guarantee that the material is of educational value. While these are taking place in a traditional form, teachers nowadays can use computer packages to support the teaching of the pre-reading skills since the trend in information technology has recently moved to a broader use across the curriculum.

Educators now have to make choices not only for traditional books and schemes, but also for electronic material that should accord to their classroom objectives (Shade, 1996) just like with the traditional books. If educators are to use technology across the curriculum then it has to have similar objectives, and assist teachers towards the implementation of those objectives. Classroom teachers have no time to spare for material that is of no educational use. Technology cannot stand alone, rather it has to be integrated with what is taking place in the classroom. Therefore, <u>if teachers have to use software that will help young pupils to develop pre-reading skills, then the content of the computer programs has to accord with the objectives of the classroom (NC / NLS) just like any other print material. This is the main hypothesis that emerges in this chapter, and the study will try to give an answer</u>.

Next I will expand on how computers have transformed teaching, the differences between traditional and computer-assisted teaching, and if they can assist the teaching of initial literacy skills to young children. But first I will discuss the changes that ICT has brought to schools and teachers.

Chapter 3. ICT in early primary education

This chapter is divided in two parts. The first part shows the importance of ICT in the NC and explains the changes the introduction of ICT has brought to schools' administrations (ICT policies, resources, management of resources, teachers' training). The second part presents an analysis of how ICT and particular kinds of ICT (software) have transformed instruction. The elements of CAI are presented (technical features and instructional characteristics), the differences between print and electronic text are tabularised, and the chapter concludes with research evidence about the effectiveness of CAI in the subject of basic literacy.

3.1. ICT in the National Curriculum for KS1

The newly revised National Curriculum 2000 has the following explicit aims and purposes for teaching ICT skills at KS1 level:

- Develop IT capability, including their knowledge and understanding of the importance of information and of how to select and prepare it;
- Develop their skills in using hardware and software to manipulate information in their processes of problem solving, recording and expressive work;
- Develop their ability to apply their IT capability and ICT to support their language and communication, and their learning in other areas;
- Explore their attitudes towards ICT, its value for themselves, others and society, and their awareness of its advantages and limitations (DfEE, 2000, p. 5).

Initially, Information Technology (IT) was identified as a component of the National Curriculum in 1989 (Watson, 1997); a new subject in its own right with skills and competencies to be delivered (programmes of study, attainment targets), and assessed. The rapid evolution of technology with its immense capacities and possibilities as a classroom tool has created some fundamental dilemmas. One of which is a dichotomy of purpose: is IT a subject in its own right with a knowledge and skill base or is it a tool to be used mainly for the learning of other subjects? This implies questions such as, do children use computers in their learning process to help them achieve some tasks, or because it is a part of their timetable schedule?

Considering the above questions and after extensive research on the role of technology in learning, official policy and curriculum documents suggest both (DFE, 1995; NCC, 1991; NC, 2000). Information Technology under the new acronym ICT emphasises a wide range of characteristics, where information is being manipulated through the use of different means and the computer is only one of them. As a consequence the concept "ICT across the curriculum" has been introduced where ICT is not taught as a separate subject rather in a variety of subjects taught in the classrooms i.e. maths, history, language and at all levels.

But what is expected from young KS1 pupils? What kind of ICT capability should they have? Over the course of this stage, pupils should develop the skills knowledge and understanding by being taught:

- About different kinds of information and how it is represented;
- How to try out different ways of obtaining and sharing information;
- To explore a variety of ICT tools and applications;
- About the uses of ICT inside and outside school.

  (National Curriculum, 2000; Falmer & Falmer, 2000, p.3; Loveless, 2002, pp. 14-15)

The above skills are transformed into standard of achievements in eight levels of increasing difficulty, which children should accomplish. What about Reception classes? Children in Reception classes and nurseries are expected to be "working towards" KS1 (Stephen & Plowman, 2002).

Undoubtedly, computers have entered primary schools and can be used by young children. But their introduction has caused new responsibilities for school administration and in particular how to organise the above skills and competencies so they will be delivered and assessed. As a result primary schools have been exhorted to develop whole-school ICT policies in order to meet the statutory objectives. It is suggested that a whole-school policy ensures the successful application of technology in schools (Kosakowski, 1998).

3.2. ICT whole-school policies

Every school should form its policy, which should have individual character. A whole-school ICT policy is a statement of the beliefs values, and goals of the school's staff working cooperatively in the context of using ICT in that school. Above all, the policy document must be compatible with any existing school policies with regard to equal opportunities, gender and disability (BECTA, 2002; NAEYC, 1996; Taylor, 1997). Why do schools need whole-school policies? Because it is one way for the school to ensure parents, teachers, LEAs, and possibly pupils, how important ICT is considered. Who should be involved in formulating the policy? BECTA (2002) suggests that all the management team, teachers, governors, parents, and possibly pupils should be able to put forward their ideas and what they feel is important about ICT in their school during the developmental stage.

The following aspects should be considered in a policy:

- Where is the school now?
- What is the school's intention and why?
- What are the goals towards the ultimate aim?
- How the school will achieve these goals? (BECTA, 2002)

From the above we can see that the policy is a compromise between what is desirable and what is possible, how to attain the intentions and resources. It is a beneficial and essential managerial tool since it provides a framework for planning and evaluation. The implementation of such a policy is the responsibility of the head teacher who may delegate it to a senior management team (SMT) (Taylor, 1997). An essential role to play in this policy is the ICT-Coordinator whose additional duties according to Agar (1998) are the hardware and software of the school site, technical abilities, up to date with new developments.

The best school policies should incorporate a system for monitoring the use of ICT facilities. Feedback from those who use the ICT resources is essential in order to enable their effective use. This would involve strategies to ensure that hardware and software are actually being used, and whether or not effective learning is taking place. Pupils' perceptions of the facilities can be very useful in identifying factors that might otherwise be overlooked (Taylor, 1997). The question that I raise here is what about classroom teachers? They can be excellent sources of information since they have direct contact of pupils using the machines. The literature does not reveal much about if and how primary schools should evaluate their ICT policy.

But policies are only one factor for successful ICT applications. In order to implement the ICT aspects of the National Curriculum, Govier (1991) argued that three types of resources are needed: 1) equipment (hardware & software), 2) technical support, and 3) teacher education which are elaborated next. Technical support does not fall in this research scope and will be excluded.

3.3. Resources

In the two surveys on Information Technology in schools (DfEE, 1999; 2003) the average *micro-intensity* figure, this is the computer to pupil ratio, in primary institutions raised from 13 pupils in 1999 to 7.9 pupils per computer in 2003. Of course it must be clear that "by itself, a favourable computer-to-pupil ratio does not necessarily assure consistently high-quality work with IT though it does mean that the school management is prepared to invest and to develop this aspect of the curriculum" (OFSTED, 1995, p. 17). But Watson (1997) argues that until there is a ratio of 1.5 computers to every pupil, and every teacher has a personal computer, it is unrealistic for schools to be asked to deliver a balanced IT curriculum. In addition, the most recent survey (DfEE, 2003) has shown that practically all primary schools are connected to the Internet via an ISDN2 connection, the average number of computers per primary school is 28.6, and the average expenditure per primary school is £11,200. The government's commitment to the promotion of ICT to improve children's ICT literacy is not in doubt. Since 1997, £1,8 billion has been spent on ICT-related initiatives under the National Grid for Learning (NGfL) banner (Poulter & Basford, 2003). The growth in ICT resources has been tremendous and is set to continue. Using computers in teaching is vastly affected by the following factors:

- The total number of computers available in the classroom or ICT suite.
- The number of pupils in the classroom.
- The student computer ratio recommended by the software, if applicable.
- The times and frequency of computer availability.
- The number of minutes required for each session with the software.
- The total number of sessions required completing the software program (Jolicoeur & Berger, 1988a, p. 10).

3.3.1. Management of resources

Initially, computers were located in the classroom of an enthusiastic teacher as stand-alone machines, but nowadays there are usually one or two bookable computer labs (ICT suites) networked or not, and other clusters of machines in subject specialist areas. Primary schools usually opt for ICT suites (Siraj-Blatchford & Whitebread, 2003).

The location of computers is a critical decision that will significantly influence who has access to the equipment, when and how it will be used (Tiene & Ingram, 2001). Basically, there are two strategies that both have merit, this is a batch of ten or twenty computers to be distributed in classrooms, or these computers be placed in an ICT suite (laboratory). Both have certain advantages and disadvantages. Computer(s) in every classroom provide a constant access with any subject (literacy, maths, history), and the activities may become fully integrated into the daily class work. Most important, it gives the teacher the flexibility to adjust the provided material to appropriate levels for either the less or more able pupils. The nub of the matter is that this strategy is expensive because each classroom needs at least 4-5 sets and in reality 1 or 2 computers are usually placed in the classroom (Leask & Meadows, 2000), but teachers have ample time daily to observe children how they are using particular software, what difficulties they have, s/he can even listen discretely to conversations and make judgements about the computer package which can be list down on a report. It is very important pupils do not feel pressed to finish an activity, to have plenty of time to explore software and come to conclusions on their own.

Adversely, ICT suites provide security and economy in hardware and software. This means that every school needs to buy smaller number of computers, peripherals and less copies of software. It is likely that each machine in the lab will have Internet access. Computer labs improve the micro-intensity figure, because small figures help to maximise pupil learning (Tiene & Ingram, 2001). But teachers have to book a timetabled fixed resource and move the class there for a limited time.

It has been stated that classes have access to 15 to 30 minutes per week (Watson, 1997), Loveless & Dore, 2002), and not on a daily basis. This time is not enough for pupils to finish substantial tasks especially young pupils who are very slow in using computers, it is too short to see possible effects of educational software on pupils' academic gains (Loveless & Dore, 2002), and it is not enough for teachers to observe their children using a particular software and see its potential capacities. It is not the resource itself rather the restricted access to it, with all the related problems of pressure for everything to be done in certain time, that causes the problem (Watson, 1997). Any attempt from the classroom teacher part to "evaluate" software under the pressure of such limitations will be proved futile (Blease, 1988). Although this may be accomplished for structured types of program, it is not suitable for open-ended exploratory software that demand flexibility and time to be explored.

3.4. Teacher training

Another factor that is related to the ICT application in schools is teachers' training and education. If teachers do not have the skills and the positive disposition towards the machines the whole novelty is in danger of failure. On the arrival of computers in primary schools in the 80s a number of strategies for INSET have been tried, but it seems that they put emphasis mainly on raising the levels of computer literacy. Teachers had to start from knowing how to operate the new machines. Gradually though the demands of teachers skills have increased. The National Council of Educational Technology's guide (NCET, 1995) lists the following skills:

- Positive attitudes to IT.
- Understanding the educational potential of IT.
- Ability to use IT effectively in the curriculum.
- Ability to manage IT use in the classroom.
- Ability to evaluate IT use.
- Ability to ensure differentiation and progression.
- Technical capability to use an appropriate range of IT resources, and to update these skills.

From the above we can see that demands are multifarious and complex. Teachers not only need to develop their skills in operating computers, but also to know how to use it effectively in the classroom, to evaluate it, to acquire technical capability, and to use it across different subjects in the curriculum. This also can be viewed as a translocation of the duties assigned initially to ICT Coordinator. S/he no longer has to be the "technician", or aware of all ICT applications. It is not possible the ICT coordinator to know "all" software in the market in all different subjects and how it can be used in different subjects. The literature indicates that teachers lack the following:

- The need for special management techniques to integrate the computer into the classroom, and
- The need for skills to select and evaluate software (Edyburn & Lartz, 1987).

But what has been done so teachers can develop such advanced skills? As I have discussed in section 3.1., ICT is not a subject in its own right, but it can be used across a number of different subjects. In the last years, the issue of ICT in subject teaching, mainly literacy and numeracy, has been acknowledged by Governmental agents (DfEE Circular 4/98) and in September 1998 the Teacher Training Agency (TTA) introduced a National Curriculum in Initial Teacher Training Institutions for the use of ICT in subject teaching, which will ensure that teachers emerging in the profession in the future have the capability and confidence to effectively use ICT to enhance the learning experience of pupils. In addition, the government has posed the QTS (Qualified Teacher Status) skills tests in literacy, numeracy and ICT that all trainee teachers in England have to meet before they are recommended as qualified (TTA, 2000).

The above show that the UK Government acknowledges the fact that updating ICT skills of serving teachers was recognised as crucial for the effective delivery of National Curriculum. In addition, from April 1999 the Government made available £230 million through the New Opportunities Fund (NOF) programme to train serving teachers across the UK in the effective use of ICT in their subject teaching. The purpose of training is to raise the level of ICT skills to the level expected of all Newly Qualified Teachers and to raise the standards of pupils' achievement. The success of this scheme has been "patchy" since the aim was to promote the use of ICT in classroom practice, and not specifically to develop teachers' ICT skills yet the training seems to have achieved the latter (Poulter & Basford, 2003).

After all these training schemes, do teachers feel confident in using computers? Governmental agents claim that two thirds of all primary education teachers feel confident in using ICT for teaching the curriculum (DfEE, 1999). But the ICT survey in UK schools 2001 conducted by BESA reveals a much smaller percentage. It was found that in 2000–2001 48% of primary teachers were confident and competent in using ICT in their curriculum (BESA, 2001). The issue is not clear. Do teachers have the skills to integrate technology into their teaching? Evidence comes from America where only one third of America's educators feel they have the skills to integrate technology into their teaching (Carvin, 2002). I did not come across any evidence in the literature for UK teachers.

It has been argued in the introductory chapter that one of the most important factors that affect the successful use of computers in schools is good quality software. Do teachers have the skills to select educational software? The literature does not reveal much on this issue. The old studies of Preece & Jones

(1985), Jolicoer & Berger (1988b), and the fairly recent of Mustoe (1999) have found that teachers do not have the knowledge to evaluate software packages. Even more, Jolicoer & Berger (1988b) showed that teachers and students involved in their research rated lower programs that were significantly more effective and concluded that their subjective judgements of the effectiveness of software were surprisingly poor.

In addition to the above factors, it is suggested in the literature that another factor that affects the successful application of technology is the quality of software (Johnson, 1987; Scandura, 1981; Buckleitner, 1996). In the introductory chapter I have argued that computers without software are empty boxes. The programs that run are what make computers to behave the way they behave. If programs are not good, teachers will hesitate to use them and children will abandon their use.

3.5. Summary of ICT in the National Curriculum

The first part of chapter 3 has shown the importance the UK government has placed on the subject of ICT as an activity to be used in a variety of subjects across the curriculum. Factors that will guarantee successful ICT application in schools are: ICT policy, resources and their management and teachers' training. The policy though should only include aims and how they should go about to accomplish them, but also an evaluation system for monitoring the ICT implementation. ICT is closely related to various computer programs (software) the schools use. The literature is not quite illuminative in that area, but such a system would ensure that computers and software are used and perhaps effective learning is taking place.

Resources are another factor of success. It seems that schools are equipped with computers and gradually the ratio dropped to 1 computer for 8 pupils. The ideal figure would be one machine for every pupil but this will be reached in the future. Computers can be placed in classrooms or in laboratories. There is evidence that schools opt for ICT suites which has its disadvantage. No doubt that the UK government spends astronomical amounts of money for schools' equipment and support, and teachers' training. The NOF scheme is a major initiative but how many teachers have participated in that scheme? There is also a controversy between DfEE and BESA findings each supporting different percentages of adequately trained teachers. What is true? This study will provide answers for the above issues. This will help to understand the issue of computer use at schools and to give evidence about the extent to which primary schools use computers and initial literacy software in particular. The issue though will be explored through the factors that affect the ICT application.

The inquiry is set out to investigate pupils' access to computers, and to basic literacy software in particular. Is there any evidence of the extent to which schools use computers? In USA, the study of Marcinkiewicz (1994-94) found that half of the elementary teachers of his study (n=170) reported not using computers for teaching, and that self-confidence in ICT skills was most closely related to teachers' computer use. The study of Norris et al. (2003) also indicates that teachers do not actually use technology in their classrooms. In UK, various writers claim that pupils have 15-30 minutes access per week (Watson, 1997; Loveless & Dore, 2002), but such claims are not research-based. What is the frequency of pupils using literacy software in practice?

It is very important for the reader to understand how the introduction of computers have influenced teaching, and the next chapter will illuminate characteristics of such teaching method with an emphasis on the teaching of literacy.

3.6. Computer-Assisted Instruction (CAI)

3.6.1. The history of computers in teaching reading

I have mentioned briefly in the introduction chapter the similarities between the two terms CAI and CAR and that throughout this study the terms will be used interchangeably, this is using computer programs to assist the teaching of basic literacy skills. It would be useful to look briefly at the early attempts to use computers to aid reading instruction. The first systematic effort to develop CAI in reading began in 1964 at the Institute for Mathematical studies in the social sciences under the direction of Patric Suppes. This work used computers that were very different from the micros that developed later. Early computer-assisted instruction was delivered on large, centrally located, mainframe computers. Three major conclusions emerged from that work:

- Efforts to develop tutorial programs for basic skills in reading were not only very expensive but also extremely difficult to anticipate all of the different instructional needs of children. The first computers lacked in large amounts of RAM (random access memory), which resulted in a slow pace of instruction because of the time required for branching, corrective activities.
- The effective overall management of the instruction is more important to its success that are unique features of CAI, such as graphics, immediate feedback, sound effects or animation.
- It was easier to program computers to deliver effective practice in decoding skills than to use them in building comprehension (Torgesen, 1986).

What the above suggest is that high cost, dissatisfaction with the instructional pace, inflexibility of the first machines (small RAM capacities) were discouraging lessons at the beginning phase. Very soon educators realised that CAI would be effective if it follows sound educational principles and not because it is delivered by a computer with its unique features (sounds, animation and the like). The fact that computers were more effective in raising decoding than comprehension skills probably reflects the relative complexity of effective instruction in the two areas, this is acquiring decoding skills involves practice (see chapter 2) of a limited set of association and rules, where as comprehension is very difficult to teach directly.

To be fair, emphasis on mastery learning was obviously the outcome of a more complex legacy of behaviourism known as *programmed instruction* (see 3.6.2.) that flourished during the 1950s. In this phrase the word *programmed* does not refer to computer programming but to carefully sequencing and developing instruction. Next I will explain the key principles of programmed instruction, as they have been presented by Tiene & Ingram (2001) so the reader can form an idea of the kind of instruction the first machines provided.

3.6.2. Programmed instruction (PI)

First, the instruction is broken down into extremely small steps. If we consider that the basic element of all behaviour is the conditioned operant, then the way to teach complex behaviours is to teach the building blocks one at a time. Second, people learn best by making active responses at each step, therefore programmed instruction generally demands that learners make overt responses every few seconds during the instruction. Third, behaviour is learned and recurs when it is reinforced. In a nutshell, this particular teaching strategy consists of a long series of small steps, which are parts of a complex behaviour, the learner reads some small bits of information, answers a question, and gets reinforced for a correct answer.

One problem with programmed instruction is that it led to one early example of instructional technology hardware: teaching machines. These machines presented information and questions, accepted the pupil's response, and informed the learner of the correct answer. Both programmed instruction and teaching machines were relatively inflexible. The steps can be very small for most pupils, there was little challenge in answering each question and the pace of instruction was becoming unnecessary slow. How many times can a pupil be told "good job" without losing all the meaning of it? All in all, while some were excellent and effective instances of programmed learning, they were also many poor ones.

The above problematic issues on the advent of computers in addition to low reliability and lack of convincing evidence regarding effectiveness resulted in a general lack of acceptance by the educational community. The situation remained static until recent advances in microelectronics and computer software appeared promising. The introduction of small, powerful and relatively inexpensive microcomputers have fuelled an explosive growth in educational computer usage and rekindled enthusiasm for computer-assisted instruction (CAI). The term *microcomputer revolution* (Roblyer, 1989) connotes the widespread use of computers in schools since 1980. CAR involves computer programs for reading activities that come in many different forms but mainly fall into the categories that will be explored below. Because CAI, or CAR, is identified with the use of computers in the teaching and computers, as I have supported in the introduction chapter, are empty without the program (software) they run on, the following categories have been found in the literature as different forms of CAI or/ and different kind of software.

3.7. Different forms of CAI (software)

3.7.1. Drill and Practice (D&P)

Drill and practice is the most common format accounting for over half of all software used in schools. With such programs it is assumed that the content of the lessons has been previously taught. The purpose is to provide practice and reinforcement. Practice is usually related to two common features: branching and feedback. They branch to easier or more difficult tasks feedback depending on the pupil's response. They are usually used on a one-to-one base and practice on a topic taught to the pupil at previous time via the conventional (traditional) teaching method or may be via a tutorial.

In reading this kind of program enables students to practice letter sounds and blends. The teacher selects a level suitable to a child's reading ability. Each response is checked immediately. If the pupil fails to answer correctly s/he may try again or there are the possibilities either for the task to be repeated or the program leads directly to the correct answer. Each activity includes a set of exercises and at the end of the activity individual performances are usually summarised and a score is often provided as reinforcement for the next stage / activity. What is important about D&P programs is that they do not take a long time to complete compared to tutorials or games although this varies from child to child.

3.7.2. Multimedia and Hypermedia

Multimedia applications consist of a mixture of text, sounds, video clips, still or animated images and information can be organised in a non-linear sequences (hyper-text). In a multimedia package the lesson words and pictures are linked to other related information without the student seeking outside help (i.e. from the teacher, other students or reference materials). By selecting specific areas of a hypermedia page, related layers of information become accessible. The additional information may be presented as digitised speech, graphic representations, animated sequences, or a combination of these modes. Selecting a letter, for example, could provide a digitised voice saying the letter name, or sound, a picture associated with the letter, or visual reinforcement for selecting that letter. Most CD ROM packages make extensive use of multimedia and CD ROM talking books are one such program.

3.7.3. CD ROM talking books

Usually these are versions of classic children's picture books, some are newly written and some are versions of popular reading scheme titles. What makes them distinct is the way they teach reading. They are an alternative to high quality children's picture books, but in addition to still pictures and text, the talking books feature animation presented in a form of hidden hot-spots (DeJean et al., 1997), and a spoken version of the words, sentences, or even the whole text. When a text is read each word can be illuminated as it is spoken which helps the child to develop a concept of word, to understand the way the print runs and the role of spaces CD ROM story books also have the ability to read in a number of natural sounding voices or languages, the ability to offer repetition and definitions of unknown words. These programs are highly interactive and offer independence to users.

3.7.4. Integrated Learning Systems (ILS)

Integrated Learning System is a quite different form of CAI first because it includes heterogeneous groups of programs, such as management software and CAI modules (curriculum content), or else courseware (Baker, 1997), and second because ILS is used on a central file server computer that is networked with as many as 30-40 pupils. From the central server, specific lessons are automatically sent to each student's computer when the student logs on. They can be used either in the ICT suite or in the classrooms computers, but in the latter a few students have access to them while the others are engaged in other activities. They can cover one or more curriculum areas across the curriculum, but mostly they are used in teaching basic numeracy and literacy skills.

Though most ILS follow a behaviourally-oriented programmed instruction, recently some ILS have moved beyond this drill and practice by adding materials that promote deep reflection and genuine understanding (Becker & Hativa, 1994) for example, spreadsheets graphing, encyclopaedias and thesauruses, word-processing following thus more of a constructivist view of learning by providing a rich learning environment.

3.7.5. Word-processors

Word-processors or writing programs allow computers to be used for writing, composing, storage and presentation of text. Some programs allow pictures and symbols to be used to support writing, which makes it interesting for the pupils to write. Many word-processors have check spellers that offer a list of alternative words when the word that is typed by the pupil is not recognised. Spell checkers appear to aid children in learning to spell particularly in identifying and correcting misspelled words (Jinkerson & Baggett, 1993; McClurg & Kasakow, 1989).

I have discussed above the variety of different software available and / or the different forms CAI can take according to the software being used. The reader can refer to Appendix 2 for a selective list of initial literacy software and a brief description. It is obvious that CAI does not have a set formula rather it encompasses a variety of programs that function differently and have different educational and instructional objectives. But these programs have certain common characteristics that will be elaborated next and which distinguish CAI from the traditional kind of instruction.

3.8. Characteristics of CAI

There are a number of differences between the traditional teaching of reading and teaching reading assisted by computers, but first the discussion will focus on the differences between text and reading a text in a print book and on the screen. I have tried to find out in the literature those differences voiced by reading various researchers and for the first time they are presented in the following table.

Table 3-1 Differences between reading textbooks and reading on the screen

Reading text in books	Reading text on the screen
Private / corporeal	Expository
Books are inexpensive and can be moved around. They are easily replaced	Computers are expensive and have a permanent place. Difficult to be replaced
Pages are turned easily from the front to the end and vice versa	Pages are turned using the scroll buttons upwards or downwards
Page can be private	Page becomes more public
The book can be skimmed through	Screen text has invisible structure
The reader cannot manipulate the text	The reader can manipulate the text
Colourful design	Colourful design that can be changed
It can be accompanied by still pictures	Pictures can be enlivened by animation
Book texts are silent	Texts are enlivened by sounds /speech / videos.
Rate depends on pupils' capability or intention	Slower rate of comprehension and word recognition. Reading is slower on screen
The reader cannot change the letter format	Letters are bigger and can be changed
	Screen width is greater than height
	Can cause eyestrain, headaches

The above table shows that the differences are referred to a) screen presentation i.e. letters, text format, and b) to technical features i.e. pictures, colourful design, animation, sounds / speech facility and videos that will be discussed in detail next.

3.8.1. Screen display

Books are private and "corporeal" (Tweddle, 1992) which means that children can hold them, skim and scan through the pages with the ease of backward and forward reference and they can carry them in any corner in their classroom. In contrast, the computer has a permanent position in the classroom and has different ways of handling it. In order to turn the page the child needs to push the scrolling buttons upwards or downwards, or buttons at the bottom corner of the "electronic" page, which involves a significant degree of hand and eye co-ordination. The letters are usually much larger than book letters, but the interesting thing is that pupils in many cases can intervene and manipulate the letter format (change size, colour, enbolden and the like) or even manipulate the whole text.

The screen has a different shape than most printed pages, and text is displayed on it differently. The computer screen is not like a book page since its display is much more "public" in the sense that everybody else in the classroom is able to see or hear what a child is working on, his achievement scores, his errors and the like, which means s/he looses a significant portion of privacy. The width of the screen is greater than the height, and young children read on it by moving their bodies much like reading notices on a board. Texts on the screen have both an invisible structure in the sense that there is more information available than can be seen since the screen shows only 20 lines or so at a time. To avoid the problem of the limited text presentation capacity, a computer program can refer the reader to the text in the book, or to shorter texts or shorter excerpts from the original passage provided that the computer program is the electronic version of book Bebawi (Undated).

Interaction with the computer screen could be a problematic issue for some pupils because of the problem of tedium and eyestrain (Clark, 1986; Tweddle, 1992), as well as headache that screen display could cause to some pupils (Motteram, 1990). Another important issue is that reading on the screen is slower than reading print and it takes longer to press a button than to make an eye movement (Higgins & Wallace, 1989; Reinking, 1988; Beveridge & Edmundson, 1989). Besides oral communication is a slower medium of transmission than print (Junor & Junor, 1994). Regarding the slow pace of reading on the screen, Montali & Lewandowski, (1996) found that when information on the computer is presented through visual and auditory channels simultaneously (i.e. bimodal presentation), the speed of processing (comprehension) and memory recall (word recognition) are enhanced for the average and less skilled readers.

Two crucial differences are highlighted between reading a book and interacting with an electronic text: the spatial dimension, and the nature of the interaction between reader and text (Abbot, 1995). Despite these differences, the literate behaviour on screen observed by Tweddle (1992) shares many of the characteristics of reading with books. When the experience takes place in a group, the users will be reading aloud, often together, they will be reaching out and touching the screen equally visible by all. Just like other reading activity they will be making management decisions about when and how to move on to the next piece of text by identifying the characteristics of the "*organisational conventions*" (menu bars, icons, lists of key words, buttons etc) of the program. Though organisational conventions are many and vary between computers and software, once the principles are understood, they are transferable to new programs and other computers, and it can be done by very young readers.

3.8.2. Technical features (pictures, colours, sounds and animation)

Just like books reading software have pictures and colourful designs. It is difficult to dispute the aesthetic value of pictures in reading books or schemes especially in the early years. Edmund Huey (1908 / 1968) made positive remarks about the increasing artwork in basals. Willows et al. (1981) found that there are two pedagogical motivational issues that pictures offer: a) pictures as aids for word recognition, and b) pictures as support for comprehension and interest. The value of pictures in teaching reading has been appreciated by other writers who supported that pictures have the practical utility in helping children to learn to read more quickly and fluently, especially when text and picture are seen as an integral whole (Marriott, 1992). Text that is familiar or accompanied by pictures is easier than straight text, or on unfamiliar topics (Sanders, 2001); visual images bring life to text and hold children's attention (Atherton, 2002); additionally, pictures have a long-lasting effect on children's understanding of text (Meek, 1991).

It is supposed that pictures have the same aesthetic value in literacy software. The difference is that in books pictures stand still and the child looks at it, where as in software pictures go beyond that and give the ability of characters / objects to move (animation), a highly motivating aspect in software, and some kinds of software, such as the multimedia, go even further. They have small video facilities that show things as they happen in real action, for example, a fish swimming, a cat actually eating (Pagett, 1997). Besides a synchronised display of sound, vision and animation / vibration can increase the sensory impact for the pupil (Watts, 1990).

Electronic books have the most interesting and powerful characteristic of all, which is sound and the talking facilities, and animation that all enliven the text. The child can type a word and the computer can read it for him/her. It can also read single words, sentences or even texts by default, or at will. Computers can generate speech in two ways, this is synthesised and digitised speech (Davidson et al., 1991):

Synthesised speech. The characteristic feature of this type of speech is the robotic quality of the voice and the poor quality of sound, which make words difficult to hear. Teachers reacted negatively to synthesised speech (Terrell & Linyard, 1982), but the problem has gradually been ameliorated, as the quality has improved. Advances of computer technology with large memory capacity developed the **digitised speech**, which is produced by recording a human voice.

While Wepner & Kramer (1987) strongly suggest pictures in software according to the rule "a picture is worth a thousand words", they are reserved though about the rest, such as vivid graphics, colours, and sounds and suggest they be used in modesty and only for conveying complex and important information. There are some concerns over the presence of sounds in particular that have to be seen to. Shade (1994) calls teachers' attention to avoid the "fun syndrome" when they come to carefully select software. Packages with the game-like format, happy face rewards are fun to use but it does not mean that it is educationally sound. As NAYEC (1992) has noted, "enjoying the curriculum is an important but insufficient criterion for curriculum selection" (p. 31). These features (pictures, colours, sounds and animation) emphasise the motivational potential of computers on children's learning, as it will be discussed in Chapter 5.

Another important and valuable aspect of CAI is *interactivity*. Interactivity is the reason d'etre of CAI, and it has been argued that without it there is seldom any compelling reason to use computers for instruction (Kearsley, 1985). Interactivity has three aspects: *branching*, *learner control* and *feedback*.

Brunching is the ability to follow different and non-linear paths in a computer program, the "crux" of interactivity (Weller, 1988). The computer has the ability to branch to appropriate levels of instruction according to pupil's response, and enables the reader to adjust the instruction to conform to her/his needs and capabilities thus making a computer program ready to be used by children with various ability levels. This capability enabled programmers to overcome the problem of designing strictly linear instruction.

Learner control is the aspect of CAI where the pupils can proceed at their own rates and the learner is given control over the sequence of topics (content control), or the number of practice items (strategy control). In computer-assisted instruction teaching depends upon the reader's entry and is designed to accommodate many different learning styles, many different types of responses and many different pathways through the program (Cohen, 1984, Tiene & Ingram, 2001).

Feedback is sometimes identified as interactivity, but the two terms are not quite the same (Weller, 1988). The sound and speech facility of computer programs can provide miscellaneous kinds of comments about the child's performance (positive and negative), and start a sort of dialogue with the pupil. Since feedback is one of the teaching principles in traditional teaching alongside with repetitions and practice, it will be analysed next under the heading "instructional characteristics".

3.8.3. Instructional characteristics

Feedback

Feedback is a unit of information about pupils' responses or progress that creates a sort of a dialogue with the user usually by producing speech. The reader makes some sort of qualitative response in order for the instruction to continue. This interactive ability enables the computer to take on the role of teacher in the reading instruction process. What has to be emphasised here is that feedback is found to improve pupils' performance (Tait, et al., 1973). This is especially true for those who are initially low achievers because feedback has little effect when few errors are made.

There are two distinct kinds of feedback *positive* and *negative*. In classroom settings, positive feedback / rewards can be offered in simple verbal methods (well done, good try); in facial expressions (smiling); in gestures (clapping hands); and a pleasant tone of voice (Kyriakou, 1992). It is known that by providing positive feedback (reinforcement) children will respond positively and be more motivated (ibid). Positive feedback (praise or encouragement) is a form of feedback that keeps the child working on the activity (Hohman, 1998). Negative feedback is when the computer is critical about the outcome of the pupils' activity.

In similar vein, Kyriakou (1992) suggests the use of specific help related to the task rather than critical feedback about performance or critical comments about the pupil. He defended its use arguing that when pupil's behaviour is rewarded, it is more likely to occur in the same situation in the future. How feedback should be delivered for beginning readers? It seems that is more beneficial to first wait and see whether the young reader can produce the right word without help. Help should be given only, for example, when an extremely long pause occurs in oral reading, or in the case of an error that substantially disrupts the meaning of the text (Hoffman, et al., 1984).

In addition, Lewin (2000) argues that stating the word immediately would go against what is being done in the classroom, encouraging independence. They found that when software gives hints to encourage independent word identification it makes the software compatible with classroom practice. Similar findings were demonstrated by the study of Olson & Wise (1989) for pupils with reading difficulties. Additionally, the study of Scott et al. (1998) suggested that when appropriate reinforcement is programmed to reward correct answers while assisting with incorrect answers, this software capability also contributes to its effectiveness as an instructional tool. Corrective feedback allows several tries to guide the child to a correct solution (Hohman, 1998).

Repetition and practice

The interactivity aspects discussed above gives computers the ability to play an essential role in teaching. What makes it more interesting is that with feedback the computer is able to provide correction facilities and even further, endless and patient repetition activities, indispensable parts of instruction. This means that the activity can be corrected by the machine and also be repeated until the pupil reaches the desired achievement target; the speed can be adjusted to the ability level of each individual reader and progressively move on to activities that demand faster rates, as well as to reset the presentation speed to a lower level if the child is not successful.

I have discussed in Chapter 2 (see 2.5.1.) the RR concept and how effective it is with poor readers. The more practise one has at a skill the more proficient one becomes (Karweit, 1985). Just to remind here that repeated reading helps less skilled children to improve fluency, accuracy, and comprehension and generalising to new reading material. In the past, this procedure was modelled by the teacher, later by the tape-recorder, and now by the computer. The facilities of speech feedback and the different modes of providing feedback, correction and repetition are integral parts of practice. In turn practice is an essential part of teaching. The above facilities make the use of computers appropriate tools for endless opportunities of practice. Shuell & Schueckler (1989) found that software received fairly higher ratings from teachers with regard to providing practice, a finding consistent with the possibility and notion that packages are used largely as a supplement to regular instruction.

Reitsma (1988) and Davidson et al. (1996) found that beginner readers had greater gains in reading fluency in terms of rate and accuracy in the first study, and on three sighted vocabulary tests (BAS Word Recognition, Frequently Occurring Words, and words from the book read) in the second study. These gains were highly positively correlated with the amount of practice. Thus, it was suggested that computers can give some effective practice in reading, and that one potential way of increasing beginning readers' basic reading skills is for them to use a computer.

Feedback, repetitions and practice are characteristics that set CAI apart from all other instructional media. Computers are famous for *individualisation* with the reader. Computer lessons are most commonly presented as a one-to-one mode of teaching. This individualised mode of instruction provides an immediate interaction between the computer and the child, which sets it apart from all other instructional material. It allows the pupils to work on and progress at their own pace / speed and monitor their performance provided that there are enough computers in the classroom. I have also discussed in chapter 2 the importance of the one-to-one teaching for poor readers, therefore computers can be excellent "assistants" in providing individualised instruction. A last element that makes CAI of instructional importance is record-keeping.

Record of achievement (record-keeping)

CAI, or computers, are also known for its managerial aspects, such as keeping files. For example, the computer can evaluate the pupil's reading rate. The child reads a passage displayed on the screen and when s/he is finished, the computer will calculate the pupil's speed. Similarly, the computer can assess the learner's comprehension by means of multiple choice or cloze tests items. It is able to record the time of use and the requests made by each pupil, it is able to evaluate the ongoing performance, and at the end of the activity, it is able to provide a total score. More over the computer can save the scores for further purposes, i.e. each pupil creates his own file of progression, which the teacher can have an easy access to and which can be used, for pupils' assessment. Another important aspect of CAI is the ability to provide instant graphic representation of their progress in pie or bar charts, which pupils seem to enjoy a lot. The computer has the ability to keep records in a way that it is impractical in other instructional settings.

Up to now I have described the various forms of CAI, and its elements being the technical features and teaching characteristic. The fascinating thing about computers is the immense potential to manipulate text, to decorate it with pictures and colours and even to enliven it with sounds and motion. These are highly motivating elements especially for young children. In addition, children are in control of their learning and can proceed either alone or with small groups or pairs. Indeed computers can be used either as tutorial instruction and practice or one-to-one teaching. Further, when the computer is connected with a projector, the classroom teacher can use it exactly as the blackboard (whole classroom instruction) provided that s/he has the skills and the preparation to do so.

But are the above technical features and interactivity reasons for teachers to use ICT? The question that I have to answer here is how computers make a contribution to learning and teaching. The next section will deal with the value of technology in the classroom.

3.9. The pedagogical value of ICT

There are four features of ICT that can help us to analyse how it might make a contribution to teaching and learning. These features are:

- Interactivity
- Speed
- Provisionality
- Capacity and range (Loveless & Dore, 2002, pp. 11-12; Agar, 1998, pp. 4-7).

As I have analysed in section 3.8.3., *interactivity* can engage young users at a number of levels and give different kinds of immediate elaboration or verification feedback, and responses to decisions and actions made by the users. Interactivity enables children to make decisions, see the consequences, and act upon the feedback accordingly. It helps children to navigate a program, it encourages them to explore, to learn from frustrations, and to develop perseverance.

The *speed* of the machines to execute tasks is extraordinary, for example organising data, manipulating changes, carrying out calculations, checking the spellings and grammar, drawing graphs and presenting findings. This leaves children time to think, ask questions, observe and interpret information at higher levels.

The *provisional* nature of ICT is its major strength. Children unhurriedly can write down their ideas, and after reflection they can put them into an appropriate order by "cut" and "paste" facilities. They can store drafts, which can retrieve, correct and change as often as they want. They can print their document and make many copies. Using the scanners, they can save pictures as files that they can insert into their texts. They can e-mail their works to their friends, or family members. When pupils are engaged with some tutorial type of program, i.e. attempting some mathematical computation skills, they are not rushed, the machine is patient regardless of the time it takes to finish the activity. Words that are not known to children can be even read out to them if the computers are equipped with the talking facility I have discussed previously in the technical features of CAI. If pupils get something wrong, the machine will not be annoyed, it will provide feedback (what is wrong), and will offer some assistance until the child succeeds. His / her scores can be stored in the achievement record which can be viewed by the teachers, or parents, or "critical" friends.

ICT demonstrates *capacity* and *range* that enable the teacher and pupils to access vast amounts of information in the form of text, visual images and sound. This information might be accessed on a CD-ROM. Such an example is a CD-ROM based encyclopaedia available in the classroom. Speech is a commonplace feature with words spoken or highlighted. Powerful computers can produce lifelike simulations (flying of aircraft, insects, the movement of planets and objects, i.e. fish swimming, animals walking, and so on). Difficult ideas are made more understandable when ICT makes them visible which again emphasis the significance of technical features of the computers. Another source of accessing vast amount of information is the Internet. The anarchy of the world wide web (www) brings with it a whole series of challenges and the amount of information is vast. The negative side of the Internet is the credibility of the information, the positive one is the possible links with "experts" using e-mail, or teleconferencing where children can have direct feedback to queries they have.

I have described above the four elements (interactivity, speed, capacity and range, and provision) that might make a contribution to teaching and learning, but I personally believe that those features concern ICT in general. Looking carefully at the literature I flagged some evidence that I believe it suggests the pedagogical value of computers in relation to classroom activities. These are:

- It is less threatening, non-judgmental and patient (Schery & O'Connor, 1997).
- Individualised instruction (Torgesen, 1986). Teaching proceeds at the child's pace (Boettcher, 1983). The child is in control.
- Sequenced instruction with clear objectives (Swan et al., 1990). The reading act is broken into component parts, a notion congruent with some reading process models (Lesgold, 1983).
- Extensive drill and practice exercises consolidate basic reading skills (Torgesen, 1986; Swan et al., 1990).
- Immediate and frequent feedback on progress, correction procedures and patient repetition (mastery learning paradigm) (Niemiec & Walberg, 1987; Swan et al., 1990).
- CAI appears to provide a multi-sensory approach to learning, increases motivation to reluctant learners, to young children, and low performance pupils (Medwell, 1996, 1998; Adam & Wild, 1997; Van Daal & Reitsma, 2001; Taylor, 1996).

It has been argued that computers are excellent tools for providing endless opportunities for practice. The view that reading is a skill that is learned pre-eminently through actual reading is implicit in several theories of learning to read (Perfetti, 1985; Stanovich, 1986; Torgesen, 1986). Actually, reading instruction is often equated with providing opportunities for practice (Topping, 1985; Dowhower, 1987; Duffy & Roehler, 1982). Therefore computer programs (in initial literacy) could be seen as part of the curriculum activities to support the development of basic literacy skills partially by providing activities for further practice, or as alternatives to traditional material used in the classroom. While there is an element of truth in the above arguments, I believe that ICT is more than a medium of practice. This reflects the now defunct concept of *teaching* *machines*. The advanced technologies of today and the use of the Internet have much more to offer than just tools for practice.

While all of the above elements are related to computer-assisted teaching irrespective of the subject been taught, the question that raises here is if CAI has a particular pedagogical value in teaching reading. In order to answer this question I will present research evidence conducted in the past as well as more recent times.

3.10. Research on CAI and basic literacy skills

I have discussed the disappointing lessons that the educational community took during the first attempts to develop CAI in reading (see section 3.6.1.). The first study I found that included Kindergarten pupils was the study of Atkinson & Fletcher (1972) who taught kindergartners and first graders to read with computer programs with an emphasis on letter recognition and recall, sight words, spelling, phonics, and sentence and word meanings and provided significant evidence that primary-grade children's reading skills develop significantly especially for low achievers with about 10 minutes work with a reading package per day.

Torgesen (1986) evaluated the effectiveness of three reading packages Hint and Hunt, Construct-A-Word (phonological analysis skills) and WORDS (sight words) regarding word accuracy and speed with elementary pupils with learning difficulties. He found that the experimental group improved substantially in both speed and accuracy of responding as a result of practice with the programs.

While Torgesen used the above programs to assess speed and accuracy as a result of practice, Roth & Beck (1987) used the same programs to assess their effectiveness for improving word recognition / decoding skills with fourth grade LD pupils, and the extent to which decoding improvements lead to improvements in reading comprehension. The findings suggest substantial increases in word recognition / decoding skills, as well as substantial improvements in comprehension at the word and proposition / sentence level, but no improvement at the passage level. Interestingly the authors found that the use of software programs were more useful for below-average readers in the fourth grade compared to the average readers who had better decoding skills. The authors concluded that even older students who have decoding difficulties could benefit from such software.

Hess & McGarvey (1987) showed that kindergarten pupils aged 5 years and 7 months old enjoyed the computer, showed interest in and rapidly learn to operate it independently despite their teachers' expressed reservations about the use of micros with young children. Even non-readers learn to master the instructions possibly by learning them as icons (symbolically) rather than as words and within the context. Over a period of six months for about an hour per week working in pairs socio-economically disadvantaged (SES) young pupils gained sufficiently in the area of keyboard knowledge and reading readiness skills. It has been attenuated by research that strategic keyboard training combined with spelling strategies contributed to improvement in spelling for pupils with learning difficulties and mental retardation (Margalit & Roth, 1989).

Reitsma (1988) compared the effects of three conditions of reading practice for beginners aged 7 years and 5 months of average: guided-reading (round-robin oral reading), reading-along (reading-while-listening with the help of a tape recorder), and speech-select (the use of computer that would read the word on request). The results indicated greater gains in reading fluency, in terms of rate and accuracy, with the group who used the computer. The study has shown that sight vocabulary can be increased by practice with computer. Torgesen, (1986) Torgesen et al (1988); Van Daal & Van der Leij (1992), and Wise et al. (1989) all produced evidence of the efficacy of CAL in teaching sight vocabulary using drill and practice exercises. Similarly, Lally (1981) found that a "talking" computer program that taught sight vocabulary to mildly mentally retarded children increased their sight vocabularies by an average of 128 percent that remained constant for over 23 weeks after the 4-week intervention.

It is also found that drill and practice programs, which are loaded with practice activities, could enhance vocabulary acquisition. The study of Johnson et al. (1987) compared two such CAI programs with mildly handicapped pupils and found that pupils reached mastery criterion significantly faster provided that the size of the practice set is about seven words for any time, Miller's (1956) "magical number." Also, their experimental software provided daily review on practiced words and periodic cumulative reviews on learned words to ensure retention. These two aspects of the experimental program seem compatible to teaching pupils with learning difficulties. The above two paragraphs raise arguments about the importance of practice in reading and particularly with early readers and that the computers can give endless practice for reading activities. It was discussed in elaboration the importance of practice with beginning readers, and computers are excellent media in providing endless and patient opportunities for repetition and practice.

Gore et al. (1989) investigated the use of computers in teaching specific reading readiness skills, specifically sounds represented by letters, letter recognition, visual discrimination, vocabulary and directionality. It was a small sample of kindergarten pupils aged 4,5 to 5,7 years old who received the intervention program twice a week one-hour session over a period of nine months in the College of Education Apple Computer Lab. The authors found that visual matching became more proficient, as well as letter recognition. The children did not receive any specific help for computer literacy skills, but the increased keyboard knowledge was acquired possibly while involved in letter recognition.

Faucett et al. (1993) used specially designed multimedia software *Selfmaster* and *Selfspell* with 10 dyslexic pupils aged 10-12 years to improve their spelling difficulties. The software provided two different techniques, this is the mastery learning and the rule-based approach. The first method ensures that the speller focuses on the whole word and its constituent parts. In short, it encourages segmentation. The second focuses on both grapheme / phoneme translation and segmentation emphasising the number of syllables. The study confirmed the efficacy of both methods of instructional spelling techniques and suggests that the multimedia presentation approach may provide a uniquely effective method for helping dyslexic children with spelling difficulties.

Hartas & Moseley (1993) studied the effects of a digitised speech software which they developed to boost reading skills. The main feature was that pupils could ask the computer, as often as needed, to "tell" them a word when they were stuck, and thus the program was called "Say-That-Again, Please." The study involved low attainers who experienced real reading problems aged 8 - 11 years old. The results indicated an average gain of nine months in reading accuracy and six months in comprehension. The study demonstrates the strength of the computer as a reading tutor, which is in line with the previous study of Reitsma (1988), which has shown that speaking computer is just as effective as a teacher sitting alongside.

Foster et al. (1994) studied the effectiveness of the computer program DaisyQuest designed to increase the phonological awareness in kindergarten children. The package taught the following skills: recognizing words that rhyme, words that have the same beginning, middle, and ending sounds; words that can be formed from a series of phonemes, and it taught also counting the number of sounds in words. The program was divided in two modules: DaisyQuest I, which contained rhyming activities as well as matching words on their first, middle and last sounds; and DaisyQuest II, which contained onset-rhyme blending, phoneme blending and phoneme counting activities. Two experiments took place with pupils aged 4,7 to 6,5 years old and 5,4 to 7,7 years of age. Pupils who performed very good, or very low, were excluded from the experiment in order to reduce the heterogeneity of the sample. The program successfully increased performance on both analytic and synthetic awareness tasks and on tasks assessing both phoneme identity and phoneme segmentation. The results indicated significantly higher scores in the post-test in favour of the experimental group. Both experiments support the conclusion that phonological awareness in young children can be increased via computer programs. This particular study is going to be replicated with at-risk children in the near future.

Boone et al. (1996) designed a hypermedia program to teach letter identification based on the Macmillan Basal Reader Series-R. A corresponding hypermedia lesson was developed for each letter of the alphabet, and used it with 143 kindergartners in both experimental and control settings. The use of the software was an independent activity that lasted 7,5 minutes, and was related to the letter that the teacher taught in classroom each time. The study lasted for three months and the interesting aspect was the unexpected amount of enthusiasm in terms of remaining on task and interacting with the software that did not wane over the course of the school year. The researchers concluded that hypermedia can provide a strong pedagogical tool for developing, or improving, letter recognition skills in kindergarteners provided that the program must be instructional not just drill and practice and should support the teacher both in content and in instructional strategy.

Interesting findings also come from studies of talking books for kindergartners. Medwell (1996, 1998) conducted two studies with a total of 102 infants, and examined the use of talking books with Reception / Yr1 pupils in regular classrooms who were tested at the end of the study in terms of word accuracy, word recognition, and comprehension of the story with different support modes. The results indicated that the highest scores were among students who received computer and teacher support producing gains in word accuracy in the context of the story. It was also suggested that the use of talking books had helped children to read the traditional book texts more accurately, as well as to understand the meaning of the stories. The researcher's suggestion was that the most profitable use of the computer is as additional support in reading traditional texts with the teacher, an argument that has been extensively supported in this study, not just a replacement for human interaction. She suggested that talking books could be useful to those teachers who are committed to introducing children to reading by sharing stories with them, but she also contemplated that they may be useful as individual reading practice just as they were used in both studies. Lastly, talking books helped infants to re-tell the story, and as they talked about it, they developed their metalinguistic awareness, which plays a part in developing as readers (Medwell, 1995). Also, the study of DeJean et al. (1997) indicates that CD ROM Talking books foster elementary readers' comprehension.

Taylor (1996) used the Naughty stories by Sherston software with year 4 to 5 pupils with reading difficulties in a qualitative kind of research i.e. observations and interviews, and his findings indicated that talking books were fun to read, children enjoyed the graphics, sounds, and animation accessibilities of the program, and were greatly motivated to read the stories. Because of their multi-sensory approach to reading talking books are appropriate for young readers as well as for low ability learners, and these packages form a very useful additional armoury available to help the teaching of reading. Similar results are reported by the study of Adam & Wild (1997) that indicate that Discis CD ROM storybooks influence equally reluctant and willing readers to demonstrate positive attitude towards reading.

Davidson et al. (1996) used computer-delivered natural speech to assist in the teaching of reading. The computer program acted as a substitute for the "expert" reader. The children could listen to various words on the screen by just clicking on each of these words. If the child had many unknown words the computer could read the whole text using for him/her. After one month, the intervention group (aged 61 to 84 months) made significantly higher gains than the control group on three measures of sighted vocabulary i.e. (BAS Word Recognition, Frequently occurring words, words from the books read).

In Israel, Mioduser et al. (2000) conducted a study that examined the unique contribution of computer-based instruction in reading for a school year in aspects of phonological awareness, word recognition and letter identification with forty-six children (aged 5-6 years) identified as "high risk," and who attended special education Kindergartens. Of the three groups, the one who received instruction in reading using both print and computer material group improved their phonological awareness, word and letter recognition by the end of the intervention. A strong element in this study was motivation (i.e. interactivity, varied work modalities, immediate and individualised feedback, sense of control).

In Holland, the two small-scale pilot studies of van Daal & Reitsma (2000) with kindergarten pupils (K2) using an ILS multimedia program *Leescircus* for practicing reading and spelling found that pupils learned to name more letters, and were able to read more words and nonwords than the children who did not had access to the software. They learned to spell more words and low-motivated children because of their learning capabilities showed more positive behaviour during practicing on the computer program.

Singleton & Simmons (2001) evaluated the multi-sensory drill and practice software *Wordshark*, a popular package that is being currently used by 10-20% of UK schools for developing word recognition and phonic skills for dyslexic children. The authors believe that *Wordshark* is also being increasingly used with children who do not have dyslexia as a means of providing children with practice in decoding and encoding skills throughout the primary and secondary schools. Teachers participated in this study evaluated that reading and spelling were improved by the use of the package. The study did not involve pupils' views.

3.10.1. The pedagogical value of computers in pre-reading skills

I have defined in Chapter 2 (see 2.5.1.) the pre-reading skills that young children have to acquire in order to become sufficient readers. These are: a) the alphabetical principle, b) phonological awareness skills, c) sight word and fluency, and e) comprehension, and the contribution of practice and repetition in learning those skills. I have also discussed the importance of teaching these skills in a traditional instructional mode based on research evidence. The studies I have presented above in relation to computers and the teaching of basic literacy skills clearly indicate that the use of computers (software) have a significant role to play in teaching each of the basic reading skills mentioned above.

The studies of Atkinson & Fletcher, (1972), Gore et al. (1989), Boon et al. (1996), Mioduser et al (2000), and Van Daal & Reitsma (2001) found that computers helped young readers to learn the letters of the alphabet. The studies of Torgesen (1986), Foster et al (1994), Medwell (1996, 1998) Singleton & Simmons (2001) provide evidence that computers can help beginning readers, able and disable, to develop phonological awareness skills. The majority of the above studies like Atkinson & Fletcher (1972), Torgesen (1986), Reitsma (1988), Johnson et al (1987), Gore et al (1989), Faucett et al (1993), Foster et al (1994), Davidson et al (1996), Mioduser et al (2000), Van Daal & Reitsma (2001), Medwell (1996,1998), Singleton & Simmons (2001) showed that computer programs can be of great value to teaching sight words especially due to the fact that the machines are excellent tools in providing practice and repetition (Reitsma, 1988; Johnson et al. 1987). Fluency and speed in reading was indicated by far less studies (Torgesen, 1986; Reitsma, 1988) probably because the nature of the medium. The summary table 3-1 (p. 20) clearly indicates that reading text on the screen is a slower process than reading a book. Computer programs are found to assist comprehension skills (Atkinson & Fletcher, 1972; Torgesen, 1986; Hartas & Moseley, 1993; Medwell, 1996, 1998; DeJean et al., 1997). In addition, children gain in spelling (Atkinson & Fletcher, 1972; Hess & McGarvey, 1987; Margalit & Roth, 1989; Faucett et al. 1993; Van Daal & Reitsma, 2001), and in rhymes (Foster et al. 1994).

The above studies were conducted with able and less able children and support that all children irrespective of the ability level can benefit from using computers in developing basic reading skills. Also such computer programs are found motivating by young users (Medwell, 1996, 1998; Adam & Wild, 1997; Van Daal & Reitsma, 2001), and motivating to read (Taylor, 1996). The majority of software that have been used in the above studies is predominantly tutorial or drill & practice with exception of Faucett et al (1993), Boon et al. (1996) (multimedia), Medwell (1996, 1998) and Taylor (1996) (CD talking books). This means that CAI has been tested largely with software designed to teach decoding skills. Moreover it aligns with Miller et al. (1994) argument that CAI in reading has predominantly concentrated on word recognition skills, or decoding, and not on higher order reading skills such as comprehension. This takes us back in the early studies of P. Suppes (1964) and one of the lessons to be learned was the superiority of CAI with decoding skills, and not comprehension skills. Is it that comprehension skills cannot be taught in a direct way as the decoding skills? More research is required.

It has been argued in the literature that statistical results allow no firm conclusions about the superiority of any different kind of CAI application (i.e. tutorials, D&P or other) (Roblyer, 1989). Similarly, the study of Underwood (2000) who compared two multimedia packages for reading, the *Successmaker* (an ILS content-specific package) and the *Broderbund* (a "talking book" open-ended package). It was found that both are equally motivating and both brought learning gains.

In the last paragraphs I have discussed the pedagogical potential of ICT, and I have also provided research evidence of the pedagogical contribution of basic literacy computer games that constitutes the core interest of this research. The research findings are promising but we have to consider that they have some serious limitations and suffer from limp conclusions (Beladjthy, 1987; Meyer & Rose, 1998). These will be explored next.

3.10.2. Research limitations of CAI in reading

A variety of observers have indicated that computers are not being well used in the field of education (Snyder & Palmer, 1986; Van Dusen & Worthen, 1994) and with very little integration of these computers into reading and English classes (Mead, 1994/95). We cannot talk of appropriate use of CAI in reading when there is a limited access to reading programs (DeGroff, 1990; Motteram, 1990). Only 25% of third-grade pupils have ever used a computer in reading and language arts (DeGroff, 1990). Research on inappropriate applications simply will not yield interesting results.

Some of the studies have been carried out not in classrooms involving a rather small sample. Subjects (children) were either from the regular or the special population making it impossible to generalise the findings. Research was done by experts in computers, and not by experts in content, or skill area. The intervention lasted for short periods, and no retention data are reported. Another problem of a deeper and more serious nature is that these evaluation studies were never exact replications of one another, and their findings have been published in isolation producing thus rather murky conclusions as far as achievement is concerned.

The so-called Hawthorne Effect (also called the halo or novelty effect) makes it difficult to project today's results, when computers are new, and therefore exciting. The novelty may increase effort and persistence, but this effect may wear off with time (Kulik, Bangert & Williams, 1983).

Rapid technological changes pose another problem for researches. Most findings quickly become outdated. Kulik & Kulik's (1991) meta-analysis of more than 250 studies most of which have found some benefits in computer use is based on research no more than ten years old. Software has fundamentally changed how teachers can use computers, rendering some of the findings irrelevant to today's classrooms.

In the existing studies, there is a wide variation in the focuses, procedures, materials, therefore the results given must be interpreted cautiously until more studies support, or deny these findings. The field of computers in reading is under-researched. Another issue is the design of the studies, which have mainly an experimental base with an emphasis on "effectiveness" with the narrow meaning of achieving higher scores. The questions that rise here is how do we define effectiveness, and is it all what CAI is all about?

So far, I have discussed issues that make CAI a pedagogical tool in classroom and in supporting the teaching of basic literacy skills. But does CAI promote higher achievement? The issue is not straightforward. The British study of Johnson, Cox & Watson (1994) that included 2300 pupils from 87 classrooms in primary and secondary schools reported that children favour technology over traditional instruction. Similarly, the meta-analysis of Khalili & Shshaani (1994) in USA (36 studies in elementary schools), and the meta-analysis of Kulik, Chen-Lin & Kulik (1987) that included 200 studies also showed pupils favoured technology. The meta-analysis of 17 studies presented in a report by Soe et al. (2000) answered positively to this question but the authors are cautious in generalising the findings because of the limitations of the studies included in their report.

On the other hand, Olson & Krendel (1990) report that though many studies show improved achievement, their meta-analysis concluded that most of those studies include flaws in the design. Feldman & Fish (1991) reported no positive effect of using CAI to increase student achievement. The conclusion is that the use of CAI is at best inconclusive and at worst flawed. Teachers should view it as a tool and not necessary as a medium that will improve children's achievement scores.

3.11. Summary of CAI and CAI in reading

The first part of chapter 3 (see the summary section 3.5.) discussed the changes the introduction of information technology has brought to schools in terms of ICT policies, resources, and their management, teachers' training, and raised some issues that need clarification which in turn will help answer one of the main concern of this inquiry (the extent to which primary schools use initial literacy software).

The second part of chapter 3 has focused on differences between traditional and computer-assisted instruction (CAI) in relation to teaching initial literacy skills, and on research evidence about its contribution to teaching literacy. First of all, CAI has various forms that correspond to phonics and whole-language approaches to teaching literacy. In traditional instruction, it is up to the teacher to select the appropriate method to teach certain skills according to the classroom objectives. Similarly, in computer-assisted instruction, the teacher can select the appropriate program according to what s/he wants to teach. Therefore, both kinds of software, i.e. content-free and content-specific have a role to play provided that they match those objectives. The essence of introducing technology to schools is that technology should be integrated with the curriculum, but computers should support, and not carry the curriculum (Goddard, 2002). Research on CAI and literacy definitely support that literacy programs can contribute towards children's learning provided that they are used on a daily basis for at least 10-15 minutes. Only then it will be possible to see the impact of technology on pupils' learning. One would assume that after all these expensive governmental initiatives described in this chapter and research findings, schools use technology frequently and is fully integrated with the curriculum.

One thing that it is important is that reading on the screen is a much slower process. This affects both recognition and comprehension. The implication of this is that pupils whose ICT skills are considerably underdeveloped should have ample time to work on literacy programs. Also, some consideration should be given to the evidence that computer use may cause headache and would make an inappropriate medium for some young pupils.

Indeed the content of literacy programs for young readers include the kind of basic reading skills taught through the traditional mode – alphabet principle, phonological awareness skills, sight word (see 2.5.1.). Pictures have an important role to play in electronic just like in print text because: a) they serve as aids for word recognition, b) they support comprehension especially of unfamiliar topics, c) they keep children's attention and interest, and d) they bring life to text and. The aesthetic value is undoubtedly high. But CAI does not provide only text and visual images, but also sounds, speech (digitised speech produces human, not computerised voice), videos and animated objects that enliven the text. All these characteristics have an important role to play in children's motivation and they promote a multi-sensory approach to reading. The literature indicates that technical features should be used with modesty and only if they convey complex and important information. Teachers should avoid the "fun syndrome" when selecting software.

Another important characteristic in CAI is interactivity. Technology can open a dialogue with the young user. The literature indicates that young children respond better to positive feedback (not to negative). It is motivating and keeps the child's interest on the work. If children need help with their reading, this should be given after long pauses, and after allowing the child to try several times. This means that immediate corrections are not appropriate, which is also true for children with reading difficulties. If software can assist pupils with the incorrect words, or gives hints, then this program becomes an effective instructional tool.

CAI can provide endless opportunities for practice, repetitions, even record-keeping facility. I have already discussed in chapter 2 (see 2.5.1) that practice helps children acquire fluency and accuracy, and are effective interventions for poor readers. Practicing words helps children understand the passage better when training words are in context, but it can be boring for able readers. Finally, computers are famous for individualisation with the reader and can provide one-to-one teaching. The literature emphasises the above positive characteristics of CAI, but there is no evidence of what teachers think of those specific elements of computer-assisted teaching.

From the above summary, we conclude that an important element in CAI is *software*. I mentioned in the introduction chapter (see 1.3., 1.3.1.) that another major impediment to CAI implementation is lack of good quality software (Scandura, 1981; Johnson, 1987a; Buckleitner, 1996; Norris et al., 2003).

There is a plethora of software available in the market, but most of it is designed without a well-established theoretical framework for instruction, and often completely ignores theories of the reading process (see 2.2.), as it has been suggested in the introductory chapter. The question that I raise here that will be a second area of investigation, is how do primary teachers discriminate what is appropriate for classroom instruction? Do teachers use criteria to select such programs? By providing this answer, the study will ensure that the quality of software does not constitute a threat to ICT application in primary schools. In order to answer this question, it is important to understand the concept of software evaluation that will be explored thoroughly in the next chapter (chapter 4).

Chapter 4. Software evaluation

In this chapter I will explore the vociferous issue of software evaluation. First I explain the nature of evaluation by clarifying some definitions. I present the reasons that made software evaluation imperative and the different approaches that various researchers have conducted, but of no effect to the classroom teacher. I discuss the difference found among evaluators, designers and teachers in terms of the criteria they employ, and I move on to why teachers need criteria to select computer packages. Then I explain why teachers need to preview software, and I gathered information about what elements in children's literacy software teachers should focus their attention on, and I present them as a set of criteria.

4.1. The nature of evaluation

There is no "right way" to define evaluation since any attempt to define the term has been contested (Cuba & Lincoln, 1989), and it is not within the realm of this study to provide one. But one that seems to persist over time is this:

"*Evaluation is the systematic investigation of the merit or worth of an object or program, what is called the evaluand, for the purpose of reducing uncertainty in decision-making*" (Mertens, 1998, p. 210).

The above definition infers that evaluation is a process, a systematic strategy that is deployed by the evaluator(s) to see if an object (or program) is "good" which will help in decision-making. The systematic strategies that one goes about to evaluate programs, or objects, varies just like any kind of research. At this point, it is essential for the reader to differentiate the meaning of the two terms *merit* and *worth* found in the above definition: *Merit* refers to the excellence of an object as assessed by its intrinsic qualities or performance, where as *worth* refers to the value of the object in relation to a purpose (Mertens, 1998).

Trying to provide a definition for "software evaluation" specifically, only one was found in the literature:

"Software evaluation is the systematic reviewing of the value and effectiveness of a piece of courseware which is normally carried out by collecting experimental and other data before coming to objective conclusions" (Jacobs, 1998, p. 3).

What is evident in this definition is that evaluation is a) a process (systematic reviewing), b) it is conducted by collecting not only experimental data but "other" data as well (questionnaires, observation, interviews), and through this process the evaluator(s) will reach "objective" conclusions about its worth and effectiveness (decision making). In other words, it requires small-scale research.

It is important at this stage to elucidate some terms that all bear the meaning of evaluation. These terms are: preview, review, selection, formative and summative evaluation. Squires & McDougall (1994) established the following distinct definitions:

a) *Preview* is a screening process that is usually done or should be done by classroom teachers and enables them to understand the software and its use before introducing it to children. Viewers go through the program and by involving a small number of pupils they understand the software potential and how it can be used in the classroom. Teachers see the *worth* of software against certain criteria according to the content of software. Previewing should precede the selection process.

b) *Reviews* are written appraisals that rely on someone else's judgment usually outside the educational milieu. For that reason they are indifferent to the social interaction and user orientation (Shueckler & Shuell, 1989). There are also *formal* and *informal* reviews (Heller, 1991). A formal review requires a thorough review of the software much like a published book review conducted by the developer, software evaluator, or by an experienced computer-using teacher. The informal review usually considers one of the many forms or criteria developed by various educational organizations. Informal reviews can be also small reports written by teachers and include their impressions about the specific software after they have used it with children. Such reports can be kept in schools files that can give an approximate idea about the piece of software to other colleagues.

c) Selection, on the other hand, is usually done by teachers without the opportunity of seeing pupils actually using the software in their classroom in groups, or individually. Their choice relies on their personal experience, but it does not guarantee the *value* of software since it is not tested in that particular setting.

d) *Formative evaluation* is generally described as:

"*..the process of collecting empirical data during the development of instructional materials to determine any needed revisions*" (Patterson & Bloch, 1987, p. 26).

This kind of evaluation is performed during the developmental period of software, and the purpose is to see the "bugs" and try to correct them before they launch it in schools (market). The above definition implicitly says that during this process the evaluators (whoever they are) need empirical data from pupils and teachers (they are the users after all) that they will consider and precede to revisions. It is an essential trial system, and it should be incorporated strictly at each stage of the software development (Patterson & Bloch, 1987).

e) *Summative evaluation* on the other hand, is concerned with the quality and variety of experiences that the software can support after being used in real educational settings. Summative evaluation is more than just comparing the obtained with the expected pupil learning outcomes rather it includes factors such as attitudes and the learning environment (Munden, 1996) that are useful in making decisions regarding the effectiveness of the lesson (content of software). It is concerned with assessing the use of the software by pupils in context (Squires & McDougall, 1996). This will make the planning team aware of the effectiveness of each decision made during the developmental process. It is a process that claims the *merit* (see 4.1.) of the software. Summative evaluation is good for writing software reviews for publication. The above two types of evaluation serve the software organisations, and the purpose is to critique their product so that educators can make informed decisions about the suitability with pupils.

Why do teachers need software evaluation? The purpose of evaluating software is to answer the following question: Is the potential educational benefit of using the software worth the cost (in time and money) of acquisition, staff training and pupil use (HMI, 1991)? Similarly, Patterson & Bloch (1987) consider software evaluation a very critical factor considering the substantial amount of funds, which are allocated every year on the purchase and utilisation of technology (hardware and software). The difficulties in software include "transparent instructional strategies, faulty sequence, inappropriate use of feedback, lack of learner control, and confusing screen design" (Billings, 1985, p. 217). Next I will discuss the development of software.

4.2. The development of software

It was discussed in the introductory chapter that the continuous production of micro-computing and their introduction in the classrooms resulted in an increasing demand of educational software. Unfortunately though much of software was produced by "amateurs" who were trying to fill the vacuum producing a plethora of software at the cost of pedagogy. In that sense the dearth of good software was the result of the rapid production of computers (hardware) at the cost of quality computer programs (software) (see 1.3.). Bell (1982) wrote, "there are fewer than 100 good programs currently available to schools" (p. 242). Reasons for this problematic situation are given by different observers of educational software and can be summarised as follows:

- Amateurish programming, poor design, inadequate documentation, and poor pedagogy; this is software that has been written either by persons expertise in computers, but not in education; or expertise in instructional theory, but not in computers. (Staples, 1985).
- Commercial software does not meet the developmental needs of young children and did not accommodate individual differences (Haugland & Shade 1988).
- The predominance of drill & practice programs and the fact that few of the educational software were field tested with actual pupils prior to distribution (Johnson, 1984).

In the 80s, we have the development of two software evaluation organisations, namely EPIE and MicroSIFT. The figures of good quality software given by these two organisations were indeed very low which verified the lack of quality software. EPIE reported that only 5% of the software they have evaluated up to 1985 has been rated as "exemplary" and only about one quarter has met even minimal EPIE standards. Similarly, MicroSIFT has been able to "highly recommend" only 17% of the software they have evaluated up to 1985 (Dudley-Marling & Owston, (1987).

The plethora of "bad" software raised serious issues of worthiness (Smith & Keep, 1988; Kurland, 1983; Gonce-Winder & Walbesser, 1987; Self, 1985; Sage & Smith, 1983; Haugland & Shade, 1988; Sloane, et al., 1989). Similar issues were raised by educators, as well. Hague, Childers & Olejnik (1986) reported that 61% secondary reading teachers required improved software before increasing the amount of computer use in their classrooms. From a personal communication with the Deputy Head teacher and ICT Coordinator of the nursery school that children's interviews for this study took place, I was told literally: "They (software designers) do not know what they are doing". What all the above suggest is that teachers in the past and present are dissatisfied with computer programs and in order for them to use software, the quality of software has to improve. The successful implementation and use of ICT in classrooms is crucially dependent on the quality of computer programs (Johnston, 1987; Buckleitner, 1996). The situation urges for some kind of software evaluation, but are there any approaches to evaluating computer packages?

4.3. Software evaluation approaches

During the 80s *checklists* were very popular as evaluation tools. They usually consist of a list of criteria which are systematic and structured according to some major categories, for example source date (title, author, publisher, copyright date, etc), technical features (hardware and software), pedagogical rational (instructional goals, strategies, etc), instructional design, management system (record keeping, data analysis, etc), overall rating, and so on (Tergan, 1998). They may contain hundreds of items up to 300 criteria (Reiser & Kegelmann, 1994) depending on how broad and detailed is the scope of the evaluation lists.

Checklists were the most popular (Tergan, 1998; McDougall & Squires, 1995a), the most common methods for reviewing, or selecting software (Preece & Jones, 1985). Some checklists have been very influential, such as the EPIE and MicroSIFT discussed above (Smith &Keeps, 1988). Reasons for this popularity were:

- They provide a list of relevant criteria and the evaluators are not obliged to develop an evaluation system, which is sometimes done through an empirical testing.
- They seem to induce the impression of a complete set of evaluation criteria and a reliable, high quality all-purpose evaluation procedure.
- Checklists are easy to handle since evaluators have to understand the meaning to the criteria and then try to match if the product matches the particular criteria.
- Software was designed with limited and poor defined objectives (Tergan, 1998; Smith & Keep, 1988).

But there is a great body of research that shows that checklists have multiple, serious drawbacks and limitations regarding software reviewed by educators. These limitations are discussed extensively in the study of Tergan (1998) and McDougall & Squires (1995a). Scattered information regarded the disadvantages of checklists are found in the studies of Preece & Jones (1985), Smith & Keeps (1988), Schueckler & Schuell (1989), (Miller & Barnett (1986), Johnston (1987), Winship (1988), Smith & Keep (1988), Blease (1988), Jolicoeur & Berger, 1986), which I summarise below:

- Checklists focus on technical rather than educational and curriculum issues.
- They are not sensitive to the constraining conditions of different educational settings.
- They require a reasonable amount of background knowledge and experience in order to make the best use of them.
- They judge equally all types of software.

- The listed criteria are inadequately defined or explained which are open to a variety of interpretations, thus issues of validity and reliability are seriously questioned.

These disadvantages did not leave out the two most prominent checklists mentioned above the now defunct MicroSHIFT and EPIE (Gonce-Winder & Walbesser, 1987). But what is more important is that the checklist approach to software in the educational context is highly disputed among authors (Johnston 1987; Preece & Jones, 1985; McDougall & Squires, 1995a; Tergan, 1998). Indicative is the following quote:

"*....the effectiveness and appropriateness of the checklist as a means of evaluation is not considered*" (Johnston, 1987, p. 43).

It is proposed that checklists should be abandoned because they are not accurate tools and cannot provide evidence of how software can be used in school settings.

In the mean time, the issue of evaluating software attracted academics of University departments with a background in technology. These studies are distinguished in experiments and learning tests, illuminative approaches, and case studies (Knussen et al. (1991).

a) *Experiments* and *learning tests* were very popular during the late 70s and 80s even in the beginning of 90s. The essence of such approaches to software evaluation is that the effectiveness of software can be estimated only if it is tested with children to see if there is an improvement in their academic scores. In other words, they were trying to see the "instructional effectiveness" of software against certain objectives by using pre and post-tests, or else the "worth". It should be acknowledged though that software in the beginning tended to have an "input-output" design (programmed learning).

Such studies were conducted by Jolicoeur & Berger (1988a; 1988b). They were small-scaled research conducted in labs, or within a school environment, but in a designated area. There were certain pitfalls with such studies, such as the Hawthorne effect where the very fact of performing the evaluation experiment affects the results (pupils may perform differently in an evaluative situation than in a normal learning situation). The outcomes then are stated in relation to that particular software that in most cases is not identified, the results can not be software, which is usually not identified, the results cannot be generalised, and can not guarantee the success nor forecast the failure of a particular software in various educational settings. Focusing the attention usually on a limited number of aspects, they produce distorted picture because they miss the influence of other aspects that cannot be measured.

Instead, informed opinion, personal judgments and observations, culled from direct experience with the medium, can provide a wealth of details that is not found in statistical compilations and should not be discounted (Smith & Keep, 1988; Kidd & Holms, 1984). Studies that used the experiments as the backbone of software evaluation and questionnaires are the ones of Zahner et al. (1994) and Reiser & Dick, (1990), and we know that they used software in spelling with primary skilled and less skilled readers. This combination of experiment and questionnaire is what Knussen et al. (1991) called *illuminative approaches* to software evaluation.

Case studies may involve all three of the techniques outlined above, but essentially it relies on a detailed observation of a small sample of students. IN-CITES is a classroom-based case study based on a triangulation technique. The observational perspectives included parents, teachers, students, administrators, software designers, educational researchers (Smith & Keeps, 1988). Such an approach provides a framework for software evaluation through a consensus between the various reference points, thus it aims to foster the growth of mutual understanding among all parties (stakeholders) instead of rigidly defined sets of procedures.

A widely known approach that takes into consideration the stakeholders view is the perspectives interactions paradigm of Squires & McDougall (McDougall & Squires, 1994, 1995). This approach to evaluation sees teachers and pupils as active actors and designers are regarded to be passive. It is based on the interactions between the perspectives of pairs of actors, i.e. teacher-pupil, teacher-designer, and pupil-designer. The interaction between teacher and pupil yields information about pupils' interaction in the classroom, the relationship between computer-based and off-computer activities, pupils' discussion and peer group learning. In other words, the teacher-evaluator is led to consider issues of the role of the teacher, learning styles and styles of classroom management. The interaction between the teacher and the designer relates to issues of curriculum relevance whether the program's aims are explicitly or implicitly stated. Squires and McDougall are among the strong advocates of software matching the curriculum. The interaction between the pupil and the designer is related to learner control, the complexity of the material and the challenge felt by learners. The paradigm has been taught to 39 post- graduate students and the results were that despite its strength, it is very difficult and more time consuming. The literature does not have any criticism (for or against) this paradigm, or if it has been tried with classroom teachers.

Later the same authors claimed that the use of educational software can **only** be evaluated by considering the use of a package in particular learning situations. Their paradigm is a predictive evaluation tool that generates issues and questions specifically tuned to the perceived use of a package without being burdened by irrelevant concerns (Squires & McDougall, 1996). What is noticed here is that software evaluation takes a naturalistic approach, a descriptive type of evaluation since it has been gradually understood that CAI or software are used by classroom teachers in unique ways in different educational settings.

4.3.1. Problematic issues with software evaluation

A problematic issue with software evaluation is the *evaluator(s).* Evaluators, usually three, are individuals who are appointed by the software evaluation organizations to evaluate programs. Sometimes they are subject specialists, media specialists, or school administrators. They use a variety of ways to "evaluate" software. Often they review the program holistically and reach an overall conclusion based on their impressions. They review it just like reviewing a newly published book (Bangert-Drowns & Kozma 1989; Johnston, 1987). In rare occasions, they include empirical evidence of student performance so as to judge the instructional effectiveness of the software (Reiser & Kegelmann, 1994; Tergan, 1998). In much fewer occasions, they observe pupils as they work their way through the program (Owston & Wideman, 1987) as a complementary task. The qualifications of external evaluators are seriously questioned (Ridgeway et al., 1984) regarding their educational experience. Only recently have teachers been employed to evaluate programs (Reiser & Kegelmann, 1994). But what is important to this inquiry is that the studies of Borton & Rossett (1989) and Bell (1982) found that evaluators, designers and teachers care about different attributes of educational software. Teachers and developers rate technical criteria higher as their main concern, where as reviewers (evaluators) tend to focus on content and instructional criteria. The studies determined that there was no shared vision and that there were three quite different constituencies.

While software evaluation is a time consuming process, the rate of new programs coming in the market is beyond reach that software of today becomes obsolete tomorrow. This leaves some teachers wonder is it worth to perform it after all? It is almost a loosing battle to evaluate all software. The ones that have already been evaluated very soon become obsolete. It is not only the rate of software production, but the different kinds of software (see 3.7.). Software that includes activities that belong to the input-output approach (such as tutorials, D&P) is easy to evaluate. But the advent of CD-ROMs, games and word processors that include animation, video clips, speech facility, true life sounds and music all have reciprocated the era of "uncommitted" material (Smith & Keep, 1988). Such software makes evaluation perplexing and rather impossible to the point where it has been suggested that games and word processors (content-free software) need no evaluation at all.

Authorities started to recognise the difficulty and perplexity of conducting software evaluation studies to the point that they questioned "is it worth it after all". The US Department of Education and Educational Testing Service (ETS) has acknowledged the problematic nature and has reported that new methods of software evaluation that look at technology in context are being investigated. (Kosakowski, 1998). Though it seems an easy and straightforward process, authorities in the field have understood that software evaluation, just like CAI application, is unique onto itself and involves a host of local variables, cost, hardware, software, place in the curriculum, nature of users attitude of the school faculty, children's ICT skills, and so on (Kidd & Holmes, 1984; McFarlane, 1997). No evaluation approach, or method, will guarantee validity in advance (House, 1980). Therefore, software can not be evaluated as an object in its own right, rather its evaluation is idiosyncratic depending on the way it is used and how learners interpret its use in an educational setting. Software evaluation approaches proved costly, time-consuming, and research expertise is needed to undertake them. Software evaluation is small-scaled research (systematic inquiry) irrespective of the agent who is conducting it (teachers, evaluators, or companies). It is this researcher's judgement that classroom teachers do not have the skills, time or perhaps motivation to perform such studies, and they still need some kind of criteria to select among the challenging number of software.

4.4. Reasons why teachers need criteria to select software

Because of the perplexing nature of software evaluation, the limitations of the evaluation approaches and the problematic issues involved (evaluators /types of software, idiosyncratic application) researchers turn their attention to and urgently call for the development of *tailored criteria*, this is additional criteria for each specific category of software. On the contrary, Ridgeway et al. (1985) argued for the concept of *central evaluation*, this is by subject associations. In the same vein, Komoski (1987) criticised the development of criteria tailored to different types of software calling them generic and insufficient and raised issues about the development of *specific criteria in separate subjects* for judging effectively the quality of software:

"*...it is important for evaluators of educational software to move beyond the assumption that all software can be evaluated by means of a set of generic criteria. The time has come to move to the development of specific criteria for judging the quality of software in separate disciplines*" (Komoski, 1987, p. 403).

Why do teachers need criteria to select software? It is repeatedly stated in the literature that there is a proliferation of software, but only a small percentage of it is qualified as "good" software (Bell, 1982; Preece & Jones, 1985; Squires &

McDougall, 1994). One of the reasons of this is that software is not subject to any sort of trial. There is evidence that designers do not often execute formative evaluation (Patterson & Bloch, 1987) mainly for the reasons provided by Jacobs (1998) and Dick (1980):

- Lack of time and funding for conducting it.
- Since formative evaluation is a type of research, there are actual problems in the actual design of any such research.
- The political issue of who does what to whom and when, for what reason, is another major barrier, thus psychological difficulties in dealing with colleagues or partners often emerge.
- Disagreements between the designers and participant evaluators on the instructional development of software.

Field-testing and subsequent modification is a crucial step in creating effective packages that will assist in pupils' learning (Watson (1987). But there is evidence that only half of the companies field-test all their software in schools (Truett & Ho, 1986) including children (Dudley-Marling & Owston, 1987), which is in conflict with the software development principles set out by Watson (1987). On the other hand publishers are unlikely to admit that their programs are full of "bugs", or have no educational use at all (Ridgway, et al., 1985).

There is also evidence that the supporting literature that accompany software is often related to technical features, or how to operate the program, but it does not provide information on its efficacy as an instructional tool (i.e. objectives, rationale, etc), or if it has been tried out with children (Blease, 1986; 1988). Teachers may find information about software reviews in general articles or research-based articles that are written using terminology and jargon inappropriate to the non-specialist (Preece & Jones, 1985). Also, such reviews are not easily accessed by educators. In relation to reviews none of them can be singled out as the best one to use (Schueckler & Shuell, 1989). There is also evidence that choosing from published resources (reviews, journals) is not the preference of teachers (Borton & Rossett, 1989).

Besides, there is strong indication among researchers that teachers should be responsible in evaluating software (Squires & McDougall, 1994; Johnston, 1987; Dudley-Marley & Owston, 1987; Owston & Dudley-Marley 1988). As such, educators have to develop some kind of criteria for different subjects. But do classroom teachers feel in the same way?

Finally, criteria would enable teachers to *preview* software. I have explained in the beginning of the chapter what this process is, and that pupils should be included (Squires & MacDougall, 1995; Reiser & Kegelman, 1994; Zahner et al., 1992), but their role can be only participatory since children are not accurate at predicting the educational value of software (Jolicoer & Berger, 1988a; 1988b). Zahner et al. (1992), based on specific research, suggested that even 3 pupils are adequate in the preview process provided that they are of high, medium and low ability levels. There are certain reasons why teachers have to preview software, these are:

4.4.1. Reasons why teachers should preview software

The following are reasons why teachers should preview software before they use it with their children. These are:

Table 4-1 Reasons why teachers should preview software

No appropriate software evaluation method has been found
Checklists are insufficient tools for teachers
Supporting literature is mostly technical information
Classroom teachers do not have access to official reviews (published journals) and probably will not understand the terminology
Companies do not usually perform formative kind of evaluations
Previewing programs helps teachers to understand how to use it with their children

Failing to preview a program may become inflexible and difficult to use (Blease, 1986; Jolicoeur & Berger, 1986; Davidove, 1987; Komoski, 1987; Kozma & Bangert-Drowns, 1987; Troutner, 1989; Rowley, 1998). There is good software and poor software available in the market. Some are poor for one teacher or pupil but good for another. Finding something that is ideal for everyone is highly unlikely (Benderson, 1985), but the preview process helps teachers to understand the specific program, its objectives, how and when to use it, and see its *worth*, i.e. does it meet the classroom objectives?

But do teachers preview software before they use it with their children? The literature is not illuminating on this issue. No evidence exists regarding the number of teachers, or how many of them, preview software before introducing it to their pupils. On the contrary, I have found some factors that may well prevent educators from previewing programs.

4.4.2. Factors that may inhibit the preview process

The literature has indicated the following factors, and from a closer look these factors are intertwined with the factors that inhibit ICT application in schools:

Table 4-2 Factors that could inhibit the preview process

Limited ICT resources
Limited access to computers and limited use
Teacher's and pupils' poor ICT skills
Lack of criteria for indicating the quality of educational software

a) <u>The school's ICT limited resources in hardware and software</u>:

A teacher who struggles to use a unique computer set with a whole class of 25-30 pupils is unable to watch children using software, and therefore cannot reach valid conclusions. The ratio of computers to pupils is a significant factor. A high ratio causes aggressive behaviour among children, and frustration, as it has been argued in this thesis (working mode), and good software under such circumstances cannot prove its value. In addition, the small number of literacy software in schools and sparsity of good software available in the market do not give teachers the privilege of choice. They have no control over decisions about software selection (Cosden, 1988); rather they use whatever is found in the school's library.

b) Limited access to computers and limited use

If software is used in a workstation based in ICT suite with a pressurised tight schedule of approximate 15-20 minutes per week (Loveless & Dore, 2001), young children would not have enough time to complete their tasks, which in turn will not allow the teacher to judge the value of the software. Since the allotted time of 15 minutes is not on a daily basis rather weekly, then the situation is worse and teachers may well omit any critical judgments. Unfortunately, teachers have no control over access and time (Cosden, 1988). School teachers are very busy people with a heavy schedule loaded with curriculum duties and rarely have the time to preview software or the resources to select and purchase software (Borton & Rossett, 1989). If access and use of computers is not regular do teachers have reasons to preview software?

c) Teacher's and pupils' poor ICT skills:

Poor designed software in the hands of a skilled teacher can be of use, where as a good software can easily be misused by a less skilful educator (Borton & Rossett, 1989). A skilful teacher can make an effective use of poorly designed software. Also teachers with negative attitude to using ICT at school, or poor ICT skills, might affect holistically the processes involved in ICT application including previewing software. Such a situation will prevent teachers from reaching objective conclusions about software.

In similar vein, undeveloped pupils' skills may seriously affect classroom teachers to form an objective opinion about software (Weeks, 2000; Haugland, 1988). These skills can be on the physical level, i.e. young children are expected to have certain difficulties in operating the computer, but equally academic difficulties could affect objective judgments. Caution needs to be taken.

d) Lack of criteria

Finally, the literature indicated that another factor that impedes the preview process is a sheer *lack of criteria* for selecting software (Kommoski, 1988;

Preece & Jones, 1985; Squires & McDougall, 1994; Tergan, 1998). In relation to the subject of reading, I have only found the Krause (1984) checklist. But this checklist is consisted of 12 criteria most of them are related to technical features and only three of its standards are related to learning issues. Besides it is regarded obsolete and discarded because of the limitations of checklists discussed above (Miller & Burnett (1986).

As it has been argued, little empirical research is currently available on the specific factors that make educational software effective (Jolicoeur, & Berger, 1986). Though there is a need for educators to have criteria, and the literature urgently calls for *specific criteria* in separate subjects, no such sets of criteria are found. Since there is not evidence that teachers preview software, and no criteria exist that would enable teachers to understand good and poor quality software, an important question that I raise here is: how do primary teachers select software?

Thus far, I have explained what is software evaluation and the related different terms that led to the need of software evaluation. I briefly discussed the various evaluation approaches that proved insufficient for the classroom teachers and explicated the reasons why teachers need criteria to select software for classroom use. The literature indicated that there are no criteria that would enable teachers to discriminate software of educational value. I have raised the question: how do primary teachers select software, and because this study is interested in software designed to support the development of basic literacy skills, the question focuses on: how do primary teachers select basic literacy software? What *specific criteria* (related to the subject) do educators need to in order to select basic literacy software? This constitutes the second part of the first broad aim of the study.

4.5. Criteria for selecting basic literacy software

4.5.1. Criteria for selecting software

Research on computers and young pupils is scarce, and only recently started to emerge because technology became flexible and sophisticated so it is accessible to young children. In the first part of this chapter, I stressed the fact that there are no criteria for teachers to select software and particularly software designed to assist basic literacy skills.

A criterion posed by Miller & Burnett (1986) is that teachers should select literacy software according to their theoretical perspectives on how reading is acquired. This was a speculation and not a research-based evidence. Does this really guarantee the value of software? But I would rebuff this argument claiming that decisions regarding reviewing / selecting software should be made on some experiential grounds rather than on the basis of philosophical positions. The compatibility with teachers' theoretical perspective functions rather as a biased limitation, equally biased with traditional print, and it seems problematic and outdated since research findings on learning to read reveal that both methods are appropriate and complementary (see 2.4.3.). Therefore, software that advocate one of the reading approaches, or the other, has a role to play in early education classrooms. It is on the teacher part to decide when, how and for what reason it will be used with the pupils just like with any traditional material.

Another critical standard found in the literature is that software has to be tried out with children (Squires & McDougall, 1994). This is a very critical point and partially guarantees its educational value. It shows that the program has undergone some trial system (an evaluation), revisions have possibly been made, and the package is ready to be used in the classrooms. I have tired to draw together various general arguments said by various authors as criteria that may guarantee the educational value of software and its appropriateness for classroom use. But first of all, how do we define this "pedagogical soundness". Indicative is the following quote:

"*Pedagogically soundness of a program is the outcome of the appropriate integration of computer-based learning with the teachers' instructional goals and with the ongoing curriculum*" (Winkler et al., 1985, p. 288).

Throughout the literature it has been explicitly stated that an important criterion that may determine the educational value of software is its relevance to the curriculum and classroom material (HM1. 1991; McDougall & Squires, 1995b; Jolicoeur & Berger, 1988a), or classroom objectives (Haugland, 1992; Taylor, 1987; Clements & Nastasi, 1992). Clear learning goals for each exercise, game or lesson, is also emphasised by TechKnowLogica (Siraj-Blatchford & Whitebread, 2003). In addition, it has been argued that only when computers are integrated into the curriculum do young children demonstrate gains in conceptual understanding, develop abstract thinking, increase verbal skills, and have gains in problem solving (Haugland (1992). Because schools are committed to the implementation of NC and NLS objectives (see pp. 36, 37), and every activity (print or electronic) has to contribute towards those requirements then it is a logical argument the content of software should be related to the classroom curriculum or objectives if this software is to be seen as pedagogically sound.

Lack of curriculum, or classroom, objectives reflect one common implementation problem teachers face when start using software in their classroom, leaving them in a quandary about *how* or *when* to use it. It is believed that programs used in classrooms are of little use on their own; they must be seen in relation to the curriculum as a whole (Ridgeway et al., 1984) so that any piece of software offers opportunities to enhance, to assist and possibly to improve work in the classroom. Finally, only when software is related to some kind of objectives will teachers be able to see its *worth*.

The truth of the matter is that the relevance of the software content with what is taught in the classroom is also found among the first set of six criteria for selecting software designed for young ages. These criteria are found in the studies of Henniger (1994), Hohman (1998), Haugland (1992, 1997), and TechKnowLogica (Siraj-Blatchford & Whitebread, 2003). There are similarities in the above criteria mainly because all of them seem to have sprung from the NAYEC* (1996) guidelines:

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* The NAYEC position statement has been update in February, 1998 (Siraj-Blatchford & Whitebread, 2003).

Table 4-3 Criteria for selecting children's software

Appropriate content and levels of challenge
Attracting and holding children's attention
Ease of use
Avoiding bias, violence and inappropriate content
Supportive use of feedback
Sequencing of learning

a) Appropriate content and levels of challenge:

The relevance to the classroom objectives is phrased slightly different here as "appropriate content". What is taught in a classroom should be appropriate for the children in that classroom. In relation to basic literacy skills, the level of the program content – alphabetical principle, and phonological awareness skills, rhyming words, reading stories, making sentences, wordbanks – is a good match for skills and concepts that develop during the early years of schooling (Hohman (1998). Such concepts reflect realistic expectations for the children (age appropriateness) and accord with the NC and NLS mandates presented in chapter 2 (see 2.7., and also list of high frequency words Appendix 1). When the content is presented in multiple levels it allows room for children to grow and allows software to be used by pupils with different ability levels.

b) Sequencing of learning:

Good software includes features to manage the sequencing of learning. The learning sequence should be clear, one concept follows the next from the easiest to the hardest which helps children build structures and knowledge (expanding complexity (Papert, 1980). Another reason for sequencing of learning is that it allows software to be used by pupils with different ability levels.

c) Attracting and holding children's attention:

The value of software with a strong content in terms of learning will be limited unless a child is motivated to spend a reasonable amount of time (about 10 minutes per session). Developers use a variety of entertaining features (technical features) to make activities attractive, such as pictures, memorable characters, colourful design, animation, sounds, music, and words can be sounded (see

3.8.2.). What the above suggests is that teachers should look for appropriate use of:

- Pictures.
- Colourful design.
- Sounds.
- Animation.

In chapter 3, I argue that pictures are indispensable features in reading software (and print texts), there are some reservations regarding sounds and animation. Such elements are useful if they convey complex and important information valuable to pupils. Educators should avoid "the fun syndrome" when it comes to selecting educational software.

d) Ease of use

Children should be able to escape to the main menu from any portion of the program (child control) and at some point after initial exposure they should be able to work independently (independent exploration) (Haugland, 1992; Henniger, 1994; Hohman, 1998). Complex and confusing software might cause frustration and children might give up the activity. Because of the underdeveloped reading skills, software for this age group should use voice sounds to guide children and provide simple icons to allow them to navigate from one part of the program to the other.

e) Avoiding bias, violence and inappropriate content:

Just like good children's literature, good software should promote balanced gender roles, positive attitudes towards, disability, gender, race and culture, good social behaviours. It should not include violent, or abusive content, and if it allows children to Internet access, it should include safeguards. (Haugland, 1992, 2000; Scott et al., 1998; Wepner & Kramer, 1987). Because of the fact that schools develop Equal Opportunities policies, they should make sure that the educational material meets those mandates, in the same way teachers have to choose electronic material for classroom use that supports their EO policy.

f) <u>Supportive use of feedback</u>:

The element (or criterion) of feedback and its various forms has been extensively explored in the previous chapter (see 3.8.3.). This is a very important characteristic in technology because it takes the role of tutor, or teacher, and because it informs the user how well s/he is performing. Software designed for creative work such as art, painting and writing does not provide feedback because it involves many different dimensions and creativity is not easily "evaluated". Feedback has an essential role to play in goal-oriented activities, such as the basic literacy skills, and provide accuracy of children's input.

The above criterion that is part of a set of six criteria for selecting children's software directs the attention to the instructional design of software. Emphasis on the instructional characteristics of software has been given by many researchers (Taylor, 1987; Shuell & Schueckler, 1989; Schueckler & Shuell, 1989; Kosakowski, 1998; Kearsley, 1985; Steinberg, 1983; Reitsma, 1988; Sloane, et al, 1989). I have discussed what the instructional characteristics are, and their contribution to CAI (3.8.3.). Briefly, these are:

- Feedback (positive, negative).
- Repetitions.
- Opportunities for practice.
- Record of achievement.

There are several advantages in using instructional criteria:

- Learning effectiveness is increased when instruction is planned, outcomes are derived from the learner's knowledge base, and learning is intentional.
- Instruction is based on curriculum needs versus those of the author, or publisher.
- The inclusion of relevant teaching-learning strategies is promoted.
- Pupils and teachers attitudes are improved toward their courses and programs (Robleyer, 1983; Diamond, 1980; Kearsley, 1984).

Although teaching from a computer (or software) differs in a number of ways from more conventional forms of teaching and learning, we should not overlook important similarities. The fact that there are differences does not invalidate underlying variables of teaching (Shuell & Schueckler, 1989). I believe that it is a logical argument since 80% of software used in schools is content-specific and since computers seem destined to play an ever-increasing role in the delivery of instruction. The capacity of computers to provide all different kinds of feedback, corrections, repetitions, ample opportunities for practice, progressive stages towards learning goals, and record-keeping facilities are indisputable and actually these are one of the main factors that make computers excellent tools in assisting teaching.

The issue here is that instructional characteristics, and links to the ongoing curriculum / classroom objectives have been overlooked by "evaluators" because they focused on technical aspects (sounds, colours, animation) (Shuell & Schueckler, 1989). Such criteria are easy to specify and there is no doubt that they are important because of their affects on user's motivation and interest (Johnston, 1987), but they do not touch central learning issues. I have reported that the early studies of Suppes (1964) in CAI and reading made researchers realise that CAI would be effective if it follows sound educational principles and not because it is delivered by a computer with its unique features (sounds, animation and the like).

4.6. Summary

Software evaluation, though it may seem easy and straightforward, this process has been proven to be onerous and deceitful because in every intention to just "getting the facts" myriad human and contextual elements are involved. This is why software evaluation has shifted towards more naturalistic approaches, where all participants' opinions must be considered. The various research-based studies of software evaluation did not succeed in providing a comprehensive picture. Neither did the various approaches (checklists, reviews and supporting literature) managed to help teachers select software of educational value.

Software evaluation is difficult to define, difficult to perform and difficult to reach objectivity. It is a process (small-scale research) employed to see if a computer program is "good". Temporarily, any attempt to evaluate computer packages has come to a halt, and there is a shift towards more naturalistic approaches to evaluation. This means that software has to be seen in the context where it is being used. But still teachers need some kind of criteria that will help them see the *worth* of the evaluand (*worth* means that educators have to see if the software is of any value to what is taking place in their classrooms).

Such criteria will help teachers to *preview* computer packages. The preview process is very important because half of the available software does not undergo any trial process (see 4.4. the reasons why manufacturers do not evaluate their products), educators do not access official reviews easily, checklists and supporting literature are not adequate resources. Finally, it helps teachers understand how to use the program. The literature though did not reveal if teachers undertake that process or how do they select educational software. This study is set out to explore the selection process adopted by primary schools.

For a long time, the perplexing situation (software evaluation) left teachers and evaluators without any criteria whatsoever to select computer programs making thus the identification of suitable software (for classroom use) a forbidding and difficult task (Ridgeway et al, 1984; Preece & Jones (1985); Taylor (1987); Squires & McDougall, 1994), which left teachers remiss. Criteria for selecting young children' packages only recently started to emerge in the literature and they are all based on the NAYEC guidelines (Haugland & Wright, 1997; Hoffman, 1998; Henniger, 1994; Haugland, 1992; DATEC, 1999-2001).

Since this inquiry is set to explore how primary teachers select software designed to support the development of literacy software, I aspire to provide specific criteria based on empirical research asking directly classroom teachers to express their experience, and then to compare them with the criteria provided by the literature (the criteria suggested by the literature are not based on research). On my part, an effort has been made to assemble information from different sources and form criteria for teachers to select basic literacy software. I have divided those criteria in a) *general influential factors*, b) *technical features*, and c) *instructional characteristics*.

a) General influential factors:

- It has been tried out with children.
- It caters for different ability levels.
- It is consistent with the school's EO policy.
- It covers NC / NLS objectives (it concerns the content of software).

General influential factors are generic criteria that basic literacy software, or any software, should fulfil. These factors mostly affect teachers since they are the ones who make the decisions. The literature clearly indicated that software has to have been tried out with children before reaching classrooms, it has to cater for different ability levels, and to be consistent with the school's EO policy (see 4.5.1.). Regarding the content of software, it is supposed that this should include activities that support the development of basic literacy skills in young readers just like the traditional textbooks (see 2.5.), and should much the ongoing curriculum objectives (this is covered in the influential factors "it covers NC / NLS objectives" of the above set of criteria). This will also ensure the age appropriateness of software.

b) Technical features:

- Pictures
- Colourful design
- Sounds
- Animation

The wonders of technology allow computer programs to include pictures and have colourful design just like print texts. More over, they have the capacity to enliven texts by including sounds, and animation. The presence of sounds is not very clear in the literature something that this study. It is suggested that sounds and animation should be used in modesty.

c) <u>Instructional characteristics</u>:

- Feedback (positive, negative).
- Repetition.
- Opportunities for practice.
- Material is presented in sequential order.
- Record of achievement.

I have discussed in the previous chapter (see 3.9.) that among the pedagogical values of ICT is *interactivity*. This is the main capacity that make computer able to take over the role of teacher since they can provide various kinds of feedback informing the pupil how well s/he is doing. It is suggested that literacy computer games should allow users several tries before providing the answer. Immediate corrections are not appropriate. Computers can also provided endless opportunities of practice for pupils who need it. For example, able readers will not enjoy repetitive activities (see 2.5.1.).

This study fully supports the above criteria – general influential factors, technical features, and instructional characteristics – as appropriate standards that would help classroom teachers to select initial literacy software (content-specific type), and has presented arguments that justified them. This inquiry will not seek to find out not only teachers' opinions regarding the suggested criteria, but also the views of developers and children. As this thesis argues, software evaluation has shifted to more descriptive approaches where the views of all participants who share common interest (stakeholders) are considered. Since children are involved, the next chapter is going to discuss issues concerning young children using technology, and what do we know up to now.

Chapter 5. Technology and young children

This chapter presents research findings that verify the appropriateness of computers as another classroom activity in early primary classrooms. Research on computers and young children is thin on the ground because only recently have computers became flexible enough to be used by young age pupils. The chapter explores associated issues of technology and young pupils, such as the time and duration that pupils should engage, the computer to pupils ratio, the suggested working mode, gender, the difficulties young children face when working on computers, and attitudes towards the new machines. The chapter concludes with a summary of reasons why young children should use computers, and the identification of gaps in the literature.

5.1. General considerations

One major question that probably tantalises teachers and educators in general is if computers should be placed in Kindergarten classroom settings and if young pupils should be allowed to use them. Of course the opinions vary and fall mainly in two categories that creates this "digital divide": the opponents of computer utilisation and the computer advocates. The debate was at its height in the early to mid 80s, yet it is still going on to a lesser degree today. The potential dangers are that computers will "replace other activities, will rob children of their childhood, are two abstract, provide children an unrealistic image of the world, lead to social isolation, reduce feeling awareness and creativity" (Haugland & Write, 1997, p. 6).

Fears of computers replacing other activities, such as blocks (Barnes & Hill, 1983), art (Cuffaro, 1984) in reality it does not occur (Buckleitner, 1993). On the contrary, research has indicated that computers supplement and <u>do not replace</u> highly value early childhood activities and materials such as blocks, sand, water, books, exploration with writing activities, and dramatic play (Ginsberg, 2001). Computers are tools that came to assist and supplement teaching and not replace it. The truth is that children in the beginning are mesmerised by computers and flock around them. But just as any other novelty, after one month computers are viewed as one of many resources available for exploration and discovery (Lipinski et al., 1986). There are children who do not fear computers and are comfortable in using them (Genishi et al., 1985), and there are pupils who are not so enthusiastic about using the computers.

I have discussed in Chapter 3 (3.8.4.) the potentiality of computers to provide *one-to-one teaching* to the reader. Because of this potential, the influx of computers into the school settings could lead to social isolation (Barnes & Hill, 1983). But such fears have consistently been shown to be unfounded. Studies with young children showed increased collaborative attitudes among infants of four and five year olds, "let me show how to do it", or " I'll work with you," as well as assisting each other in keyboard manipulations and the "booting up" of software (Shade et al., 1986). Papert (1980) is among the first to argue that computers might serve as potential *catalysts of social interaction*. Additional studies have shown that the social effects of using computers are "overwhelmingly positive" (Bergin et al., 1993; Margalit, 1987; Lepinski et al., 1986; Clements & Nastasi, 1992; Genishi et al., 1985) even to children with significant social interaction deficits and language impairments (Spiegel – McGill et al., 1989).

Fears of computers would change children's thought processes, would create individual devoid of feelings and creativity are unfounded. On the contrary, research confirms that they experience interest, enjoyment, and surprise as they explore software (Shade, 1994; Genishi et al., 1985). *Motivation* is a crucial factor in learning; the motivational value of the computer is high (Cox, 1994), Computers are equally motivating with skilled and less skilled pupils (Margalit et. al., 1987; Speziale & La-France, 1992; Lewin, 2000; Singleton & Simmons, 2001). In Chapter 3 (3.8.2., pp. 71-73) I have explained the characteristics that accentuate the motivational aspect of technology.

Brady & Hill (1984) and Elkind (1995) stress the abstract nature of computers and doubt the possibility that computers can provide concrete operations, which kindergarten children have yet to attain. *Concrete operations* enable children to reason syllogistically, to follow rules, and to grasp that one and the same thing can be two things at the same time. Clements et al. (1993) though oppose the above accusations suggesting, "what is concrete to the child may have more to do with meaningful and manipulable than with physical characteristics" (p.56). If the computer program is relevant, a concrete representation of the real world and children can explore and experiment throughout the program, then the computer program provides young children a concrete experience. The zest of the above argument is that software has to be relevant to classroom activities and experiences in order to enhance pupil's learning.

Opponents fear that we are rushing young children too soon to learn skills that are too abstract and they are not ready to learn, and we are pulling them away from play experiences valuable for their cognitive development (Barnes & Hill, 1983; Elkind, 1985, 1987, 1996). But Flanigan (1997) argues that sensitive and retrospective children can work as they please meaning they can engage in self-directed play when they choose to retreat from group play, or to collaborate as a participants of parallel play. The issue of creativity can be overcome if teachers select software developmentally appropriate to young users (open-ended software). Research confirms that it is not computers, but the type of computer experiences provided that determine whether computers enhance, or inhibit, development (Haugland & Wright, 1997). In short, it is the software and its material that contributes to any benefits to children's progress.

Sheingold (1984) believes that the symbolic nature of the microcomputer does not make it inappropriate for use by young children. She believes that computers can provide cognitive support as a means for reflecting on other activities, and better understanding other media, as well to help children take a broader view of the computer as an important instrument of technology. Whether computers will "rob" children of their childhood depends totally on how they are utilized and what kind of software they are practicing on (Haugland & Wright, 1997). Davis & Shade (1994) argue that the best way to use computers is to integrate them with the ongoing curriculum and not to isolate them because only then will children use them as natural tools for learning (Shade & Watson, 1990). In similar vein, the DATEC initiative, funded originally by the European Community (1999-2001), which is now sponsored by the IBM Corporation, in common with the UK National Curriculum (QCA / DfEE, 2000) present ICT education within the broader framework of an integrated technology curriculum (Siraj-Blatchford & Whitebread, 2003). I have discussed the concept of "ICT across the curriculum" further in section 3.1.

The Developmentally Appropriate Technology in Early Childhood (DATEC) (1999-2001) identifies eight general principles for determining the appropriateness of the ICT applications to be applied in the early years. These are:

- Applications should be educational.
- Encouraging collaboration.
- Integration and play through ICT.
- The child should be in control.
- Applications should be transparent and intuitive.
- Applications should not contain violence or stereotyping.
- Awareness of health and safety issues.
- The educational involvement of parents (Siraj-Blatchford & Whitebread, 2003, pp.7-13).

5.2. The appropriate age for young children to start using computers

Computer use is not recommended for children younger than 3 year old simply because it does not match their learning style (Hohman, 1998). Klein (1998) explored the *how* and *what* children of that age feel about computers, and suggested that they are overwhelmed by computers, and should not be pushed, or rushed ,to play with them. Besides computers at that age are not appropriate to the developmental needs of children.

The 4.6 – 5 year old child initially shows an anxiety that appears to decrease significantly. They seem to express curiosity, interest and enjoy experiencing their effect on them. By the age of 5.6 – 6 years the accumulation of success or failure experiences seem to determine the child's feelings and attitudes toward the computer. Therefore it becomes extremely important to deal effectively with the first encounter between the child and the computer, and attempt a best match between the two.

5.3. Length of time children should engage in computer activities

As early as 1972, Atkinson & Fletcher found that 8-10 minutes of CAI per day helped first graders to gain over the control group. Since then it has been confirmed that about 10-15 minutes work with a reading package per day significantly benefits primary-grade children's reading skill development especially for low achievers (Clements & Mcloughlin, 1986; Haugland, 1992). Similarly, Torgesen (1984) concluded that as little as 10 minutes a day could significantly affect their academic achievement of mildly handicapped pupils that may be found in mainstream classrooms. A far as younger ages (3-4 year olds) are concerned, there should not be any time limits. Their skills are not adept enough to manipulate the machines, and need plenty of time to experiment and explore (Haugland, 1992). Though 10 minutes of daily initial literacy computer activities seems adequate and can significantly affect children's academic achievement, it is not known the approximate time young users are using the machines in UK schools a significant contribution of this study.

5.4. Children's access to computers in the classroom

The ratio of computers to young children is important – at most 1 to 5. The goal should be to have multiple computers in classrooms (5 or more), so that all children irrespective of gender can easily access these tremendous learning tools. It has been found that large computer to pupils ratio i.e.1:22 causes aggressive behaviour (Lipinski et al., 1986), which means that such a factor may well influence social behaviours. Good software, when used by a group of pupils fighting over turn-taking, will not reveal much to the teacher about its worth. This helps us to conclude that computers when used by small number of pupils (1:3 maximum 1:5) allow teachers to preview and evaluate software. Rightly then Haugland (2000) argues that small micro-density figures not only encourages collaboration, but also enables teachers to effectively integrate computers into their curriculum. All the above help us understand that the small ratio is essential for the following reasons:

- Schools provide a balanced ICT curriculum.
- Pupils have easily and free access to computers.
- Better quality of learning experiences.
- Pupils develop positive social behaviours, and
- Previewing process becomes easier.

5.5. Suggested working mode

In traditional instruction, pupils like working in pairs and it is found to be more effective than working alone (Kruger, 1993). Working on computers, preschoolers and primary pupils prefer working in dyads or triads (Shade et al, 1986) and with minimal teacher supervision (Jackson et al., 1988; Clements, et al., 1993). Similarly, Spiegel-McGill et al. (1989) also found that children with social interaction and academic deficits benefit more, and improve their social skills when working on the computer in dyads with non-handicapped classmates in integrated classrooms.

The computer area is rich in social interaction, children discussing what they are doing, asking a peer for help, exploring a program together, showing a friend the picture they have drawn, participating in play activities and the like. The study of Shade (1994) though showed slightly different results indicating that the older preschoolers like to work on their own. The truth is that as children grow older then they prefer to work in isolation because of the academic demands that require concentration and problem solving skills (Justin III, 1985). Do beginning readers like to work in pairs or small groups when engaging with basic literacy software?

5.6. Difficulties young children face while working on computers

The two online surveys The Computer Clubhouse and Plugged-In (1999-2000) showed that elementary pupils have difficulties with turning on the computer, finding the program, knowing what to do next when things go wrong, or when the computer freezes more less frustrations and difficulties similar to all ages (The Future of Children, undated). The above evidence shows that the main problem of pupils is navigation. Weeks (2000) observed that Reception pupils find it very difficult to keep hold of the mouse, and click after they had positioned it on the screen. This is due though to the fact that the children had not been taught how to hold or use the mouse before and did not have enough time to practise and learn this skill since the study took place in the beginning of the school year. Usually young children take to the medium very quickly learning machine operations surprisingly fast (Hayward, 1990; Genishi et al., 1985).

5.7. Young pupils' gender and ICT

Regarding gender issues the studies of Williams & Rosenwasser (1987-1988), Todman & Dick (1993), Williams & Ogletree (1992), and Yelland (1995) investigated the issue with preschool children of 3 and 4 year olds and the findings addressed no sex differences in computer competence and interests. Other studies though support the opposite, that computers are characterised as "masculine" and a tendency to be used more by males than females (Siann et al., 1990; Martin, 1991; Wilder et al., 1985; Hawkins, 1985). Research is divided in this issue.

5.8. Young children's attitudes towards computers

The primary pupils' attitude towards technology is positive, as it is shown in the studies of Yelland (1995), Williams & Ogletree (1992), Selwyn & Bullon (2000). The two online surveys, the Plugged In, a community technology centre serving low-income children in East Palo Alto, California, and the Computer Clubhouse in Boston both conducted in 1999–2000 both highlight the important role computers could play in the learning process (The Future of Children, undated).

The two online surveys mentioned above found that children justified their positive attitude towards computers because of playing games, drawing pictures, writing letters, and surfing the Web. The quote of the 5-year-old Ronald: "play with my friends on the computer" showed that perhaps preschoolers like computers because they play with their classmates, or friends. Similarly, the study of Yelland (1995) showed that pupils like to use the computer because they can play games, followed by writing messages, tell you things, and help you to do sums, which can be interpreted that they like computers primarily for their games and secondarily they perceive computers as a medium to help them with and/or perform classroom activities. An interesting finding is that young subjects believe that computers can help them to learn (ibid). The truth is that this evidence comes from studies done outside the UK, and it is not sure if they apply to children in this country.

Additional research has shown that children feel confident and competent in using computers (Selwyn & Bullon, 2000; Yelland, 1995; Genishi et al., 1985), that they enjoy using computers, and quickly learn to manage the operations required independently (Hess & McGarvey, 1987; Genishi et al., 1985), and that children like computers, and are positively motivated to use them (Shade et al., 1986; Wright & Samaras, 1986; Shade, 1994). Again these studies were conducted with children outside this country.

5.9. Reasons why young children should engage with computers

As more families purchase computers for home use more, children are becoming familiar with them. They view computers as familiar objects, and they may well serve as another bridge from home to school. But having a PC at home is not indicative of a child being a home computer user (Selwyn & Bullon, 2000; Haugland, 2000). The study of Selwyn & Bullon (2000) found that 73% of the children had domestic access, and parents, siblings, extended family and friends were all cited as providing help and encouragement. This means that they are social factors that encourage the further use of computers at schools.

The "they are here to stay" outlook is another factor that has influenced the thoughts of many educators and adults who support the earliest possible introduction of computers and that children should enter the computer world as early as possible (Cuffaro, 1985). Early experiences with computers are important if positive attitudes towards computing are to develop (Williams & Ogletree, 1992).

Besides, there is little doubt that the importance of ICT in the primary school will only increase (Selwyn & Bullon, 2000). Since computers gain a permanent place in secondary and primary classrooms there is a need to introduce technology to early years classrooms provided that we have made the appropriate adjustments for this age group.

Additionally, teachers have the opinions that computer instruction can teach and actually improve readiness skills in three areas: reading (recognising / sequencing letters, and sounds / phonics; math (recognising numbers, basic addition and subtraction facts, counting, and greater than / less than); and visual (directional concepts, shapes and colours) (Edyburn & Lartz, 1987). The Kindergarten teachers of the study agreed that it was necessary to introduce computers to their pupils.

5.10. Summary

This chapter, the last of the literature review, has focused solely on issues related to computers and young children, a field that only recently has been explored. Despite the initial reservations in the introduction of computers to young children, evidence in the literature shows that computers are highly motivational and pedagogical tools. Young children are capable and enjoy working on the machines, provided that the computer activity is their choice, their age is over 3 years, the time of play does not exceed 10 –15 minutes daily, and the ratio is small i.e. 1:3 maximum 1:5. In the previous chapters (3 and 4), I presented arguments that the content of software should match the classroom objectives, this is also true for programs designed to be used by young children at school. This does not only guarantee the appropriateness of technology, but contributes to affective ICT application in schools. The issue of gender and children's difficulties is disputed. Children prefer to work in pairs, or triads.

While all the above concern general issues of technology and young children, the literature is not illuminative regarding children's opinions on using initial literacy software. The study will all the above arguments (pupils' difficulties with computers, gender, preferred working mode, opinions on literacy software and contribution to their learning) and focus them specifically to using initial literacy software. Further more, it will seek pupils' opinions on specific elements in software (technical features and instructional characteristics). It is this writer's belief that classroom teachers, and designers, have to be aware of the characteristics in software that children like, or dislike. No such evidence exists in the literature and no assumptions can be made until this research is completed. Young users' confessions will validate the provided criteria. The contribution of this study is that it will bring to life pupils' views on software elements that would enable teachers and developers to make the right choices when it comes to selecting software. Pupils are after all the reciprocates of this novice, but they have been greatly ignored (Klein, 1998).

5.10.1. Identified research gaps

Thus far, chapter 2 has demonstrated the importance of pre-reading (basic literacy) skills in the early years curriculum delivered by the traditional teaching style, and how these skills are usually taught to pupils using traditional textbooks and methods. Textbooks are one source that may assist children in developing basic literacy skills. The introduction of computers (ICT) has brought innovative ways of teaching. Teachers have to select print or electronic material that will contribute towards NC / NLS objectives.

In Chapter 3, I have presented the changes that ICT (computers) have caused on schools management and teacher training, the importance of ICT in the NC and the costly initiatives £1.6 billion has been spent since 1997 on ICT-related initiatives under the NGfL and £230 million lottery money for the NOF scheme (teacher training). In the same chapter I have explored how the use of ICT changes instruction by presenting the different characteristics and types of computer-assisted teaching (CAI), and I have presented research findings that encourage its use in supporting the development of basic literacy skills in early readers provided that young children should engage with computers for 10 minutes daily in order for educators to see the impact that technology has on their learning (Haugland, 2000). Loveless & Dore (2002) and Watson (1997) argue that in primary settings computers are used on average 15 minutes per week. In USA, Marcinkieewicz (1993-94) and Norris et al. (2003) have found that teachers do not actually use technology n their classrooms. What is the reality in the UK, and specifically in relation to initial literacy software? This is a niche found in the literature that will be explored in this study, namely the extent to which initial literacy programs are used by primary teachers.

In Chapter 3, besides the positive effects of CAI in reading, I have discussed various factors that may impede the implementation of CAI (ICT policies, resources and their management and teacher training). Another serious factor is good quality software (Scandura, 1981; Johnston, 1987; Buckleitner, 1996). There is also evidence that teachers are not satisfied with software (Hague et al., 1986) to the point that the amount of computer use will not increase in the classroom unless the quality of software improves. Unfortunately the majority of software is regarded as poor quality (Preece & Squires, 1984; Taylor, 1985; Cosden, 1988; Borton & Rossett, 1989). What is more alarming is the fact that there is no evaluation method for teachers to select software, and no sets of criteria to use in order to recognise software of educational value (see Chapter 4). No criteria are found for teachers to select basic literacy software that falls within the interest of this thesis and leaves one wondering how primary teachers select initial literacy software. This is the second niche found in the literature that will be explored further. The above void spaces in the literature review justify the first research aim of this investigation (see also 1.5.):

"*To explore the use and selection procedure of basic literacy software in primary / nursery schools*".

Chapter 4 that has dealt with issues of software evaluation suggest that pupils' opinion should be sought in any process of software evaluation (either this be a small-scale research, or the preview process done by classroom teachers). The scant criteria found in the literature are sheer speculations of adults. We cannot reach valid conclusions, suggestions, or criteria unless we ask pupils themselves. After all they are the reciprocates of this novice, but their opinions have been greatly ignored (Klein, 1998) in designing computer programs, and only recently have they been sought (Scaife, et al., 1997). Further more the literature indicated that children are capable, and enjoy working on computers. Studies in relation to gender and children's difficulties 's show some sparities that will be explored further in this study. Most of the findings of various studies though are not based on adult observations and not on pupils' "confessions" about the machines. There is total lack of information about young children using basic literacy software and their opinion about specific elements, this is technical features and instructional characteristics in computer programs. This was a gap in the literature that will be explored for the first time by asking directly KS1 pupils.

Moreover, it has been argued that there is much to learn from collaboration among teachers, developers, and pupils working in the classroom (Walker & Raynolds, 2000), but instead there is evidence to show a gap of communication among stakeholders (Ridgeway et al., 1984; Scaife, et al., 1997). I did not find any study that sought information from all stakeholders (teachers, designers and pupils) views and compare these views to see where do they diverge or converge.

The above-identified gaps justify the second aim of this study:

"*To explore young pupils' (KS1) on using initial literacy software and on software elements (technical, instructional)*"

So far, I have presented the theoretical background of the study as well as the research gaps of the study. Next in the Methodology chapter, I will analyse how I will go about to investigate the above aims, the methods employed, the sample, the design of the research tools, and the analysis techniques that will yield valid interpretations.

Chapter 6. Methodology

Now that the research gap and aims have been identified, the first part of this chapter will describe and justify the constructivist stance of the study, which in turn will justify the constructivist methodology by Guba & Lincoln for this research. The research questions will emerge and will be stated explicitly and finally, the chapter will end with its summary paragraph.

The world we live is full of complex, "locked" phenomena and an innate attribute of human nature is the curiosity to come to grips with these phenomena – natural or social – occurring in the environment, we ask questions, and give answers. Regarding the social phenomena, there is no way to answer these questions in an unambiguous and certain way or in a way that is capable of proof (Guba & Lincoln, 1989; Eisner, 1994).

Nevertheless the set of answers the researcher gives is the basic belief system or *paradigm* (Guba & Lincoln, 1989; Silverman, 2000), thus paradigms are patterns we understand the world and its phenomena. There are two major paradigms in social and educational research: the positivistic and the interpretivist / heurmineutic paradigm that vary significantly on ontological, epistemological and methodological issues that will be elucidated in the following paragraphs. This study adopts the constructivist paradigm proposed, and next I will discuss its origins and axioms.

6.1. The contours of the constructivist paradigm

Constructivism falls within the broad spectrum of Interpretivism /Heurmineutic tradition that form the canvas of qualitative research. Interpretivism stems from the tradition of heurmineutics in sociology, the phenomenology, and the critiques of positivism and scientism (Denzin & Lincoln, 1998). Historically, interpretivists / constructivists argue for the uniqueness of human inquiry and roughly hold the view that the aims and methods of the social sciences are different to those of the natural sciences: the goal of the latter is scientific explanation, where as the goal of the former is grasping or understanding (*verstehen*) of the social phenomena. Spradley (1980) likens the differences between posivitists and interpretative researchers to those between petroleum engineers and explorers. In this analogy the former knows what s/he is looking for, how to look for it, and what to expect; the positivistic researcher works in a linear, sequential or step-by-step fashion. On the contrary, interpretivists – the explorers – are trying to map an uncharted wilderness (Hitchcock & Hughs, 1995) with little or no knowledge of the area. Positivists try to discover, to prove or to falsify, where as their qualitative colleagues try to describe what they have found.

The fundamental disagreement of hermeneutics /constructivism lies on "objectivism", this is that "truth" exists out there in the world independently (*ontology*), separating thus knowing subjects (researchers) from objects (the researched) (*epistemology*). Scientism is not the single mode of acquiring knowledge "true" knowledge. Thus qualitative researchers argue that there are multiple realities (truths) in the social world, which may be in conflict, and the scientific inquiry *alone* fails to grasp the multiplicity and complexity of the "lifeworld" of individuals (Scott & Usher, 1999, p. 26). In addition, the researcher can not be viewed as separate since the aims of qualitative researchers is explaining the social world which involves understanding or "making sense" of the world through the frames and pre-understandings of the researched. Though understanding something is always "subjective" and knowledge in that sense includes a "subjective" element, exponents of the interpretivist / constructivist paradigm claim that meaning is created by the interaction of the researcher and the researched working together within a social context. What is really taking place then is a dialogue, or what Gadamer (2003) calls "fusion of horizons" (pp. 306, 374 and 378), where the researched-into understands the question and the researcher understands the answer. Knowing is not passive and the mind is active in the construction of knowledge.

Though constructivism (later version of interpretivism) and interpretivism share a common emphasis "on the world of experience as it lived, felt, undergone by social actors" (Denzin & Lincoln, 1998, p. 236), constructivists echo that knowledge and truth are created, not discovered by mind (Mertens, 1998). In this sense, humans do not find or discover knowledge so much as they construct or make it. Humans invent models, concepts, and schemes in order to make sense of experience and we continually test and modify these constructions in the light of new experience (Schwandt, 1994, 1998). They view that the world is not real in an absolute sense, but it is made up and shaped by cultural and linguistic constructs (Patton, 2002). *Constructions* are people's interpretations based primarily on experiences. They represent the efforts of people to "make sense" out of their situations or the state of affairs they find themselves in. Guba & Lincoln (1989) believe that the best means of developing *joint constructions* is the "hermeneutic – dialectic" process, so called because it is interpretative and fosters comparing and contrasting divergent constructions. If the inquiry fails to reach consensus, then an agenda for negotiation can be provided instead that fall within the nature of the inquiry (Schwandt, 1994, 1998).

What constructivism unambiguously supports is that there is no true or valid interpretation (Crotty, 1998), or no interpretation can ever be uniquely correct, "fact of the matter" in a positivist sense because there are no criteria that produce correct interpretations or settle the validity of any one interpretation in conflict with others (Scott & Usher, 1999, p. 26). As Fuss (1989) explains exponents of this paradigm are "concerned above all with the production and organisation of differences" (p. 3). Through comparing and contrasting interpretations, a consensus can be achieved despite the *differences*. As such, constructivist understanding is a learning process involving dialogue between the researcher and the researched which most of the times is ongoing and incomplete. In other words no explanation is ever definitive but always contains a capacity for resisting closure (Scott & Usher, 1999, p. 27). It is also important to note that the circular and perspective qualities of interpretation, which make it always partial and incomplete, are not something extraneous as Bohman (1991) notes. Actually this forms the conception that the formation of knowledge is iterative and spiral. Finally, constructivist researchers must recognise their situatedness, therefore their interpretations must be temporarily suspended, and to use the term "bracket" used by Scott & Usher (1999, p. 28), or more accurately interpretations should be essential starting points that need to be left open to modification

(Gadamer, 2003). Knowledge is an unpredictable emergent rather than a controlled outcome.

6.1.1. The precepts of the constructivist methodology by Guba & Lincoln

Guba & Lincoln (1985, 1989) acknowledge that constructivist, interpretive, naturalistic, and hermeneutical are all similar "traditions". The constructivist paradigm - just as the conventional one (positivist), deals with three questions: *ontology*, *epistemology* and *methodology*.

Relativist ontology (nature of reality). There exist multiple, socially constructed realities ungoverned by any natural laws, causal or otherwise. "Truth" is defined as the best informed (amount and quality of information) and most sophisticated (power with which the information is understood and used) construction on which there is consensus (although there may be several constructions extant that simultaneously meet that criterion).

Monistic subjectivist epistemology (nature of knowledge). The researcher and the researched-into are interlocked in a way that the findings of an investigation are the *literal creation* of the inquiry process. Note that this posture effectively destroys the classical ontology-epistemology distinction.

A Hermeneutic methodology (approach to systematic inquiry). It involves a continuing dialectic of iteration, analysis, critique, reiteration, re-analysis and so on, leading to the emergence of a joint (among all the inquirers and respondents, or among etic and emic views) construction of a case.
(Guba & Lincoln, 1989, p. 84).

The constructivist paradigm from the Guba & Lincoln's point of view rests on two elements: a) *responsive focusing* – determining what questions to be asked and what information to be collected including the constructions of *all stakeholders*; and b) *constructivist methodology* – carrying out the inquiry within the ontological and epistemological presuppositions of the paradigm (Guba & Lincoln, 1989; Mertens, 1998). The paradigm patently suggests an in-the-world (naturalistic) set of methodological procedures should be employed that will seek to understand phenomena via induction; emphasis is put to the process, context, values and interpretation, where as findings are reported in a narrative form (Mertens, 1998, 2003; Grotty, 1998).

The primary assumptions of the paradigm include the following:

- "Truth" is a matter o consensus among informed and sophisticated constructions, not of correspondence with objective reality.
- Facts have no meaning except within some value framework, hence there cannot be "objective" assessment of any proposition.
- "Causes" and effects do not exist except by imputation...
- Phenomena can only be understood within the context studied; findings cannot be generalised.
- Data from a constructivist inquiry have neither special status nor legitimation; they simply represent another construction to be considered towards consensus (Guba & Lincoln, 1989, p. 44-45; Patton, 2002, p. 98, Schwandt, 1994, 1998).

In this scientific paradigm, the researcher identifies the *claims* (favourable to what is investigated), the *concerns* (unfavourable to what is being researched) and the *issues* (areas of disagreement) among the *stakeholders*. The model seeks out different views of the stakeholders with respect to claims, concerns and issues where the researcher tries to reach consensus on all contentious areas, if that is possible. But the researcher cannot pronounce which perspective is "right" or more "true" or more "real", but s/he can give added weight to the perspectives of those with less power and privilege to "give voice" (Patton, 2002, p. 98). The model does not rule out quantitative modes, as is mistakenly believed (Guba & Lincoln, 1989, p. 42), but deals with whatever information is responsive to the unresolved claim, concern or issue. As each group copes with the "constructions" posed by others, their own constructions alter by virtue of becoming better informed and more sophisticated. The researcher soothes out differences and the final conclusions are thus arrived at *jointly*. All this negotiation though among stakeholders is done via a hermeneutic – dialectic process and the "final report" is a *joint construction* of all participants rather than the depiction of some "objective" situation. Thus through this methodology we construct knowledge about reality and not reality itself (Shadish, 1995, p. 67). But constructivism does not escape from its critics.

6.1.2. Disadvantages of the constructivist paradigm

Of course the constructivist / interpretivist paradigm, just like the conventional one, has its disadvantages. What follows below are general concerns resonated by various writers, namely the paradigm:

- Produces soft data (journalism, soft scientists).
- It is biased (value-laden nature of inquiry).
- It is subjective (unreliable, impressionists).
- Emic (insiders' point of view), ideographic, case-based position that directs the attention to the specifics of particular cases (Denzin & Lincoln 1998; Mertens, 1998)

6.1.3. The constructivist paradigm and this study

One of the aims of the present study was to explore two things: the use of initial literacy software and the selection procedure of such computer packages deployed in primary educational settings. Starting from this point (general problem) I tried to identify the major features of the terrain. Initially I sought information in the literature, and I began gathering information going first in one direction, retracing that route, then starting out in a new direction and eventually finding out the avenues that my topic is related to. The research questions could not possibly be definitely established before the study began.

Soon I identified that my topic would be appropriately investigated not solely by teachers, but also by pupils who after all are the reciprocates of such programs and their views have greatly been ignored until recently (Klein, 1998; Scaife, et al., 1997). In addition, AN indispensable part of computer programs is its creators and their input would be essential in elucidating certain aspects of my inquiry. In a nutshell, there was a need to collect information from three *stakeholders*. The driving force of my study would be pupils because their opinions count more in the design of software. By exploring the views of the three stakeholders and pointing to *differences*, I could possibly reach a consensus, or to use the Gadamerian term "fusion of horizons". What I am trying to say here is that I entered the field as an "explorer" seeking to describe a "wilderness" area and not trying to "discover" something. I did not "expect to find" something predetermined following a linear and cumulative course (like the petroleum engineer), rather the investigation was done inductively and in a circular mode where I was entangled in an interactive process trying to "make sense" of the chosen topic and interpret the stakeholders' interpretations (constructs).

In turn these constructs were critically analysed and reflected upon in order to define the *claims*, *concerns* and *issues*, which will be jointly reported. This study does not claim that will reach the absolute "truth" and will not pronounce whose perspective is right, true or real. Rather it will add weight to children's interpretations (*confessions* in Eisner's term) regarding initial literacy software. The constructions (perspectives) of the three stakeholders (teachers-pupils-developers) gathered together will be seen as starting points open to further investigation and possible modification, and this because their perspectives have only recently been sought and reported jointly, and this research constitutes a foundation upon which further and sophisticated investigations are required in order to reach *consensus* among the three groups.

A final touch, the adoption of the constructivist paradigm and the scant remarks made above for the conventional paradigm, by no means should be construed as belligerent attitudes on positivism. They are sited only to contrast the belief systems of the two paradigms. This researcher strongly believes that the positivistic paradigm has played and will play an important role in the social and natural sciences. I do align with Eisner's (1994) position, who argues: "One approach is superior to the other but only with respect to the nature of the problem one chooses to investigate" (p. 235). In that sense, if I had to "find" the impact of specific initial literacy software on young children's learning basic reading skills, or if this was part of my inquiry, then definitely such a question would have been dealt with a quantitative method with a pre- and post-experimental design. Besides the constructivist paradigm does not rule out the use of quantitative modes (Guba & Lincoln, 1989, p. 42; Cuba & Lincoln, 1989, in Mertens, 1998); actually they do not even regard their paradigm as qualitative (Guba & Lincoln, 1989, p. 45). Rather they suggest that the researcher should deal with whatever information is responsive to answer the questions (*responsive focusing*). Thus I can use a variety of resources and a variety of methods, they even can employ low-level of statistical analyses (Denzin & Lincoln, 1998). This is why I feel like a *bricoleur* – one who uses different techniques and methods to provide solutions to a problem, and their work, the *bricolage*, or quilt making is the emergent construction that changes and takes new form as different techniques and methods are added to the puzzle (Denzin & Lincoln, 2003, p. 5).

It is necessary at this point to delineate the term *methods* from paradigms. *Methods* are the tools and techniques with overall guiding strategies, such as questionnaires (surveys), observation and interviews. Though there are meaningful differences between the ontological and epistemological levels, these differences do noT matter in the day-to-day conduct of inquiry because methods are independent of paradigms (Miles & Huberman, 1984, Denzin & Lincoln, 1998, 2003; Guba & Lincoln, 1989).

6.2. Aims and research questions of the study

This study was set out to explore two broad aims:

A. To explore the use and selection procedure of initial literacy software in primary/nursery schools.

This aim will be investigated through the following questions:

a) *What is the extent to which primary education teachers use software to assist teaching basic literacy skills?*

This question will be explored through the following avenues:

1. Approximate time pupils use computers daily.
2. Frequency of using basic literacy software.

3. Elements of the school's ICT policy.
4. ICT Resources and management of resources.

   i) Computers, printers, literacy software, scanners, Internet

   ii) Special software for pupils with reading difficulties

   iii) Micro-density figure (computer to pupils ratio).

   iv) Nature of the timetabled access to ICT resources.

5. Teachers ICT skills.

b) *Do primary school teachers use criteria to select software for classroom use?*

This question will be explored through the following paths:

1. Schools written guidance for selecting software (criteria if any).

   i) Skills teachers need to select basic literacy packages.

2. General influential factors in selecting software
3. The review process (involvement of pupils, feedback of the results to the developers

Parts of the above question (2 and 3) will be investigated through the developers; perceptions of the same issues. In addition, developers will be asked the following:

- Experts participating in designing literacy software.
- The purpose of their products.
- Link of the software material to the NC / NLS requirements
- The length of time each literacy activity takes to be completed.
- The frequency their product needs to be upgraded.

The second aim of the study is:

B. To explore young pupils (KS1) thoughts on using initial literacy software and their thoughts of software elements in such packages.

It will be explored through the following routes:

1. Pupils thoughts of using:

   i) Computers, and their contribution to pupils' learning.

   ii) Initial literacy software and their contribute to learning pre-reading skills.

   iii) Gender.

2. The preferred working mode when using such programs.
3. Pupils' difficulties when using such games.

   i) Pupils' difficulties will be compared to the opinions of teachers and developers on that issue.

4. Children's views on technical features and instructional characteristics in literacy software.

   i) The opinions of pupils on software elements will be compared to those of teachers and developers.

Now that the research questions and paths of investigation have been stated, I will present the chronological plan of the whole study, its four stages and the activities involved in each of the stage, and then I will proceed with the selected methods and rationale.

Table 6-1 The research timeline and activities involved

Stage 1	Teachers' survey (June, 2001)	Involved Designing the research instrument Piloting the research tool Choosing the sample of teachers Deciding the way of collecting the information Deciding the way of analysis
Stage 2	Developers' questionnaires (July, 2001)	Involved Designing the research tool Finding the sample of developers Deciding the way of collecting the information Deciding the way of analysis
Stage 3	Naturalistic observation (Nov.- Dec. 2000)	Involved Gaining entrée (school, classroom, teacher, pupils) Deciding my role as an observer Way of collecting the information Way of presenting it
Stage 4	Pupils' interviews (July, 2002)	Involved Forming the interview questions Choosing the sample Piloting Conducting the interviews and using scaled questions* Deciding the way of analysing the information

* I used scaled questions during the interviews with the Yr2 group.

The above table shows that this research adopts a *multi-method sequential* design (Morse, 2003) in the sense that quantitative and qualitative strategies are adopted as a series of complementary projects, but they are not mixed (this is, they did not take place at the same time) because of the nature of the study (responsive focusing). Rather they took place in different chronological periods and each of them is complete in itself. I believe that one of the strengths of such a design is that it provides a different perspective on the phenomenon investigated just like looking through a crystal, but the real strength is that it provides different levels of data enabling (Morse, 2003), thus this researcher to obtain a more clear picture of teachers using initial literacy software, of teachers selecting such computer packages and at the same time asking developers, and finally investigating pupils' experience on using initial literacy programs. I did not expect to find a convergence in their perspectives, as there is no such a thing as "peaceful coexistence" (Erzberger & Prein, 1997, p.146). It is rather infrequent to find convergence in mixed methods, rather divergent findings are rather valuable since one of the major reasons for following such a paradigm is to elucidate divergent aspects of a phenomenon (Johnson & Turner, 2003). Besides *divergence* in stakeholders opinions constitute one of the precept of constructivism, which enhances the position of this study. The methods and the activities involved will be presented next.

6.3. Selected methods and rationale

Thus far I have outlined the paradigm, the research aims, questions, and paths of investigation as well as I provided the research plan with the activities involved. It is now time to justify the selected methods, this is a) survey for approaching teachers, b) questionnaires to developers, c) naturalistic observation, and d) interviews with young pupils and how they are linked to the aims of this study a process that Cohen et al. (2000) describe as "fitness for purpose", this is matching the research paradigm with the research purpose and research questions but not neglecting at the same time the practical considerations that are implicated.

6.3.1. Survey: general considerations

It is a procedure in which standardised information is collected systematically from a specific population or a set of cases (*sample units*) selected from a defined population (Robson, 1998). It is used with the intention to look at individuals, groups, institutions, methods and materials in order to describe, compare, contrast, classify, analyse and interpret events, opinions, attitudes, behaviours, or relationships (Cohen et al., 2000) as they are at that time of the inquiry. In a nutshell its major aims are: description, explanation, and exploration (Babbie, 1990) of certain aspects of the world out there as it is.

Indeed surveys represent one of the most common types of empirical social science research because they have major strengths. These are:

a) *Economy* in terms of its capacity for wide application and broad coverage.
b) They can reach far distanced subjects, consequently very *large samples* are feasible, making thus the results statistically significant.

c) They guarantee *anonymity* (if postal survey), which encourages *frankness*.

d) *Standardisation* is another advantage of the method in concern. Standardised questions make measurement more precise by enforcing "uniform definitions" upon the participants ensuring in this way that similar data can be collected from groups. Additionally, the potentiality to suggest further areas of research for detailed study by other methods make them a strong research tool (Malim & Birch, 1997).

6.3.2. Survey in relation to this study

This research was designed as a descriptive study with the intention to see the extent to which teachers use basic literacy software with their pupils, and how they "evaluate" such software. The denominator of the two issues is school's ICT equipment and teachers' training. Such issues, as well as attitudes towards the use of ICT at school, have been extensively explored by governmental agents DfEE (1997, 1999), and by the studies of Johnston (1987), Edyburn. & Lartz (1987), and Cosden (1988). Similarly, Haugland (1997) used questionnaire to assess teachers' views on important software characteristics. Much of the information requested was within the school environment and teachers had the time to reflect and provide accurate answers from their point of view. Surveys are effective for answering questions of the "what is" variety (Goodwin & Goodwin, 1996) and the sub-questions of the first aim of this research are of this nature (informational).

In addition, it was my intention to explore as many teachers' views as possible in as much wider educational context as possible. I also intended to view the data in a way to explore associations and differences between factors and variables that emerged from the literature review and which could affect the use of software and the software selection procedure. The literature indicated that the use of basic literacy software is connected to the ICT provision of the school, and that the ICT provision of the school affects the selection process. Having "variables" already predetermined and with the intention to use descriptive statistical measurement, "hard data" (Verma & Mallick, 1999) from a *mail survey* was seen as the best option.

6.3.3. Limitations of surveys

There is no method in conducting inquiries that does not suffer limitations (Cohen et al., 2000; Silverman, 2000). I did appreciate the limitations of surveys, which is the danger of *distortion*, more specifically data are affected by the characteristics of the respondents e.g.

- Memory (hard to recall information).
- Knowledge (does not know the answer).
- Experience (lacks appropriate experience).
- Motivation (insufficient interest).
- Personality and time (hurriedly given responses).
- Low response rate.
- Inflexibility (inability to probe or reword).
- Surveys can seldom deal with the context (Nachmias & Nachmias, 1981; Husen & Postlethwaite, 1994; Munn & Drever, 1996; The CSU Writing Center, 1997-2003; Gillham, 2000).

All the above may lead to inaccurate and untruthful data, which threaten the validity of the research. I did keep in mind the above limitations and I tried to tackle them in the following ways. The first is *format*. I cared for appropriate language level, precision, clarity in wording and instructions, short questions, relevance, and suitability of questions to the problem situation. I also grouped the questions into areas of common dimensions and cared for proper sequencing. The pilot stage helped a lot with rewording some questions and clearing out misunderstandings.

The *length* of the questionnaire just like the format, affects motivation so I made an effort to design it as short as possible. Though my research instrument is long I still believed that it could not affect motivation by making the subjects believe that the results will affect them or their practices (Anderson, 1990). This was done in the cove letter and also by sending the questionnaires through the internal mail of the LEAs offices that participated in the study.

The inability to probe, or else *inflexibility*, was addressed through the use of open-ended questions so that teachers would feel free to express elements that the questionnaire did not include and would give the ability to teachers to explore their ideas to the extent they saw fit (Oppenheim, 1992; Bryan, 2001). Within surveys, the questionnaire is a commonplace instrument for "observing" data beyond the physical reach of the researcher. Though it is accused as indifferent to "context", it can yield rich data from a larger population.

In order to cope with the low response rate that is high in surveys I took the advice of Cohen, et al. (2000) and Oppenheim (1992) to enclose a cover letter with the questionnaire explaining the purpose and other details and a FREEPOST return envelop. They suggest that such actions will ensure confidentiality.

Besides the design difficulties, there are also difficulties with data analysis since surveys cannot provide a causal connection, rather they indicate associations / correlations (Robson, 1998; Verma & Mallick, 1999). Therefore I had to be careful in their analysis and reporting conclusions and findings.

6.3.4. Designing the survey instrument

The selection of a method is based on what kind of information is needed, from where it will be collected and under what circumstances. The data collection tools employed for the survey is a semi-structured questionnaire for the school teachers and for the software developers.

Teachers' questionnaire

In order to answer the research questions of the survey a semi-structured questionnaire was developed with fixed alternative questions and open-ended ones with which the respondents would be able to express themselves more freely. It is divided in three sections (see Appendix 3A). The demographic questions in section A of the questionnaire regarding gender (q. 1), age (q. 2), teaching experience (q. 3), participation in NOF training (q. 4) and school classification (q. 7i) will provide information about the teachers' identity and the schools they come from, very valuable for the analysis. Question 6i and ii (school's ICT policy and its key elements) will investigate whether schools have an ICT policy, but mainly if an important element in this policy is the selection or purchase of software. Questions 7i, 7ii, and 7iii will provide information about the schools' equipment in ICT resources, if teachers have a computer in their classroom and the micro-density figure, which are very important in the effective application of ICT. Questions 8i and 8ii will yield answers about the nature of the timetabled access to ICT provision. Question 9 carries a double mission: to see the workload of ICT Coordinators and to estimate the true response rate.

Section B, titled "The use of initial literacy computer packages", is comprised of 4 questions (10-13). Question 10i will bring information about the extent to which teachers have general access to computers, where as 10ii will inform about the access to initial literacy software. The two questions will differentiate if teachers (or pupils) have access to computer but not to specific literacy programs. Question 11 seeks to find out if teachers are aware of the difficulties young pupils encounter when working on literacy software. When evaluating software, teachers have to know these difficulties so as to make accurate judgements about various programs. Next question (q. 12i and 12ii will give information about the schools' provision for pupils with reading difficulties, this is if they buy specific software for those learners and which of them have they found helpful. The last question in section B (q. 13) asks teachers to rate how influential do they find the list of provided general influential factors in selecting software. This is, software that has been tried out with children, software that caters for different ability levels, programs that are linked to the NC / NLS objectives, and packages that are consistent with school's EO policy. Question 13 requests teachers to rate on a 4-point scale (1, 2, 3, 4) the above influential factors that could affect their choice. This researcher has adopted the same scale found in Oppenheimer's (1992) book (p. 169).

The questions of section A and B (1-13) reflect the avenues through which the first research question (see 6.2.) will be answered. In the same vein, questions included in section C of the questionnaire reflect the routes that the second research question will be investigated (see section 6.2.). Both of those questions explain how the first aim of this thesis was investigated.

Section C is comprised of three parts. The first is titled "The selection process" and includes questions 14 - 16. Question 14i seeks to find out if schools (teachers) employ some kind of written guidance to select educational software and 14ii will inform me about the key elements in this "guidance". Next question 15 requests teachers to rate on a 4-point scale the technical features (still pictures, colourful design, sounds, and animation) and instructional characteristics (feedback positive and negative, repetitions (practice), related off-computer activities, material presented in order and record of achievement). The above elements in software are found to serve both motivational and pedagogical purposes, and this research seeks to find out how teacher rate this importance. Question 16i will reveal how competent teachers feel using ICT, and 16ii will inform me with what skills teachers feel they need to select software.

The second part of section C is titled: "The review process" and has one question (q. 17) but divided in three sub-questions. Question 17i will clarify whether teachers do perform some sort of evaluation - previewing before using software with their children, if they involve pupils in the preview process (16ii), and if they communicate their judgements to the developers (q. 16iii), in short if there is some sort of communication with developers after they have used their product with children.

The last part of section C is titled "Teachers' thoughts about aspects in software designed to support initial literacy skills". It is the last question of the research instrument (q. 18), where teachers openly express their opinion regarding the particular aspects that they would like to find in initial literacy software and that developers should consider. In reality the question acts as a "window" where a direct dialogue between teachers and designers initiates, and teachers' views will be seen as the appropriate criteria.

The developers' questionnaire

A copy of this questionnaire is found in Appendix 3B. The answers provided will represent the whole company and not a particular person, as it was arranged on the telephone interview I had with each of the companies. This instrument is not comprised of sections rather of five parts a, b, c, d, and e. Part **a** is titled "Information about your product" and includes 5 questions (1-5) that required general information about the product. Specifically question 1 is interested in who are the people (the team) that participates in designing the software; question 2 wants to find out what is the purpose of the product, do developers see it as educational or recreational medium? Next question (q. 3) wants to ensure that software – if seen as having some educational purpose – accords with the NC / NLS objectives. The fourth question will inform the length of each activity included in literacy software. The length of the activity is important to investigate, especially when we are talking about children using that software of pupils with some difficulties and special care should be given the activities to be short. The length is also important when the prevailing information is that ICT access is timetabled. Lastly, question 5 will provide information about the frequency a product needs to be upgraded. This is a serious reason that affects the evaluation process in the sense that evaluation is an expensive and time-consuming business and when it needs to be done frequently, then it is more likely companies avoid it.

The second part that headed "The evaluation process" has two questions (6 and 7). Question 6i asks indirectly developers to tell if they evaluate their product before they launch it in the market; 6ii will bring information of the person(s) who perform the evaluation process, and 6iii if they involve pupils. Question 7i is interested in finding out if there is channel of communication with teachers after they have used their product. This question will be compared with question 17iii in teachers' questionnaire to find out the strength of this communication. The next question (7ii) will explore why developers do not seek feedback from teachers, if this is what really happens.

Part **c** is titled "Your perception on teachers' and pupils' ICT skills", and has one question (q. 8) divided in two sub-questions. Question 8i refers to the developer's perceptions on teachers' ICT skills. It would be interesting to know what do developers think of teachers' competency, which will be also contrasted to what teachers talk about themselves (q. 16i in teachers' questionnaire). Lastly, question 8ii wants to find out if developers are aware of the young children's skills in operating software. As it has been attenuated in the literature, young pupils' ICT skills affect greatly the use of computers and the evaluation (preview) process. An evaluator, being him/herself a teacher, or an independent person, should always consider children's underdeveloped computer skills. A child being slow or having difficulties does not necessarily mean that software is not "good". This question (8ii) will be analysed and contrasted with question 11 in teachers' questionnaire to see if both groups are aware of children's limitations, and what are they? Later their views (teachers and developers) will be compared with the pupils' views on the difficulties they experience, so a clear picture will be formed.

Part **d** is titled "Influential factors when selecting software" and has one question (q. 9) that requests developers to rate on a 4-point scale (1, 2, 3, 4) the influential factors (pp.114-115) in selecting software. To remind here that the same question was asked to teachers (q. 13) as well, and consequently the provided information by both groups will be contrasted.

Finally part **e** has the title "Technical features and instructional characteristics in initial literacy software". It has one question (q. 10) that asks developers to rate on the same 4-point scale that was used throughout this research the technical features (still pictures, colourful design, sounds, and animation) and instructional characteristics (feedback positive and negative, repetitions (practice), material presented in order and record of achievement. Just like the previous question, the same question was asked to teachers (q. 15) and the information of both groups will be compared. Later the same elements found in this question (technical features and instructional characteristics) were asked to pupils during the interviews in the same form of 4-point rating scale and the results will be contrasted.

6.3.5. Types of questions

The included questions in both questionnaires were framed in a variety of ways:

Closed questions: they suggest categories of response.

Dichotomous questions: answer with Yes or No. In teachers' questionnaire, such questions are: 1, 6i, 7ii, 8i, 12i, 14i, 17i, 17ii, and in developers' research instrument are: 3, 6i, 6iii.

Multiple choice questions: choice of predetermined possible answers. In the first instrument (teachers) such questions are: 2, 3, 4, 5, 7i, 7iii, 9, 10i, 10ii, 16i, 17iii, where as in developers' questionnaire such questions are found to be: 1, 4, 5, 6ii.

Scaled questions: they provide intervals of a value and are regarded the most obvious ways of collecting opinions. Throughout this study I used the 4-point scale in all three questionnaires (teachers, developers and pupils), but it was clarified well what 1, 2, 3, and 4 stands for. They are not numbers rather they represent a category (a characteristic behaviour of each sample). For example, 1 = not at all valuable, 2 = slightly valuable, 3 = fairly valuable, and 4 = very valuable. In order this to be understood with children, I explained thoroughly with *each individual child* what 1, 2, 3, and 4 represent. For that reason in the analysis they will be perceived as *categories*. In teachers' questionnaire such questions are found to be the 13 and 15; in developer's the 9, and 10, and all children's rating scales (1-10).

But when at some point in the data analysis I will compare for differences among teachers, developers and pupils then the scaled questions above will be viewed as 4-point rating scales (continuous variable) in order the appropriate statistical test to be employed (see 6.2.).

Open questions: these do not suggest categories of response leaving respondents free to answer in a way that seems most appropriate to them. Such questions were provided at the end of closed questions to serve as "probes" for providing more relevant and "unguided" information. In teachers' questionnaires such forms of questions are: 3, 6ii, 7iii, 8ii, 11, 12ii, 14ii, 16ii, and 18, where as in developers research tool such questions are found to be: 2, 7ii, 8i, and 8ii. Finally, I followed the advice of Simmons (2001) who suggests that all closed questions must be pre-coded. Questionnaires should allow space for as many alternatives as possible, so I did offer an "other" category in questions 7i, and 13 in teachers' questionnaire and 4, 5, 6ii, and 9 in developers that I perceived as appropriate. An effort was made to limit the lay out of teachers' questionnaires to no more than six sides of paper. I also minded the positioning of the questions to be such like in a normal conversation with each question arising logically from the one before.

6.3.6. The piloting stage

It is essential before distributing the research instrument to test it on a small group of the target sample, which aims to "debug" the questions in terms of ambiguity in wording, familiarity with terms, clarity of instructions, and the time to be completed. Without piloting, there is a risk of a different interpretation of the questions by different respondents. In the worst case, the researcher might have to dismiss such questions from the data analysis or to drop some of the respondents altogether, risks that distort the sample.

For that reason, a letter was sent on the 19th of February to Head teachers of 10 schools within proximity to the University. It requested permission to visit and pilot my research instrument with their classroom teachers. I received no answer. After two weeks I pursued contact by telephone calls but due to tight schedules, work load, perhaps indifference some refused and some asked me to contact them after the Easter vacations. Finally, through colleagues, I managed to pilot my questionnaire with six teachers just before Easter with the disadvantage that I had no personal conduct. But they did comment on a few things and the wording of some questions. Though the main structure of the design remained intact, I omitted two questions where the wording was exceedingly technical. I added instructions for some questions. I also moved some questions from once section to another. Due to time and accessibility restriction, I did not pilot it for the second time. I did not pilot the questionnaire for the software developers, which was also suggested by my second supervisor on the ground that most of the main questions included were the same as the ones included in the teachers' questionnaire, which already had been piloted.

6.4. Sampling design and methods

6.4.1. Teachers' sample

Sampling designs are the procedures and mechanisms that collectively constitute the method of sample selection (Greenfield, 1996). There are two major categories: *probability* and *non-probability* designs.

A *probability sample* draws randomly from a wider population, seeking to represent this population and to make generalisations about the conclusions and inferences from the inquiry. On the other hand, a *non-probability* sample seeks only to represent a particular group, e.g. a group of teachers or pupils, *purposive samples* (Robson, 1998).

Regarding the present study, ideally, with a large random and representative sample size more stable and generalisable values would be obtained about the target population: all schools in the London Boroughs. However, practical issues often dictate compromises in real world research: accessibility of the participants, time constraints imposed by my Government, financial limitations since I am self-supported, inaccessibility to schools, and also the descriptive nature of the inquiry that has no intention to generalise the findings to the general population dictated the selection of a non-probability sample. Among the different kinds of non-probability designs proposed by Cohen et al., (2000) - purposive, quota, snowballing – I chose the *convenience sample.*

<u>Convenience sampling</u>: It is sometimes called *accidental* or *opportunity* or *haphazard* sampling. It involves choosing the nearest individuals to serve as respondents and continuing that process until the required sample size has been obtained. The researcher chooses the sample from those to whom s/he has easy access. Deliberately this method avoids representing the wider population; it simply represents itself. So I chose to survey five LEAs as the *sampling units* (Sapsford & Jupp, 1996; The CSU Writing Center, 1997-2003) in the SW crest of London – most of them to a close proximity to the University.

Considering the overall "convenient" profile of my study, I appreciate that the results deriving from this project will not be able to be generalised. However, despite this harm to external validity, it is anticipated that the findings will still yield valuable information, enabling the deduction of inferences from the survey population (Greenfield, 1996). Probability sampling and statistical inference are not all. Being unrepresentative of the whole population it may demonstrate skewness or bias. This is not to say that probability samples are bias-free and free of sampling error (Cohen, et al., 2000). Besides, it is argued that in practice few instances of survey research (organization studies) are based on random samples (Schwab (1985).

At first, the sample consisted of a total number of 217 schools (Infant 27; Infant & Nursery 28; Primary 138; Primary & Nursery 2; Junior & Infant 10; Junior, Infant & Nursery 12). The names and addresses were found in the Education Directory provided by the University. To ensure variability in the results – usually determined by avoiding homogeneity of the sample – there was consideration for the inclusion of a mixture of characteristics associated with the selected areas of schools, such as *socio-economical status,* and the presence of *ethnic minorities*.

I decided to address the questionnaires not only to KS1 classroom teachers, but also to teachers with different duties in schools; this is Head teachers, ICT coordinators, and SENCOs for the following reasons. Since the use and selection of educational software is an indispensable part of the ICT schools' policies and under the Head teachers' and ICT Coordinators' jurisdiction, I deemed that their information would be valuable. Besides they have the experience of classroom teachers. The provision of ICT resources including software is a matter within the ICT specialist' range of responsibilities (Ager, 1998). Finally, in many cases, schools may well have to cater for less skilled readers who partially fell within the competency of SENCOs, as more knowledgeable about the educational and learning needs of those pupils. Teaching those children using electronic material becomes the responsibility not only of the classroom teacher and SENCO, but also with the support of the ICT Coordinator (*shared provision*).

6.4.2. Software developers' sample

As for the software companies, an effort was made to include the entire number of companies that design such programs. For that reason, I used the BESA (British Educational Suppliers Association) website the members of which are also members of ESPA (Educational Software Publishers Association). The website introduced me to 28 companies, and I had a *telephone interview* with *each one* of them. My question was if they produce packages to support initial literacy for beginning readers and pupils with reading difficulties, and if they would have any objection to complete my questionnaire. I also explained who I was and what was the purpose of the research. Moreover, I requested to introduce me to other manufacturers (snowball sampling) that produce such packages, as it happened in two cases, and I promised to inform them about the results of my inquiry. Finally, I used the leaflets that I had being collecting during my attendances to NASEN and BETT shows.

6.5. Conducting the research

After targeting the research samples, the next step was to dispatch the research instruments to the recipients.

6.5.1. Sending the questionnaires to schools

On the 1st of June, 2001, four copies of the questionnaire were posted to schools in a signle envelope. The questionnaires ware addressed to the Head teacher, SENCO, ICT co-ordinator, and KS1 classroom teacher. The total number of questionnaires posted amounts to **868** copies. They reached schools in a sealed envelope containing a FREE POST envelope for the respondents' convenience. A covering letter, addressed to the Head teacher, was attached to each envelope informing him / her of the identity of the researcher, the reason for contacting the school, the topic of interest, and the rationale of the study. I assured confidentiality (see Appendix 4), and the deadline was set on the 20th of the same month.

I consider factors, such as the *return rate* because of the nature of the tool (postal questionnaire), and the busy time of the year. The truth is that I received only 10 questionnaires by the 20th of June fact that distressed me. I started to prepare a reminding letter (see Appendix 5) addressed to the Headteachers, which was sent on the 1st of July. Towards the end of the month, I made phone calls pleading non-respondents to participate.

In the meanwhile, threatened by the low response rate, I decided to include in my study teachers that formed the APD (Academic & Professional Development) group of Brunel University 2000 – 01. I got the list of their names from the Administrators' office, and I targeted **80** colleagues of primary education. They received the questionnaire through Brunel's correspondence with a cover letter (see Appendix 6) dated June 26.

Because of teachers' work load at that time, the ICT Advisor of the N. London LEA that participated in the study suggested, and agreed, the study take place in early October 2001 when teachers would not be so pressed by work. The schools of this LEA were **36**: First 17; First & Nursery 2; First & Middle 16. This time 3 questionnaires were sent to each school. Head teachers were excluded because of previous comments of being busy, and the nature of their job "*we are not classroom teachers*". I sent the same cover letter that I had sent in June. Finally, the total number of questionnaires was **112**.

6.5.2. Sending the questionnaires to developers

The questionnaires were sent by fax, or e-mail, or post (I left the choice to them) after having their consent. No cover letter accompanied the questionnaire because they had already been informed on the phone (see 6.4.2.). Finally, I ended up with a list of 16 software companies, two of which refused participation because it was their policy not to answer questionnaires of any kind. The limited number of companies plus avoiding to answer certain questions, left me with limited information. Therefore, evidence that comes from developers' questionnaires will be viewed with caution. A similar situation is also found in the study of Barker & King (1993, p. 313) who wrote:

" *...unfortunately very little support was offered from software developers...only two were prepared to discuss design issues*".

6.5.3. Resources

It is important to mention here that the University undertook the expenses of printing the questionnaires, the postage of questionnaires and follow-up letters, telephone calls, and faxes. Also, four Directors (out of the five LEAs that participated in the study) undertook the postal expenses of the questionnaires, which were sent through their internal mail. I am deeply obliged to all.

6.6. Design of analysis

The next and critical step in my study was to decide how I would analyse the questionnaires that included close and open questions. The qualitative nature of my study led me to adopt frequency counts, tabulation, and low-level statistical analysis. Because of the rather sizeable number of returned questionnaires (112), I chose to use the SPSS (Statistical Package for Social Science) for windows 2000 Version 10, something that nowadays most researchers do. Computer analysis was necessary in terms of time and effort. Besides, statistics provide standardised information, and a means by which researchers may more comprehensively view data (Malim & Birch, 1997).

Munn & Drever (1996) provide three main stages in analysing questionnaires: data preparation, data description and data interpretation. The last two stages are part of the next two chapters, i.e. results and discussion. Regarding data preparation, the overall aim is to make the mass of information received more manageable and an effective way is coding.

6.6.1. Data preparation: coding

Coding is analysis. Codes are tags or labels that assign units of meaning to the descriptive or inferential information compiled during the study (Miles & Huberman, 1994). They are used as means to organise and retrieve chunks of data and to categorise, cluster and display the data (Bailey, 1997). Theoretical, systematic coding procedures support and facilitate the management and manipulation in the interaction with the data.

Coding the closed-ended questions of the semi-structured questionnaire was a straightforward – *a priori* process, as the categories had already been planned before the distribution of the research instrument and thus, numeric values were given to all variables. Pre-coding was proved very helpful because as soon as the questionnaires were received the data were entered straight into the SPSS, and I avoided piling them. I tried to ensure that I put the same code to the same value. The only care was to ensure that codes have been entered accurately. For that reason I re-entered the data in the SPSS.

The next step was to start the *univariate* analysis; this is finding the frequencies of each question and presenting them in pie charts straight from the SPSS. The majority of the data in this study is categorical (nominal). As I went on, I performed the *bivariate* level of analysis, namely I looked for relationships between two variables. Independent variables in this study are age, and years of teaching experience. In order to select the statistical tests, I had to examine certain issues that will be discussed next.

6.6.2. Statistical tests used (analysis of hard data)

There are a lot and different tests in statistics that help researchers to see relationships or differences between the same, or different groups, but as all researchers, I first had to decide the following before embarking on the analysis:

- Subjects (same or different)
- Condition
- The use of parametric or non-parametric tests, this is if one or more independent variables are tested in each statistical test (Greene & D' Oliveira, 1999, p. 29-32).

During this phase, I will be examining one group (teachers), one condition, this is teachers' opinions were asked once, and not repeated. The nature of the data (categories) requires the use of non-parametric test. But what are non-parametric tests?

6.6.3. Non-parametric tests

Non-parametric tests are the statistical procedures that require limited distributional assumptions about the data. These tests are generally less powerful than their parametric counterparts since they do not analyse the actual data. Instead they rank it and use the ranks to assess significance. However, they are most useful in situations where parametric procedures are not appropriate, for example when the data are categorical or when the sample size is small. This study had both small sample size and categorical data. In particular, this study looked at the relationships that will be shown schematically next:

<u>Variables</u>

Age (q. 2) ⟶ Sufficiently trained to select & use software (q. 16i)

Years of teaching experience (q. 3) ⟶ Teachers use special sw for pupils with RD (q. 12i)
Software has been tried out with children (q. 13, 1)
Sufficiently trained to select & use software (q. 16i)
Teachers preview software before use (q. 17i)

I also wanted to see if any significant relation exists between the following pair of variables:

Teachers feel sufficiently trained to use and select software"(q. 16i) ⟶ Teachers preview software before classroom use (q.17i)

In order to examine the above relationships between pairs of variables (both giving categorical data), chi-square test will be used.

<u>Chi-square test</u>

Chi-square tests are used to analyse categorical / nominal data although they are used with any level of measurement – nominal, ordinal, or interval – which is a reason why they are so popular (Sirkin, 1995; Howell, 1999). Subjects are divided in categories and the intention of the researcher is to see if an association exists between the different categories. For the above reason chi-square was a suitable test to use in my study since the subjects were assigned to categories. The essential characteristic of chi-square is that it does not deal with scores, instead it should only be used for the all-or-none behaviour (Greene & D' Oliveira, 1999). Its weakness is that it is non-directional. The analysis of chi-square is presented in *contingency* tables (or two-dimensional tables) that tabulate the frequency distribution of one variable in the rows and that of another variable in the columns and that is used especially in the study of correlation between the variables.

As for developers' questionnaire because of the very small number (10) no statistical tests can be performed (for example to see any directions among the companies). The person who completed it represents the whole company and not a single person, as it was agreed on the telephone interview. So the data will be presented in frequencies and charts. There are though 2 questions (q, 13, 15 in teachers' research tool, and 9, 10 in developers' questionnaire) that were asked in both groups and will be compared if they are any differences between the two different groups (teachers and developers). But the outcome of the developers' group will be seen in caution precisely because of the small number of participants. The figure below shows the different groups and the dependent variables that will be compared:

Groups	Influential factors in selecting sw
A. Teachers (q. 13) B. Developers (q. 9)	1.Software has been tried out with children 2. It caters for different ability levels 3. It covers NC / NLS objectives 4. It is consistent with school's policy on EO

Here again, I face the same considerations (subjects, condition, and type of data) as I did for the bivarate analysis. The subjects here are two independent (different) groups, namely teachers and developers who are "investigated" once (one condition). The most appropriate test in this case is the Mann-Whitney.

Mann-Whitney U test

This technique is used to test for differences between two independent groups on a continuous measure. In this case the continuous variable is the 1, 2, 3, and 4 scale of each of the influential factors of question 13 (teachers' questionnaire) and question 9 (developers' questionnaire). This test is the non-parametric alternative of the t-test for independent samples. Instead though of comparing means of the two groups, as in the case of t-test, the U test actually compares medians. It converts the scores on the continuous variable to ranks, across the two groups. It then evaluates whether the ranks for the two groups differ significantly. As the scores are converted to ranks, the actual distribution of the scores does not matter (Pallant, 2001).

At some point in my study I will test if significant difference are found between the three groups (teachers, developers and pupils) in relation to various elements in software such as technical features and instructional characteristics. I will present this schematically:

Groups		Technical features and instructional characteristics in sw
		1. Still pictures
		2. Colourful design
		3. Sounds
A. Teachers (q. 15)		4. Animation
B. Developers (q. 10)		5. Positive feedback
C. Pupils (q. 1-8)		6. Negative feedback
		7. Repetitions on errors
	→	8.Related off-computer activities
		9. Material presented in sequential order*
		10. Record of achievement*

* Pupils did not participate

This time I am dealing with three independent (different) groups, and one condition (not repeated measurements). The appropriate test to be used is the non-parametric Kruskal-Wallis H.

Kruskal-Wallis H test

Kruskal-Wallis H is the non-parametric alternative to a one-way between-groups analysis of variance. It is group analysis of variance and can see *overall* differences, but not *trends* between the different groups (Greene & D' Oliveira, 1999). It allows you to compare the scores on some continuous variable for *three* or *more groups*. It is similar in nature to the Mann-Whitney test presented above, but it allows to compare more than just two groups. Scores are converted to ranks and the mean rank for each group is compared. This is a "between-groups" analysis, therefore different people must be in each of the different groups. In the case of this study I have three different groups, i.e. teachers, developers and pupils. When a significant difference is found between groups, then I can check the *Mean Rank* for the three groups that will tell me which of the groups had the highest overall ranking that corresponds to the higher score on the continuous variable (Pallant, 2001). The continuous variable in this case is the 1, 2, 3, and 4 scale of each of the technical features and instructional characteristics of question 15 (teachers' questionnaire), question 9 (developers' questionnaire), and 1-8 pupil's scales.

6.6.4. Level of significance

The statistical tests were all two-tailed meaning that the effect of the independent variable may go in either direction but not being prepared to say what this direction will be (Green & D'Oliveira, 1999). The level of significance (the p value) was set at .05, and .001. p stands for probability and is easily understood in terms of how often a given result could occur by chance. Significance at .05 means that 5 chances in 100 could occur by chance, and .001 is interpreted that 1 chance in 1000 could occur by chance. The less often the result could occur by chance the higher the probability that your result is significant (Gillham, 2000).

6.6.5. Content Analysis: technique for the "soft" data

As for the open-ended questions in both questionnaires (teachers and developers) and children's interviews that will follow, I used a simple level of classical *content analysis*, namely *conceptual analysis* that is also known as *thematic analysis* (The CSU Writing Center, 1997-2003). This analysis technique was used initially in journalism, but due to the fact that it can be applied to examine *any* piece of writing, or occurrence of recorded communication, it is currently used in a dizzying array of fields, ranging from media studies and marketing to literature, cultural studies, psychology and cognitive studies, and many other fields of inquiry.

Content analysis involves counting communication phenomena and categorizing them according to a taxonomy or typology scheme (The Fullerton Education, undated). I personally chose this technique because of the nature of the data. The information given was terse, this is the respondents, teachers and developers, did not write long narratives; rather they responded in short lines. No effort was needed on my behalf to "read between the lines". The frequency of repeated words formed clusters, which in turn helped me to conceptualise the categories that were listed in tables according to the question.

Content analytic procedures have several advantages over other data-generating and analysis techniques:

- They look directly at communication via texts or transcripts and gets at the central aspect of social interaction.
- They can allow for both quantitative and qualitative operations.
- They are unobtrusive means of analysing interactions.
- They are safe and flexible forms of analysis – if you mess up you can start all over again.
- They can also analyse statistically the coded form of the text (The CSU Writing Center, 1997-2003).

But there are though certain limitations of content analysis. These are:

- It lacks theoretical base.
- It can be extremely time consuming.
- It often tends to simply consist of word counts, and often disregards the context that produced the text losing some of the richness inherent in the message – this is why it is better suited for examining "manifest" as opposed to "latent" meaning.
- It is subject to increased error when it is used to attain a higher level of interpretation (The CSU Writing Center, 1997-2003).

Though it may lack theoretical basis, it is particularly noteworthy the growing use of content analysis as a technique in graduate theses and dissertations (Neuendorf, 2000). Indeed, it is a time-consuming procedure when it is done manually, as it was done in this case. Patterns of the same words were highlighted with the same colours, which helped a lot in counting the frequencies. Frequencies were counted repeatedly so as to avoid miscalculations. I was extra careful to consider the word within its sentence so as not to be mislead. As I have mentioned above, the nature of the data were such that it was quite easy to detect latent meaning. Once I had decided the type of analysis of the soft data, the next stage was to start the preparation of open-ended questions, and this was coding.

6.6.7. Soft data preparation: coding

Regarding the open-ended questions – a *posteriori* coding was opted for, as they involved qualitative information. the respondents' opinions cannot be predicted. First of all, I made a file in my computer with all open-ended questions and all the answers provided by the subjects. This helped me a lot because very easily and quickly I could see what information each question gathered and what every respondent had said for every question. I highlighted same words with the same colour with the highlight facility on the computer. Then I printed the open-ended questions and their responses, and I turned their consistency into a document.

Having the document with the highlighted words ready, it was very easy manually to find the frequencies of words using the content analysis technique discussed above. Counting the similar patterns of words into groups, helped me formed the categories of each open –ended question. I did read and re-read the open-ended questions many times so as to be sure that each word fits in the appropriate category, and also to have a good feeling of my data.

Thus, a list of categories was developed and condensed into mutually exclusive groups, a process called *selective reduction*, which is the central idea of content analysis. The categories were ranked; this is ordered based on the total number of responses in each. I was coding for *frequency*, and not for *existence* (predetermined conceptions). I decided to code not only for a single word but phrases as well provided that they were carrying the same meaning to certain categories (level of analysis). Careful attention was paid to ensure that a range of views and variables are included, avoiding the loss of data (Bailey, 1997). Finally *irrelevant information*, though scanty, was re-examined but ignored because unclassified information poses threat to validity.

6.7. Naturalistic observation: general considerations

Naturalistic, or informal, or unstructured observation, consists of gathering impressions of the surrounding world through all relevant human faculties (Adler & Adler, 1994), namely observation does not only involve visual data gathering, but also recording, analysing and interpreting what has been observed (Robson, 2002). The researcher is given the opportunity to look at what is taking place *in situ*, and inductively sees things that might otherwise be unconsciously missed (Cohen, et al., 2000).

Traditionally, one of the hallmarks of observation is its *non-interventionism* (Adler & Adler, 1994; Robson, 2002). Observers do not manipulate nor stimulate the subjects. Instead they follow the flow of the events as they would without the presence of the researcher. Another advantage is the *entrée*, this is the researcher enters the natural setting, establishes a *vis-à-vis* contact with the subjects under investigation, and even participates actively (if s/he wishes) in the ongoing events. This allows the researcher to have a direct experience of the activities s/he is observing, and a better access to the meaning of participants (Scott & Usher, 1999). Another of its strengths lies in its *emergence*, this is observers construct theories that generate categories, and posit links among them. During the process, they are free to change the problems and questions as they gain knowledge of the subjects. Finally, the greatest rigor observation produces is *when combined with other methods* (ibid).

6.7.1. Observation in relation to this study

In conjunction to the above, there are two important reasons that led to chose naturalistic observation. These are: my *lack of hands-on experience*, and the fact that I did not have any *predetermined direction* – no intention to investigate predetermined variables. I realised that I could not proceed to interview children unless I knew what was really taking place in real classrooms. Observation would help me funnel down to specific questions. By witnessing certain events would enable me to understand better children's "confessions" later. An encouraging factor was that naturalistic observation was used by other researchers, such as Storey (1992) and Weeks (2000). An equally important reason is that observation would be valuable as an alternate source of data for enhancing, or crosschecking, or triangulation against information gathered through other means. Thus, it would serve as another source of validity and comprehensiveness in my study. However, I bear in mind that observation suffers from the following limitations.

6.7.2. The limitations of observation

Just like all other research methods, the major disadvantages of observation are its *validity* and *reliability*. Observers rely only on their own perceptions and interpretations of situations, thus they can be susceptible to *bias*. Naturalistic observation, like qualitative research, yield insights that are more likely to be accurate for the group under study. In order to tackle the credibility of my observation, I used direct quotes from children, as suggested by Adler & Adler (1994). Naturalistic inquiry is easy to conduct (writing field notes), but difficult and time-consuming to reach interpretations. The researcher performs difficult tasks, such as synthesis, abstraction, and organisation of data (Robson, 2002).

6.7.3. Arranging the observation schedule

The observations took place at an Infant and Nursery school through the personal conduct of a University colleague. Firstly, I visited the school to make a personal contact with the Deputy Head teacher who happened to be the ICT Coordinator of that school. The same teacher was the classroom teacher whose class I would "observe". I explained the topic of interest – young pupils working on initial literacy software. The total arranged visits were 6 (from November up to Christmas) every Thursday 9.30 in the morning. Twice the arranged time had to be changed because of internal events in the school. In cases when she was not in the classroom I was notified not to go to school that day, limiting thus the observation to take place only in the same classroom (Yr2 pupils). Twice I stayed and observed the same children, the same day, but in different sessions with a different teaching subjects. So the total observation sessions were 8, roughly 20-30 minutes each. I observed a class of 21 children working on spelling, math, and spreadsheet packages. The children I observed were not the same during all sessions. In addition, I had a small conversation with the teacher regarding issues of my topic.

6.7.4. Conducting the observation

In the first two visits my role was an aloof "visitor". I was introduced to the children as a teacher from another country that was interested to see how the children in this classroom work on computers. I needed some time to accustom myself to the children, and how certain things function in that place. During the next 6 sessions, I fully participated in the ongoing classroom activities, and when the time was to work on computers, I helped them with navigation (enter, find their way around, change activities, find the appropriate buttons, and the like). I had the opportunities to ask them some questions (diagnostic interviews) the content of which was kept in a diary at the end of each session.

That particular school did not have an ICT suite, but a cluster of 8 computers placed in a rather noisy corridor. This corridor was leading to the bathrooms and the playground, and it was also the place where children hung their coats and lunch boxes making the place quite boisterous. While children were working on computers, the locomotion and noises were interfering with pupils' work and many time I found them distracted or annoyed. The classroom teacher appointed what pupils will engage with the machines after they (pupils) had completed their classroom literacy activities. Children were working in triads.

I watched pupils using a spelling program for 5 sessions, a math program (the multiplication table of 2 and 3) for 1 session, and spreadsheet software for 2 sessions. The first two computer packages (spelling and math) were designed in a behaviouristic pattern (input-output) with a talking facility. The teacher could not remember the names of the packages, or the companies that produce them. This particular class was also using CD talking book, but I never had the chance to observe the pupils working on such software. Pupils had to log in first, and then find the appropriate program.

The first cluster of words (*fin*, *gills*, *habitat*, *scale*, *shark*, *colourful*, *reef*, *waves*) was associated with a story of a fish that already had read in the classroom. So these activities were *related off-computer* activities. The second cluster (*table*, *chair*, *bathroom*, *garden*, *window*, *storeroom*, *garage*, *kennel*, *roof*) belonged to a literacy program that introduced familiar words about the compartments of a house. The teacher could change these words to new ones, when mastery was achieved. The program had pictures associated with each word. The last cluster of words were from a history book "Henry VIII" and pupils were taught words like "*crown*, *armour*, *sword*, *queen*, *wife-wives*" which were found in small texts. It also extended to the plural number of irregular words, such as *wife-wives*, *knife-knives*, *wolf-wolves*, *life-lives*, and children had to type in the correct spelling.

As for the spreadsheet program, the teacher assigned the class in four groups, and then asked children to "collect information" on pupils' height, colour of the eyes and hair, gender, age, favourite sweets, meals, and pets. When all this information was written down, the teacher explained what is the spreadsheet program, what it does, and what they (pupils) will find out. Then she explained and modelled a few times, and showed where the pupils' names would be placed (horizontally), and the information collected vertically in the appropriate cells.

When these sessions had finished, I made an effort to visit another school through a neighbour teacher in order to have a different experience. Unfortunately, this particular school had a computer in each classroom because an ICT suite was under preparation. On the day of my visit, the classroom teacher used the sole computer to create a card for mother's day. During all this engagement, the teacher modelled and explained what she was doing, and then asked a few children to come to the computer and press various buttons. Not all children had the chance to press buttons. That particular school had only two initial literacy software (CDs). My supervisor personally wrote to the Head teacher requesting access (4 visits on a weekly basis), but he received no answer. Finally, I tried to approach other schools in the vicinity, but I had no replies. Due to time and financial pressures, I was not able to pursue further visits to other schools, and I went on preparing my final stage of my research, namely, interviews with children.

6.8. Interviews with young children (KS1)

The second aim of this study is to explore children's (KS1) thoughts on basic literacy software (impact on their learning to read, difficulties, gender, preferred working mode), and their opinions regarding technical features and instructional characteristics in such software. Because this study involves young children, it would be a serious omission not to discuss legal issues regarding the participation of children in research studies.

6.8.1. Legal issues in research with children

Only in the last twenty years or so, has there been a growing recognition of the importance of listening to children's views and wishes (Qualidata, Undated). This is a reflection of the changes, which have occurred in terms of how we regard children in our society. The UN Convention on the Rights of the child, which was ratified by the UK Government in 1991, states that:

"State parties shall assure to the child who is capable of forming his or her own views the right to express those views freely in all matters affecting the child, the views of the child being given due weight in accordance with the age and maturity of the child" (UN Convention, article 12, Qualidata, Undated).

Another agent that contributed to a change of how we perceive children is the Children Act (Department of Health, 1989) that includes provision for the child's wishes and feelings to be considered in court hearings and in research decisions about the child. Earlier inquiries tended to be ***on*** children as subjects of research examining the lives of children in the future tense (children as they "develop" into adults), and not in the present tense (children as they "are" in their own everyday lives) (Tammivaara & Enright, 1986). Increasingly, research is conducted ***with*** children as active participants. Very common methods to research children are interviews.

6.8.2. Interviews: general considerations

Interview is a specific form of conversation; it is a dialogue between two or more people discussing a topic of mutual interest (Kvale, 1996), but with a purpose. It is initiated by the interviewer, the person who seeks to obtain research-relevant information, and who also tries to elicit responses from the interviewee(s), the person(s) who supply the information. This transaction enables participants to talk about their sentiments, observations, ideas and opinions on a particular subject, or to give meanings and interpretations of the world in which they live. Finally, this interchange of views enables the interviewer to describe and / or explore the subject in target in various levels of depth, and to produce knowledge. Interviews with children have three general purposes:

- To do research about children.
- To learn about a child who requires clinical assessment/screening, and
- To get information for the purpose of an inquiry for something the child has experienced (Garbardino & Stott, 1992, p. 184).

The third purpose applies to this inquiry. Young children use computers at school (and initial literacy software), they have "lived" experiences, and the interview method would help me identify what children like, or dislike about such programs and their elements.

6.8.3. Interviews in relation to this study

I mentioned above the rigour of interviews as research methods, but interviews were chosen for the following practical reasons, as well:

- The pupils' age and literacy level did not allow me for self-completed instrument.
- The intention of my study was to explore *what* pupils think about using literacy software and its elements, therefore I needed to probe and elicit information not only on *what*, but also *why*. This kind of information is better sought through direct conduct exactly because of young pupils' limited literacy skills.
- Generally, interview is the most preferred method in researching young children. In relation to ICT, studies that have used the interview method to see children's views on computer are the ones conducted by Yelland (1995), and Klein (1998).

The above arguments functioned as mandates to adopt interview as the appropriate method. I used a semi-structure type of interview the characteristics of which will be explored next.

6.8.4. Interview type employed

There is a continuous debate concerning the relative value of using both types of interviews with children (structured and unstructured) and the latter is usually suggested for ethnographic studies "...tell me what happened" (Tammivaara & Enright, 1986). I was not entering a field that I had no idea of what I will encounter. The observation sessions and the research gaps in the literature (see 5.10.1.) helped me to focus on specific areas and questions. Due to the fact that I had formed questions on specific software elements of software, and because I wanted young children to explain further on those specific questions, I chose a *semi- structured* type of interview. It is worth noting that semi-structured interviews are appropriate for young children aged 6 and above (The Journal of the American Academy of Child and Adolescent Psychiatry, Sept., 1987). There are though certain limitations with children's interviews, just as there are limitations whatever research is put in practice (Silverman, 2000; Cohen, et al, 2000). These will be explored next.

6.8.5. Interview limitations

Young et al. (1987) have listed 26 sources of interview misinformation in interviewing adults, but more than half of these factors are commonly mentioned in connections with interviewing children (Garbarino & Scott, 1992). Looking at various authors in literature, the most common limitations with interviews are:

- The structure of the instrument, sequence of questions, vague/ ambiguous terms).
- The respondent (memory, stress).
- Interviewer subjectivity.
- Errors in recording.

In order to overcome the above limitations that would constitute threats to validity, I had to seek advice from more experienced researchers. A rule of thumb in children's' interviews is to try to understand the interview situation and the specific question being asked from the perspective of the child. This can be overcome if the questions do not exceed their capabilities, and if they seek information about events that are part of children's own interests, or part of their everyday experience. Asking young pupils about computer reading "games" (using children's language), these are games that young children are familiar with since they use it at school and at home.

As a researcher and teacher of early education, I was aware of certain language limitations of young children, i.e. children generally understand more complex sentences than they can produce. Therefore, I made an effort to simplify the format of the questions using words that young children would understand easily. I did consulted native speaking teachers to approve of the wording. I was also aware of the stress some children might experience during the interview process, namely the unfamiliarity of the interview situation – trying to understand the adult interviewer and the reasons for having the interview, trying to respond to questions and to "please" the interviewer. For that reason I made an effort to provide an unthreatening and comfortable environment by the following means:

- I greeted each individual child with a smile.
- I repeated my name though I had already been introduced, and I asked his/her name, which I wrote down in a diary, and used repeatedly during the interview.
- I reminded them individually of the purpose of the discussion. I did not know how young children feel about computer games (playing the dumb), and I really wanted to find out.
- I sat next to the child, and not opposite, on a small chair.
- I assured confidentiality, "nobody would ever know what we have talked about today".
- I clarified from the beginning that if somehow s/he felt uncomfortable, it was her/his right to withdraw at any time.
- I demonstrated genuine acceptance of and interest in the child's responses even when s/he "rambled away", thus allowing the child to exercise some control in the interview.
- I never interrupted the flow of children's narratives.
- In frequent intervals, some of the school personnel, "a significant adult", would pop in to check how things were going and reassure that pupils were fine. When interviews were taking place in special rooms, I always kept the door open.

Another issue that is related to children' stress in adult-child communication is the amount of power, or authority, exercised in the question, namely *valence* (Hatch, 1995; Tammivaara & Enright, 1986). Children are very sensitive to this feature of communication. It was very important for me, and for the sake of the whole study, to make young children feel that I am not seeking to identify the limits of their knowledge; rather I was seeking information about reading software that they had probably used, and <u>only themselves</u> knew the answers. I exercised special care to avoid conveying the impression that a request for information is a demand; rather what was taking place was a "friendly talk". It has been argued by Garbarino & Scott (1992) that some of the above tactics, such as the familiarity of the educational setting and adults, the context, and the purpose of the interview do not only help children to familiarise themselves with the interview process itself (establish rapport), but also enable them to be more proficient using language. In addition, the attention span of young children is short, and rarely can adults keep a child engaged in an interview long enough to get "all the information" they want (Garbardino & Stott, 1992). For that reason, I made an effort to ask a few questions the most pertinent to my inquiry.

The basic approach to interviewing young children is to take nothing for granted, to rely on modes of communication familiar to the child, and to constantly be alert to the possibility of misunderstanding in both directions (adult – child). For that reason, I used "meta-linguistic reflections", or probes. *Probes* are tactics to get the interviewee to expand on a response when the researcher intuits that s/he has more to give, or to clarify. Such tactics were:

- A period of silence.
- An enquiring glance.
- "Mmhmm"
- Repeating back all or part of what the interviewee has just said (Robson, 1993).

I also use more direct explanations, such as:

- What do you mean when you say ...X?
- Could you go over that again, please?

In some occasions, I had to restate a question, or I had to explain further by giving examples, in order to reach the child's understanding. This is quite normal since it has been said that 25 to 40 per cent of the questions asked are accompanied by clarifying remarks (Dijkstra et al., 1985). This helped me to ensure that children understand the question in the same way, a situation that Oppenheimer (1992, p. 86) calls "stimulus equivalence". Indicative are the following examples:

Example 1:

Interviewer: "What is hard for you?" (What difficulties do you have when using the computer?).

Pupil: "Well I find it hard to get up early in the morning and go to school..."

Example 2:

Interviewer: "How to you find it?" (What difficulties do you have when using literacy games).

Pupil: "Oh it is easy. I go to **Start** then I click **Programs**, and then I recognise the program and I double-click...."

In addition, I found that questions are not always asked in the same order as written down by the interviewer because of the dynamic nature of interviews; rather they are sprinkled during the interview process.

6.8.6. Designing the interview instrument

When designing the questionnaire, I had to keep in mind the above series of things that the literature suggests. I used as warm up questions the first two questions of the interview agenda (see Appendix 3D), namely "do you have a computer at home; do you use it", "do you like to use the computer in the classroom, and why". The third question, "Have you used games that help you with reading words or spelling words", and the related ones "Do they help you with your reading? In what ways", were of great interest to my research because they would provide me with children's experience of using such programs.

The fourth question "how do you prefer to work on reading games, (alone, dyads, or in small groups, and why) would inform me the preferred working mode that is very essential when children work on reading games. It is also essential for the previewing process (see 4.4.2.). The fifth question deals with the kind of difficulties young children encounter when using literacy games in particular. The provided answers would delineate what these difficulties are (children's experiences). This would enable the comparison among the stakeholders' views on that issue at a later stage of the data analysis.

Question number 6 on the list is concerned with the technical features in software, this is still pictures, colourful design, sounds, and animation. There are general impressions that children favour them with some reservations about sounds and animation, but such information does not come straight from children' experience. Similarly, the seventh question on the agenda asks young pupils about the instructional characteristics in literacy software, this is positive feedback (rewards / praises) and negative feedback (critical comments), practice (corrections, repetitions). The items of the two last questions (6 and 7) are designed in rating scales that will be rated by young children, as well.

Question 8 on the list asks pupils if they like literacy programs that read out the words for them, and if they like games that read out the instructions. The last question (q. 9) "do you think computers help you to learn and how" was the epilogue of my discussion with children, which asked them their overall judgement about computers, and the general ways computers contribute to their learning.

6.8.7. Pupils' sample

I found two Infant & Nursery schools where I could conduct the interviews. Throughout this study, these schools will be named school A and school B to ensure anonymity of both, schools and children. School A is an inner-city school situated in N. London with a population of mixed ethnicities, where as the school B is situated in SW of London with middle-class children. My choice of schools ensured the heterogeneity of my sample in terms of socio-economic status, ethnicity, and achievement levels. I conducted the interviews with **98** **KS1**, young pupils (Year 1 and 2).

On the phone, I arranged separate meetings with the Head teachers of the two schools, where we talked about my study and the questions that I would ask young pupils. I provided them with a copy of the interview questions and the rating scales (see appendix 3C, "Pupils' rating scales), and they kept a copy of each for their reference. They showed special interest at the format of the scaled questions and they found it interesting and appropriate for this age group.

6.8.8. Arranging turn taking of children

On the day of the interviews, the Head teacher introduced me to the classroom teachers (who had been informed) and to the children. They told them my name, Litsa, a teacher and friend from a foreign country, and the purpose of my visit (to talk with them about computers). It was repeatedly stressed that their participation is not obligatory. This conversation is not compulsory just a "friendly talk" about computers, and their games. The classroom teacher asked children to raise their hand if they wanted to participate. What I witnessed was that hands rose eagerly, and children showed enthusiasm. The Head teachers determined the place of meeting and the classroom teacher arranged the turn taking. Names were called arbitrary, for example Alex goes first, Alice second, Michael, third, and so on with the obligation the returned pupil to notify the next one. Thus, I had no control over the sex and turn taking of the sample.

The place, where I was meeting the pupils of school A, was the library but very soon I was transferred to an open place – TV room, which frequently was becoming quite boisterous. Some times, I had to interrupt the interview until this is over. I had no choice. This of course affected the recording, and in some cases it was not clear enough to transcribe. The same happened the first day I visited School B because the office of the Deputy Head teacher was next to the Assembly room. The following day they allotted me a quieter place and had no distraction during the interviews.

6.8.9. The pilot stage

Initially, I had not intention to pilot the questions. I started the interviews with 13 pupils, but I found myself in a difficult situation. Two major problems emerged: first I asked many of the questions in a closed form due to my inexperience, which was leading me to the collection of "hard" data. Second, I realised that when children responded with a "yes" in an attitude question, I had no measures of that "yes", especially when the facial expressions were not showing enthusiasm and assertiveness. I listened to the tape over and over, and I decided that somehow I have to measure that "yes" "sort / kind of" "hummm... well yes" construct. I decided then to include an instrument that would provide some indication of this indecisiveness. But have rating scales been used before with young children?

I stopped temporarily the interviews and did a quick search in the literature. I found that Miyashita & Knezek (1992) have designed a Likert-type research instrument for first-graders, and it was used for assessing their attitudes to computers in instruction. I decided then to design scaled questions on a 4-point scale (1, 2, 3, 4) (similar to the ratings scales used in the questionnaires of teachers and developers) that would help me to compare later in the data analysis. For a copy of pupils' scaled questions, the reader can refer to Appendix 3C). Instead of numbers though (1, 2, 3, 4) I drew hearts, as it is shown below:

(-) = Not at all	♥ ♥ = Fairly
♥ = A little	♥ ♥ ♥ = Very much

In particular, I used scales for questions regarding software elements (technical features and instructional characteristics) I also used rating scales with question 8i and 8ii of pupils' interviews regarding software that reads out the words / instructions for pupils. I piloted this instrument with 6 Yr2 pupils who showed no difficulty whatsoever in understanding it. I did not involve Yr 1 pupils in completing the rating scales because it was not found anywhere in the literature that children of that age are capable to understand the concept. Preschoolers are much more proficient using language to describe persons, objects or events than to clarify, evaluate the truth of, or reflect on statements (Garbardino & Stott, 1992).

6.8.10. Conducting the interviews at schools

Treating the child as an informant is an important way for adults to obtain information from children, but a very perplexing one. Though young children can provide rich verbal accounts of their own experiences related to their own feelings, behaviours, abilities and social relationships, and of their understanding of the world around them, in order to achieve these "active linguistic exchanges", it takes a skilled teacher / researcher (Wood & Wood, 1983; Garbardino & Stott, 1992).

I do not claim that I was a skilled interviewer, only a beginner researcher who made an effort to consider throughout the interviews aspects of computer literacy games, and tried to elicit information on children's attitudes towards these games including certain software elements (technical and instructional characteristics). I made an effort to follow closely the guidelines how to conduct the interviews suggested by more experienced researchers. Admittedly, I face difficulties that I will state next:

Firstly, it was my first time I was talking to an English-speaking child of that age, and I realised that in some cases I could not understand well. I was asking to repeat the response, and if I still did not understand I was proceeding to the next question. The problem was mostly with some of the Yr1 pupils. They seemed shy and spoke so quietly almost whispering. The responses were not lost because the transcription of the interviews was done first by me and then by an English-speaking transcriber. I did lose though the chance to probe more.

I came across children who were responding with small sentences, they were shy, and generally I felt that I couldn't elicit more. Even if I probed them still their answers were very short. I found myself inexperienced and unable to handle such situations because of language and cultural barriers. I did not know how English speaking researchers / teachers would tackle these "problems". Another reason why I was not probing enough was that I wanted to avoid suggestions. In my personal experience working with young children, when you suggest things to young pupils, they pick one of the suggested options. This is not certain that the answer (suggestion) is true.

While conducting the interviews with some children, environmental noises distorted the conversation that I did not perceive at that time, but when I came to transcribe this part of the conversation, I found that it was not possible not only for me but for the English-speaking transcriber. I did not pinpoint this problem in advance because I transcribed the interviews after I had finished with both schools.

Many questions were not answered simply because some children were honest and said with outspokenness "I don't know," I really can't tell," "I am not sure," "Could you say that again" and kept silent instead of giving me a desirable answer, fact that I now appreciate because at the end those responses would distort the validity of results.

Lastly, I realised that children responded differently to different questions. Just like Allerton (1993), I found that pupils answer more to close-ended questions (yes / no), and less to open-ended ones, for example not all pupils could explain why they like, or dislike, certain features in software. In addition, some answers were richer than others, i.e. children developed serious and meaningful allegations against sounds, but these were not so rich when they were asked to explain why they like, or do not like, moving characters.

Note taking was found hard and impossible (Robson, 1993; Garbarino & Stott, 1992). I found it hard, time consuming, distracting, and I was loosing valuable information, such as facial expressions and chances to probe. Finally, I found very useful to write down the gender next to the child's name because I was not acquainted with first names, and the gender they purportedly carry. I strongly recommend this practice to future researchers who come from different socio-cultural environments other than the subjects.

6.8.11. Analysis of interviews

I used content analysis to analyse the interviews just as I did with the open-ended questions in both questionnaires. First, I had to change the oral discussions into a verbatim script. It was a long and slow process, but it was worth it because it reminded me the points that impressed me at that particular time and setting, and also it helped me to have a feeling, and a better understanding of my data. The texts were checked for accuracy by an English-speaking transcriber. Having transcribed the whole content of the interviews into documents, and not only parts, helped me in revisiting the parts I wanted easily.

Coding the interviews texts was done slightly differently than coding the open-ended questions. I made two printouts of the interview documents. One was kept as reference. The second was used as a textbook, where words of familiar pattern were circled with the same coloured marker so as to become easily distinguishable. Then, they were cut up and glued on blank sheets of paper under the relevant interview question. In this way, I formed another third document the content of which was "cuts" of children's responses. I classified those responses according to each interview question. Each of these "cuts" was accompanied by the name of the student. Each question was also classified according to school and year (Yr1 and Yr2), so as to make comparisons that would help the analysis later.

The analysis of rating scales was done in the SPSS. I entered the data in the same way as I did with the questionnaires. SPSS helped me compare the views of the three stakeholders (pupils, teachers and developers) regarding the technical features and the instructional characteristics in software. In addition, I performed a bivarate level of analysis (testing the relationship between two variables) using as independent variable gender (boys and girls), and as dependent variable "repetition", as follows:

Pupils' gender ———▶ Repetitions on errors (q. 7, pupils' rating scale)

The statistical test used is Chi-square (see 6.6.3.) in order to see relations between categories, gender (boys – girls) and "repetitions on errors". To remind the reader again that the data are categorical / nominal. The chi-square test was two-tailed, and the significance level was set at 0.05.

6.9. Criteria for judging qualitative research

Thus far, the chapter has focused on describing the processes undertaken to establish the methodology and methods used in this research (survey, observation and interviews), and has linked the critical and practical considerations of the methods employed to the research aims and questions. This section will explore the criteria adopted to judge the quality of this research.

6.9.1. Definitions

Reliability is the consistency with which the measuring instrument performs (Leedy, 1997), and deals with the question whether "the results of the study are repeatable" (Bryman, 2001, p. 29). In other words, reliability is the ability of an independent researcher to replicate the findings provided that s/he follows consistently the same method, tool and procedures. Validity on the other hand refers to "the integrity of the conclusions that are generated from a piece of research" (Bryman, 2001, p. 30), and deals with the question "are the inferences drawn from data trustworthy" (Eisenhart & Howe, 1992)? In summary, reliability could generally be seen as an "external", where as validity would be seen as an "internal" process. Interestingly, Lincoln & Guba (1985; 1989) use close analogues to those of the positivistic paradigm, (true value, applicability, consistency and neutrality), but as many educational researchers, I do continue to have respect for the positivistic concepts of validity and reliability. Because of the qualitative nature of this research, it is necessary the application of broader concepts of validity and reliability that accommodate ideas emanating from both quantitative and qualitative methodologies. The issues of reliability and validity in qualitative studies are highly debatable among researchers (Goodwin & Goodwin, 1996).

A concept that is sometimes confused with validity and reliability is that of "truth". Carspeken (1996) defines it as the individual belief that the statements of the researchers are accurate, but he concludes that all claims of truth are fallible, and can be disproved at some point at present, or in the future. I do take his advice and I do not seek the "final truth" (p. 57); instead I concentrate on being "truthful".

6.9.2. Reliability of the study

It would be helpful at this point to see what other authors have said about the issue of reliability. "No study (qualitative or quantitative) can be exactly replicated. The opportunity for independent, separate researchers to discover the same phenomena is impossible without full and complete descriptions of how the original research was developed and conducted" (Goodwin & Goodwin, 1996, p.

139). Similarly, Oppenheimer (1992) argues that even if an independent researcher copies exactly an original study, it is high unlikely to find similar findings since people's attitudes change, or change in tensity. I do agree with the above authors that no replications can be achieved in the social sciences. Besides the premises of the philosophical stance of this study include the uniqueness and idiosyncrasy of the situations, therefore the study cannot be replicated – actually this is their strength and not their weakness.

In relation to this research, it is difficult to ascribe the reliability of the research instruments, if applied again even using exactly the same methodological structure. Firstly because schools are equipped more and more with computers sets, the quality of ICT provision improves gradually, which in turn is associated with more frequent use of technology in classrooms. The micro-density figures gradually drops to smaller figures, which is regarded as a significant factor in effective ICT application in schools (better provision affects the ICT access). Secondly, software is becoming more advanced and flexible, and easily accessed by young children. More and more research is conducted aiming at improving the quality of software by finding out what is that young children like in such "games". Thirdly, teachers' skills and confidence is on the increase through in-service or personal training, and they are exposed to more sophisticated software that might influence them differently. More and more young children become adept in using computer and programs. Fourthly, software developers become aware of what needs to be included in children's software, consequently the changes will affect teachers' and pupils' preference. Finally, if we consider the qualitative nature of this study, the fact that we are dealing with humans and the variability of dynamics that develop between humans and their contexts, then replicating this study and bringing the same results is rather impossible. The phenomena that this study has investigated are changeable; therefore reliability would be useless as a goodness criterion.

6.9.3. Validity of the study

Validity being described as an "internal" process (insidious and pernicious) and is mostly dealing with the methodological criteria that can ensure that the researcher has carried out the process correctly (Guba & Lincoln, 1989, p. 245).

Because this thesis was set out to conduct qualitative research (with the exception of the low-level statistical analysis of survey), it is necessary the application of broader concepts of validity. There are three rules of thumb suggested by Eisenhart & Howe (1992, pp. 657-663) that enhance the validity in any given piece of research – qualitative or quantitative:

1) *The fit between research questions, data collection procedures and analysis techniques.*

This means that the aims and the research questions of this study drive the data collection procedures (fitness for purpose). Regarding the survey, the choice of criteria have been discussed in section 6.3.1. and 6.3.2.; for observation are found in 6.7. and 6.7.1.; and children's interviews in 6.8.2. and 6.8.3. To remind once again that there not only critical, but also practical reasons for the choices I have made. The statistical tests were determined according to the type of data, as it is analysed in 6.6.2. and 6.6.3. In section 6.6.5., I explained the reason for adopting content analysis as the most appropriate analysis for soft data.

2) *The effective application of specific data collection and analysis techniques.*

These criteria have to do more-or-less with the technicality of the study, in particular I provided credible reasons for the choice of sample (subjects), when the research took place, how instruments were designed and piloted, data gathering procedures (how I conducted the survey, observation and interviews), and ensuring the validity of the analysis techniques used.

Survey: A central issue in considering the validity of questionnaires (survey) is that of sampling (Morrison, 1993). An unrepresentative, skewed sample, one that is too small, or too large, can easily distort the data, and in the case of small samples can prohibit statistical analysis. Lack of familiarity, anonymity and standardised tools were the particular ways with which I tried to control those threats, which could harm the validity in my design. Also, careful wording, format, and content can reduce significantly the subject's own unreliability.

Observation: The validity of the observation method suffers in this study mainly because I was the only observer, and there are no other colleagues to cross-check each other findings. The time of observation was limited, and I feel that I am not aware of antecedent events and / or if I have depicted all the phenomena accurately. Validity is based on the way the findings are written in a way that appears to be true (*verisimilitude*), but this could be seen as the "swindler's story". In this study, phenomena in observation will be seen only as corroborating to the findings of children's interviews and vice versa.

Children's interviews: All the precautions taken for conducting the children's interviews are in detailed discussed in section 6.8.5. Very briefly, the topic was familiar, the wording was simple, piloting, good rapport, but as inexperienced researcher and non-English speaking native, I did not always understand children's responses and I did not probe enough. I did not follow the exact sequence of the questions, but I did make sure that children understood what the question was seeking to find out. The generation of codes was approved by colleagues, and my supervisor, and the counts are presented in tables so that any inquirer can trace the sources. Also, the quotes enhance the accuracy of my data. I let the data generate categories, and not vice versa. The rating scales used during the interviews functioned as a way of checking the accuracy of what was said during the interview.

3) Alertness to and coherence of prior knowledge.

This criterion deals with the identification of the disciplinary context in which the study, and its methodology, was conceived. In other words, "does this researcher use methods similar to other investigation in the field in question"? I sought to explore the views of three different samples for the first time and within the same research project. Usually, other studies sought the opinions of each of the stakeholders separately. Perhaps the most common way to seek teachers' opinion on using ICT is the use of a semi-structure questionnaire, as it has been done in the studies of Johnston (1987), Edyburn. & Lartz (1987), Cosden (1988), and in the various governmental surveys of DfEE (1997; 1999). Questionnaire, as a tool, was also used in the study of Haugland (1997) to assess teachers' views on important software characteristics. Research on young children using computers though research is scanty. Yelland (1995) and Klein (1998) used interviews (the last researcher used children's drawings in addition) in order to explore such an issue. Storey (1992) and Weeks (2000) used observation as the main tool, where as Shade et al. (1986) used observation paired with questionnaires. So the tools deployed in this study have already been used with other researchers and are appropriate for the age group that participated in this study.

4) Ethics.

Ethical considerations were put in an appropriate context throughout the planning and conducting the research project. In research ethics – questions and dilemmas – is not a discrete entity, but it could rather be perceived as a conceptual framework, which permeates every feature and stage of the research process, and regards any person involved in it (French et al., 1998; Mertens, 1998). It is concerned with the question "Is the research conducted in a professional manner and accurate manner?" Accordingly, the ethical issues, which I took into account in my research, concerned the continuum from the formulation of ideas, until the dissemination of findings (thorough knowledge of the scientific literature, objectivity and reliability, accuracy of presented results, appropriate use / misuse of resources.

Regarding the survey, emphasis was placed on anonymity and confidentiality, privacy, and informed consent: provision of full explanation of the aims and the purpose of the research and the identity of the researcher, the nature of participation entailed in research, and the way the research findings would be utilised (Denzin & Lincoln, 1994). All names and identifying details are kept confidential (respondents and schools). They participated voluntarily and they had the opportunity to withdraw at any time. All the above constitute the core principles adopted by the British Educational Research Association (BERA, 1992).

Particular emphasis was given to the ethical principles for conducting research with children. The SCRE centre (undated) calls for "special care" and precautions on the part of the researcher. This special care concentrates on the ethical issues involved, such as the *welfare* of the children. The schools' authority must be confident that the children's safety, rights and interests are fully safeguarded. Authorities must be also confident that the research carried out with children is conducted to the highest ethical standards. Finally, the researcher must be protected against any misunderstandings, or possible allegations, of misconduct arising from her/his dealings with the children.

Safety is a very important consideration covering not only the legal aspects of the study, but also the quality of data (The SCRE Centre, undated). This was ensured by conducting the research within the "protected environment" of the school, by getting the approval of the schools' Head teachers (whom the parents have conferred responsibility for their children). Building *rapport* with children was another strong aspect of safety where I reminded the subject child that interviewing is not coercive, that withdrawal is possible at any time s/he feels uncomfortable, as well as confidentiality and privacy (PMRS, undated).

It is also imperative when conducting research with children to provide sufficient information to the person responsible for the child – in this study the Head teachers – regarding the topic and context of the questions intended to be asked. In addition, it is essential to take into account and adjust questions to the child's level of maturity. I showed the Head teachers the design of my research tools and a copy was given, as well. Head teachers arranged interviews at a convenient time for the children. It is desirable that some responsible adult apart from the interviewer remains close at hand while the interview is carried out, however it is not necessary that this person is actually present in the same room – this may be undesirable is some cases. In this study, significant adults were popping in to check if everything works properly (school B). In the first school (school A), interviews took place in an open space and familiar "faces" were passing by. Children did not feel intimidated.

In qualitative data, validity might be addressed through the honesty, depth, richness and scope of the data achieved, the participants approached, the extent of triangulation, and the objectivity of the researcher (Cohen et al., 2000). I agree with the previous eminent authors, and I whole-heartedly believe that an issue associated with the concept of ethics is the *honesty* of the researcher. I wholly accept the responsibility of presenting a truthful picture of all data generated. Because this study was initiated out of my personal interest and funding, this researcher does not feel "obliged" to favour any of the three stakeholders, rather to depict "truthfully" their experiences.

5) Supervision.

Another criterion is supervision and Prof. Roy Evans has supervised this investigation. Carspeken (1996, pp. 88-89) highlights each of the above techniques as contributing to validity.

6) Triangulation.

It is a very intriguing concept, and has its supporters and critics alike. It is used for both qualitative and quantitative studies. Firstly, in this thesis, it is defined as the usage of several methods (questionnaires – observation – interviews) to explore an aspect – initial literacy software (Denzin & Lincoln, 2003; Cohen et al. 2000; Flick, 1992). The more methods we use the better our chances to gain some understanding of how stakeholders "construct their stories" they tell us about. The stories are collected from three different perspectives (teachers – developers – pupils), so triangulation is used primary as a tool to generate the views of the three groups of people who share a common interest. The fundamental principle that I took into consideration is that methods should be mixed in a complimentary way, and not to overlap weaknesses. This principle is followed by elucidating the divergent aspects of the phenomena, and by obtaining convergence, or corroboration of findings (Johnson & Turner, 2003, p. 299).

Secondly, triangulation in this study is also defined as a means for "cross-checking findings" (Black, 2001, p. 273; Mertens, 1998, p. 185). Questions 11 (teachers), 8ii (developers) and question 5 of pupils' interviews regarding pupils' difficulties when working on computers will be cross-examined. Similarly, questions 15 (teachers), 10 (developers) and pupils' rating scales (1-8) regarding technical features and instructional characteristics in software will be contrasted for any differences using the Kruskal-Wallis H test. Moreover, questions 16i (teachers) and 8i (developers) regarding teachers' confidence in using ICT will be contrasted with the developers perspectives. Similarly, question 13 (in teachers') and 9 (in developers' questionnaire) regarding general influential factors for selecting software will also be examined by both groups using the Mann-Whitney U test.

It is not within the intention of this researcher to criticise differences found in opinions as "right", or more "true", but I will give added weight to the perspectives of those with less power and privilege to "give voice" (see 6.1.1.). Finally, the limitations of the naturalistic observation as a method in this study are acknowledged, and its findings will be only corroborating the findings of the children's interviews.

6.10. Summary

This chapter has outlined the adopted methodological principles within the current research project. Namely, the study adopts the constructivist paradigm of Cuba & Lincoln because the inquiry is set out as a perspectives study, where the views of the three stakeholders (teachers – developers – pupils) will be explored, and will serve as coordinates to elucidate the research questions of the study. The first aim of the study (see 1.5. and 5.10.1.) is branched to the following questions:

a) What is the extent to which primary teachers use software to assist teaching initial literacy skills?
b) Do primary teachers use criteria to select initial literacy software for classroom use?

The chapter has highlighted the avenues through which the questions will be explored (see 6.2.) and certain elements will be investigated by seeking the developers' views. The second aim is to explore pupils' views (KS1) on using initial literacy software computer programs and their thoughts on elements in such computer packages. The paths of investigation have been clearly identified.

In addition, the chapter highlighted the stages that this project took place, with all the appropriate planning and preparation strategies, the design of research tools – why each question was asked – as well as their justification, their strengths and limitations. Finally, it showed, and justified, the analysis techniques that will help me reach valid conclusions, and concluded with the discussion of validity and reliability of the study. Next, I will move to the data analysis chapter.

Chapter 7. Data analysis

This chapter begins with the response rate according to the three different stages that the survey took place (see table 6-1), and continues with the analysis of the response rate. Then the chapter is divided in three parts. The first part presents the data analysis of the survey, the second the analysis of the developers' questionnaires, and the third proceeds with the analysis of the qualitative data (children's interviews). The chapter concludes with a summary of the important findings.

7.1. Response rate

During the three stages of the survey, different numbers of questionnaires were sent to different schools. The table below shows the number of teachers that participated in the study and the different classification of the school they came from.

Table 7-1 The response rate according to different schools and stages of research

Count

	Stages of research			
	1st stage of research	2nd stage of research "Brunel group"	3rd stage of research	Total
Infant & Nursery	22	1		23
First & Nursery	7	4	4	15
Infant, Junior & Nursery	6	3		9
Primary	41	8		49
First		1	10	11
First & Middle			5	5
Total	76	17	19	112

The return rate during each of the stages varied.

<u>1st Stage</u>

868 questionnaires were sent to 217 schools in the four LEAs, and **76** were returned with the 9% response rate.

2nd Stage

80 questionnaires were sent to individual teachers that formed the APD Brunel group at their home address. I received 17 back with a response rate of 21,25%.

3rd Stage

108 questionnaires were sent to 36 schools and 19 came back raising the response rate to 17,6%.

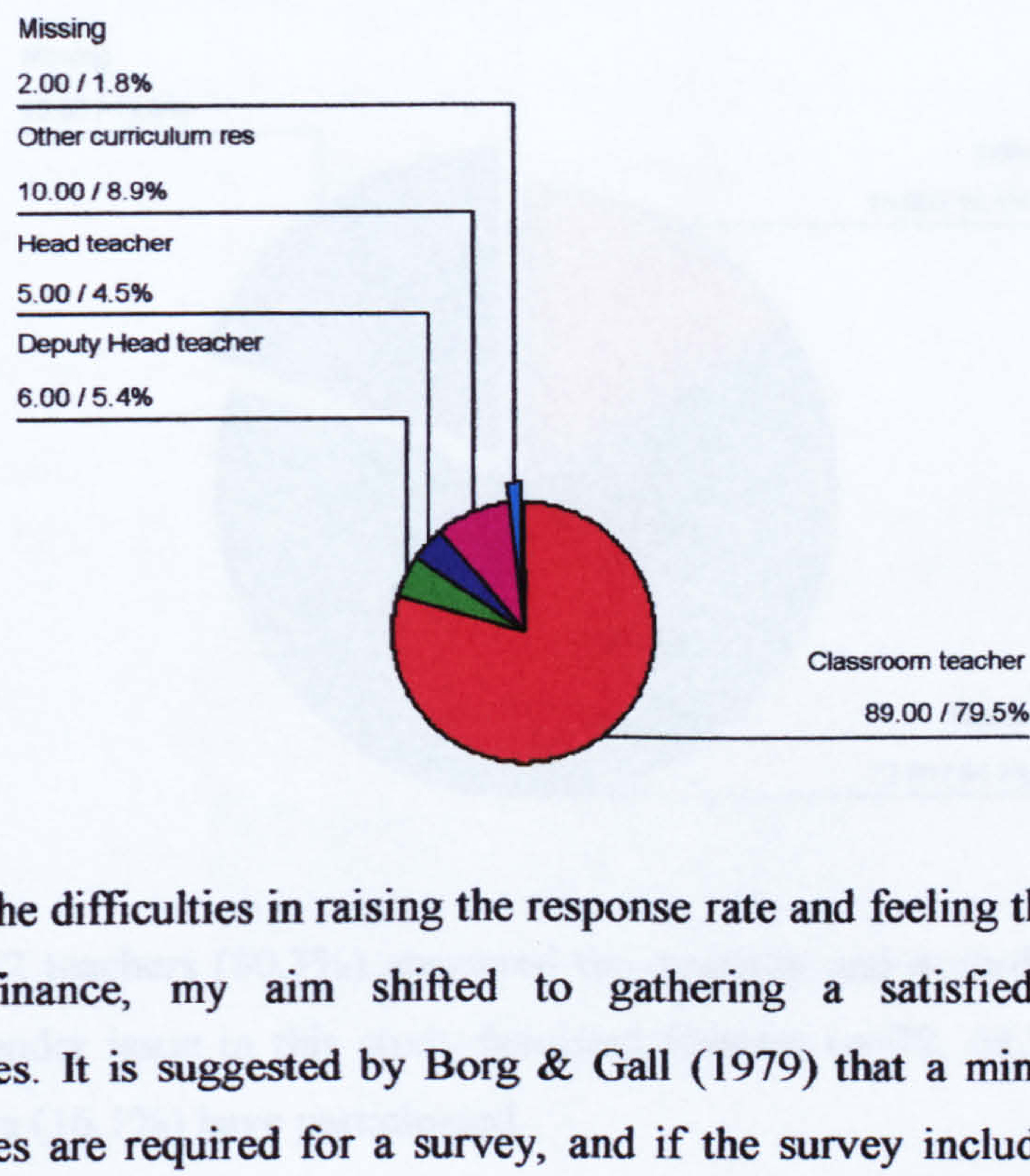
7.1.1. Analysis of the response rate

Surveys are notorious for low response rate despite the precautious measurements I have taken while designing and conducting the survey (see 6.3.3.). But the low response rate is ought to external variables beyond reach. During the first stage of my research, I realised that the timing of the study coincided with a very busy time for classroom teachers. When the survey was repeated in a supposedly less busy period, the response rate did increase, but not to a satisfactory level. The response rate is higher during the second stage of the survey (the Brunel group), and a possible explanation would be that those teachers were researchers themselves, and they understood the difficulties I encounter. It is my personal estimation that low response rate is attributed to the fact that teachers are very busy people - irrespective of the timing of the study - loaded with many responsibilities. Schools receive hundreds of questionnaires not only from other studies but also from administrative agents forming a highly pressurised situation for educators.

A problematic issue that I came across in my study is that questionnaires never reached their destination making thus impossible to know how many of the questionnaires sent finally reached classroom teachers. I made about eleven follow-up phone calls, and I realised that the ICT Co-ordinators had not been informed of the survey. Therefore, it is not certain if subjects received the questionnaires after all. After the follow-up letter, 17 of the Headteachers called up and asked new questionnaires to be sent because they had received nothing in the first place. 27 Headteachers kindly responded that their school would not be able to participate due to workload, which is respected. Among this group 3 openly stated that it is their policy not to participate in *any* survey.

The truth of the matter is that I anticipated low response rate for one more obvious reason. The four questionnaires sent to each school were addressed to four different teachers with different responsibilities, but the fact is that the same teacher, in many cases, has dual duties, this is a Headteacher is the ICT Co-ordinator, or the classroom teacher is the SENCO of the school. This is also verified by the analysis of question 9 that showed that almost 80% of the sample indicated that the ICT Co-ordinator of their school is also a classroom teacher. Those teachers were not expected to send two questionnaires.

Figure 7-1 Other duties of the ICT Coordinator



Because of the difficulties in raising the response rate and feeling the pressure of time and finance, my aim shifted to gathering a satisfied number of questionnaires. It is suggested by Borg & Gall (1979) that a minimum of 100 questionnaires are required for a survey, and if the survey includes subgroups then 20-50 of each minor subgroup is the minimum limit. Considering this, I proceeded with the data analysis. Finally, the number and percentage of teachers that form the four groups within teachers' sample of this study is shown below:

Table 7-2 Different groups of teachers that participated in the study

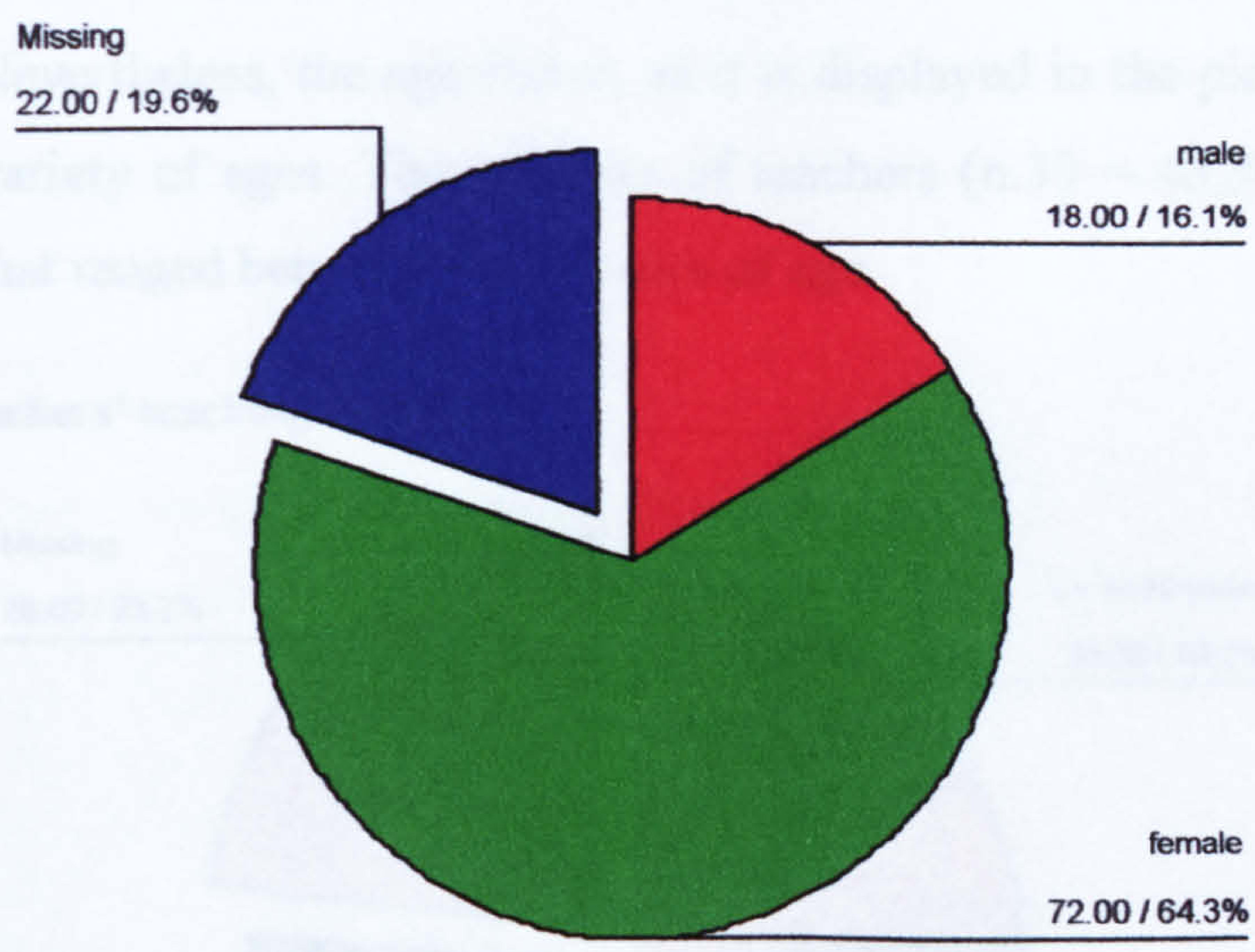
Group of Teachers	Counts
ICT Co-ordinators	30
Classroom teachers	30
Special Needs Co-ordinators	21
Head teachers	31
Total number of teachers	**112**

7.2. Analysis of teachers' questionnaire

Section A.

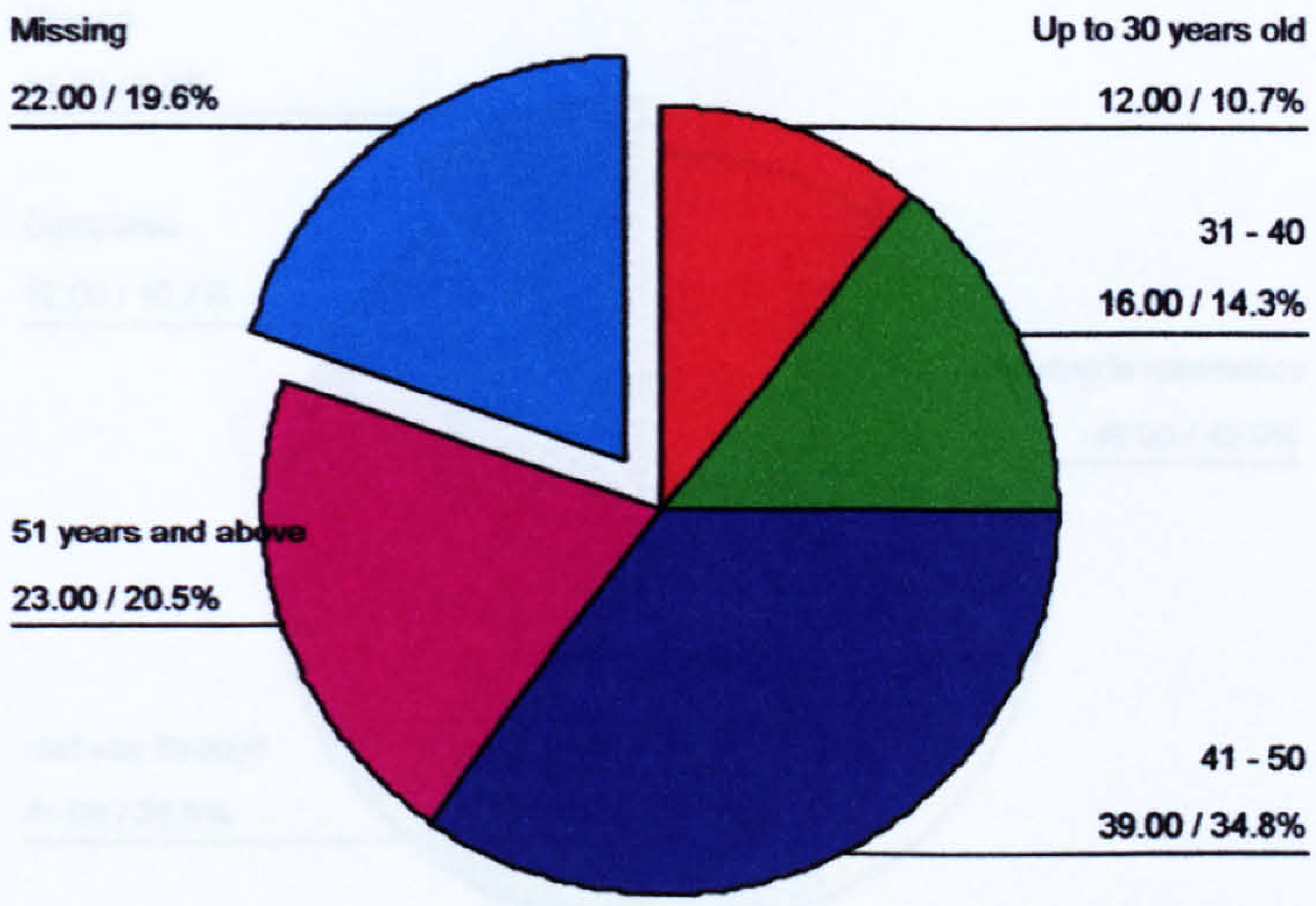
a) Information about the respondent

Figure 7-2 Gender



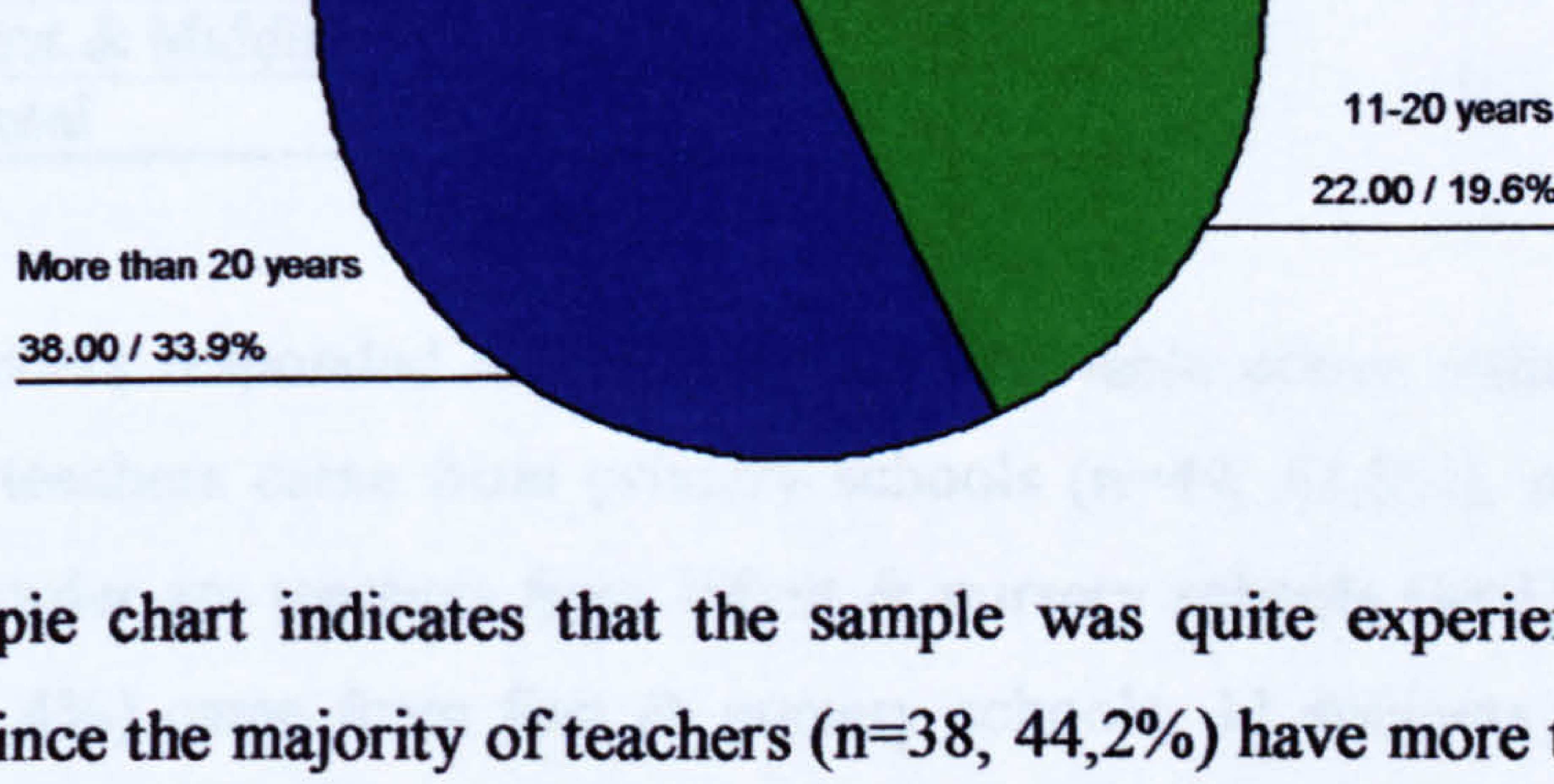
90 out of 112 teachers (80,3%) answered the question and according to the pie chart, the gender issue in this study favoured females (n=72, 64,3%). Only 18 male teachers (16,1%) have participated.

Figure 7-3 Teachers' age groups



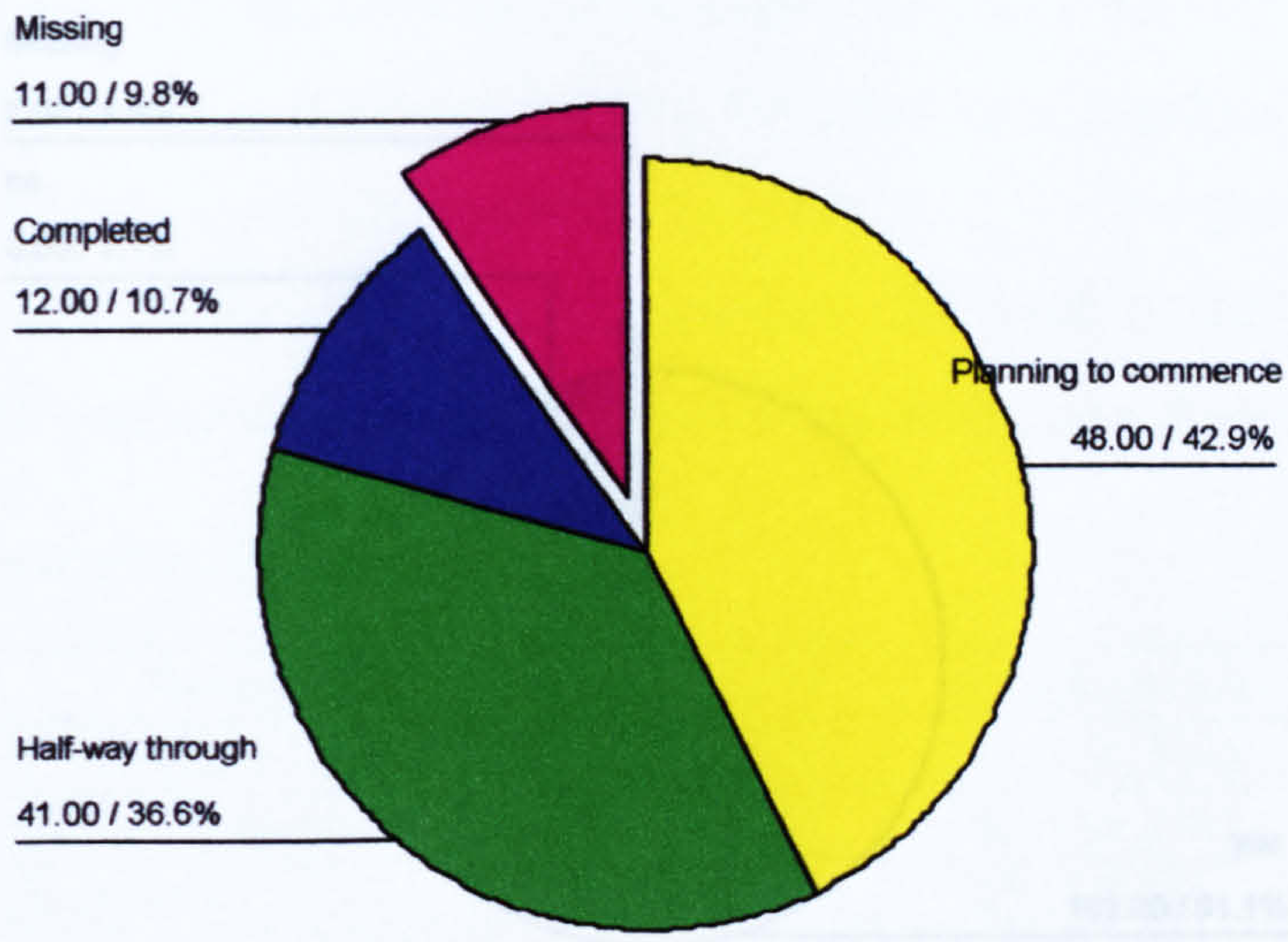
Because only two teachers were found to belong to the "Under 25 years old" value, I combined them with the "26-30 years" cohort and renamed it "Up to 30 years old". Nevertheless, the age factor, as it is displayed in the pie chart above, indicates a variety of ages. The majority of teachers (n.39 = 43,3%) were of a mature age that ranged between 41-50 years of age.

Figure 7-4 Teachers' teaching experience



The above pie chart indicates that the sample was quite experienced in their profession since the majority of teachers (n=38, 44,2%) have more than 20 years in education, 22 of them (25,5%) are 11-20 years in the teaching profession and 26 teachers (30,2%) fall within the range of "Up to 10 years".

Figure 7-5 Participation in NOF training



The pie chart above shows that only a small portion of the sample (n=12, 10,7%,) has completed the NOF training. 41 teachers (36,6%) are half way through, where as the rest 48 subjects (42,9%) are planning to start the training. The conclusion is that the majority of teachers are planning to commence the training.

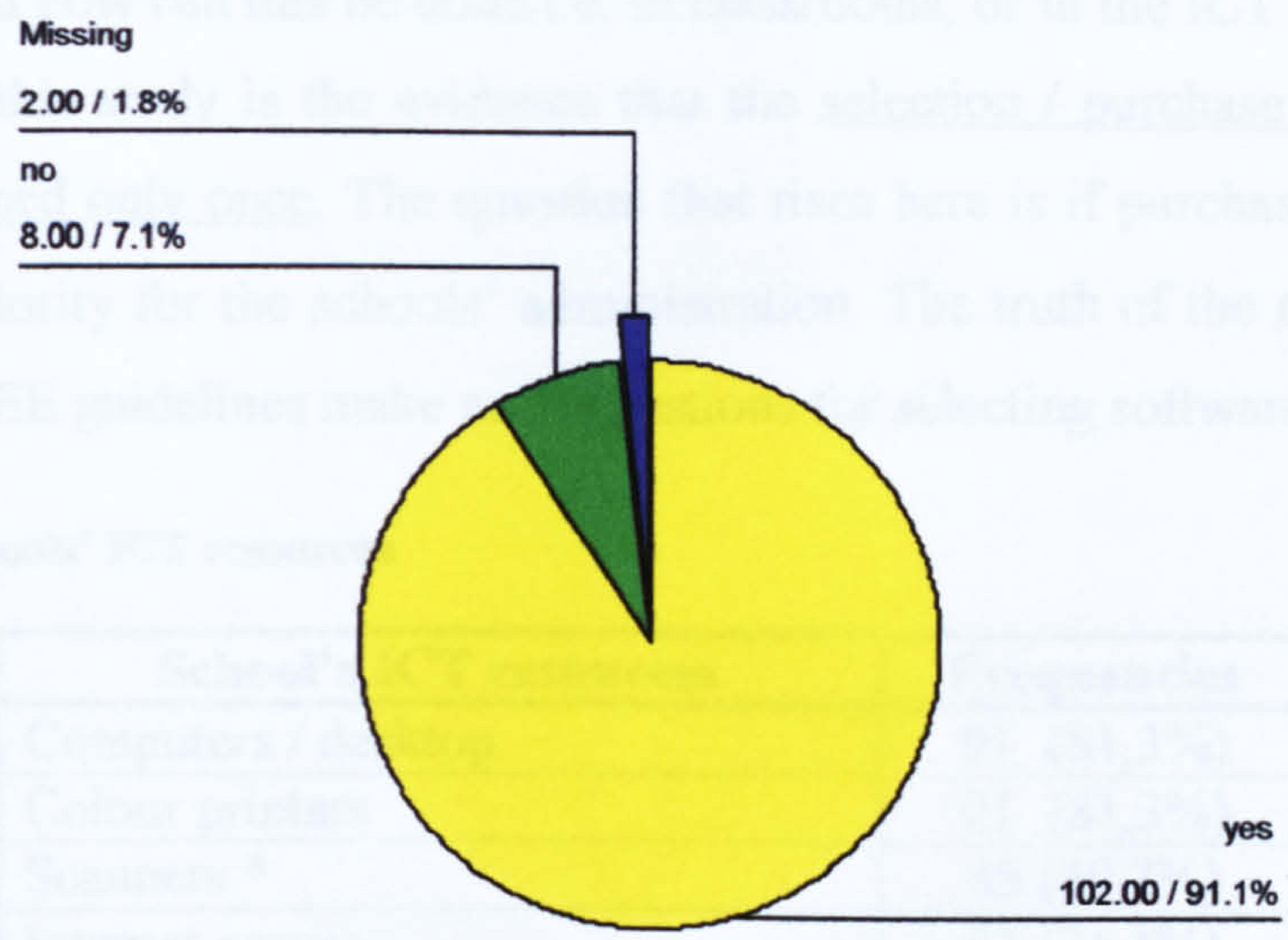
b) Information about your school

Table 7-3 Number of teachers and the classification of their school

	Counts & %
Infant & Nursery	23 (20,5)
First & Nursery	15 (13,4)
Infant, Junior & Nursery	9 (8)
Primary	49 (43,8)
First	11 (9,8)
First & Middle	5 (4,5)
Total	**112**

All 112 teachers responded to the question. The table above indicates that the majority of teachers came from primary schools (n=49, 43,8%), and second in descending order are teachers from infant & nursery schools (n=23, 20,5%). 15 teachers (13,4%) came from first & nursery schools; 11 subjects (9,8%) came from first schools, 9 educators (8%) came from infant, junior & nursery, and 5 participants (4,5%) came from first & middle schools. The majority of teachers came from primary schools (43, 8%), and from infant & nursery (20,5%).

Figure 7-6 Schools have an ICT policy



110 subjects (98,2%) responded to the question. The overwhelming majority (n=102, 91,1%) came from schools that have a written ICT policy, where as 8 said that their school does not have a written ICT policy. Key elements of the ICT policy were given by 66 subjects (58,9%), which are presented in the following summary table:

Table 7-4 Key elements of the schools' ICT policy

	Counts
Aims / objectives / rational	28
The policy conforms with the NC (QCA / WoS)	22
Equal access to using the computer	18
Management of access and resources (hardware – suite – network)	17
ICT across the curriculum / links with other Key stages	17
Health and safety	6
Internet	3
Purchasing software	1

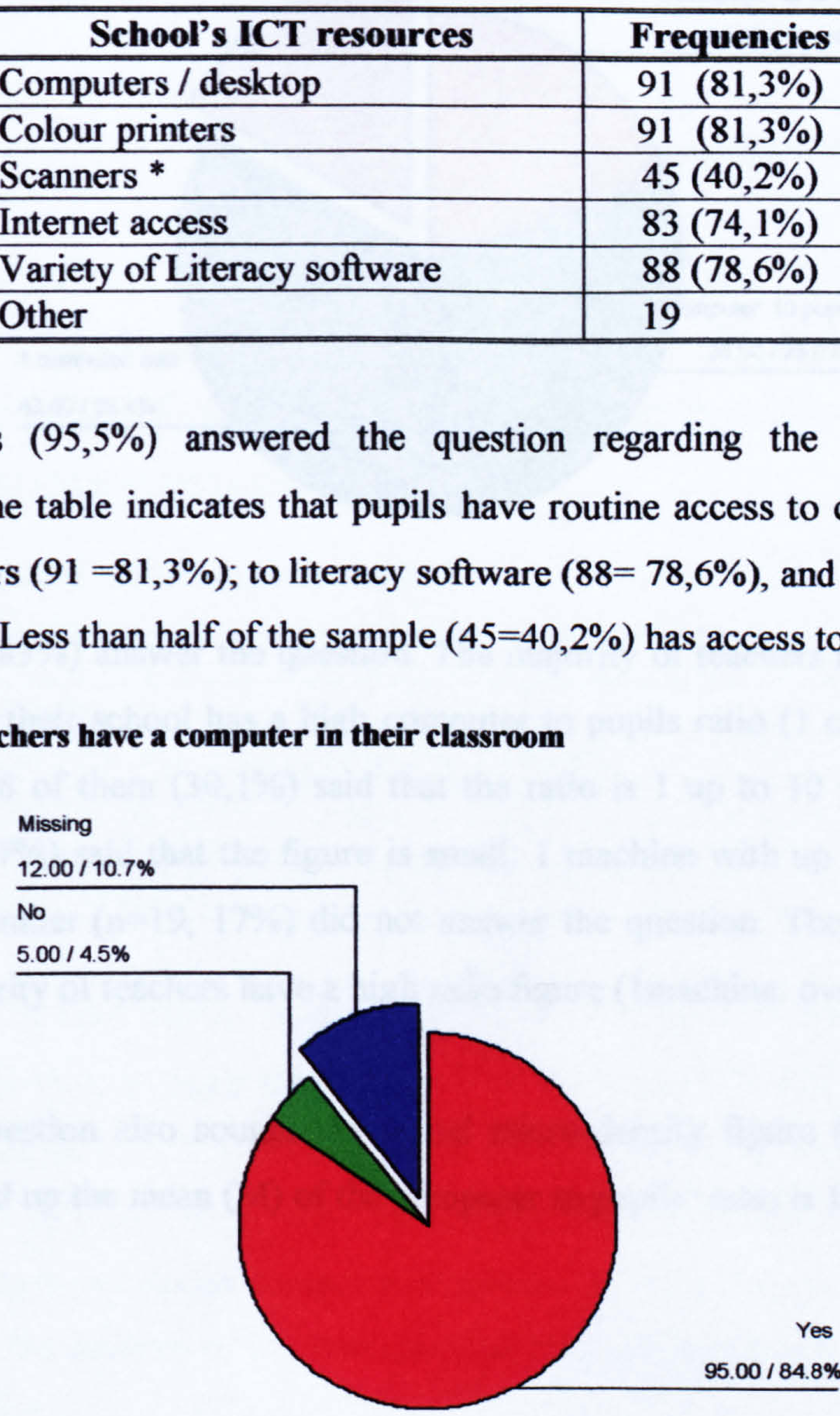
The list above shows that a significant number (n=22) did not provide particular elements; rather they said that the school's ICT policy conforms to the DfEE / NC guidelines. The majority of the subjects (n= 28) said that the key elements of the ICT policy are aims. 18 teachers said that their policy cares for the equal access of children to computers so as to avoid any kind of discrimination. Of equal frequencies (n=17) are found: the management of ICT access and resources, as well as the use of ICT across the curriculum. This means that schools are making plans to arrange the number of computers to the number of children, and how can this be done i.e. in classrooms, or in the ICT suit. What is relevant to this study is the evidence that the <u>selection / purchase of **software** was mentioned only once</u>. The question that rises here is if purchasing software is a high priority for the schools' administration. The truth of the matter is that the NC / DfEE guidelines make no suggestions for selecting software.

Table 7-5 Schools' ICT resources

School's ICT resources	Frequencies
Computers / desktop	91 (81,3%)
Colour printers	91 (81,3%)
Scanners *	45 (40,2%)
Internet access	83 (74,1%)
Variety of Literacy software	88 (78,6%)
Other	19

107 subjects (95,5%) answered the question regarding the ICT school's provision. The table indicates that pupils have routine access to computers and colour printers (91 =81,3%); to literacy software (88= 78,6%), and to the Internet (83=74,1%). Less than half of the sample (45=40,2%) has access to scanners.

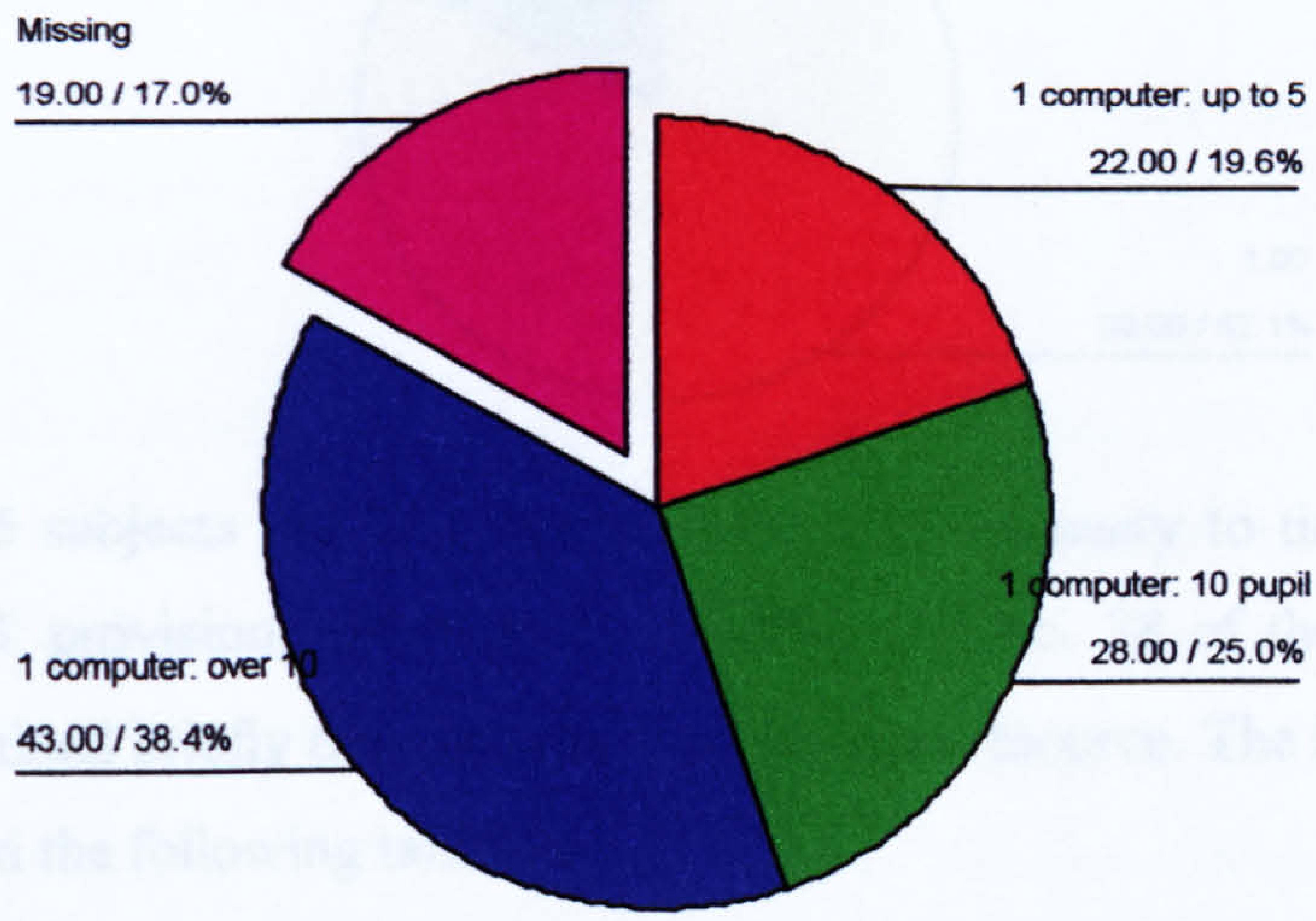
Figure 7-7 Teachers have a computer in their classroom



* Scanners when linked to computers with speech-synthesisers can be used in early education since they have been found to help less skilled readers to read and spell (Scrase, 1997). Besides quite easily young users can scan pictures which they can accompany with some words or small sentences.

100 teachers (89,3%) answered the question. The majority of them (n=95, 84,8%) have a computer in their classroom, where as only 5 (4,5%) said that they do not have.

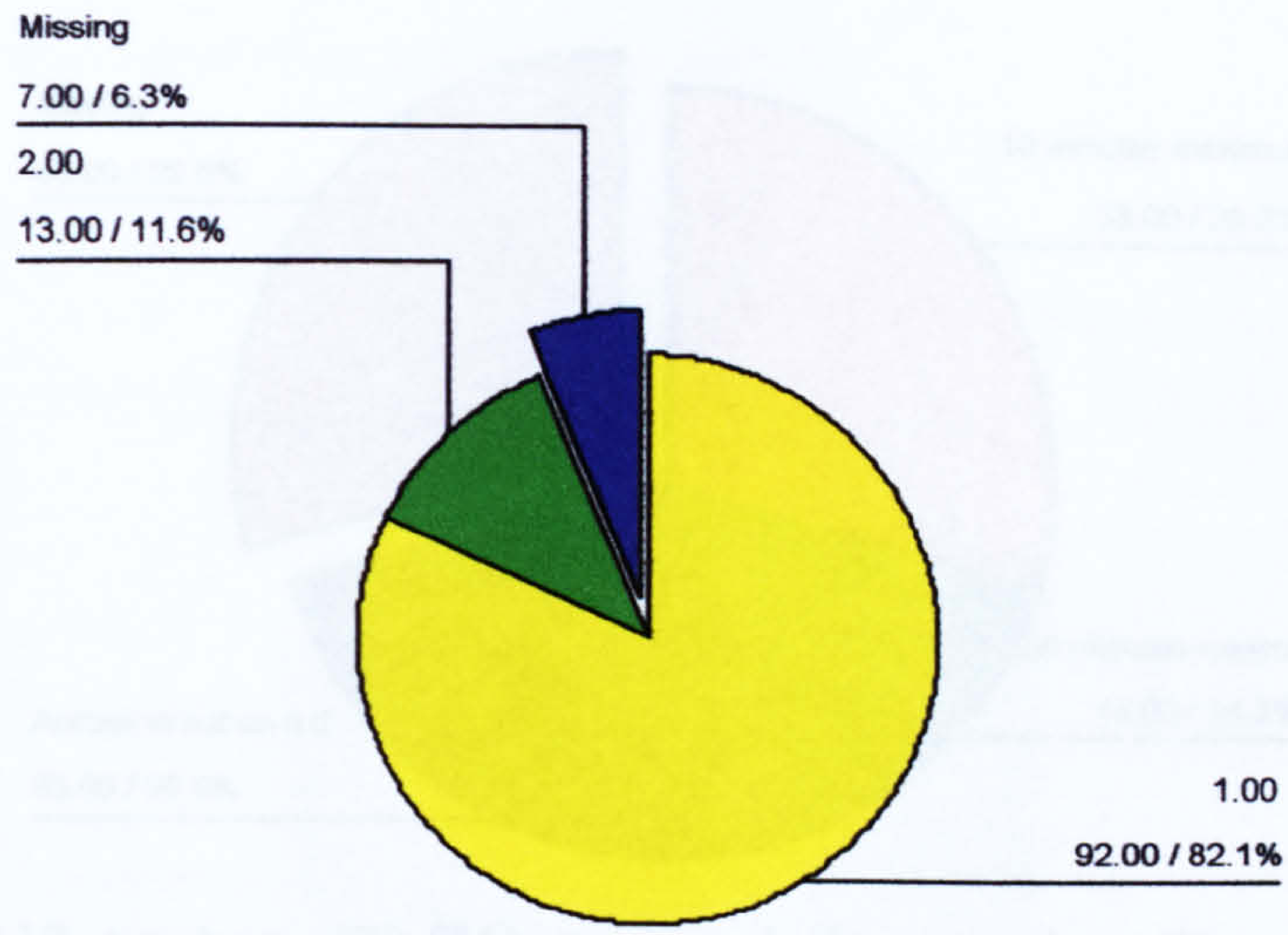
Figure 7-8 The computer to pupil ratio (micro-density figure)



93 teachers (83%) answer the question. The majority of teachers (n=43, 38,4%) reported that their school has a high computer to pupils ratio (1 computer over 10 pupils), 28 of them (30,1%) said that the ratio is 1 up to 10 pupils, and 22 teachers (23,7%) said that the figure is small: 1 machine with up to 5 pupils. A respectful number (n=19, 17%) did not answer the question. The conclusion is that the majority of teachers have a high ratio figure (1machine: over 10 pupils).

The same question also sought the actual micro-density figure (see Appendix 3A). Rounded up the mean (M) of the computer to pupils' ratio is **1:13**.

Figure 7-9 Timetabled access to ICT provision



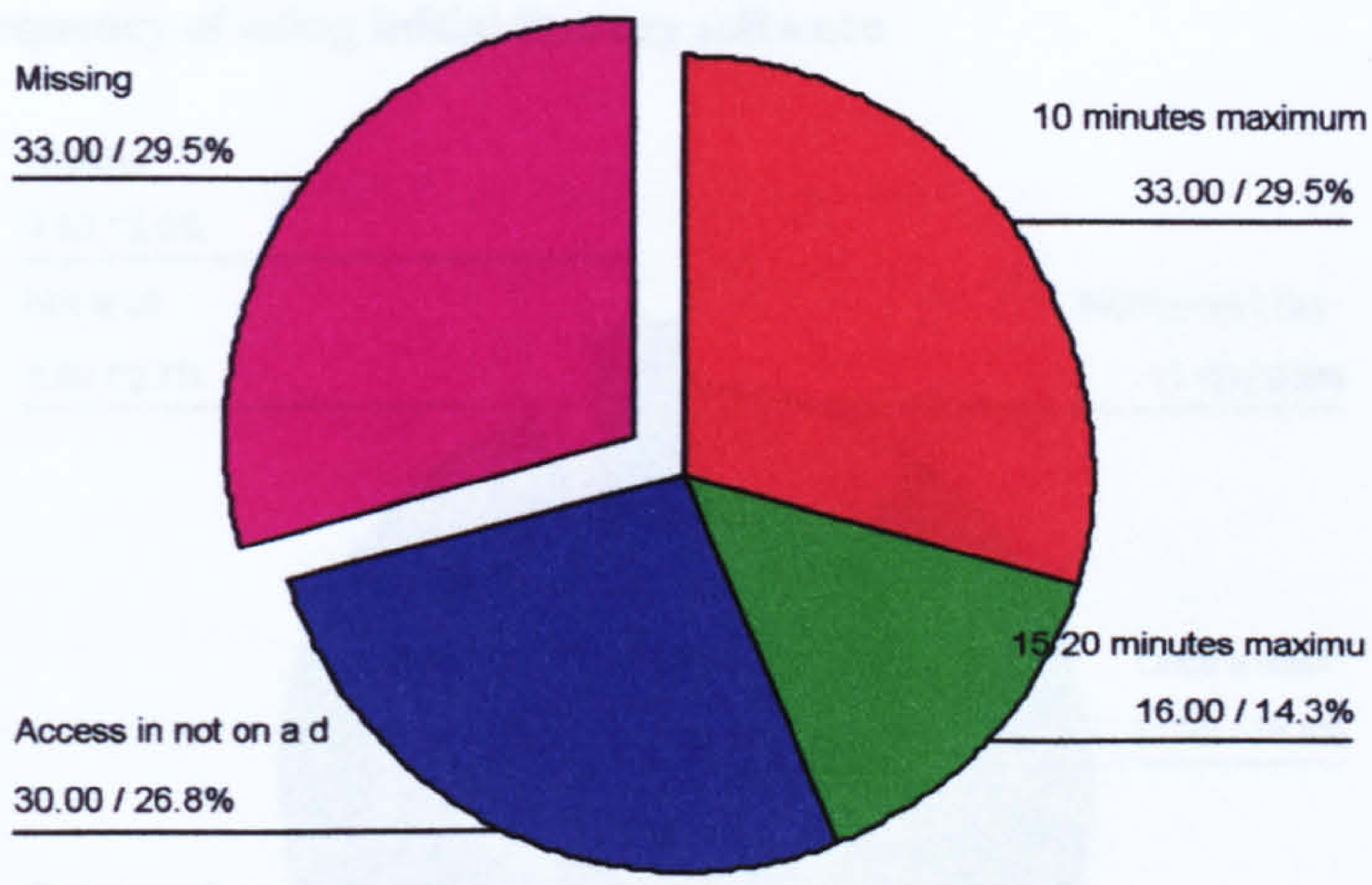
92 out of 105 subjects (82,1%) reported that it is necessary to timetable pupil access of ICT provision, where as 13 (11,6%) said no. 78 of the 92 teachers (84,8%) explained briefly the nature of the timetable resource. The information is summarised in the following table:

Table 7-6 The nature of the timetabled resource

	Counts
ICT suite	53
Classroom provision (almost daily access)	9
Equal access / SEN	7
Portables / laptops	5
Slots / smartboard	2

The majority of the sample, this is 53 out of 78 (57,6%), said that they have an ICT suite that must be timetabled. Only 7 of this cohort (7,6%) said that their pupils have access to ICT provision based in their classroom. Very few schools have portable ICT provision, and interestingly only 2 teachers said that their pupils have daily access to computer programs. This last piece of evidence is supported by the analysis of the next question that shows that a few teachers use computers daily.

Figure 7-10 Time pupils work on computers daily (in approximation)



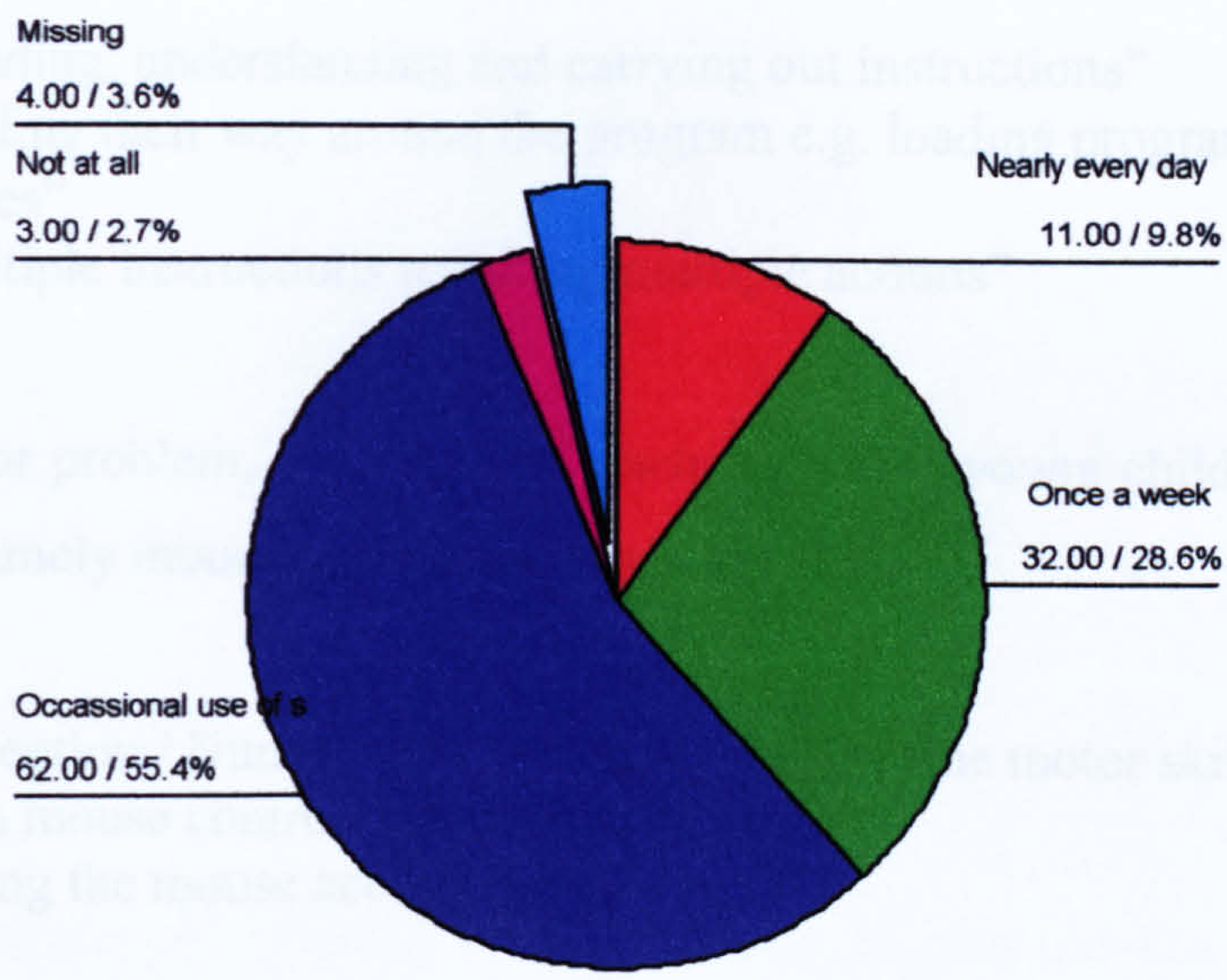
79 out of 112 teachers (70,5%) answered the question. The percentage of "missing" information is rather high (n=33, 29,5%). Only one case was found to indicate that pupils work for 20 minutes. I combined it with the "15 minutes" category, and I renamed it "15-20 minutes maximum". The pie chart shows that the sample is roughly divided in three groups. The first one is the "missing group". The second is the group of teachers who (n=33, 29,5%) report that their pupils use computers for 10 minutes maximum daily, and the 16 subjects (14,3%) who have daily access for 15-20 minutes. The third group is 30 teachers (26,8%) who indicate that they do not use ICT on a daily basis. On the contrary, they give quite discouraging information, this is the time is much less than 10 - 20 minutes. 10 – 20 minutes is the maximum time pupils engage <u>per week or fortnight</u>.

Quotes: "The time varies from pupil to pupil, from teacher to teacher, and from week to week "It depends, computer activities are not everyday activities"
"Computer is a choosing activity in the classroom"
"10 minutes in fortnight"
"10 minutes per week"

The conclusion is that 49 teachers out of the 112 (43,7%, the second group combined) said that their pupils have a 10-15 minute access to computers irrespective of what program the machines run. The picture is rather incomplete because of the high percentage (29,5%) of missing information.

Section B.

Figure 7-11 Frequency of using initial literacy software



108 subjects (96,4%) answered this question. The information according to the pie chart is that a significant number of teachers (n=62, 55,4%) occasionally use such programs. Only 11 subjects (9,8%) use such software every day, where as 32 teachers (28,6%) use it once a week.

As for the difficulties young children encounter when using initial literacy software, an equal number of subjects (n=71, 63,3%) gave their opinion on this open-ended question. The information obtained and its counts are presented in the following table:

Table 7-7 Difficulties young children encounter when using literacy software

	Counts
Understanding / reading / following / remembering instructions / navigation	27
Poor ICT skills (mouse /keyboard)	18
Reading text / Spelling	15
Need teacher's support	11

Difficulties with following instructions / navigation seems to be the prime difficulty young children face when working on literacy computer games, according to teachers' views. They claim that youngsters have difficulties with reading / understanding instructions, and with following / remembering instructions, especially when they are complex.

Quotes: "Reading, understanding and carrying out instructions"
"Finding their way around the program e.g. loading program, changing games"
"Multiple instructions requiring multiple actions"

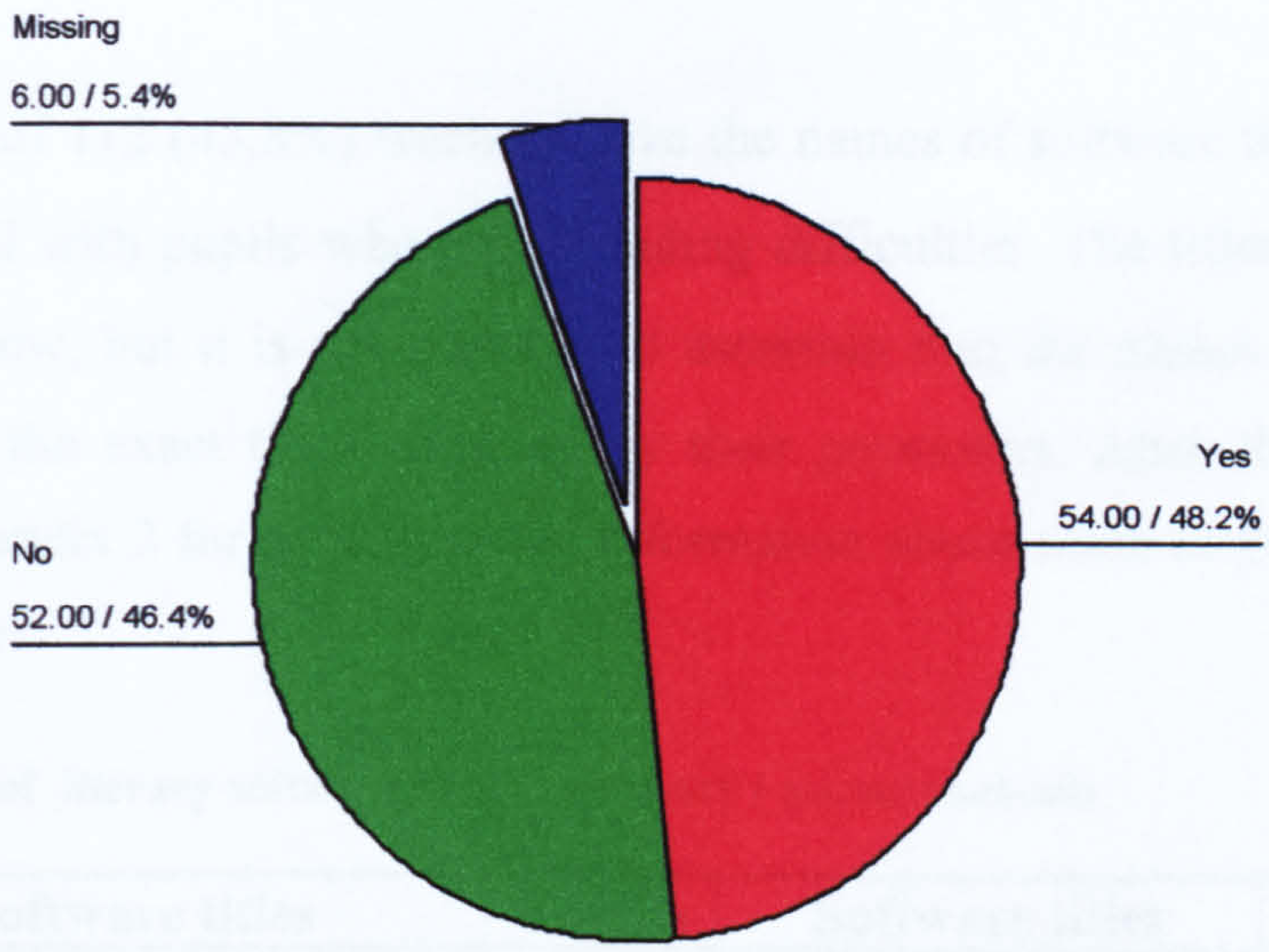
Another major problem, according to teachers, is that young children have poor ICT skills, namely mouse control and keyboard skills.

Quotes: "Reception / Nursery Year struggle with the fine motor skills involved with mouse control, i.e. click and drag"
"Using the mouse accurately"

Lastly, young children do not have adequate basic literacy skills, such as reading and spelling. Consequently, they encounter some difficulties performing literacy tasks. These cannot be attributed to the computer program *per se*; rather to academic difficulties similar to the ones faced in traditional teaching method, or print texts.

Quotes: "Lack of language skills"
"Some have trouble with letter recognition"
"Problems reading text"
"Longer words / phrases" and "spelling"

Figure 7-12 Teachers use special software for pupils with RD



106 out of 112 teachers (94,6%) answered the above question. We notice that the sample is almost divided. Half of it (n=54, 48,2%) claimed that they use special software for their special needs, where as the other half (n=52, 46,4%) said that they do not.

Table 7-8 Teaching experience & Teachers use special software for pupils with RD Contingency table

		Teaching experience			
		Up to 10 years	11-20 years	More than 20 years	Total
Yes	Count	7	15	21	43
	% within Teaching experience	28.0%	68.2%	60.0%	52.4%
No	Count	18	7	14	39
	% within Teaching experience	72.0%	31.8%	40.0%	47.6%
Total	Count	25	22	35	82
	% within Teaching experience	100.0%	100.0%	100.0%	100.0%

Chi-square: 8.975 (df 2), sig: .011, $p < .05$

The contingency table above shows that 15 out of 22 (68,2%) of the teachers who belong to the 11-20 years of teaching experience, and 21 out of 35 (60%) of the teachers with more than 20 years in the profession tend to use specially designed software for pupils with reading problems, where as the majority of young in teaching experience respondents (n=18 out of 25, 72%) do not choose special software with their less able readers.

Only 49 out of 112 (43,8%) teachers gave the names of software that have been found helpful with pupils who show reading difficulties. The titles are listed in the table below, but it is not possible to ascertain that the names given by the teachers are the exact titles assigned by their promoters. Also, the reader can refer to Appendix 2 for some detailed information about some software found in the list below:

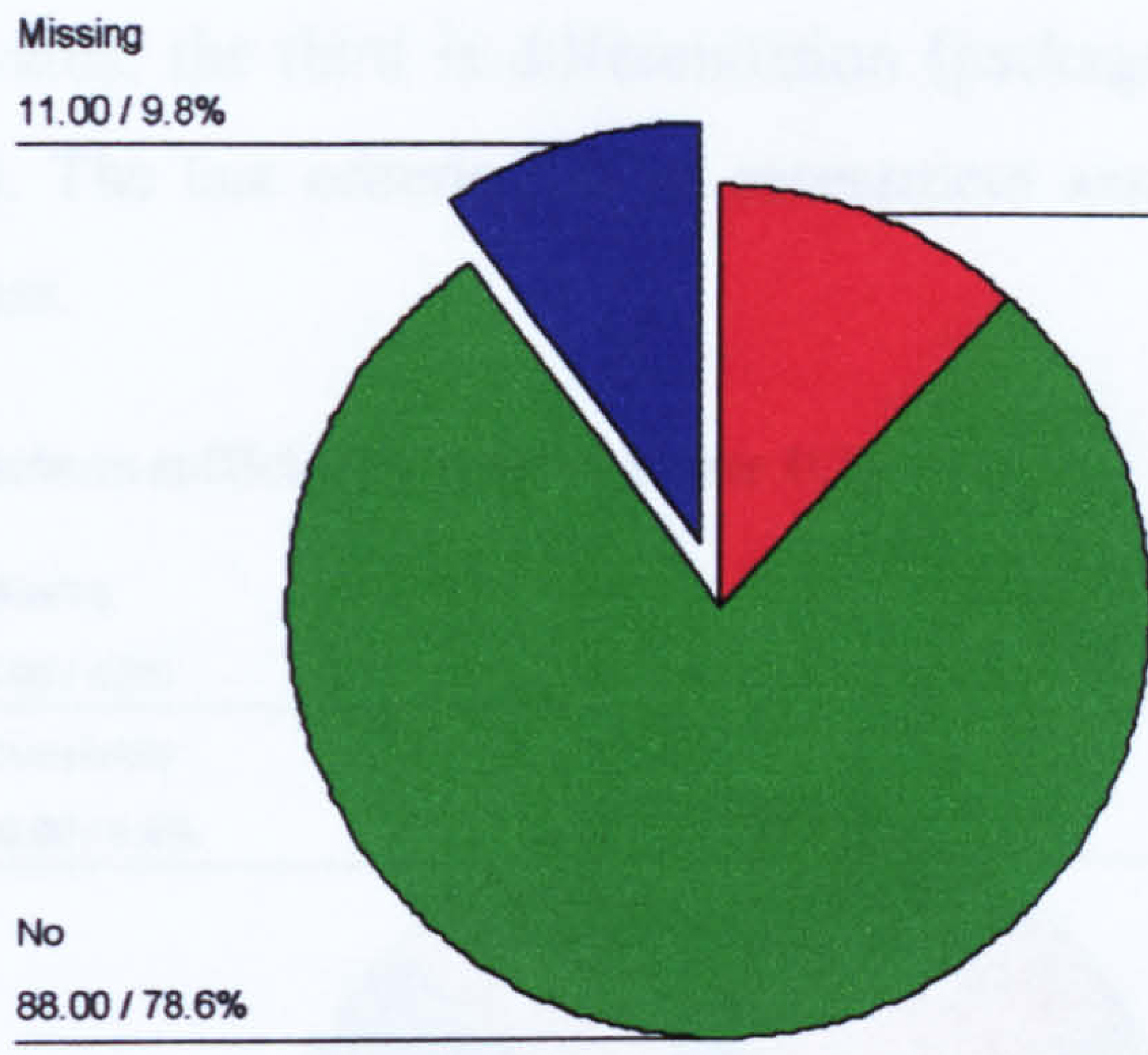
Table 7-9 List of literacy software used in primary / nursery schools

Software titles	Counts	Software titles	Counts
Oxford Reading Tree	16	Amazing Dictionary	1
Starspell	13	Granada learning	1
Clicker 4	9	Primary writer	1
Wordshark	7	Accelewrite	1
Animated Alphabet	5	Alphabet workshop	1
ORT Talking Stories	5	MS Publisher	1
Word aloud	4	My world English	1
Sherston Rhyme and analogy	3	Crick spelling	1
Wellington Square	3	Look Hear Talking topics	1
Acceleread	3	Dragon naturally speaking	1
Multimedia Flashcards	2	Inspiration	1
Catch up	2	Little books	1
All my words	2	Visual tracking programs	1
Nessy	2	Brilliant computers	1
Success maker	2		
Big ABC	1		
Tizzy	1	Writers' toolkit	1
Type to learn	1	Tomorrow's promise	1
Talking first word	1	Widgit	1

Section C.

a) The selection process

Figure 7-13 Teachers have a written guidance to select software



101 out of 112 (90,1%) teachers answered the above question. The pie chart shows that an overwhelming majority of the sample (n=88, 78,6%) do not have any guidance for selecting software, where as only 13 teachers (11,6%) indicated that they use a written guidance to select software.

11 out of the 13 teachers who have a written guidance reported the criteria in the table that follows. These criteria will be named *existing criteria*:

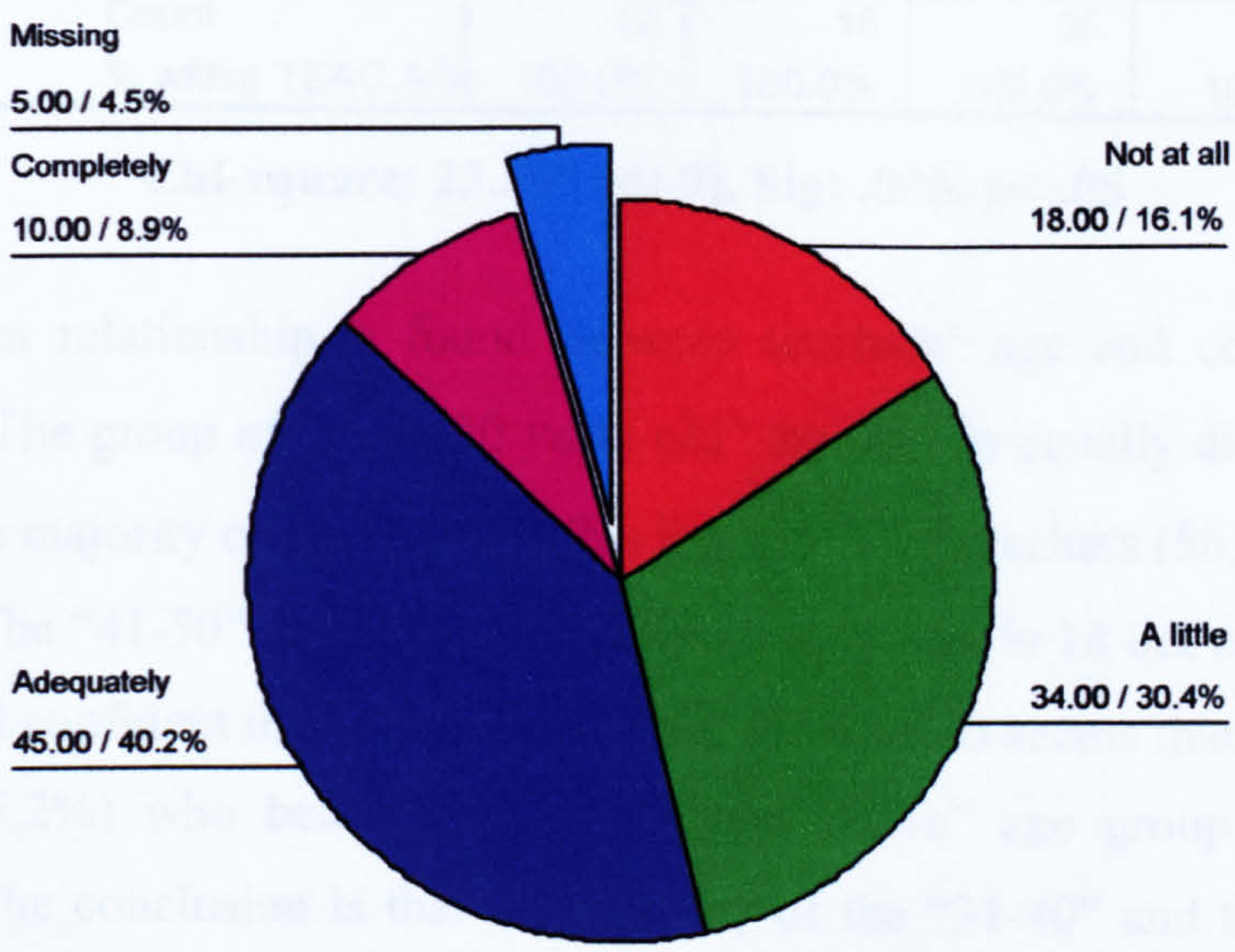
Table 7-10 Criteria for selecting initial literacy software *(existing criteria)*

	Counts
Specific content appropriateness. Links to NLS / NC	16
Interactivity (feedback)	6
Differentiated	5
Assessment	2
Easy	1

Quotes: "Elements to develop phonological awareness and use of frequently used words including C-V-C and C-C-V-C"
"Phonics + progression in phonics"
"….uses features of the literacy hour / NC…using first 100/200 words"
"immediate feedback, reward, talking books"
"To provide for children with different ability level"
"…..assessment system….to be easy"

The primary criterion seems to be the subject content of the package, this is phonics and progression through phonics, the list of the most frequently used words. In short, the main criterion is the content of software to be related to the literacy hour and NC requirements. The second criterion is interactivity, this is feedback, rewards; the third is differentiation (package that caters for different ability levels). The last criterion is an assessment system for keeping track of pupils' progress.

Figure 7-14 Teachers sufficiently trained to use ICT



107 teachers of the total sample (97,5%) answered this question. The pie chart above indicates that opinions are roughly divided since 55 (45 + 10) of the above cohort (49,1%) feel rather adequately or completely trained, where as the rest 52 (34 + 18) that amounts to 48,6% feel that they have not had enough training.

Table 7-11 Age & Teachers sufficiently trained to use ICT. Contingency table

		Teachers' age groups				
		Up to 30 years old	31 - 40	41 - 50	51 years and above	Total
Not at all	Count	3	5	9		17
	% within TEAC.AG	25.0%	31.3%	25.7%		19.8%
A little	Count	3	4	8	15	30
	% within TEAC.AG	25.0%	25.0%	22.9%	65.2%	34.9%
Adequately	Count	4	4	17	8	33
	% within TEAC.AG	33.3%	25.0%	48.6%	34.8%	38.4%
Completely	Count	2	3	1		6
	% within TEAC.AG	16.7%	18.8%	2.9%		7.0%
Total	Count	12	16	35	23	86
	% within TEAC.AG	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-square: 23.809 (df 9). Sig: .005, p< .05

A significant relationship is found between teachers' age and competence in using ICT. The group of "up to 30 years old" teachers is equally divided (50%), where as the majority of the "31-40", this is 9 out of 16 teachers (56,3%) feel less confident. The "41-50" group is marginally divided, this is 18 out of 35 teachers (51,5%) feel confident in using and selecting software. It seems that 15 out of 23 teachers (65,2%) who belong to the "51 and above" age group feel a little confident. The conclusion is that the majority of the "31-40" and the "51 years and above" teachers feel less confident in using ICT.

Table 7-12 Teaching experience & Teachers sufficiently trained to use ICT Contingency table

		Sufficiently trained to use ICT				
		Not at all	A little	Adequately	Completely	Total
Up to 10 years	Count	7	3	12	4	26
	% within Sufficiently trained to select and use software	41.2%	11.1%	36.4%	66.7%	31.3%
11-20 years	Count	5	5	11	1	22
	% within Sufficiently trained to select and use software	29.4%	18.5%	33.3%	16.7%	26.5%
More than 20 years	Count	5	19	10	1	35
	% within Sufficiently trained to select and use software	29.4%	70.4%	30.3%	16.7%	42.2%
Total	Count	17	27	33	6	83
	% within Sufficiently trained to select and use software	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-square: 15.988 (df 6) Sig: .014, p<.05

Similarly, a significant relation was found between teachers' teaching experience and confidence in using ICT. The adequately and completely trained are the younger in the profession teachers with up to 10 years of teaching experience (12+4 = 18, 46,2% + 15,4% = 61,6%). The majority of the "11-20 years" of teaching experience (11+1 = 12, 54,5%) feels confident. But the great majority of educators with more than 20 years in the profession feel a little, or less confident (5+19 = 24, 68,6%). The conclusion is that the older in the profession teachers the less confident feel in using ICT than their younger in the profession colleagues.

67 teachers (59,8%) gave their opinion about what additional skills they feel they need that would help them select software. The question was open-ended and the information falls into the following categories:

Table 7-13 Skills teachers need to select software

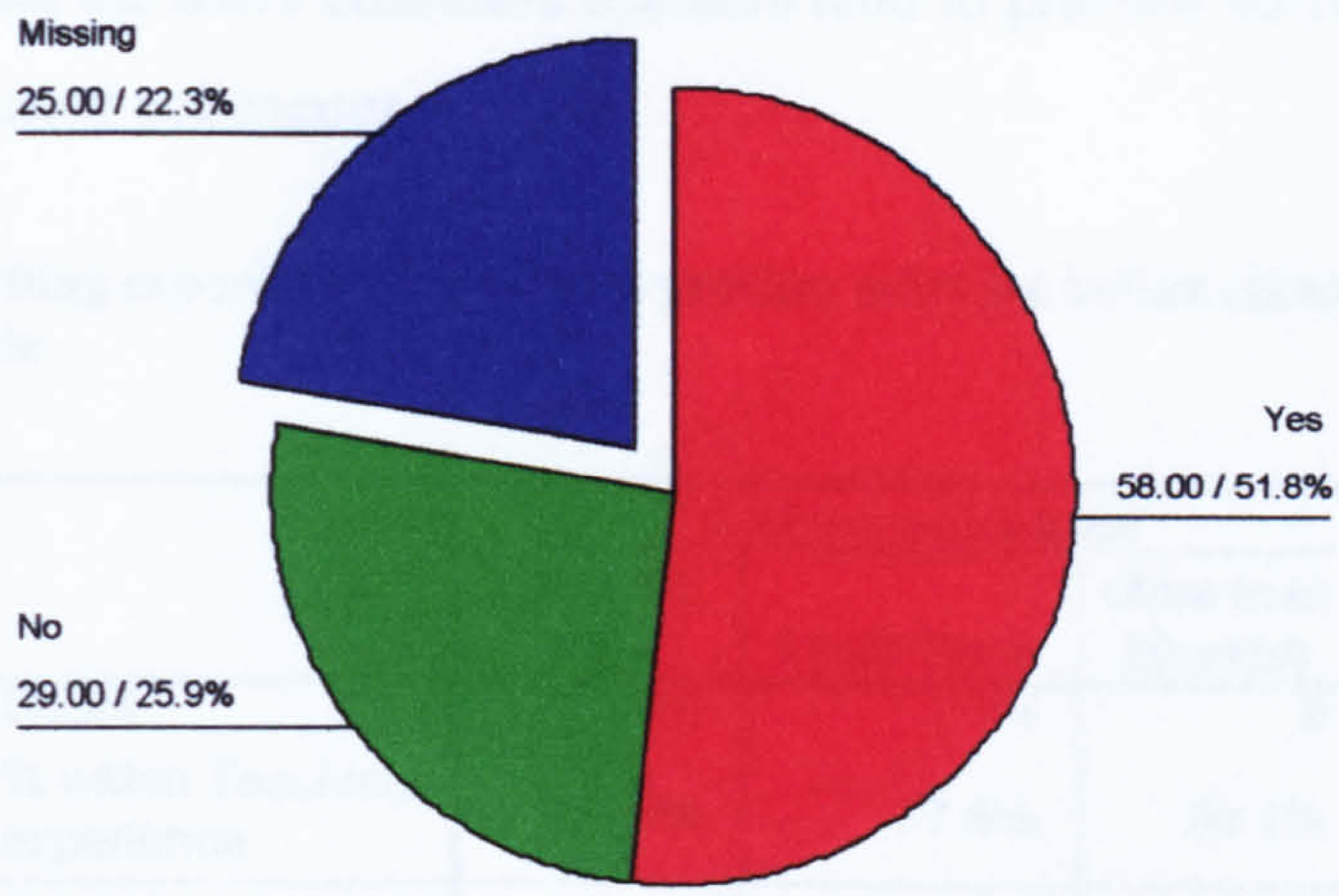
	Counts
Time/ opportunities/ criteria/ sources to look for and preview computer packages (i.e. experience from colleagues and access to quality reviews).	53
I do not know	14

A significant number of teachers were found in dilemma, not being able to provide an answer (n=14, 20,9%). The rest of this cohort (n= 53, 79%) stressed that they need time and places to preview packages or even consult colleagues who have been using particular packages before they purchase or use it in their classrooms. They admitted that they do not have appropriate criteria to select software and use it in their curriculum. They also do not know what is available in the market and what has good reviews:

Quotes: "Time for reviewing ...a sort of trial system before buying it"
"Need opportunities to try out different software so that choices can be made. Choosing from a catalogue is no use"
"Being able to evaluate it for educational value"
"How it matches the N.C. requirements"
"Greater awareness of the range of software available"
"Access to high quality review materials"

b) **The preview process**

Figure 7-15 Teachers preview software before classroom use



87 out of 112 (77,7%) teachers answered the question. Roughly half of the sample (n=58, 51,8%) review the computer package before using it in the classroom, where as 29 (25,9%) do not. It is important to note that the number of "missing" information is rather high (n=25, 22,3%). The result indicates that just over half of teachers seem to preview software before classroom use.

Table 7-14 Teachers sufficiently trained to use ICT & Teachers who preview software before classroom use. Contingency table

		Sufficiently trained to use ICT				
		Not at all	A little	Adequately	Completely	Total
Yes	Count	7	14	27	10	58
	% within Sufficiently trained to select and use software	50.0%	53.8%		100.0%	66.7%
No	Count	7	12	10		29
	% within Sufficiently trained to select and use software	50.0%	46.2%	27.0%		33.3%
Total	Count	14	26	37	10	87
	% within Sufficiently trained to select and use software	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-square: 9.335 (df 3). Sig: .025, p< .05

The cross-tabulation table above shows that all teachers who feel "completely" trained (n=10, 100%), and the majority of those who feel "adequately" (n=27, 73%) preview software before they use it in their classroom. In contrast, half of the teachers (n=7, 50%) who do not feel at all sufficiently trained in ICT, and the majority of those who feel "a little" (n=14, 53,8%) do not preview software before classroom use. The proportion of teachers who preview the software and teaching experience in years is found significant since the level is less than .05. The result is that the more confident teachers tend to preview software more than their less confident colleagues.

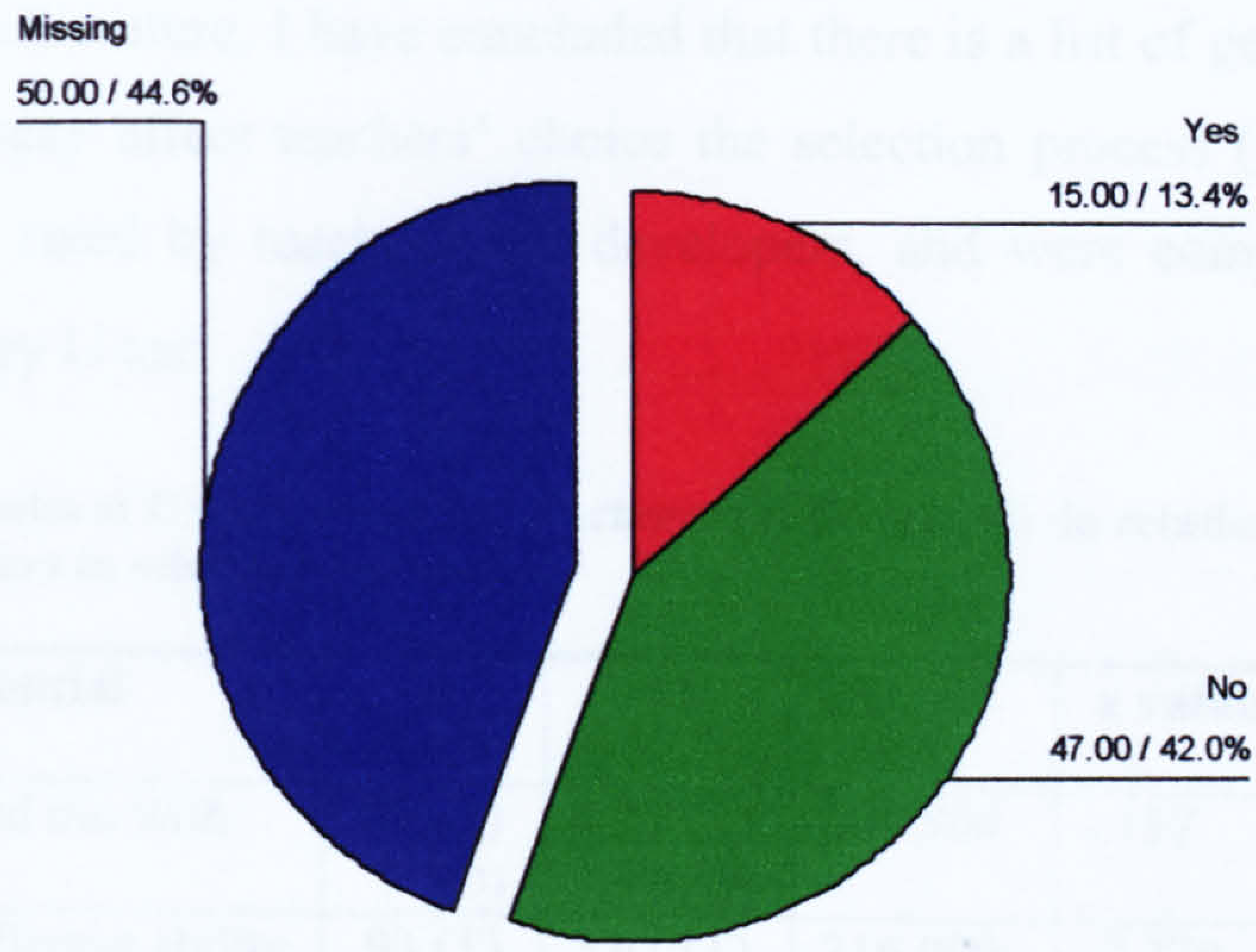
Table 7-15 Teaching experience & Teachers preview software before classroom use. Contingency table

		Teaching experience			
		Up to 10 years	11-20 years	More than 20 years	Total
Yes	Count	15	14	9	38
	% within Teaching experience	65.2%	77.8%	39.1%	59.4%
No	Count	8	4	14	26
	% within Teaching experience	34.8%	22.2%	60.9%	40.6%
Total	Count	23	18	23	64
	% within Teaching experience	100.0%	100.0%	100.0%	100.0%

Chi-square: 6.761 (df 2) Sig: .034, $p < .05$

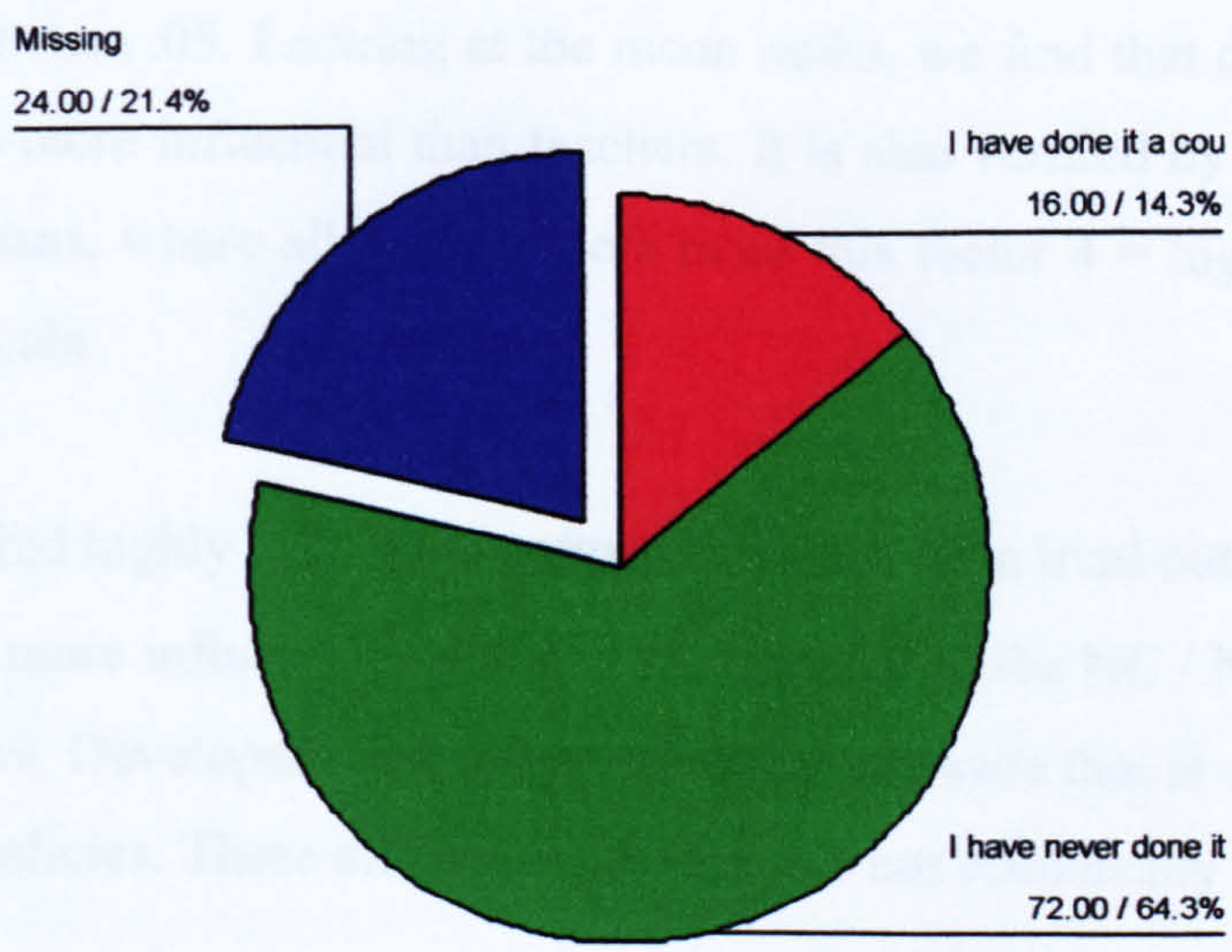
The contingency table above shows that the majority of teachers (n=14 out of 23, 60,9%) who do not preview software before classroom use are teachers who have more than 20 years in the profession. In contrast, 15 out of 23 (65,2%) teachers with up to 10 years of teaching experience, and 14 out of the 18 (77,8%) teachers with 11-20 years of experience preview software before they use it with pupils. The result is that the majority of teachers with more than 20 years in school teaching do not preview software compared to their young in the profession colleagues.

Figure 7-16 Teachers involve pupils in the preview process



62 out of 112 teachers (55,4%) responded to the question. Missing information is quite high (44,6%). The great majority of teachers (n=47, 42%) do not involve pupils, where as only 15 of them (13,4%) include pupils in the preview process.

Figure 7-17 Teachers give feedback to developers



88 teachers out of 112 (78,6%) answered this question. It is obvious that there is a gap of communication between software developers and teachers since the majority of the sample (n=72, 64,3%) indicated that they never communicate the outcomes to the producers after they have used the literacy computer program with their classroom children. Only 16 (14,3%) subjects have done it once or twice.

Based on the literature, I have concluded that there is a list of general influential factors that may affect teachers' choice the selection process (see 4.6.). These factors were rated by teachers and developers, and were compared using the Mann Whitney U test.

Table 7-16 Results of U test comparing teachers and developers in relation to general influential factors in selecting software

General influential factors	N	M	U test	z value	sig	Mean Rank
It has been tried out with children	89 (T) 7 (D)	3.37 (T) 3.42 (D)	301.500	-.157	.875	48.61 (T) 47.07 (D)
It caters for different ability levels	93 (T) 8 (D)	3.41 (T) 4.00 (D)	216.000	-2.270	**.023**	49.32 (T) 70.50 (D)
It covers NC / NLS objectives	91 (T) 8 (D)	3.34 (T) 3.00 (D)	330.000	-.479	.632	50.37 (T) 45.75 (D)
It is consistent with school's E.O. policy	90 (T) 5 (D)	3.02 (T) 3.60 (D)	136.500	-1.587	.112	47.02 (T) 65.70 (D)

(T) = teachers' group, (D) = developers' group

The results of the U test show that there is a significant difference between the two groups in relation to "software caters for different ability levels" because the p value is less than .05. Looking at the mean ranks, we find that developers find such software more influential than teachers. It is also verified by examining the column of means, where all 8 developers rated this factor 4 = highly influential on a 4-point scale.

Both groups find highly influential software that has been tried out with children. Teachers find more influential software that is linked to the NC / NLS objectives than developers. Developers find more influential software that is consistent with schools' EO policies. These differences though are not statistically significant.

Table 7-17 Teaching experience & Software has been tried out with children Contingency table

			Teaching experience			
			Up to 10 years	11-20 years	More than 20 years	Total
I t	Not at all influential	Count	1		1	2
		% within Teaching experience	4.5%		3.6%	3.0%
	Slightly influential	Count	6	1	1	8
		% within Teaching experience	27.3%	5.9%	3.6%	11.9%
	Fairly influential	Count	9	3	8	20
		% within Teaching experience	40.9%	17.6%	28.6%	29.9%
	Very influential	Count	6	13	18	37
		% within Teaching experience	27.3%	76.5%	64.3%	55.2%
Total		Count	22	17	28	67
		% within Teaching experience	100.0%	100.0%	100.0%	100.0%

Chi-square: 13.899 (df 6), Sig: .031, p< .05

The above table shows that 37 out of the 67 respondents (55,2%) find software that has been tried out with children very influential, but what is interesting is that 13 out of the 37 (35,1%) belong to the "11-20" years of experience, and 18 out of 37 teachers (48,6%) are educators with more than 20 years of experience. The result is that the more experienced teachers find computer packages that have been tested with children very influential before they select a package for classroom use.

62 teachers (55,3%) gave their opinions on important aspects that would appeal to them and they would expect software developers to consider. Missing values are high. The information is presented in the following table:

Table 7-18 Important aspects that would appeal to teachers and they would expect developers to consider

	Counts
To be easy and used independently	57
Motivating and interesting (sounds, colours, animation, fun)	44
To be linked to the NC / NLS objectives. Content and age appropriateness of material	40
Interactivity (positive feedback, rewards, corrections)	39
To cater for different ability levels	26

According to the above table shows, teachers believe that software should be:

Firstly, easy - mostly for pupils and less for teachers – to be able to find the way around the program and use it independently:

Quotes: "Easy of use by pupils"
"Easy navigation for pupils"
" ...to be easy so that pupils can use on their own"

Secondly, interesting, attractive, appealing and motivating in terms of its layout. Software should be bright and colourful, it should have sounds, animation, pictures, graphics and should be fun. Of almost equal importance, software should include teaching variables mainly feedback and rewards, which stresses the interactive nature of computer programs:

Quotes: "Good, colourful, clear and attractive characters and print"
"......good quality sound....."
"Good interesting animations to keep children's interest and motivation"

Thirdly, literacy software should be linked to the NC / NLS requirements, and should involve basic literacy skill games, such as phonics, letter recognition, rhymes, progression to syllables and sentences, material that is appropriate to their age group:

Quotes: "...phonics, rhymes incorporated to child's age and abilities"
"....to complement National Literacy strategies"
" ..linked to the NC objectives for the year and age group"

Fourthly, it should promote interactivity by providing positive feedback, corrections, opportunities for practice (instructional characteristics):

Quotes: "Interactive..."
"Give rewards...."
"Ample opportunities for practice..."

Lastly, literacy computer games should cater for different ability levels so as to provide individual programs tailored to their abilities –low, high, ESL. Additionally, computer packages in teaching reading should have a progressive approach to teaching literacy from simple to more advanced tasks:

Quotes: "Wide range of possibilities - accommodate pupils with SEN, able children (high abilities), or pupils whose English is second language"
"Sequential sound teaching e.g. alphabet, initial blends, digraphs and endings"
"Building up of sentences and progression into creative story writing"

7.3. Analysis of the developers' questionnaire

10 out of the 16 companies replied having thus a response rate of 62,5%.

a) <u>Information about the product</u>

Table 7-19 Experts participating in the development of software

	Counts
Software designer	10
Reading specialist	7
Classroom teacher	9
Special educator	3
Early Years specialist	-
Other	-

There is unanimity among the developers that the software product is the outcome of teamwork. Regarding the expertises that are present in that team, the following table shows frequencies. The most frequent pair is that of the software designer and the classroom teacher and / or the reading specialist. In four occasions the special educator is present mainly in companies that develop software for children with special needs.

Table 7-20 The purpose of the developers in producing software

	Counts
To support the development of literacy skills and to provide practice in support of a textbook	11
To support the development of ICT skills	6
To support learning through computer games	2
To support children with SEN	2
To help teachers plan and prepare	1

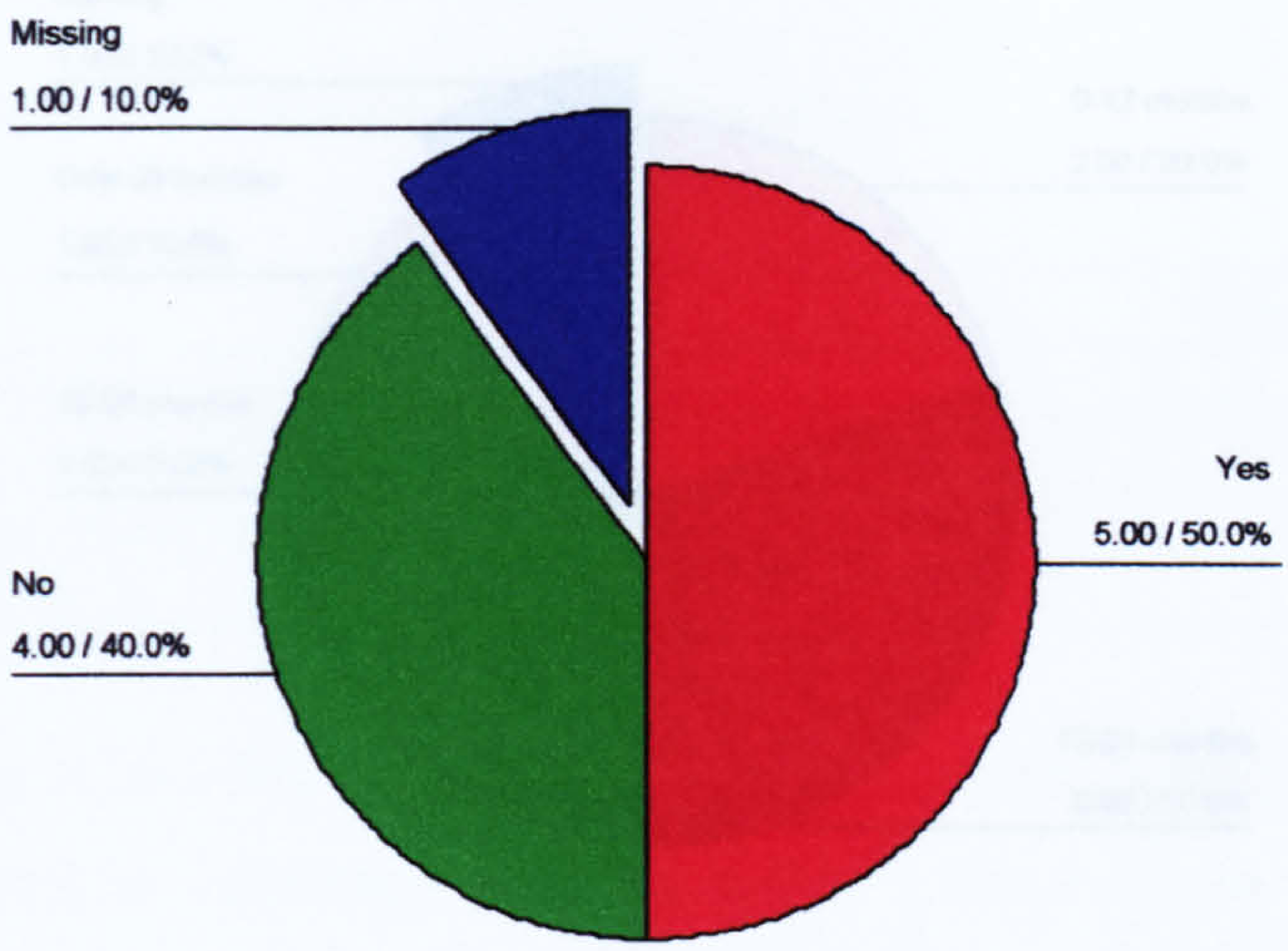
In general, the purpose of their product is to support the development of literacy skills, and half of the designers reported that they intend to support the development of pupils' ICT skills. It seems that the designers see their product as a potential educational tool that will assist classroom teachers and not as an amusing toy just to occupy pupils' free time:

No 9 company: "supporting the teaching and learning of spelling."

The two developers who commented that the purpose of their products is to assist pupils with SEN are representatives of companies that are advertised for developing computer programs for pupils with SEN:

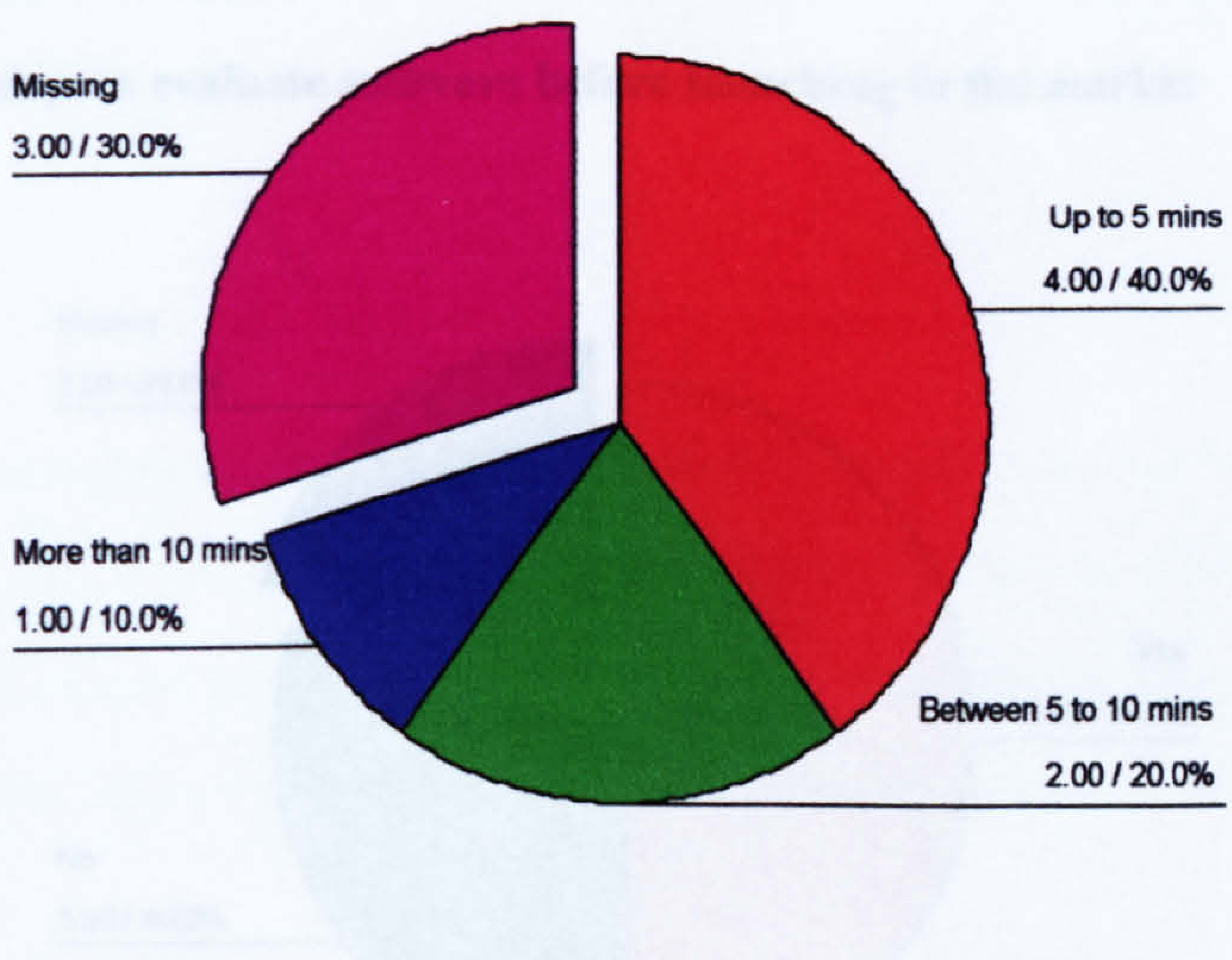
No 6 company: "to assist non-text users to communicate".

Figure 7-18 Software is always linked to the NC / NLS objectives



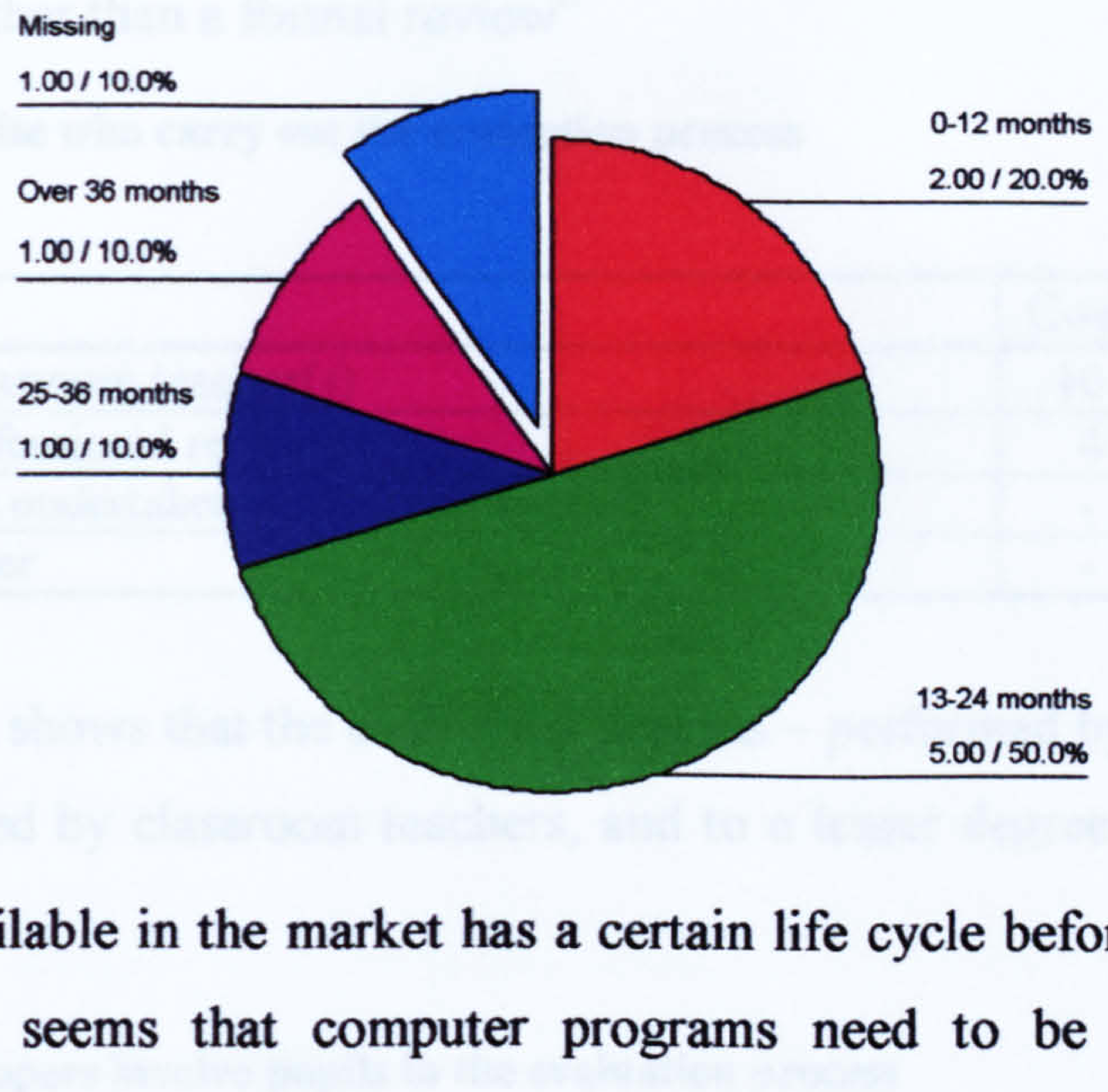
The question has divided developers. Five of them (n=5, 50%) always link the content of software to the NC / NLS objectives, where as 4 (40%) said that the content is not always linked.

Figure 7-19 Approximate time each literacy activity takes to be completed by pupils



It seems that the majority of companies (n=6, 54,6%) design literacy activities that take young children up to 5 minutes to complete. It is not easy to interpret why a significant part of the sample did not answer.

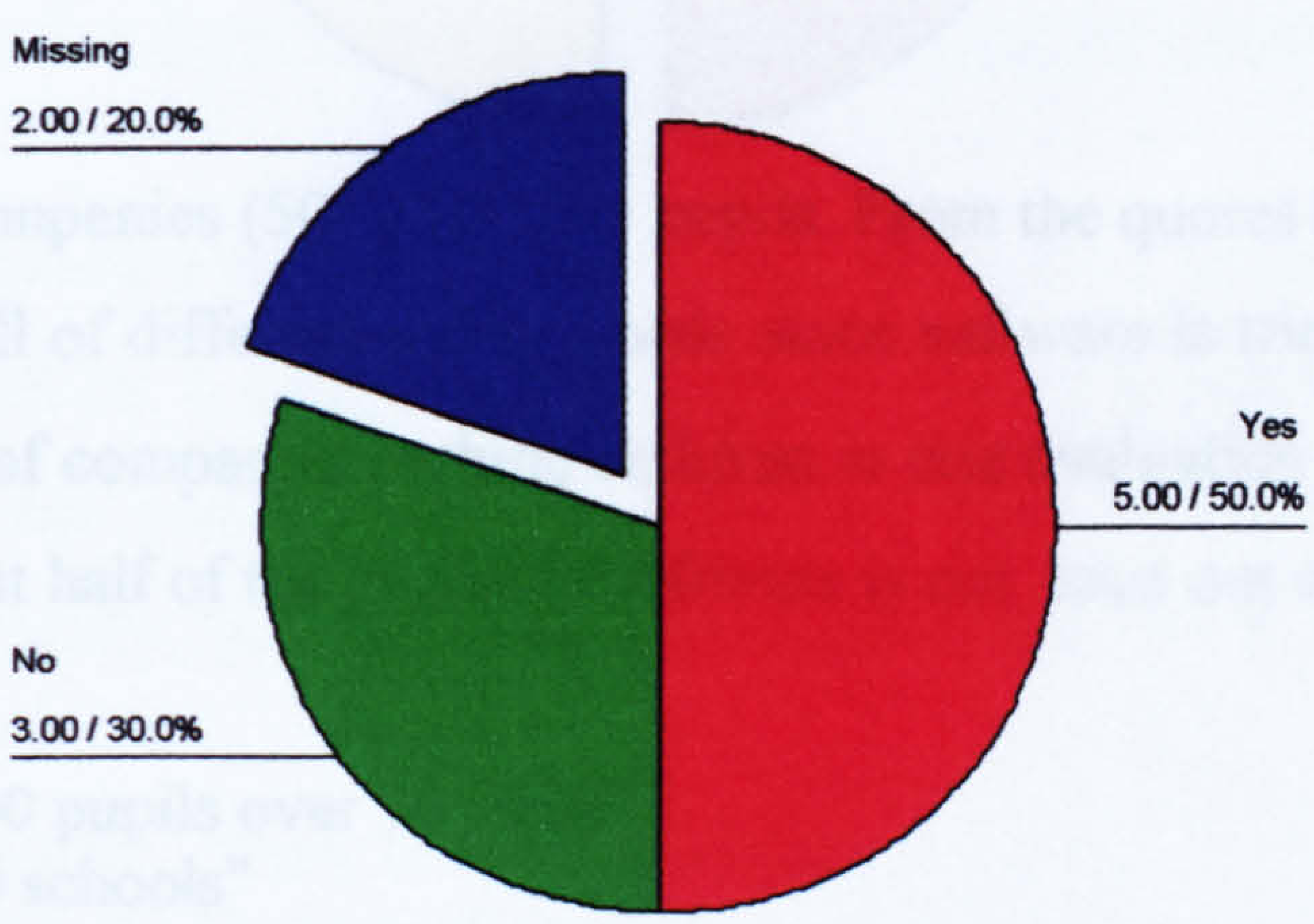
Figure 7-20 Time that software needs to be upgraded



Software available in the market has a certain life cycle before it needs to be upgraded. It seems that computer programs need to be upgraded quite frequent since the majority of companies (n=8, 80%) indicated that their product needs to be upgraded every one or two years.

b) <u>The evaluation process</u>

Figure 7-21 Developers evaluate software before launching in the market



5 companies out of 10 (50%) evaluate software before launching it in the market, where as 3 (30%) indicated that they do not evaluate their product. The question though puzzled 2 developers in terms of the definition. To them, evaluation is conducted during the developmental process:

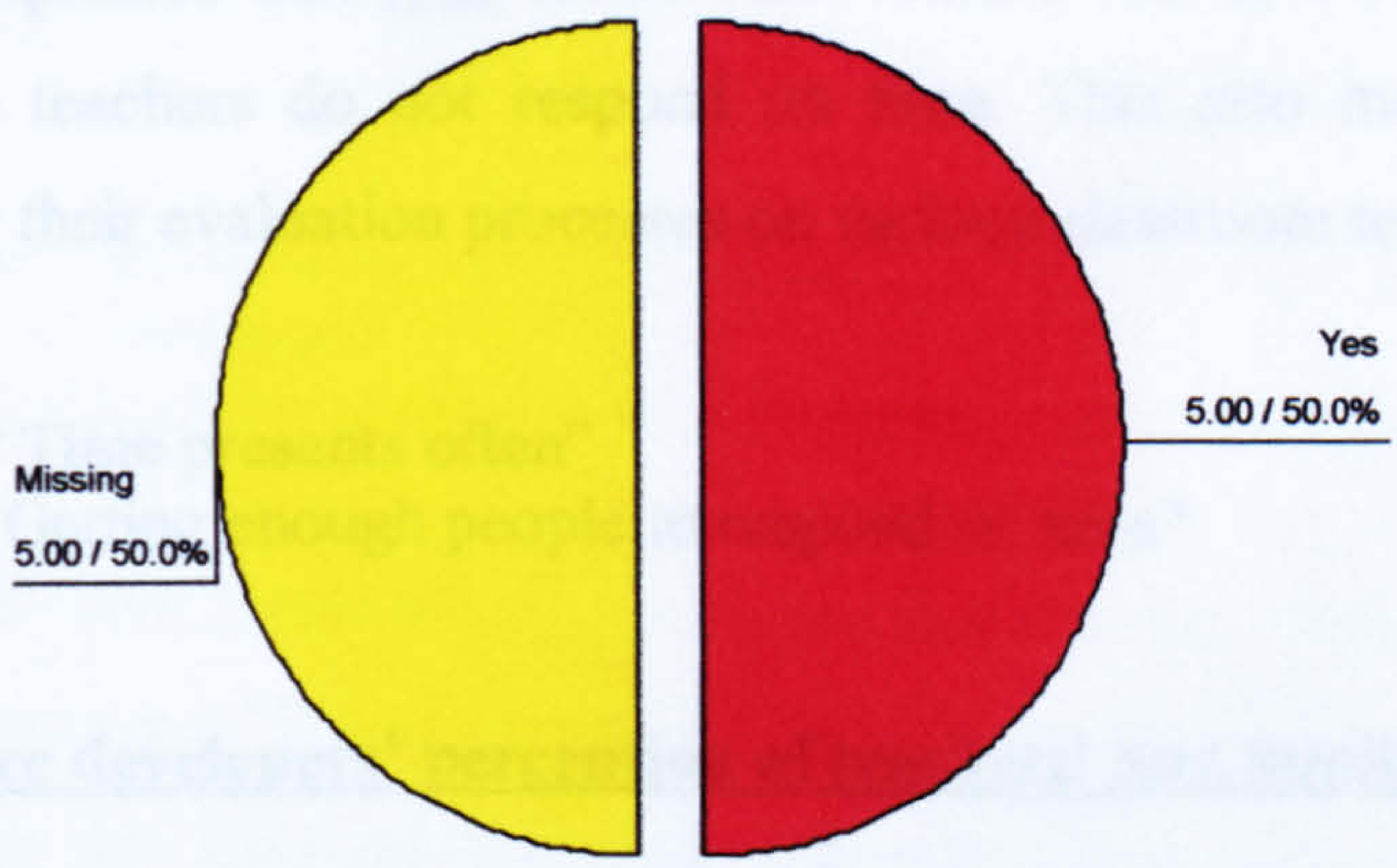
Company 9: “It really depends on what you call evaluation. We always have a feedback loop in the developmental process and seek responses rather than a formal review”

Table 7-21 Expertise who carry out the evaluation process

	Counts
Classroom teacher(s)	10
Professional reviewer	4
It is undertaken by University staff	-
Other	-

The above table shows that the evaluation process – performed by companies – is mostly conducted by classroom teachers, and to a lesser degree by professional reviewers.

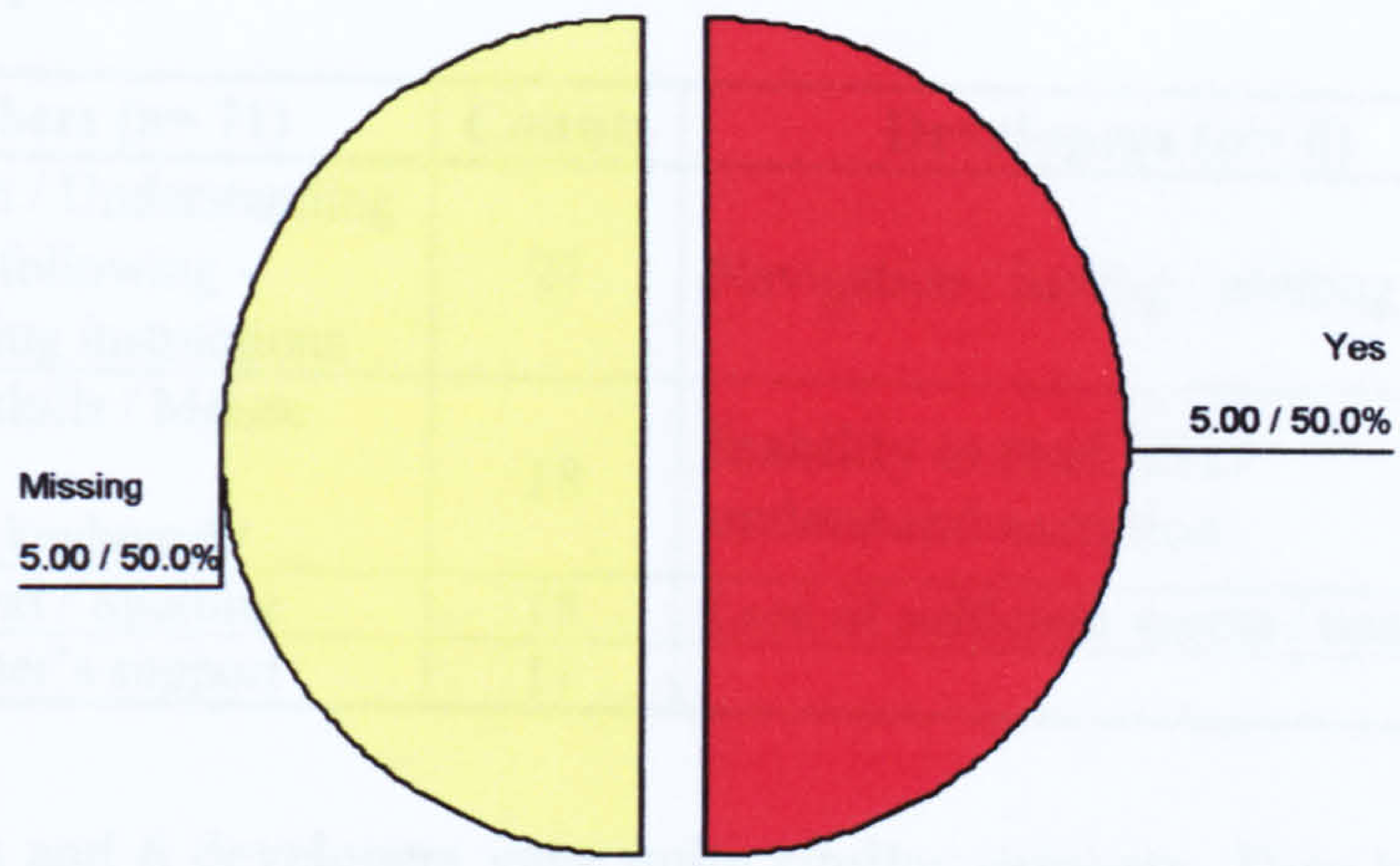
Figure 7-22 Developers involve pupils in the evaluation process



Only 5 of the companies (50%) involve pupils. From the quotes below, we gather that pupils are all of different ability levels since software is tried out in schools. Since only half of companies include children in this evaluation process, then we can conclude that half of the available software is not tried out with children.

Company 6: “100 pupils over 10 years”
Company 1: “20 schools”

Figure 7-23 Developers seek feedback from classroom teachers



Only half of the sample (n= 5, 50%) seek feedback from classroom teachers. The rest did not answer the question at all. In cases where feedback is not requested, 2 companies explained that time is the main reason, and as a second they said that classroom teachers do not respond on time. This also means that some companies rely their evaluation processes on various classroom teachers:

Company 10: " Time presents often"
Company 11: "Getting enough people to respond on time"

c) Software developers' perception of teachers' and pupils' ICT skills.

Regarding the assumption software developers make about teachers' confidence in using ICT products, 6 designers implicitly, or explicitly, assume that teachers' ICT skills are rather low, and because of that they make efforts their product to be as "teacher-friendly" as possible to encourage them to use it:

No 4 Company: "Very little for basic use"
No 10 Company: "Low confidence!"
No 11 Company: "We understand that these (ICT skills) are generally quite weak, so we provide unlimited support and training courses.

Table 7-22 Comparison of the teachers' and the developers' views on children's difficulties in using computers

Teachers (n= 71)	Counts	Developers (n= 6)	Counts
Navigation / Understanding - reading -following - remembering instructions	27	Navigation / Saving / printing	5
Poor ICT skills / Mouse control / Use of the keyboard /	18	Inability to read text / understand narration	1
Reading text / Spelling	15	Lack of sufficient access / time	1
Need teacher's support	11		-

71 teachers and 6 developers gave quite similar opinions. They both agree that children's major difficulties are: navigation and inability to read text. Finding their way around is closely related to their reading ability when instructions are presented in a written form. Teachers pointed out pupils' poor mouse skills and difficulty in using the keyboard.

No 3 Company: "Reading non-content based text … Hearing / understanding narration…"
No 9 Company: "Possible problems with navigation to different exercises"

Finally, 2 developers found the chance to say that children do not have frequent access to computer use. Though these answers are regarded as being irrelevant to this question in fact they are revealing that software designers are aware that young pupils do not have frequent access to computers at school. Such evidence emerged during the interviews with children in school A:

No 1 Company: "Lack of sufficient access."
No 3 Company: "Lack of time"

Next, I will proceed with the analysis of children's interviews and points that coincide with my field notes will be accentuated.

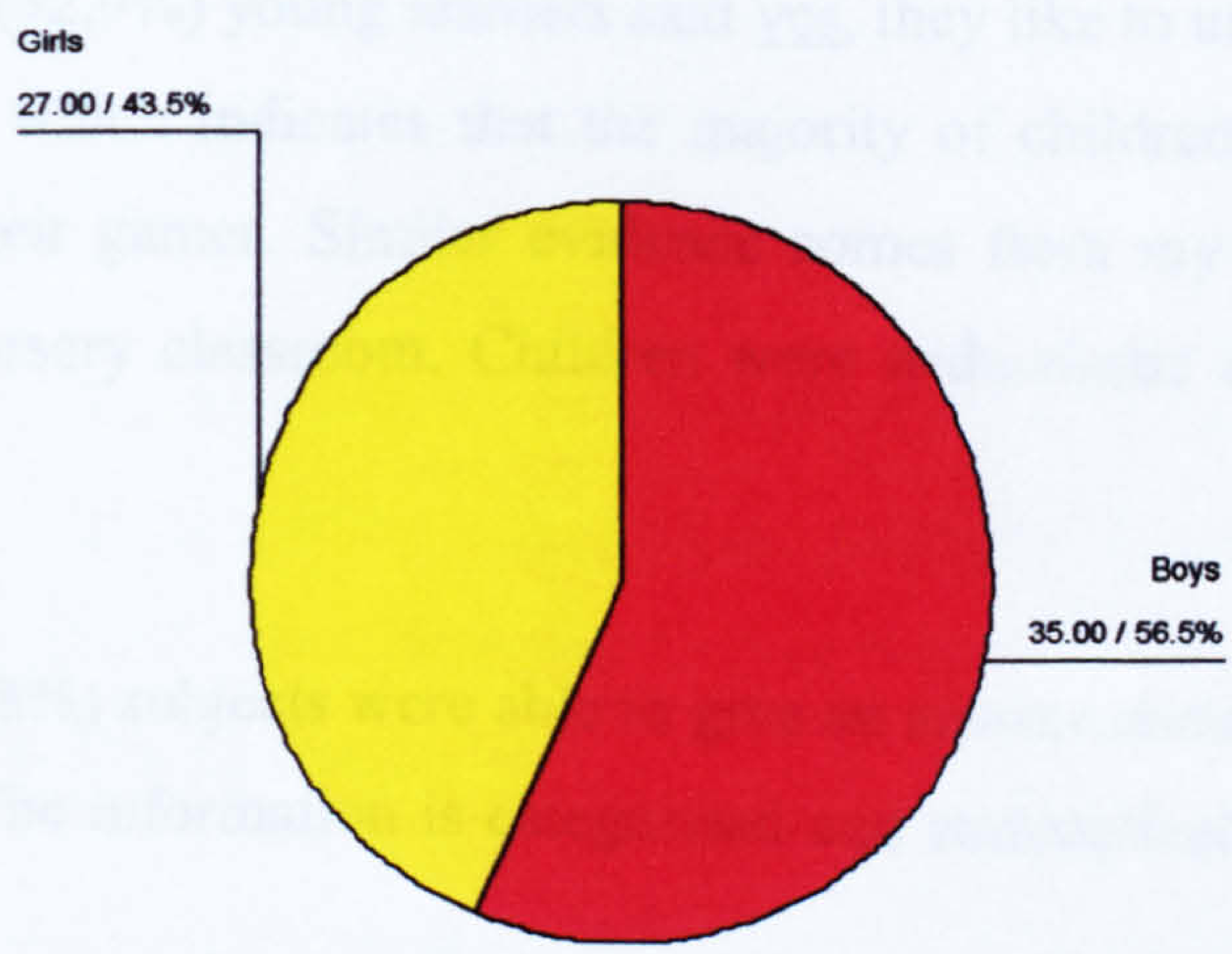
7.4. Analysis of pupils' interviews

Table 7-23 Pupils' gender split

Pupils	Males	Females	Total
School A Yr1	10	4	14
Yr2	25	12	37
School B Yr1	7	15	22
Yr2	10	15	25
Total	52	46	**98**

98 pupils participated in the interviews. The above table summarizes the number of pupils according to school and gender. So, I conducted the interviews involving 52 males and 46 females. From the group of males, 17 (10 + 7) boys were Yr1 and 35 (25+10) were Yr2. From the girls group, 19 (4 + 15) were Yr1 and 27 (12 + 15) were Yr2.

Figure 7-24 Yr 2 pupils' gender split



The above figure shows Yr 2 pupils' gender. The total number of Yr2 pupils is **62**. 35 (56,5%) were boys, and 27 (43,5%) were girls. The majority of the Yr2 group are boys.

Question 1: Do you have a computer at home? Do you use it?

Table 7-24 Pupils have a PC at home

	Counts
Yes	87 (88,8%)
No	11 (11,2%)
Total	**98**

87 out of 98 (88, 8%) pupils reported that they have a PC at home. This question revealed a series of cute narratives regarding family issues and computer use, i.e. what programs they play on the machines, who is supervising them, quarrels among siblings of who is going to use it, for how long, and a lot of other family matters.

Question 2: Do you like to use the computer in your classroom? Why?

Table 7-25 Children like to use the computer in the classroom

	Counts
Yes	91 (92,9%)
No	7 (7,1%)
Total	**98**

91 out of the 98 (92,9%) young learners said yes, they like to use the computer in their classroom, which indicates that the majority of children enjoys using the machines and their games. Similar evidence comes from my experience as an observer in a nursery classroom. Children were enthusiastic about working on computers.

79 out of 91 (89,8%) subjects were able to give an answer about why they like to use computers. The information is categorised and summarized in the following table:

Table 7-26 Reasons why children like to work on computers

	Counts
Games	43
Because it is fun	19
Basic literacy activities	19
Drawing activities	19
Because they find out things	10
Work together with friends	5
Irrelevant	8

The primary reason why children like computers is because they play games, all funny , good and nice, and interesting games:

Abdullah: "Because you learn things and you play games, and when you play games, all funny games, you laugh sometimes"
Ryan: "Because it has got good games on and you can play stuff on there and work"

The children I observed in the nursery school told me similar reasons, this is they enjoy working on "games", and they find them fun. "It is really fun to work…I like the games".

Secondly, children find working on the computer fun:

Harriet: "Because it is fun and I can get all kinds of things like good games to play and CDs…"

Thirdly, children like to work on the computer because they perform basic literacy activities; this is reading and spelling, writing, and maths activities. By literacy activities pupils mean learning to read words, reading text or stories, spelling words and writing stories:

Imash: "…sometimes there is a reading job to do, or something like that….sometimes I do reading on the computer then on the book"

Jennifer: "..because I get to play spelling games"
Kylie: "Because you can do nice style of writing"

Fourthly, they do drawing and painting. 12 out of 19 children who indicated art activities belong to the Yr1 group, and it seems that younger children either enjoy more, or use more often Clip Art in their classroom:

Connor: Because I like drawing and the colours"
Jamil: "Because we do symmetrical shapes and stuff and we paint them"

Fifthly, young learners enjoy working on computers because they find out (discover) about various things. They like to work on the computer because they discover about other countries, animals, work out math and spelling activities:

Henry: "Because it tells you a lot of information"
Interviewer: Information about what?
Henry: "About animals and stuff."

Lastly, but to a lesser degree, children like to use the computers because they have a chance to work with their friends:

Laura: "Because you are not alone and you have got all your friends there with you"

Question 3: Have you used games that help you with your reading / spelling? Do they help you? In what ways?

Table 7-27 Pupils have used literacy computer games

	Counts
Yes	65 (66,3%)
No	33 (33,7%)
Total	**98**

Out of 98 subjects 65 (66, 3%) have used reading / spelling games, where as 33 (33,7%) have not, or they were not sure. It is regarded as a significant portion since it reaches one third of the sample. Instead they mentioned that they have used other kinds of computer games.

Table 7-28 Computers help children with literacy skills

	Counts & %
Yes	46 (70,8%)
No	12 (18, 5%)
Don't know	7 (10,7%)
Total	**65**

Out of the 65 pupils who said yes to the previous question, 46 (70,8%) think that reading and spelling games help them with their reading / spelling skills. 12 (18, 5%) said no they do not believe so. Interestingly 9 out of the 12 were boys.

Out of the 46 pupils who answered positively to the above question, 38 (82,6%) were able to elaborate more and provided a variety of responses, as presented in the following table:

Table 7-29 Ways in which computers help pupils with basic literacy activities

	Counts
Reading and read out words	19
Practicing spelling	18
Listening to talking stories	13
Writing about something	7
Making sentences	1
Don't knows	8
Irrelevant	3

The majority of this group (n=32) claimed that reading games can help them with certain basic reading skills, like letter recognition, learning words, spelling, typing words or their names, making sentences or even read out words / sentences for them. Children like a lot talking stories, and CDs that have speech facility, and they think that CDS help them with their reading, as well. In addition, literacy games make them think – the spelling games in particular – and provide opportunities for more practice:

Jennifer: "There is a word and there is all those letters and you touch it and make the word and it tells you if it wrong or not and it helps to learn spelling"

Himash: "Yes, I think …it teaches letters and then we try to read the word….so it helps us to learn to read"

George: "Yes, because I get to know the alphabet and the alphabet helps me to read words"

Victoria: "Yes, because I am using this game....I go in, and make sentences"
Interviewer: How do you make sentences?
Victoria: "There these words and I have to fit them in the right place to make the sentences"

Abdullah: "There are these CDs that read out stories, and they read out words for us"
Interviewer: Do you like these talking stories?
Abdullah: "Yes, very much"
Interviewer? Why?
Abdullah: "There these nice stories...and pictures, and we learn lots of words"

Abbey: "Um....I think because we do extra work like ..spelling words. We do it again and again and that helps"
Interviewer: Do you mean that you practice spelling words on computer?
Abbey: "Yes, instead of using paper and pencil, we do it on the computer"

It is interesting to mention that some of the Yr1 pupils were simpler in expressing themselves, but still indicated that reading games help them with letter recognition and blending:

Interviewer: How do you think computer games help you with your reading?
Melissa Yr1: "Because a, b, c, ...and like A-m-y... Amy"
Interviewer: Do you mean that these games help you to learn the alphabet?
Melissa: "Yes!"

Michael: "I like it because it helps you with your reading"
Interviewer: How does it help you?
Michael: "When you click on this word, it reads it out to you if you can't read it"

Jennifer: "I like it because I get to play spelling games ...."
Interviewer: How does it help you with spelling?
Jennifer: "Well, there is this group of words and we try to spell.... and we think how to get them right."

Question 4: <u>How do you prefer to work on literacy games? Alone, in pairs, or in small groups</u>?

I discussed with 87 (88,8%) young pupils how they like to work on computers, alone, in pairs, or in small groups. No differences were found between age groups or gender. The table shows that the preference of children is to work in pairs, but there is a significant number of pupils who like to work on their own:

Table 7-30 Pupils' preferred working mode on computers

	Counts
In pairs	37
In small groups	29
Alone	18
All the above modes	3

37 out of the 87 pupils (42,5%) prefer to work in pairs, 29 pupils (33,3%) like to work in small groups where as 18 (20,7%) prefer to work alone.

34 pupils explained that they like to work in pairs firstly because working in small groups gets a bit crowed and annoying in a sense that a lot of shouting takes place, children shove to take turns, and a few times it was mentioned that they feel embarrassed of the group when they have made a mistake. They have also mentioned that quite often there is not enough time for all of them to use the computer:

Abby: "I don't like groups because they will be like talking and interrupting each other like: "click on that.. no.. no that... that," and I get a bit annoyed"
Harry: "Because it can be a bit noisy and they argue over who is on the computer and who is not"
Victoria: "Because sometimes we have to do a lot of things and it takes a long time and then I don't get any turn."
Jennifer: "I like it with a friend coz if you do something wrong they are sometimes laughing"

Similar evidence was found during the observation sessions where small groups of 4 pupils was becoming crowed and each child had to wait quite a while until his / her turn comes causing thus impatience and quarrels:

Pupil: "Come on Nancy, it is taking you ages...the teacher will call us back and I didn't had a chance to play..."

The second reason is that they just like being and working with a friend who can also be of some assistance when needed:

Ryan: "Because I like this friend and I like to work with him"
Heather: "Because if you need help you can ask your friend"

The interviews though do not suggest that girls show more interest in working with their friend than boys. In contrast, the girls I observed tended to work in pairs, or small groups, where as the boys worked on their own. Perhaps because the teacher assigned who is working, when and with whom.

70 subjects (71,4%) indicated yes, they have some troubles when using the computer, and 28 (28,6%) do not have any difficulty what so ever; actually, it is easy for them to use the computer. No differences were found among age groups.

Question 5: Do you have any difficulties when using literacy games? What are they?

Table 7-31 Difficulties young pupils experience working on literacy games

	Counts
Navigation	41
Performing academic tasks	17
Use of the Internet	8

It seems that the primary difficulty children face when working with computer is navigation, this is when they press the wrong button and then they find themselves in an awkward situation where they do not know what to do, how to proceed and feel "stuck." This information is supported by my field notes during the observation stage. The cause that makes children feel lost is memory, they do not remember what key, or button to press. As a result children have difficulties in finding programs, finding their way around the program, or changing to other games.

Lauren: "Like when I get stuck…it can't help you because they don't tell you anything"
Interviewer: What makes you get stuck?
Lauren: "I press the wrong button or something"

Rosie: "I forget"
Interviewer: You forget what?
Rosie: "What button to press"

Conan: "When I am playing a game, I ask for information about it and then I've
forgot how to get back to question that it is asking"

The children I observed faced similar problems. After logging in, they had difficulty to find the program they were supposed to work on, or to return to a previous activity. This is when they need assistance most.

A second major difficulty is that they can not perform the academic tasks that the computer programs asks them to do, such as in literacy and maths, evidence that is supported by my observation notes. In addition to navigation, children need help with the academic tasks.

17 out of the 70 children indicated that their difficulties are related with performing academic tasks, such as spelling, reading words, and maths, in a similar way to performing academic tasks in textbooks evidence found during the observation period, as well:

Daniel: "Reading some hard words"
George: "Making sentences"
Rhiannon: "Spelling words in some games are quite hard."
Mandeep: "Not really with the computer, but mostly with maths."
Tom: "Subtraction stuff"

Lastly, it is found that one of the difficulties young pupils (8) experience is related to the use of Internet:

Sean: "If I want to go onto the Internet it is really hard"
"I can not send e-mails to my friend"

Against the ethical considerations about leading questions in research, I probed 33 out of the 41 pupils who indicated navigation as one of their difficulties to tell me if operating the mouse and typing (keyboard) are hard tasks to perform for young children. The majority (n=22, 66,6%)) said that they are quite easy, or they become easy after a period of practicing and familiarisation. Their view was: " It is hard in the beginning, but later I get to know it better".

When I observed young pupils, I formed the impression that they are very slow in typing, they need time to find the correct button. Perhaps because the observation took place before Christmas, where as interviews took place at the end of the school year, which indicates that children feel much confident by the end of the school year. In table 7-22, the opinions of teachers, developers and pupils are juxtaposed, and it is noticeable that the opinions of the three stakeholders coincide. They all agree that the main problem children face is navigation, and difficulties performing literacy activities very similar to activities provided by conventional teaching. This leads us to conclude that working on literacy software takes much longer than working on print material.

Question 6: <u>Technical features in literacy software</u>

At this point, the analysis of the interviews regarding pictures, colourful design, sounds and animation will be analysed according to groups (Yr1 and Yr2) in cases were differences were found.

i) <u>Pictures</u>

Table 7-32 Pupils like pictures in software

Pictures	Counts		Total
	Yr 2	Yr 1	
Yes	49	28	77
No	13	6	19
Don't know		2	2
Total	62	36	98

<u>Year 1</u>

The majority of this group (n=28 out of 36, 77,8%) emphasised that they like pictures because they are nice to look at emphasising thus the aesthetic value of pictures. 15 of the 36 (41,7%) Yr1 children indicated that they like pictures in reading games because they help them with their reading task:

Henry: " I like pictures in story games. They make it like real"
Lucy: "Because it is nice to look at pictures"

A small percentage of Yrl pupils (n=5, 13,9%) said that they like to draw the pictures which means that they confused the pictures with the ones who are given by computer packages to draw:

Romily: "I use the brush and nice colours and I really do a good job"

<u>Year 2</u>

The majority of the Yr2 cohort (n=49 out of 62, 79%) said that they like pictures because they help them with their reading tasks, i.e. comprehension of text:

Lizzie: "If it (reading game) asks me words, and I can't find out the words, I can just look at the picture, and it gives me the clue, and that helps"

Ben: "By looking at the pictures I can understand the story"
Interviewer: How do you think pictures help you understand the story?
Ben: "Well some of the stories, they speak so fast sometimes and I can not understand what they are talking about and then I look at the picture and I know"

The analysis indicates that the majority of children (n=77 out of 98, 78,6%) like pictures in reading computer games. The difference is that the older children seem to acknowledge the educational value of pictures to the reading process, where as the youngest group enjoys looking at pictures, or painting them.

ii) <u>Colourful design</u>

Table 7-33 Pupils prefer the colourful design in software

Colourful	**Counts**		**Total**
	Yr 2	**Yr 1**	
Yes	55	34	89
No	7	2	9
Don't know			
Total	62	36	98

89 pupils (90,8%) said yes, they like computer games to be colourful. 74 children elaborated further saying that games look prettier, and colours make programs more attractive:

Ravenna: "Because it looks like a rainbow, and I like the colours of the rainbow"
Lucy: "Yes, because it looks nice"
Tom: "I guess it is more attractive that is why I like it"

iii) Sounds

Table 7-34 Pupils like sounds in software

Sounds	Counts		Total
	Yr 2	Yr 1	
Yes	29	29	65
No	33	7	33
Don't know	-	-	
Total	62	36	98

Year 1

29 out of 36 Y1 children (80,6%) seem to enjoy various sounds made by some programs and they like sounds because they make games interesting, and look or sound like real:

Hannah: "I like sounds because it makes it real. You think you are by the seaside when you hear the waves"
Jennifer: "When you read a good story I don't want to just watch pictures, I don't like that. But with sounds, it makes it then interesting"

10 out of 29 Yr1 subjects (34,5%) who said yes to sounds, at the same time they were referring to the speech facility of the computer games:

Henry: "Yes, because if you have to spell, it tells you the word, so it is easier to do the game"
Connor: "Yes, it helps me with the words I don't know"

Though they are positive about sounds, 11 pupils (38%) of this cohort posed conditions about their presence in the computer games. They like them only if they are of some use, or if the volume is low indicating that loudness makes them problematic:

Abdullah: "Yes, ...but only if it is low"

Sandra: "Yes, ...only when it reads out a word for me"
Matthew: "I like sounds that tell me how to pronounce letters"
Abby: "I like sounds or voices only when I listen to a good story. It makes it more interesting"

Year 2

33 out of 62 Yr2 subjects (53,3%) showed disappointment with sounds and explained that they find them annoying, distracting and irritating because of being loud and noisy:

Billy: "Because sometimes when you are trying to do something, it gets on my nerves"
Eve: "Sounds are interfering especially when I am trying to read. They are loud and noisy"
Ciara: "Sort of"
Interviewer: Why?
Chiara: Because sometimes you can get headache"
Interviewer: Do you mean that sounds cause you headache?
Ciara: "Yes, too noisy"

The pupils also indicated that poor quality of the computers' speaking facility is another reason why they are not font of them:

Michael: "...sometimes they buzz or squeak a little bit"
Tyrone: "They sound horrible sometimes"
Sandra: "Usually games don't have nice sounds or voices"

In addition, children find sounds boring especially when an activity takes a long time, and sounds keep on repeating:

Dominic: "No, because it is a long time, it might get a little bit boring"
Mandeep: "They keep repeating and it is boring"

The analysis reveals that the two different age groups have different opinions about sounds. Yr1 group is attracted by sounds / speech facility because they find them helpful with learning the sounds of letters and words. Adversely, sounds appeal much less to Yr2 pupils for two major reasons: poor quality and loudness. Sounds cause distraction, confusion, irritation, boredom, and young users can not get on with their work. Dissatisfaction with sounds was found also during the observation stage. When a child was notified for his / her mistake, the whole class was informed and annoyed by that particular noise. It was not a nice feeling for the computer user that a whole knew about the "mistake".

iv) <u>Animation</u>

Table 7-35 Pupils who like animation in software

Animation	Counts		Total
	Yr 2	Yr 1	
Yes	45	26	71
No	17	4	21
Don't know		6	6
Total	62	36	98

71 out of 98 KS1 pupils (72,5%) said that they like moving characters in software, where as 21 of them (21,4%) %) said **no** to animation. But children were unsure of why they like them. 62 (87,3%) of this cohort were able to explain laconically why they like animated characters, or objects mainly because they are <u>funny</u>:

Abdullah: "Yes, some of them have funny faces and make me laugh"
Rosie: "They are really funny, they look like the cartoons I watch on TV, and I like that"
Conan: "It is sometimes funny to watch, nothing else"

Question 7: <u>Instructional characteristics</u>

v) <u>Positive feedback</u>

Table 7-36 Children like to be praised

Positive Feedback	Counts		Total
	Yr 2	Yr 1	
Yes	47	28	75
No	13	3	16
Don't know	2	5	7
Total	62	36	98

75 children (76,5%) said yes to positive feedback (rewards) in verbal cues because it creates a nice feeling of success, while 16 said no (16,3%). 49 of the above cohort (65,4%) were able to explain why they like it. Pupils indicated that positive feedback (reinforcement) boosts their self-esteem, creates a nice positive feeling (n=34), and it lets them know how well they are doing (n=15):

Victoria: "Yes, I like that because I know I am doing fine"
Alexandra: "Yes, I like it when I do things right"
Raaj: "Yes I feel I am succeeding something"
Erion: "Yes, especially when it says, "Good try"

A new theme that emerged at this point is that youngsters (n=17) like verbal cues only, and not scores, or points:

Billy: " Yes, I think I like that but some games gives you like numbers or points or something like that, and that I don't like"

vi) Negative feedback

Table 7-37 Children who like negative feedback

Feedback	Counts		Total
	Yr 2	Yr 1	
Yes	25	26	49
No	29	8	37
Don't know	8	4	12
Total	62	36	**98**

Year 1

The majority of this group 26 out of 36 (72,3%) said yes, they prefer the computer to tell them when they have made a mistake, but only 11 were able to explain why. The main reason is that negative feedback gives them a sense of where they stand, what actions to perform next, and makes sure that they are not going to make it again. Interestingly, the younger age group believes that they learn from their mistakes:

Samantha: "...then I know what is wrong and what it is right"
Kieran: "Yes, because I make sure that I wont' do it again"
Jamil: "Because you learn from your mistakes"
Grace: "Because I can go onto another activity and move on"

Year 2

Conversely, 29 out of 54 Yr2 pupils (53,7%) do not seem pleased when receiving negative feedback, and the table below shows the reasons:

Table 7-38 Reasons why children do not like negative feedback

	Counts
It causes discomfort / upsetting	13
Children prefer to find out by themselves	12
Children prefer a more discrete mode	6
Don't know	5

It looks as if the main reason is that negative feedback causes discomfort in three different ways. Specifically, negative feedback **a)** hurts their feelings; **b)** obliges them to repeat the same activity, and **c)** too much "talking" is taking place. Adding all up leads us to the conclusion that negative feedback functions rather as a discouraging agent for Yr2 pupils:

Daniel: "It hurt my feelings, I feel nervous"
Stephanie: "It is annoying to know when I make a mistake"
Josh: "It makes me feel stupid, and then I want to do something else"
Imash: "Because it will tell me to do it again, and I don't like that"
Adrian: "It annoys me if it speaks too much"
Erion: "it is upsetting to hear it saying: you've made a mistake. I go home and I still think about it"

Promptly 16 children suggested that they would prefer to be informed in a more discrete way, which indicates that probably young learners are not happy about the way feedback is given:

Alexandra: "I would like the computer to just tell me "please correct it"
Tyrone: "Just to put some kind of a sign up that I spelled it wrong"
Benjamin: "I don't like the computer to talk to me. Imagine if I have many mistakes and the computer keeps talking... I would be very annoyed"
Daniel: "I don't like it telling me "wrong or something"

During my observations, I noticed children's discomfort of negative feedback " Oh shush up! I know I've made a mistake...!" A pupil (Liz) told me that she prefers the computer to tell her "good try", and that she feels very annoyed by the noises.

Another important reason why they are not so happy about negative feedback is because they prefer to <u>discover</u> the mistake they have made by themselves, and they do not like when the correct answer is offered (n=12):

Matthew: "I will figure it out myself"
Joshua: "I want to try and think how well I have done by myself"
Grace: "I like to sort it out myself"

Conclusively, a difference of attitudes among age groups is present. Younger children (5-6) do not seem to mind negative feedback; where as the older pupils somehow seem to be hurt, and annoyed, or feel able enough to find out their mistake and correct it rather instead of having it offered. There is a possibility that this age group is displeased not because of the element *per ce*, but rather with the way it is given. Perhaps it is the nature of these critical expressions that causes distraught.

vii) <u>Repetitions</u>

Table 7-39 Pupils like to repeat activities

Repetition	Counts		Total
	Yr 2	Yr 1	
Yes	30	28	58
No	32	5	37
Don't know		3	
Total	62	36	98

<u>Year 1</u>

It seems that the majority of this group (n= 28 out of 36, 77,8%) likes repeating an activity on the computer until they do it right. <u>Only 16</u> were able to explain why, mostly because it becomes easier and they learn it easily. They do not mind repetitions, and they find it fun:

Lucy: "..., because then it becomes easier"
Connor: "..., because it is quite fun"
Abbey: "...., because I learn if I repeat it"
Rosie: "I don't mind if I have to do it again"

Year 2

In contrast, the older group is roughly divided with a marginal superiority of the dissatisfied group (n=32 out of 62, 51,7%). The reasons are shown in the following table:

Table 7-40 Reasons why Yr2 pupils do not like to repeat activities

	Counts
Impatience / frustration / annoyance	11
Boredom / it is not fun	7
Time consuming	5
It is not necessary / don't know	9

It seems that the main reason why children do not like repetitions is because they experience impatience, frustration, annoyance, boredom, and it is time consuming. Young pupils sometimes feel that there is not enough time to complete the activity:

Reece: "No, I just like to go on"
Karen: "Well, I may feel like sometimes I get frustrated when I have to do again and again"
Eve: "...because I feel like I am going to make it again and it is annoying"
Dominic: "It is boring"
Conan: "....cos it takes a long time to finish and I would worry if my classmate needs to take over"

What the analysis shows is that younger children (5-6 years of age) are more tolerant towards having to repeat tasks on the computer, and appreciate the fact that practice help them to learn better, where as Yr2 subjects seem to be impatient, annoyed (hurt feelings), and frustrated. To a lesser degree, they feel that they do not have enough time to finish the activity, which infers that the time allotted to children is rather limited.

An interesting theme came up while discussing the above question with 15 children. The discussion was if computer games should pose time limitations on children's activities. Children point-blankly said that they do not favour such programs because of the pressure, and the unfairness:

Rhiannon: "Once you've started it is not nice to press you"
Laura: "No, I don't find that fair"

Performing a chi-square test between the two variables, gender and repeating the computer activity, a significant relation was found:

Table 7-41 Gender & Repeating the activity on the computer. Contingency table

		Repeating the activity on the computer				
		Not at all	A little	Fairly	Very much	Total
Boys	Count	7	5	14	9	35
	% within REPETITI	63.6%	50.0%	82.4%	37.5%	56.5%
Girls	Count	4	5	3	15	27
	% within REPETITI	36.4%	50.0%	17.6%	62.5%	43.5%
Total	Count	11	10	17	24	62
	% within REPETITI	100.0%	100.0%	100.0%	100.0%	100.0%

Chi-square: 8.546 (df 3) Sig: .036, $p < .05$

The majority of the "not at all" group (n=7, 63,6%), half of the "a little" (50%) group, and the majority of the "fairly" group are boys. Only 9 boys (37,5%) are found to have rated repletion "very much". The relation is significant since the *p* value is less than .05. It is indicated that boys are less willing or tolerant to having to repeat their work than girls.

viii) Practice

Table 7-42 Pupils like to work on the same computer activities found in textbooks

	Counts		Total
	Yr 2	Yr 1	
Yes	42	28	70
No	15	2	17
Don't know	5	6	11
Total	62	36	**98**

70 pupils (71,4%) do not mind to work on computer activities similar to ones they are working in their classrooms evidence found during my observations in the nursery school.

Question 8 i): Do you like literacy games to speak out words in a text?

Table 7-43 Pupils like the literacy games to speak out the words

	Counts		Total
	Yr 2	Yr 1	
Yes	39	34	73
No	17	1	18
Don't know	4	1	5
Total	62	36	**98**

Both groups (n=73 out of 98, 74,5%) agree that this kind of facility would be of great help. The difference between age groups lies in that a significant number of the older children (n=26 out of 62, 62%) want to try first, and if they fail, then they are happy to call for assistance. The reason is that they feel confident in reading, and that they should be given a chance to try first. The issue of the quality of the talking facility is raised again:

Nina: "Yes, it would help a lot"
Louise: "I quite like it, but the voice must be good"
Tom: "Yes, but I want to try first. I don't want to just sit and listen in front of the screen all the time"
Ryan: "But I want to have a chance to read it first because I can read"

Question 8 ii): Do you like literacy games to read out the instructions?

Table 7-44 Pupils who like the literacy games to read out the instructions

Read out the instructions	Counts		Total
	Yr 2	Yr 1	
Yes	48	33	81
No	13		13
Don't know	1	3	4
Total	62	36	**98**

81 pupils out of 98 (82,7%) said yes to computer programs that read out the instructions because it would be of great help and relief founding the way around easily. But 23 pupils of the Yr2 age group (47,9%) thought deeply and mentioned again the issue of speech facility, and continuous " talking". They said that though this sounds very helpful, they are afraid that it would cause a lot of disruption, as the quality of "voice" is not good. In addition, it was mentioned that such facility would patronize the way children want to use the computer:

Hugh: "Actually I would really like that because it would help me find my way around"
George: "Yes, but not constantly talking"
Interviewer: Why?
George: "Yes, but it becomes sort of annoying. I don't like it telling me what to do all the time"

Question 9: Do you think computers help you to learn?

Table 7-45 Pupils think that computers help them to learn

	Counts
Yes	76
No	6
Not sure/ do not know/no answer	16
Total	98

76 out 98 (77,6%) young pupils said yes, they believe that computers help them to learn. I came across such evidence when I had the "diagnostic" interviews with the children I observed. 6 of the above cohort (6,1%) do not believe that computers help them to learn, where as 22 (29%) were unsure, or they said that they do not know

62 out of the 76 (81,6%) children explained and the information is summarized in the table below:

Table 7-46 Ways in which computers help children to learn

	Counts
Reading words/ text, reading out words, listening to stories, spelling, and writing.	41
Other curriculum subjects, find out things / quizzes	17
Internet	6

The majority of youngsters believe that computers help them to learn mainly because they learn a variety of basic literacy skills, such as reading words, and spelling. It is also shown here that the answers to this question are very similar to the answers of the question 3c, specifically how do computers help you with your reading / spelling:

Scott : "Because it helps you to read and spell better"
Interviewer: How does computer helps you to read and spell better?
Scott: "It (game) has different words and we try to learn and spell them"

Himash: "Yes, because the games we play there is a reading job or something like that....so we do reading on the computer and then on the book"

As an observer, I was told similar things, i.e. that computers help them to learn. Because the teacher assigns them to do spelling activities on the machines, and thus they learn more words: "We learn new words, because the teachers gives us to do spelling on the computers".

To a lesser degree, computers help pupils with maths, history, quizzes and discovering "things" that can be similar, or connected with activities found in classroom textbooks:

Liam: "Yes, because it has more information about different countries and other things like that and we get to find out and write about them"

Erion: "We do learn from computers. I go on the computer and there is a spelling bit and you have to press the right key to write the word cat. So it helps me to know the first letter of cat is c"

Grace: "Yes because when I am doing a textbook and then I am at the computer, I find out more about the stuff. We find out about things"
Amy: "Yes, they tell you a lot about the Queen and the King"
Interviewer: What King?
Amy: "King Henry. It is this game that we read about and then we try to answer questions....."

Though only 6 Yr2 pupils mentioned Internet, all 6 said that they use it at home. It is indicated that Internet has an essential role to play in children's learning when linked to classroom activities in the form of extensive learning, as in the following quote:

Harriet: "Yes, It gives me Information"
Interviewer: What kind of information?
Harriet: "For example, I go to Netscape, and I am in the Internet and I type Van Gogh"
Interviewer: Oh really? Why are you interested in painters?
Harriet: "We have this book in class that tells us about famous painters. My favourite painting of Van Gogh is the "Sunflowers." I also like Monet. He used watercolours more"

I was also interested in contrasting the views of the three stakeholders (teachers-developers-pupils) to see if they differ significantly in relation to technical features and instructional design in software. I performed the Kruskal Wallis H test, which showed the following results:

Table 7-47 Summary of Means Ranks (Kruskal-Wallis H test) and means (M) of the three stakeholders **

	T**	N	M	D**	N	M	P**	N	M	H	df	sig
1*	65.30	89	2.6	84.81	8	3.00	100.48	62	3.3	23.525	2	.000
2*	80.31	91	3.4	101.33	6	3.33	77.48	62	3.51	.753	2	.686
3*	88.78	91	3.4	79.50	8	3.67	69.77	62	2.9	7.125	2	.028
4*	88.45	92	3.5	63.06	8	3.00	73.56	62	3.1	6.105	2	.047
5*	80.31	91	3.4	101.33	6	3.86	77.48	62	3.3	1.905	2	.368
6*	75.80	89	3.1	80.42	6	3.50	82.25	61	3.0	.825	2	.662
7*	81.61	89	3.1	91.08	6	3.33	74.09	62	2.9	1.614	2	.446
8*	82.53	90	3.2	95.64	7	3.50	74.56	62	3.0	2.257	2	.324

*1= Still pictures
2= Colourful design
3= Sounds
4=Animation
5= Positive feedback
6= Negative feedback
7= Repetitions
8= Related off-computer activities

** T = Teachers, D = developers, & P = pupils

The Kruskal-Wallis H test shows significant differences among the three groups in relation to pictures, sounds and animation because the significance level is less than the alpha value of .05. The column of means and means ranks shows that:

- Still pictures are valued more by pupils and less by teachers.
- Sounds are valued most by teachers and less by pupils.
- Animation is valued most by teachers and less by developers.

The fact that pupils value less sounds is verified by interviews. Similarly, Yr2 pupils do not prefer animation in literacy software. Despite the variations of means, the rest of the software elements are not found to differ significantly. .

7.5. Summary

This chapter has presented the findings of quantitative and qualitative data, in charts, or tables respectively. After each chart or table, an analysis of the findings (frequencies and percentages) follows. Regarding open-ended questions and interviews, a series of quotes straight from the transcripts have been presented in order to support the arguments of the thesis. In addition, contingency tables show significant relationships, when found, between variables. Finally, the results of Chi-square, Man-Whitney U, and Kruskal-Wallis H tests are presented in summary tables accordingly. At this point, It would be useful for the reader to present the significant points found in the analysis. This will help him / her understand the arguments made in the discussion chapter that will follow.

Significant points

29,5% of the participated teachers indicated that their pupils have daily access to computers, but an also identical percentage (29,5%) did not answer this question. In relation to pupils' access to initial literacy software, the majority of educators (55,4%) occasionally use such computer programs.

The thesis argues that the use of ICT is greatly influenced by the schools' ICT policy, resources and their management, and teachers' confidence in using ICT. 91,1% of the sample come from schools that they have developed an ICT policy, but only one teacher has mentioned that purchasing software is a key element in that policy; 81, 3% have computers and another 78,6% are equipped with literacy software. The micro-density figure is 1:13. The nature of the timetabled access to ICT provision is ICT suite (57,6%).

Regarding teachers' confidence, the sample is divided, this is 49,1% feel adequately / completely confident, where as 48,6% feel a little, or not at all confident. There is a significant relation with a strong *p* value (.005) between sufficiency in ICT training and the 4 different age groups of teachers, this is 65,2% of the 51 years old and above group, 56,3% of the 41-50 age group, and 51,5% of the 31-40 age group feel less confident in using ICT. The "Up to 30 years" age group is equally divided. Similarly, a significant relation is found between teaching experience and sufficiency in ICT training (*p*: .014), this is 68,6% of the over 20 years in the profession groups feel less confident in using ICT. 54,5% of the 11-20 years in teaching, and 61,6% of the up to 10 years in the profession feel confident. The conclusion is that the older in age and in the profession teachers feel less confident in using ICT. Developers also acknowledge that teachers have low ICT skills.

As far as the criteria teachers employ to select software and literacy software in particular, the study finds that the majority of teachers (78,6%) do not use any criteria for selecting software. Among the skills that teachers believe they need are the following: **a)** to time to look around and greater awareness of what software is available and of other colleagues' experiences in using such software; **b)** opportunities to try out software before they decide, and more time to preview software that would enable them to see how it is linked to the NC requirements; **c)** access to high quality reviews. The teachers reported that choosing from catalogues is of no use; they also feel unable to see the educational value of software, which means that they are not aware of what makes software of educational value.

Regarding the preview process, a marginal majority of teachers (51,8%) preview software. The rest are divided between those who do not preview at all (25,9%) and those who did not answer (22,3%). Significant relation was found between sufficiency in ICT training (*p*: .025) and the preview process. Similarly, a significant relation is found between teaching experience and the preview process (*p*: .034). The analysis indicates that teachers, who feel completely (100%) and adequately (73%) trained in ICT, preview software more than their less confident colleagues. But the majority of the respondents (42%) do not include children in the preview process, and equally an overwhelming majority (64,3%) do not, or are not asked to convey, their impressions to the software developers. The conclusion is that teachers do not practice any kind of evaluation before using software in their classrooms.

In relation to evaluation conducted by developers, the analysis shows the following: only half of the companies (50%) perform a kind of formative evaluation (during the developmental period), equally half (50%) involve pupils, and similarly half of them (50%) seek feedback from classroom teachers. The conclusion is that approximately half of the existing software does not undergo any kind of evaluation, and that there is a gap of communication between teachers and developers.

The literature has suggested criteria appropriate for selecting software for children (*criteria suggested by the literature*). This study has found that a small number of teachers (11,6%) use some criteria for selecting literacy software (*existing criteria*), and also has formed criteria derived from the teachers who are unaware of any (*ideal criteria*). The result is that there is a perfect congruence among the three different sets of criteria. The *ideal criteria* that emerged from the present inquiry are: **a)** easy to use; **b)** attractive motivating (to include a lot of the technical features); **c)** links to the NC / NLS objectives; **d)** interactive (to include instructional characteristics); and **e)** to cater for different ability levels.

The general influential factors for selecting educational software are rated by both stakeholders – teachers and developers – but no significant differences were found with the exception "software caters for different ability levels. Developers find such software more influential than teachers. Software that covers NC / NLS objectives was highly rated by teachers (3.34 on a 4-point scale), but only half of the companies (50%) are found to link their computer material to NC / NLS objectives. A significant relation was found between teachers' teaching experience and software that has been tried out with children (*p*: .031). The more experienced teachers are influenced more by software that has been tested with children than their new in the profession colleagues.

As far as young children is concerned, they like to use computers in the classroom (92,9%), and they provide reasons, mainly because computers are fun, which emphasises the motivational value of the machines. Computers though can cause eyestrain or headaches, but only to a small percentage of children (5,1%). They have used literacy software (66,3%), which they believe helps them with their learning basic reading skills. They prefer to work in pairs (42,5%), they face difficulties mostly related to navigation (58,6%), and trying to find the correct answer. They believe that their difficulties can easily be overcome by practice and frequent use. Teachers and developers are well aware of the difficulties young children encounter. The analysis indicates that young pupils face dual difficulty when working on literacy software, this is trying to find their way around, and at the same time to complete the reading activity. Therefore engaging with literacy games requires more time than the conventional notebooks.

The analysis also indicates pupils' preference to certain software elements. Differences were found between the two level groups. Yr 1 group likes pictures mainly because of its aesthetic, where as Yr2 for the pedagogical value, this is they help them with their reading. The colourful design and animation in literacy software are both appreciated by both groups. Sounds have divided the two groups. Yr1 does not mind sounds though expressed reservations for the loudness. On the contrary, Yr2 group expresses serious reservations about their presence.

As for the instructional principles, the analysis shows that positive feedback is accepted by both groups, where as negative feedback, and repetitions have both divided the two groups. Yr1 seems not to mind negative feedback, nor repetitions, where Yr2 pupils expressed discomfort and upsets. A significant relation is found between Yr2 pupils' gender and repetitions (*p*: .034). It seems that boys less tolerant towards having to repeat an activity than girls. KS1 pupils do not mind the computer activities to be an extension of the textbooks being used at school; they also prefer computer programs to read out the instructions and words provided that pupils are given first a chance to try for themselves. Young users believe that computers contribute to their learning and one of the ways is the development of reading skills. A small number indicate that the Internet plays an important role to their learning.

Among the views of the three stakeholders, there are significant differences in relation to software elements. In particular, pictures are more valuable to pupils and less to teachers (*p*: .000); sounds are less valuable to pupils and more to teachers (*p*: .028); animation is valued more by teachers and less by developers (*p*: 047).

In light of these findings, I will proceed with the discussion that follows in the next chapter, where evidence found in this study will be compared with evidence from the literature, and safe explanations will be provided when possible.

Chapter 8. Discussion

Many interesting issues came up during the data analysis but we will focus on the ones that fall within the aims of this study. The analysis will be presented according to the research aims and questions and within the context of the literature. Issues that are looked from the stakeholders' perspectives will be presented together in order to view it holistically and make sense of it. Evidence of this inquiry will also be discussed in terms of whether they support or not other research findings in the literature review.

8.1. Presenting the findings

The aims of this study have been stated initially in the introduction of this thesis (1.5.), and later in the methodology chapter with the specific paths that would be investigated (6.2.). The first research question was to explore the extent to which primary educational settings use software to support the teaching of basic reading skills. Initially, I will present the frequency that primary teachers use computers irrespective of the programs they run. The study has found that:

a) Only 29,5% of teachers indicate that their pupils have 10 minutes daily access to computers, where as 26,8% state that the access to computers is much rarer than that (10 minutes per week or fortnight). Unfortunately the picture is not very clear because 29,5% of the respondents did not answer this question, which probably enhances the evidence that children do not have daily access to ICT resources. The general picture is that primary pupils do not work on computers on a daily basis irrespective of programs being used. Such evidence is supported by the studies of Marcinkiewicz (1993-94) and Norris et al. (2003), in USA. Nevertheless, similar findings are supported by Watson (1997) and Loveless & Dore (2002), in UK. They claimed that teachers have ICT access approximately for 15 to 30 minutes per week. Certain issues are raised here.

First of all, the limited access seems compatible with the 10 minute-period that each activity in literacy software lasts. Developers design each activity to last no more than 5 minutes, which perfectly fits into the small slots allocated by school timetables. While this is compatible with tutorial and drill & practice computer packages, the time is not enough for pupils to explore an open -ended program, which demands flexibility (skills), and more time to be explored. What about the skills of young users who are slow? Less skilled readers demand more time to finish a task and limited access would make them abandon the activity at hand. Young children's skills are not adept enough to manipulate the machines and they should be allocated plenty of time, as Haugland (1992) has argued. Rightly Loveless & Dore (2002) then claim that limited access does not allow teachers to see any academic gains in pupils, and what is relevant to this study is that this limited access does not allow classroom teachers to see the educational worth of software (Blease, 1996, 1988). A last issue in relation to ICT application, teachers have indicated that their pupils have regular access to the Internet. The question that is raised here is how do pupils manage to use it "regularly" with such infrequent access to ICT resources?

b) Similarly, the study has found that initial literacy software is not used frequently. The majority of teachers (55,4%) occasionally use such computer programs (only 9,8% of them use it on a nearly daily basis). Research on computers and reading indicate that 10 minutes of daily access may affect significantly children's academic achievement (Clements & McLoughlin, 1986; Torgesen; Atkinson & Fletcher, 1972). In this case, we cannot possibly expect the restricted use of computers by young children to have a significant impact on the development of pre-reading skills nor can teachers see the benefits of such computer programs. But we have to look at the important issue of computer access, and the use of CAI in teaching literacy, from the right perspectives.

The present inquiry has argued for and focused on three factors that affect the successful and effective ICT application (and CAI) in schools, these are: a) the school's ICT policy (Kosakowski, 1998), b) the resources, the management and the small micro-density figure, and c) teachers' ICT training (Govier, 1991; Poulter & Basford, 2003).

ICT school policy

The majority of schools have an ICT policy (91,1% of teachers came from schools that have such policy). The literature indicates that schools' ICT policy should consider the following aspects:

- Where is the school now?
- What is the school's intention and why?
- What are the goals towards the ultimate aim?
- How the school will achieve these goals? (BECTA, 2002).

The administrations of the schools that have participated in this study include all the above considerations, as key elements in their ICT policies. Indeed important elements in their policies are aims, objectives and rational. The aim, according to the DfEE / NC guidelines, is pupils to develop ICT capabilities including knowledge and understanding of the importance of information, and how to select and prepare it. They should understand the value of technology for themselves, others and society and its advantages and disadvantages. A second priority of schools is the equal access of their pupils to resources. This guarantees that pupils are not excluded because of different academic abilities, gender, and nationality and make sure that the Equal Opportunities policy is in effect. The third priority is how to manage their ICT resources. Schools try to find out ways to fund their institution in order to purchase the expensive machines (hardware, software and peripherals), and how they will manage the pupils' access. The prevailing option is the ICT suite something that the present study also confirms. Finally, schools want to integrate ICT across the curriculum.

The above analysis shows that school administrations are concerned with applying successfully technology in their school, they want to ensure that their pupils learn and understand the value of this novice, and of course the effort will continue. While all the above reveal the theoretical part of the schools' ICT application, the practical side remains that children do not have regular access to ICT resources and literacy software in particular. Despite the intentions (aims and objectives) and efforts, and despite the provision for ICT resources still teachers do not use adequately this novice. It is a very intriguing issue that needs immediate attention and investigation by further research in the future. The implications of this reality is that **a)** ICT is not fully integrated with the curriculum, **b)** teachers cannot see the impact of technology on pupils' academic gains, and **c)** educators cannot see the educational value of software. The second factor that influences the schools' ICT application in schools is the ICT resources. Are schools well equipped with computers and peripherals?

ICT resources

Primary educators (84,8%) have a computer in their classroom, their pupils have routine access to computers and colourful printers (81,3%), to literacy software (78,6%), and to the Internet (74,1%). Nevertheless, in relation to the topic of this study, it seems that schools are equipped with computers and literacy software and of course the situation will continue to improve after the government' commitment in ICT application in education. Teachers (48,2%) use specific software for pupils with reading difficulties. The most widely used software for this purpose is: The Oxford Reading Tree, Starspell, Clicker 4, Wordshark, Animated Alphabet, and Sherston Talking Stories. The literature has pointed out that there are not many software specially designed for pupils with learning difficulties (Lazari, 2001, Agar, 1998). The study also supports such evidence that emerged from a personal communication with the companies regarding their participation in this study (see 6.4.2.). Available literacy software is designed and can be used by pupils of all ability levels.

The micro-density figure

In relation to ICT resources, the literature indicates that the small computer to pupil ratio is essential for the following reasons:

- Schools provide a balanced ICT curriculum.
- Pupils have easily and free access to computers.
- Better quality of learning experiences.

- Pupils develop positive social behaviours, and
- Previewing process becomes easier.

The large figures of 1 computer for large groups of 20 for example are found to cause aggressive behaviours (Lipinski et al., 1986). Watson (1997) and Haugland (2000) have suggested that the desired figure is 1:3 maximum 1:5 for young users. Besides, small number of pupils working with one machine **a)** enhances collaboration, **b)** enable teachers to effectively integrate computers into their curriculum, and most importantly **c)** enables teachers to see the educational value of particular software (Blease, 1986, 1988). If we compare the two latest ICT surveys of DfEE, we notice that the ratio figures are improving, in 1999 it was 1:13, and in 2003 1:7,9 (DfEE, 1999; 2003). When this study took place (summer 2001), the average of computer to pupils was **1:13**, a similar figure of the DfEE ICT survey in 1999. Most of teachers (42,6%) have 1 computer with more than 10 pupils. 30,1% of the sample have a ratio of 1:10, and only 23,5% indicated that the micro-density figure is 1:5. With the majority of schools having a large micro-density figure, it is highly unlike primary teachers to be able to provide balanced curriculum where children have free access to computers, better learning experiences, and positive behaviours when working with classmates on the computers. It is also highly unlike to see the educational value of software. The question that I raise here is if the large micro-density figure deters teachers from using the machines. It could be a possible factor, but this merits further exploration.

Management of ICT resources

Primary schools opt for computer suites (Siraj-Blatchford & Whitebread, 2003) since they cannot have a sufficient number of computers per pupils. Such evidence is supported by this inquiry. Teachers (82,1%) have to timetable pupils' access to ICT resources and they explained that their school adopts the ICT suite option. One of course should not overlook the advantages of the ICT suite, for example computer labs are more economical, better secured, improve the micro-density figure, computers can easily be connected to the web and share other peripherals, like scanners and printers. But such an option has its disadvantages one of which is the restricted access (Somekh & Davies, 1997), and the discouragement of integrating ICT with the rest of the curriculum (Siraj-Blatchford & Whitebread, 2003). The question that rises here is if the strictly timetabled access to computers is a possible reason that might deter teachers from using more frequent computers and literacy software. Is restricted access the main reason that teachers do not use computers on a regular basis? The issue merits further exploration.

Teachers' ICT training

I have discussed the astronomical amounts of money (£1.8 billion, see 3.3.) invested in ICT application and ICT teachers' training. The NOF scheme alone cost £230 millions (see 3.4.). NOF training was initiated to promote the use of ICT in classroom practice, and not specifically teachers' ICT skills, but the success has been "patchy" (Poulter & Basford, 2003). This study cannot support such evidence, but it can show that by the summer 2001, only 10,7% of teachers has completed the NOF training. 36,7% of primary educators is half way through, where as the majority (42,9%, n=48) is still planning to start the training. The question that rises here is do teachers who finish the NOF training feel more confident in using ICT and select software? More research needs to be done to see the effect of NOF training on teachers' ICT skills.

Do primary teachers feel confident in using ICT? I have noticed in the literature a disagreement between DfEE (1999) and BESA (2001) reports (see 3.4.) regarding teachers confidence. DfEE claims that the percentage of confident teachers is 75%, where as BESA argues for less (48%). This study has found that teachers are roughly divided to those who feel sufficiently trained (n= 55, 49,1%) and b) those who feel less confident in ICT training (n=52, 46,5%), therefore this evidence matches mostly the results provided by BESA (2001). In addition to that, the study has found a significant relation between age and confidence ($p < .005$). The overall picture is that the older the teachers the less confident they feel in using ICT. The truth of the matter is that the low teachers' confidence in ICT skills, irrespective of age and teaching experience, is greatly acknowledged by software developers. Another significant relationship found is between teaching experience and confidence in using ICT. The majority of educators (68,6%) with more than 20 years in the profession feel less, or at all, confident in using ICT. In a nutshell, age and teaching experience is related to teachers' low confidence in using ICT, but the relation is correlational, and not causal. There are indications that the infrequent computer access is related to teachers' low confidence in using ICT. The issue needs further exploration.

Up to now, the issue of access to technology, and basic literacy software in particular, has been viewed through the school's ICT policy, ICT resources, management of resources and the micro-density figure, and through teachers' ICT training. But a crucial factor that may affect the use of software (technology) in schools is good quality software (Johnson, 1987; Scandura, 1981; Buckleitner, 1996). The literature indicates that after the use of technology in schools, there is a plethora of software available in the market at the cost of quality and pedagogical value. Very early, researchers started to investigate how should primary educators tackle this problem. A series of studies were initiated but they did not manage to provide concrete criteria (general or specific). The situation is that there is a sheer lack of criteria (Kommoski, 1988; Preece & Jones, 1985; Squires & McDougall, 1994; Tergan, 1998). In relation to the subject of reading, no such criteria exist either. Only recently, did general criteria for young children started to emerge (NAYEC, 1996, Henniger, 1994; Hohman, 1998; Haugland, 1992, 1997; DATEC 1999-2000).

Therefore, the second research question of this inquiry was to explore what criteria primary teachers use in order to select software designed to support the development of basic literary skills. Teachers (78,6%) do not have any written guidance (no criteria whatsoever), evidence that buttresses the argument of this thesis (see 4.6.), and the arguments posed by various researchers (Kommoski, 1988; Preece & Jones, 1985; Squires & McDougall, 1994; Tergan, 1998). The truth of the matter is that the purchase of software was not found among the key elements of schools ICT policy with the exception of only teacher. If teachers do not have any criteria, how do they know that particular software is appropriate for classroom use? Though 49,1% of teachers feel adequately trained in using

ICT, this does not guarantee that teachers feel confident in selecting software, as well. What skills do teachers need to select software?

The older studies of Preece & Jones (1985), Jolicoer & Berger (1988b), but also the recent conclusions of Mustoe's (1999) thesis have alleged that teachers do not know to evaluate software. Carvin (2000) claimed that only one third of teachers feel confident in dealing with software in the curriculum. Teachers of this study (50,8%) indicate that they do need some kind of selection skills, but implicitly indicate that they lack such skills. These are:

- Teachers need to know what criteria to employ.
- They need to know what makes software of educational value.
- How to link software to the NC requirements.
- They need to access official reviews, trials that would help them make the right decision. They need more time and greater awareness.

The above show that many teachers do not know to evaluate software evidence supported by older and recent studies of Preece & Jones (1985), Jolicoer & Berger (1988b), Mustoe's (1999) and Carvin (2000). Teachers seem to lack criteria as this thesis has argued. What is interesting is that teachers expressed the need not for specific skills that they should know; rather greater awareness of what is available, easy access to software, time and places to preview packages, and access to official reviews, or hands-on experience from colleagues. This suggests indirectly that teachers do not feel responsible for performing any evaluation. Instead, they need information found in reviews that would help them to use it in their classroom and in turn it would help them to decide on its educational appropriateness. Classroom teachers do not find helpful the information found in the manuals (supporting literature), as Blease (1986, 1988) has reported. One thing that emerged in this study is that educators do not access, or are not aware of, the available websites that present software reviews (see Appendix 7A).

What criteria should teachers use in order to select software to support basic literacy skills? But first of all, I will discuss the "general influential criteria" (see

4.6.) that can be applied to all educational software. The literature suggests a list of such factors. These are: **a)** software has been tried out with children, **b)** it caters for different ability levels, **c)** it is consistent with the school's EO policy, and **d)** it covers NC / NLS objectives. Indeed, it has been argued in the literature that software that has not been tried out, or does not cover NC objectives, should be dismissed (Squires & McDougall, 1994; Clements & Nastasi 1993). All general influential factors are found very influential by both stakeholders.

Software that has been tried out with children is found highly influential by both teachers and developers. The study revealed a significant relation between teachers' teaching experience and software that has been tried out with children. 48,6% of educators with more than 20 years in the profession tend to find "software that has been tried out with children" more influential than their younger in the profession colleagues. The more experienced teachers find such computer packages very influential compared to the new in the profession colleagues. Moreover, a significant relation is revealed between the two stakeholders (teachers and developers) in relation to "software caters for different ability levels". It means that developers find more influential software that caters for different ability levels than teachers do.

As for criteria, only a small number of teachers (n=13, 11,6%) have a written guidance or criteria to select such software (I have named them *existing criteria*, see 7.5.). The analysis of question 18 (teachers' questionnaire) sought to find out the aspects of software that would appeal to teachers and they would expect developers to consider. These aspects were named *ideal criteria* and function as criteria found or proposed by this inquiry. What is even more interesting is that the existing and ideal criteria are very similar to the ones found in the literature (Henniger, 1994; Hohman, 1998; Haugland, 1992; NAYEC, 1996; DATEC, 1999-2001). I have named them *criteria suggested by the literature* (see 4.5.1.). The following table summarises all three kinds of criteria and shows the similarities:

Table 8-1 Contrasting the existing criteria, the criteria suggested by the literature and the ideal criteria

Existing Criteria	Criteria suggested by the literature	Ideal Criteria
Content appropriateness. Links to NLS / NC	Appropriate content.	Easy to use
	Attractive (technical features)	Attractive. Motivating (technical features)
Interactivity (feedback) Instructional characteristics	Supportive use of feedback. Instructional characteristics	Linked to NC / NLS Objectives / content / age appropriateness
Differentiated	Different levels of challenge. Sequencing of learning	Interactive (instructional characteristics)
Easy	Ease of use	Differentiated
Record of achievement	Avoiding bias, violence and inappropriate content	

Considering the above convergence of criteria that this study has found, I will proceed to a brief analysis of the *ideal criteria* because they are the ones proposed by the classroom teachers. They are based on their personal experience after observing their pupils using computers. They are presented in order of preference. An analysis of each of them follows.

a) <u>Easy to use</u>

It is a nice start when children embark on a new activity to find it fairly easy after a few trials. Complex and confusing software might cause frustration and pupils may give it up. At some point, after initial exposure, children should be able to use it independently. Usually, young children (beginning readers or less skilled readers) do not like to be patronised unless they face difficulties (see 3.11.). Besides, teachers do not have the time to be present all the time while pupils work on the computer. This is true for less able pupils that need a lot of guidance and supervision. The teachers of this study have stated, as a first criterion, software that is easy to use.

b) <u>Technical features (sounds, pictures, animation, colours)</u>

The ability of computers to use a variety of entertaining features, such as pictures, memorable characters, colourful design, sounds, speech facility makes it a highly motivating tool for young users. Pictures are motivational not only of the aesthetic value, but because they help children to recognise to words, help with comprehension, hold attention, and have long-lasting effects on children's understanding of text. The use of speech facility and picture can provide a multi-sensory approach to reading, a very appropriate method for teaching young children, and children who have reading difficulties, to learn to read. Animation is seen as highly motivating. The teachers of this study have experienced the powerful impact of these technical features and see them as an essential criterion in selecting software. They find all these features as appropriated criteria for selecting educational software for young children, and it seems that they are not aware of the risks of sounds and animation. Happy faces and the game-like format do not mean that software is of educational value (see 3.8.2.). Sounds and animation should be used in modesty, and only when conveying important information. It seems that educators cannot avoid the "fun syndrome".

c) <u>Links to the NC / NLS objectives</u>

The relevance of the content of computer packages to the ongoing learning goals has long been suggested in the literature (McDougall & Squires, 1995b; Jolicoeur & Berger, 1988a; Haugland, 1992; Taylor, 1987; Clements & Nastasi, 1992; Winkler et al., 1985; Ridgeway et al., 1985; DATEC, 1999-2001). The pedagogical soundness of software is defined by Winkler et al., (1985) as the outcome of the appropriate integration of computer-based learning with the teachers' instructional goals. Teachers in this study are found to expect the content of software to be linked to NC / NLS. Educators are working under a tight schedule and it is high unlikely to have time to occupy young learners with content that is not relevant to their objectives, and does not contribute to pupils learning. The study reveals that only half of producers (50%) link the content of their product to the NC objectives. <u>It is logical to argue then that half of the existing software does not satisfy teachers in that respect and that existing</u>

software cannot be integrated with the ongoing curriculum. Such a criterion (links to NC / NLS) also ensures the age and content appropriateness of software.

Age and content appropriateness

It refers to the content of software that includes various pre-reading skills. In Chapter 2 (see 2.6.), I have discussed what these skills are and their importance, namely the alphabetical principle, phonological awareness – onset and rime skills, and sight words. Teachers have to select software that "teaches" those skills (phonics, syllables, making sentences, wordbanks) just as they would do if they come to select print material. Besides, those activities are a good match for skills and language concepts that develop during this school period. Such concepts reflect the realistic expectations that education has for young pupils. The teachers of this study have clearly stated the importance on that issue and find critical the content to be appropriate to the age and academic level of their pupils.

d) Instructional characteristics (rewards, mild corrections, repetitions, interactive)

Special attention to the instructional design is also accentuated by various authors (Taylor, 1987; Shuell & Schueckler, 1989; Schueckler & Shuell, 1989; Kosakowski, 1998; Kearsley, 1985; Steinberg, 1983; Reitsma, 1988; Sloane, et al, 1989), and has become an area of specialisation on its own. Kearsley (1985) argued that interactivity is the *reson d' etre* of technology in schools mainly because it makes computers capable of providing *individualised* instruction. In a way, the machine takes over the teacher's role (it does not substitute the teacher). Educators of this study realise the potentiality of the machines of giving and different kinds of feedback and have suggested that literacy packages should provide positive feedback (rewards), practice but not too repetitive (mild corrections). It would also be very helpful if software includes an assessment system that would enable both teachers and pupils to track the progress.

e) <u>Differentiation or Sequencing in learning</u>

Just like textbooks begin with simple activities that gradually are enriched with more complicated activities, computer programs, designed for multiple levels of achievement, allow room for children to grow. Reading, just as any other activity in early primary classroom, is mostly acquired in a sequential mode moving to more difficult tasks provided that they have consolidate the previous levels. Papert (1980) has called it *expanding complexity*. This feature allows software to be used not only by able children, but also by their classmates who show some difficulties compared to their classmates, or by older pupils with reading difficulties who are found to be at the same reading level with KS1 pupils. The teachers of this study stated differentiation as a criterion mainly because they can use it with pupils with different ability levels and because such programs would help young users to acquire pre-reading skills progressively. Up to here, I have discussed the criteria that teachers in this study have indicated as appropriate criteria (*ideal criteria*) for KS1 teachers to use in order to select software designed to support teaching basic literacy skills. I have emphasised the lack of criteria and that no appropriate software evaluation method exists. Do teachers evaluate (*preview*) software before classroom use?

I have described in Chapter 4 (4.1.) the nature of the preview process and its importance. Why is previewing essential? The literature (4.4.1.) indicates the following reasons:

- There are no software evaluation methods for teachers. Checklists, reviews, accompanying literature mostly provide technical information.
- Half of the companies do not perform any evaluation.
- It helps teachers understand how to use software with their pupils.

Nowhere did I come across any piece of information regarding teachers previewing software. This study reveals that just above half of teachers (51,8%) preview software. But the preview process should include children (Squires & MacDougall, 1995; Reiser & Kegelman, 1994; Zahner et al., 1992), and that their role should be only participatory since children are not accurate at predicting the educational value of software (Jolicoer & Berger, 1988a; 1988b). This study shows that the majority of teachers (42%) do not involve pupils (both questions had high percentage of missing information, namely 22,3% and 44,6% respectively).

But what this study has found is a significant relation between sufficiently trained teachers to use ICT and teachers who preview software before classroom use. All teachers who feel "completely" trained (n=10, 100%), and the majority of those who feel "adequately" trained (n=27, 73%) preview software before they use it in their classroom. In contrast, half of the teachers (n=7, 50%) who feel "not at all" trained, and the majority of those who feel "a little" trained (n=14, 53,8%) do not preview software before classroom use. The more confident in ICT teachers tend to preview software more than their less confident colleagues. Because confidence is related to more training, perhaps their training informed them to be cautious of the quality of software. Similarly, a significant relation is found between teachers experience and teachers who preview software before classroom use. The majority of teachers (60,9%) who do not preview software are teachers who have more than 20 years in the profession. In contrast, 65,2% of teachers with up to 10 years of teaching experience and 77,8% with 11-20 years of teaching experience preview software before classroom use. What all the above indicate is that the confident teachers in using ICT, and the young in experience teachers (up to 20 years in teaching) tend to preview packages more than their less confident and older in the profession colleagues. The relationships are correlational, and not causal.

The literature has indicated several factors that may inhibit the preview process (4.4.2.). These are:

- Limited ICT resources (computers, large micro-density figure, a few software).
- Limited access to ICT resources (not frequently used)
- Teachers' and pupils' ICT skills
- Lack of criteria.

This study has found that teachers have access to ICT resources (computers and literacy software), but their access is not frequent. Patently, this research has indicated sheer lack of criteria, and teachers' low confidence in using ICT. There is a strong probability the above factors (limited access and lack of criteria) prevent teachers from previewing software, but more exploration is needed. The evidence that teachers do not preview software especially including children perhaps means that teachers just skim through the program and familiarise themselves. Another possible reason why teachers skip the preview process is the limited number of software in their library (they use whatever software is available and the do not have the privilege to choose). It seems that educators are not aware of the precious information they might gain observing children using software.

The study has shown that just over half of teachers evaluate (preview) computer programs before classroom use. What about developers? Do they software before launcing it in the market? The literature indicated that only half software is evaluated by developers (Truett & Ho, 1986; Dudley-Marling & Owston, 1987). Tergan (1998), and Reiser & Kegelmann (1994) wrote that companies seek no empirical evidence of student performance. Owston & Wideman (1987) took a medium position saying that in much fewer occasions evaluators observe pupils as they work their way though the program. The following summary table depicts the situation by contrasting sides, teachers and developers:

Table 8-2 Summary table of teachers who preview software and developers who evaluate their products

Teachers **The preview process**	**%**	**Developers** **The evaluation process**	**%**
They preview software	51,8	They evaluate software	50
They involve pupils	13,4	They involve pupils	50
They give feedback	14,3	They seek feedback	45,5

The findings of this study fully support the evidence of Truett & Ho (1986) and Dudley-Marling & Owston (1987) that only half of companies evaluate software. Equally half of them are found to involve pupils in the evaluation process, as Owston & Wideman (1987) have reported. Evaluators use a variety of ways to "evaluate" software, this is they often review the program holistically, and reach an overall conclusion based on their impressions. They review it just like reviewing a newly published book (Bangert-Drowns & Kozma 1989; Johnston, 1987). This study though cannot provide evidence of how exactly this evaluation process takes place, it shows that half of software do not undergo any trial neither from teachers nor from developers.

It was indicated in the literature that one of the problematic issues is who is conducting the evaluation process. There are strong indications that teachers should be the evaluators of educational software (Squires & McDougall, 1994; Johnston, 1987; Dudley-Marley & Owston, 1987; Owston & Dudley-Marley 1988). The positive finding of this research is that manufacturers mostly use classroom teachers in designing and evaluating software. Classroom teachers did not indicate that they should be the evaluators; rather they want to have access to reviews and experiences of other teachers.

A significant discrepancy found in the previous table (8-2) is that the majority of the developers (50%) seek feedback from classroom teachers. In contrast, only 14,3% of the teachers gives feedback to teachers. The issue that emerges here is the gap of communication between the two stakeholders (teachers and developers). Developers indicate that they usually send their product to schools, and then expect classroom teachers to "evaluate" it, and send a critical report. The picture is vague here. Actually, such arguments about the miscommunication have long being supported by Ridgeway et al. (1984) and Scaife, et al. (1997). There is some indication in this study that by "evaluation" developers mean a trial process during the developmental period, a *formative* kind of evaluation:

Company 9: "It really depends on what you call evaluation. We always have a feedback loop in the developmental process and seek responses, rather than anformal review".

The over all picture of software evaluation is not clear and merits more investigation. Software evaluation though is not an easy process (see 4.6.). It has proven to be a forbidding, difficult, and expensive task (Ridgeway et al, 1984; Preece & Jones (1985); Taylor (1987); Squires & McDougall, 1994). In chapter 4 (see 4.4.), I have pointed out factors that prevent developers from conducting formative evaluation (Jacobs, 1998; Dick, 1980). This study shows that *time* is the main factor that inhibits the evaluation process. There is also another side to consider. Namely, software needs to be upgraded. This study reveals that 45,5% of the companies has to upgrade their products every 1 – 2 years. The fact that the evaluation process is indeed expensive, difficult by nature and time-consuming, then evaluation can become an extremely problematic issue for them. *Money* issues are clearly involved.

Thus far, I have discussed the issues related to the first broad aim of the study. Now I will move on to the second aim, which is to explore children's attitudes towards using initial literacy software and the technical and instructional elements in such software.

Young children like to work on machines because of the **fun games**, because they do **literacy activities**, and other curriculum activities. To a lesser degree, because they **discover things**, and **work with friends**. All the above indicate that computers are highly motivating tools that young children not only enjoy using, but also they find that they can be a valuable asset in their learning. Regarding initial literacy software, 66,3% of the children, participated in this study, have used basic literacy "games". Most of them (70,8%) believe that such programs help them with their reading and spelling. In particular, they find that such software helps them with the following skills:

Table 8-3 Reading skills that computers help children with

Reading and read out words
Practicing spelling words
Listening to talking stories
Writing about something
Making sentences

Children indicate that such games help them with basic reading activities, such as letter recognition, learning words, spelling, typing words or their names, making sentences, or even read words out for them. Quite a few young voices said that "the Talking stories CDs" are very helpful in that respect. The studies of

Medwell (1996, 1998) with nursery children, and Taylor (1996) and Adam & Wild (1997) with children with reading difficulties found that such programs contribute towards pupils academic gain in terms of pre-reading, in this study such evidence comes straight from the pupils experience. An example of such CDs is the Oxford Reading Tree and Sherston Naughty stories (see Appendix 2), that this study has found that are used widely in primary schools.

Another reason why pupils like basic literacy games is that they these programs make pupils think, as young Jennifer (Yr1) said:

"...there is this group of words and we try to spell...and we think how to get them right"

Finally, literacy games help them with their reading by providing opportunities for practice. Discussing the pedagogical value of ICT (3.9.), the literature extensively supported the use of computer as a patient tool that provides ample opportunities for practice in reading (Reitsma, 1988; Davidson, 1996), especially learning sight vocabulary (Torgesen, 1986; Van Daal & Van der Leij, 1992; Wise et al., 1989). The studies of Torgesen (1986) and Swan et al. (1990) show that practicing further on the computer helps children consolidate basic reading skills. In this study, the evidence comes directly from young learners' experience. Abbey clearly shows this by saying:

"..because we do extra work like spelling words. We do it again and again and that helps"

It is not only the motivational aspect of computers, but also their contribution to pupils' learning. Young computer users (77,7%) believe that the machines help them to learn. The reasons why they believe so are: **computers read texts and stories** and **reads out words** for them. Additionally, they do **writing and spelling**, and other curriculum activities, such as geography, history, and maths. Interestingly, Yr2 pupils find that **Internet** helps them learn in terms of extensive learning (the topic is introduced to children in the classroom, and then they search for further information in the web (i.e. children's confession about Van Gogh and Henry VIII). Conclusively, there is no doubt that pupils enjoy working on computers, and that they have positive attitudes towards technology. Such evidence comes also from the studies of Yelland (1995), Williams & Ogletree (1992), and Selwyn & Bullon (2000). The arguments of Clark (1986) and Tweddle (1992) that the screen causes tedium and eye strain or give headaches (Motteram, 1990) was only found in 5 young learners (5,1%).

The opinions of the pupils regarding to literacy games, to computers in general, and their contribution to learning are summarized and contrasted in the following table so the reader can visualise pupils' responses:

Table 8-4 Contrasting children's views on: A) basic literacy games, B) on computers in general and C) computers' contribution in learning

Column A **Specific ways that computers help with literacy**	**Column B** **General reasons why children like computers**	**Column C** **General ways that computers help pupils learn**
Reading and read out words. Making sentences. Listening to talking stories	Games (good, nice, interesting, funny)	Reading words / text, reading out words, listening to stories, spelling, and writing.
Practicing spelling	Because it is fun Basic literacy activities	Other curriculum subjects, find out things / quizzes
Writing about something (think).	Drawing activities, other curriculum activities	Internet
	Because they find out things	
	Work together with friends	

No matter how the question was stipulated, directly or indirectly (do you like working on computers, in what ways do basic literacy games help you, or do you think computers help you to learn) the above table shows that initial literacy software have a positive impact on their learning, and on the development of basic literacy skills. Pupils' confessions are explicit and clear.

The literature is not clear regarding gender and computers. The studies of Williams & Rosenwasser (1987-1988), Todman & Dick (1993), Williams & Ogletree (1992), and Yelland (1995) addressed no sex differences. On the contrary, the studies of Siann et al. (1990), Martin (1991), Wilder et al. (1985) and Hawkins (1985) suggested that computers are "masculine". This study investigated computers in relation to literacy games and found no gender discrepancies. Equally, boys and girls like to work on such games. In addition, pupils, irrespective of gender, feel confident in using the machines.

Regarding the working mode, the literature indicates that the preferred working mode in young children is "in pairs" in traditional teaching (Kruger, 1993). In using computers, the studies of Shade et al. (1986) and Spiegel- McGill et al. (1989) have come up with similar conclusions. Align with the above reports are the conclusions of this inquiry. Children (42,5%) prefer to work in dyads. More over, they provided reasons why they like to do so. These are:

a) Small groups get a bit crowed, disruptive and annoying since a lot of shouting and shoving takes place. Such evidence is supported by the study of Weeks (2000) who observed that groups of three children were more likely to become distracted by background noises, as they were not always involved in the computer activity. Lipinski et al. (1986) came up with such findings.

b) Pupils prefer working in pairs because they work with a friend and they do not feel embarrassed when they have made a mistake. In larger groups they do not have privacy in that respect and pupils interfere with the work of others.

c) To a lesser degree pupils like to work in dyads because quite often there is not enough time for all members of a group to finish the tasks on the computer, and they are afraid that not enough time will be left for them. Here again we come back to the strict timetable access to ICT resources and its disadvantages, as well as the importance of a small micro-density figure. The computer users implicitly refer to all those reasons that make the computer to pupil ratio essential in teaching (see 5.4.). Being unable to finish their tasks, the quality of their learning experiences is doubted. Working in large groups makes some of them to lose their turn suggesting thus unequal access to ICT resources. Finally, pupils feel that under such circumstances, antisocial behaviour emerges, which of course frustrates and confuses them, and interferes negatively with their learning.

Various researchers have talked about different difficulties that young pupils encounter when working on computers. The two online surveys "The Computer Clubhouse" and the "Plugged-In" (The Future of Children, undated) found that young pupils have difficulties with operating the computer (navigation). They do not know when things go wrong, and find their way around the program. Weeks (2000) observed that young users have difficulties with the mouse. In contrast, Hayward (1990) and Genishi et al. (1985) found that none of the above is true. This study has directly asked pupils to talk about their difficulties with an emphasis on literacy software, and also has contrasted them with that of teachers' and developers'. The majority (71,4%) admitted that they face difficulties that have to do predominantly with **navigation**. Just like the findings of the online surveys, children are unable to load a program, to log in, to change games and activities. It seems that quite often they click on the wrong icon, the program shuts down accidentally, and then have problems resetting it. They do not know what to do next when the computer freezes:

Lauren: "Like when I'm stuck…it can't help you because they don't tell you anything".

What makes them stuck is that they press the wrong button; they forget what button to press for different operations. Because of these difficulties children, like Lauren, ask for visual aids or instructions that would help them to find their way around and use games independently.

A second major difficulty pupils come across is to **perform the literacy activities**. Their confessions were quite clear. They do not know how to read and spell words, and they do not know to make a sentence in cloze activities. Just as they have difficulties in reading words or spelling using textbooks, children find themselves in the same condition when using literacy computer programs. Either in traditional teaching, or CAI, beginning readers face the same difficulties Young readers find some computer spelling games quite hard. It seems that working on literacy games, young children have double difficulties: **a)** to find the right answer, and **b)** to find their way around the program. The above definitely mean that working on literacy games is harder than working on text material. I have accentuated that reading on screen is much slower than reading textbooks (Higgins & Wallace, 1989; Reinking, 1988; Beveridge & Edmundson, 1989) (see 3.8.1.).

The third thing that young children find difficult in computers is using the **Internet**. I did probe a number of pupils (n=33) about the mouse, but the majority finds it quite easy. Of course they face such difficulties in the beginning, which they overcome with practice and familiarisation. This finding opposes the observations of Weeks (2000) that children have difficulties with the mouse probably because the children in the study were younger and the observation period lasted a couple of weeks. Or perhaps her study took place in the beginning of the school year when children do not have enough time to practice. These interviews were taken place with older children at the end of the school year (July).

Further this study has contrasted the difficulties that young children encounter. It seems that the perceptions of the three stakeholders perfectly match, as the table shows below. This means that teachers and developers are well aware of the difficulties young users encounter.

Table 8-5 Contrasting the stakeholders' opinion on pupils' difficulties

Teachers	Developers	Pupils
Navigation / mouse keyboard	Navigation / Saving / printing	Navigation
Reading text / Spelling	Inability to read text / understand narration	Performing literary tasks
Need teacher's support	Lack of sufficient access / time	Internet

Up to now, I have discussed general issues regarding the use of technology by young learners (gender, preferred working mode, what children think of computers and initial literacy software, how do they contribute to their learning, and their difficulties in using them. Now, I will move to more intrinsic elements in basic literacy software. Computer programs do not only consist of the content, but also of the technical features (pictures, colourful design, sounds, animation) and instructional characteristics (positive and negative feedback, repetitions, opportunities for practice). This study asked pupils to voice their opinions about each of the above elements in literacy software.

Technical features

The aesthetic value of pictures is difficult to dispute especially in the early years. Huey (1908/1968) made positive remarks about them. But it is not the aesthetic aspect of pictures that make them valuable. Many authors believe that pictures contribute to pupils' learning. In particular, images help beginning readers to read more quickly and fluently (Marriot, 1992), to understand unfamiliar topics found in the text (Sanders, 2001; Meek, 1991). Pictures are highly motivational and sustain pupils' attention (Atherton, 2002) Willows et al. (1981) found two pedagogical issues in pictures:

- Pictures as aides for word recognition.
- Pictures as support for comprehension and interest.

The above assumptions though are found in relation to textbooks. For electronic material there is the evidence of Wepner & Kramer (1987) who strongly suggest pictures according to the rule "a picture is worth a thousand words", but it was not researched-based, merely an assumption. This study shows that KS1 pupils (78,6%) like pictures in literacy software. The difference is that Yr1 pupils emphasised the aesthetic value "pictures make the story like real", where as the Y2 group seems to acknowledge the educational value of pictures to reading. Pictures, in literacy software, help them to read, understand words, and to understand the story:

Lizzie "....if I can read the word, I can just look at the picture, and it gives me the clue, and that helps"
Ben: "By looking at the pictures, I can understand the story"

It is suggested that electronic pictures, just like in textbooks, have a dual purpose: aesthetic (motivational) and pedagogical (helps pupils to read and understand words or texts). This evidence fully supports the findings of Willows et al. (1981) regarding traditional teaching.

Regarding the colourful design, the literature has not shown any information involving children, probably because the colourful design irrespective of the text format (print or electronic) is taken for granted. Indeed colours attract young pupils' attention. KS1 pupils (90,8%) like the colourful design exactly because it makes it attractive:

Tom: "I guess because it is more attractive, that is why I like it"
Ravenna: "Because it looks like a rainbow, and I like the colours of the rainbow"

As for the sounds and animation, Wepner & Kramer (1987) expressed reservations and suggest that they should be used prudently. Similarly, Shade (1994) warns teachers to avoid the "fun syndrome" when it comes to software selection. This study sought the opinion of pupils regarding the above elements. Differences were found between the two age groups. Yr1 group 80,6% enjoys the sounds, and they like it because the make the story interesting, like real:

Hannah: "...because you think you are by the seaside when you hear the waves"
Jennifer: "....I don't want just to watch pictures.....sounds make the story interesting"

A significant part of this group (34,5%) likes sounds because they identified the concept with the speech facility. They said that they like it because it reads out words they do not know to read, or spell, read out whole stories, or pronounce letters for them. Among the Yr1 children, there was a significant portion (38%) that posed certain condition. They stated that they like sounds but the volume must be low.

On the contrary, the majority of Yr1 pupils (53,3%) expressed serious concerns about sounds.

Billy: "I don't like sounds because when you are trying to do something....it gets on my nerves".
Eve: "Sounds are interfering especially when I am trying to read. They are loud and noisy".

Patently, Yr2 pupils disfavour sounds. They complained about their quality and explained that sounds are annoying, distracting and irritating because they are loud, noisy, or squeaky. Some noises scare young users, or they give headache. A serious allegation is that sounds interfere when trying to perform an academic task, such as reading. It seems that older pupils seem to value the work on the computer as part of the classroom activities, and wish to complete in peace without environmental disturbances just like any conventional classroom activity. Wepner & Kramer (1987) rightly expressed reservation about sounds suggesting modesty. This study provides similar evidence; further more it reveals differences in opinion between Yr1 and Yr2 pupils. As for animation, the majority of KS1 pupils (72,5%) likes moving characters mostly because they are funny, and they are similar to cartoons they watch on TV. Children had not much to say about why they like animated characters.

Instructional characteristics

One of the main characteristics of computers, the reason d' etre, is *interactivity* (3.8.2., pp.72-73) that gives computers the ability to play an essential role in teaching by letting the child to be in control, branching to activities of different levels and by providing feedback.

As I have discussed in 3.8.3., feedback is a unit of information about the pupil's progress that in traditional classrooms is given by the teacher. In CAI, feedback creates a sort of dialogue between the program and the user. As it has been argued throughout this document, this sort of interactivity makes computers popular for *individualised* teaching. Tait et al. (1973) emphasised that feedback improves pupil's performance, especially for low achievers. Feedback has little effect when few errors are made. There are various kinds of feedback, but this study has concentrated on *positive* and *negative*. In traditional classrooms positive feedback (rewards) can be offered in simple verbal methods (good try, well done), in facial expressions (smiling), in gestures and a pleasant tone of voice (Kyriakou, 1992). Computer games can imitate teachers' responses using the speech facility and / or animated characters. The above author defended the use of praises (positive feedback) arguing that the rewarded behaviour is more likely to occur in the same situation in the future, a widely known principle based on the theory of behaviourism. Moreover, Hohman (1998) argues that positive feedback keeps the child working on the activity. This study has asked young pupils' opinion about this specific kind of feedback given by computers (software), and the feelings that it produces. Positive feedback seems to have a great appeal to the majority of pupils (76,5%), mainly because:

- It creates a nice feeling, and boosts their self-esteem.
- It lets the child know how well s/he is doing.

Raaj: "Yes, ...becauseI feel I am succeeding something"
Victoria: "Yes, ...because I know I am doing fine".

What the children are telling us here is that feedback has a dual effect on young pupils' feelings, motivational and pedagogical. The motivational aspect of praises is that it boosts their esteem and confidence, where as the pedagogical is that pupils know how well they are doing. Such findings give support to the arguments of both authors above (Kyriacou, 1992; Hohman, 1998). This study is limited though in providing appropriate ways in which positive feedback should be delivered (i.e. facial expressions, or verbal cues. Throughout the discussion with some pupils (n=17), it came up that pupils prefer verbal cues, such as "good try" or "well done", to the point system, but the issue needs further exploration.

Negative feedback is the unit of information delivered by the computer games that makes critical comments about pupils' performance. Kyriakou (1992) defended that pupils need specific help, not critical comments. The issue has divided KS1 pupils.. The majority of Yr1 pupils (72,3%) like the computer games to be critical of their progress, and inform them about their mistakes because:

- Negative feedback helps them to know how well they are doing.
- It prevents them from having to repeat the activity.
- It allows them to go on to another task.
- It helps them to learn from their mistakes.

Samantha: "…then you know what is wrong and what it is right"

Conversely, the majority of Yr2 pupils (53,7%) disregard this teaching characteristic (negative feedback), and they are not pleased, for the following reasons:

- Negative feedback hurts their feelings.
- It annoys them.
- It makes them feel incompetent.
- It leads to more repetitions and then much talking is taking place.
- It does not allow them to discover.

Daniel: "It hurts my feeling… I feel nervous"
Josh: "It makes me feel stupid, and then I want to do something else"

The differences between the two age / level groups are striking. Yr1 pupils do not mind negative feedback, they find it helpful in their learning, where as Yr2 pupils find it annoying, hurting their feelings, and obliging them to repeat activities. But what is interesting is that Yr2 pupils do not like negative feedback because they want to discover their mistakes by themselves. I have mentioned above that one of the reasons why pupils like computers in general is because they find out about various things. In the literature, the studies of Hoffman, et al. (1984) and Lewin (2000) concerning feedback and reading, suggest that by providing the word immediately does not encourage independence. Similar findings are suggested by the study of Olson & Wise (1989) with pupils with reading difficulties. Scott et al. (1998) suggested that software programmed to reward correct answers while assisting with incorrect contributes to its effectiveness as an instructional tool. Corrective feedback should guide the child to the correct solution (Hohman, 1998). This study does provide evidence that supports the above arguments, this is negative feedback does not allow pupils to discover the mistake by themselves; in other words, it does not encourage independence. Further this study suggests that negative feedback has a detrimental effect on pupils' feelings (Yr2).

In Chapter 2 (see 2.5.1.), I emphasised the importance of practice and repetition in acquiring pre-reading skills. Karweit (1985) identifies proficiency in reading with ample opportunities for practice. A series of eminent researchers has also emphasised the importance of practice in reading (Herman (1985; Rashotte & Torgesen, 1985, 1986; Dowhower, 1987; (Perffetti, 1985; Stanovich, 1986; Topping, 1995; Huey (1908 / 1968; Duffy & Roehler, 1982) either in decoding, fluency or comprehension. But Tan & Nicholson (1997) suggest that RR (repeated reading) can be boring for fluent and able readers. Computers are famous tools for providing one-to-one teaching, and for providing endless and patient opportunities for practice (see 3.9.) provided that there are enough computers in the classroom (Torgesen, 1986; Swan et al., 1990). Extensive drill and practice exercises consolidate basic reading skills.

Having to repeat computer activities has divided the two groups. Yr1 pupils (77,8%) have no problem being asked to repeat the activity, though only a small number could provide an answer (n=16). They do not mind, it is fun for them, and they believe that this helps them to learn:

Abbey: "...because I learn if I repeat it"
Lucy: " ...it becomes easier"

Adversely, Yr2 pupils (51,7%) do not like being asked to repeat the computer activity, and the reasons are that (repeating an activity):

- It causes boredom.
- It makes pupils impatience.
- It is annoying and causes frustration.
- It is time-consuming.

Karen: "Well, I may feel like sometimes I get frustrated when I have to do again and again"
Conan: "...'cos it takes a long time to finish....I would worry if my classmates needs to take over"

Yr2 pupils take a different stance. Having to redo a task causes impatience, annoyance and frustration. To some of them repeating is boring. Also, they are concerned with not allowing their classmates to take over. Here again, the issue of restricted access and large micro-density figure emerges. Strict timetabled access, and large computer to pupil ratio interfere with pupils not being able to finish their assigned tasks. It does not give pupils ample time to "practice" on their work limiting thus the capability that the machines can do best: provide opportunities for practice.

What is interesting in this study is that a significant relation between gender (Yr2 pupils) and having to repeat a computer activity has been found. A significant part of Yr2 pupils (63,6%) – who rated "Not at all" software that asks them to repeat the activity – were boys. This indicates that boys are less willing to repeat their work than girls. The issue merits further exploration.

Finally, KS1 pupils (71,4%) do not mind working on similar activities found in textbooks. The majority (74,5%) have said that they like literacy games to read out words. The difference is that Yr2 pupils (62%) want to try first, and if they fail, then they are happy to call for assistance:

Ryan: "...but I want to have a chance to read it first because I can read".

What Yr2 pupils state here is that they do not want software to volunteer help; rather they want to be granted the opportunity to test their abilities first. This evidence aligns with what Hohman (1998) and Lewin (2000) have argued for. Corrective feedback should allow several tries to guide children to the correct solution and should not be giving immediately. All the above lead to the conclusion that pupils do not like immediate feedback.

KS1 pupils (82,7%) like games that read out the instructions. The difference is that a significant number of Yr2 pupils (47,9%) like this facility, but expressed their reservations fearing that it might cause a lot of disruption due to noises and poor quality of sounds. They are afraid of too much patronizing from the machine:

George: "Yes, but it becomes sort of annoying. I don't like it telling me what to do all the time."

Finally, the study compared the views of the three stakeholders (teachers, developers, pupils) on technical features and the instructional characteristics discussed previously. The results of the Kruscal-Wallis tests have shown significant differences in pictures, sounds and animation. In particular:

- Pictures are more valuable to pupils and less to teachers.
- Sounds are less valuable to pupils and more to teachers
- Animation is valued more by teachers and less by developers.

The rest of the software elements were not found to differ significantly among the three groups, which means that stakeholders do not view them differently. The study is not able to give explanations why these differences are found. This would be illuminated if interviews had taken place.

8.3. Summary

In this chapter, I have discussed issues that emerged from the data analysis keeping in mind the aims and research questions of the study, as well as the different paths that each of them were investigated. The illumination gained by the above presentation will help the researcher to reach the conclusions that will be dealt in the next chapter. First, I will refer briefly to the important points in the above discussion.

<u>The extent to which teachers use initial literacy software</u>

Literacy software is occasionally used in primary schools. Schools have formed ICT policies, which mostly accord with the DfEE / NC guidelines. Their policies emphasise the importance of technology to pupils' learning and how schools will achieve those aims. Schools are equipped with computers and literacy software, but still technology is not used regularly. Therefore, teachers are not able to see the impact of technology on young children's learning ("No use, no impact" Norris et al., 2003). Thorny issues related to limited access are: **a)** the micro-density figure **(1:13)** that is quite high. In sections 3.3., and 5.4., I have clearly defined the importance of small micro-density figure and its implications; **b)** teachers' low confidence in using ICT. There is just a marginal difference between the confident and the less confident groups. A significant finding of this study is that the older in age educators and those with many years in the teaching profession fell less confident in using ICT than their young in age and in the profession colleagues. Moreover, the developers' opinion is that teachers ICT skills are low.

Criteria to select software

Teachers do not have any criteria to select software. Only half of the companies perform some kind of evaluation (*formative* in nature, see 4.1.) and just over half of teachers preview software. Children are not included in neither of the above evaluation processes. This means that software does not undergo any kind of evaluation (formative or previewing) before reaching children. In addition, there is a gap of communication between teachers and developers.

Teachers do not know what makes software of educational value, and it seems that they do not need skills; rather they need time to preview software, to be informed of the available software and how to link it with the NC requirements, to have access to official reviews and discuss with other colleagues their experiences. The above shows that teachers are unaware of the available computer literacy programs and they do not know sources that provide software reviews.

Regarding the general influential factors (see 4.6.), teachers find them highly influential for selecting software. Older in the profession teachers find software that has been tried out with children more influential than their new in the profession colleagues. As for specific criteria for selecting initial literacy software, they have emerged in this study (ideal criteria) by classroom teachers. These are: **a)** software should be easy, **b)** it should be motivating (include technical features), **c)** it should be linked to the NC / NLS objectives, **d)** it should include instructional characteristics (praises, mild corrections and repetitions – interactive, record keeping), and **e)** it should cater for different abilities.

An interesting finding is that these specific criteria (*ideal criteria*) perfectly match the *criteria suggested by the literature*, and the criteria employed by a small number (n=11) of teachers (*existing criteria*).

Young children and initial literacy software

Children find computers not only motivational tools, but also they stressed the and pedagogical value. Young pupils have used literacy software and believe that they help them with their reading in the following ways: **a)** read out words, **b)** practice words (spelling), and writing, **c)** listening to talking stories, and **d)** make sentences. Children like to work in pairs and they explained why. No gender differences were found. They face two main difficulties when working on such programs: **navigation** and **providing the correct answer**. Therefore, it takes longer to work on literacy computer activities than to work on traditional work sheets. Interesting, teachers and developers are well aware of those difficulties. A few children (5,1%) find tiresome to work on the machines.

In relation to specific elements in software, significant differences were found between the stakeholders in relation to pictures, sounds and animation, and between the two age groups (Yr1 and Yr2). Furthermore, children have provided reasons why they like, or do not like those elements. Young boys (Yr2) are less tolerant having to repeat a computer activity than girls of the same level.

Chapter 9. Conclusions

This chapter will start by positioning the thesis in the context of the literature; I will present the conclusions and the implications of the findings. Next I will highlight the contribution of this research to knowledge and practice (its novelty) by providing a list of recommendations derived from the literature and the results of this study. The chapter concludes with the research limitations and avenues for further research. The journey to Ithaca has reached its destination.

9.1. The context of the study

The UK government has invested heavily in equipping schools with ICT resources, and ensuring that schools will apply ICT effectively. Its position is that ICT can contribute significantly to pupil's academic achievement and learning and should be used not only as a separate subject with its own objectives, and but also across the curriculum. Schools have developed ICT policies in order to cope with these demands where they state how to equip their establishments with machines and peripherals, and how to manage effectively these resources so as all their pupils have access to them. The government has also introduced expensive initiatives (NOF and NGfL) to raise teachers' ICT skills. The role of computers in teaching is increasing and one would assume that after all these initiatives and commitments, teachers would use computers regularly in their teaching. In USA, the studies of Marcinkiewicz (1993-94) and Norris et al. (2003) show that classroom teachers do not use technology. In UK, primary pupils use computers approximately 15 to 30 minutes <u>per week</u> (Watson, 1997, Loveless & Dore, 2002). However no studies have examined the extent to which primary schools use initial literacy software.

Research on CAI and the subject of literacy is not adequate, but the existing studies despite the limitations that apply to any piece of research indicate that a minimum of 10 minutes of engagement with such programs daily can contribute significantly to young pupil's development of pre-reading skills. In order for teachers to see the impact of technology on pupils learning, pupils should access it for a minimum of 20-15 daily. Only then can educators see the impact of technology on children's' learning and the contribution of computer-assisted instruction (CAI). In addition, regular access would enable teachers to integrate technology in the curriculum, and to see the value computer programs (Haugland, 2000).

Factors that may influence positive, or negatively, the ICT application is the ICT policy, the resources (ratio, management) and teachers' ICT skills. But an additional factor that impedes the implementation of CAI (irrespective of the subject) is good quality of software (Johnson, 1987; Scandura, 1981; Buckleitner, 1996). Software is what makes the machine run and determines if its content is appropriate for classroom application. The introduction of computers to school has caused software to mushroom in the market, but the majority is of poor quality (Preece & Squires, 1984, Taylor, 1985; Hague et al., 1986; Cosden, 1988; Borton & Rossett, 1989). There is a need for criteria that would enable teachers to select software. Only recently have criteria emerged in the literature for selecting children's software. Do teachers use criteria to select initial literacy software? This study has explored this particular area.

In order to improve the quality of software and make them of educational value, the input from classroom teachers and pupils is required. They are, after all, the reciprocates of this novice, but their opinion has been greatly ignored (Klein, 1998). Studies in young children using computers are thin on the ground, and even scarcer are studies that seek children's opinions. What we know is based on adults' observations and assumptions and is related to general issues (i.e. gender, motivation, the impact of computers on pupils' learning). No research has studied young children in relation to using initial literacy software and has listened to children's confessions regarding the use of such software. No study has focus on software elements (technical features and instructional characteristics) something that this project has focused on.

There is much to be gained from the collaboration among the three stakeholders - teachers, developers, pupils (Walker & Raynolds, 2000) because it is the only way to improve the quality of software. Therefore this study, adopting the constructivist paradigm, for the first time brought together the views of all three groups, a triangular interaction that offered numerous insights.

9.2. Conclusions and research implications

This study was set out to explore:

A. The extent to which primary teachers use software to assist teaching basic literacy skills.

The answer is that the majority of teachers (55,4%) occasionally use initial literacy programs (only 9,8% of teachers use such programs on a nearly daily basis for ten minutes). It is argued in this thesis that computers have an important role to play in teaching reading skills provided that they are used for 10-15 minutes daily (see 3.11.). Therefore, the infrequent use does not ensure that literacy programs could have an impact on children's learning to read. The above research question was investigated through various paths (ICT policy, resources and their management, and teachers' training:

ICT policies

Schools have formed ICT policies, where they emphasise the importance of technology, the rationale of that policy and how they are going to achieve their objectives (equipment, funding). All ICT policies accord with the DfEE / NC guidelines. Schools are equipped with computers, the great majority of teachers have a computer in their classroom, and literacy software, but technology is not in use. Factors that affect the use of computers are the large micro-density figure (1:13), and teachers' confidence in using ICT.

Micro-density figure

It is suggested in the literature that the ideal figure is 1:3, maximum 1:5. Large computer to pupils' ratio is essential for the following reasons (see 5.4.):

- Schools provide a balanced ICT curriculum.
- Pupils have easily and free access to computers.
- Better quality of learning experiences.
- Pupils develop positive social behaviours, and
- Previewing process becomes easier.

Until the appropriate ratio 1:3, or 1:5, is reached, schools cannot possibly guarantee that all the above take place. Primary schools opt for an ICT suite as a source for managing pupils' ICT access. The consequences of this option are (see 3.3.1.):

a) Restricted access, and
b) The discouragement of integrating ICT with the curriculum.

Teachers' confidence in using ICT

Teachers are roughly divided into two groups: those who fell confident and those who feel less confident. The older in age and in teaching experience educators feel less confident than their younger in age and new in the profession colleagues. Developers are well aware of educators' poor skills

This study was set out to explore:

B. Do primary teachers use criteria to select software for classroom use?

Unfortunately, primary teachers do not have, and do not use, any criteria to select initial literacy software (only 11,6% use a written guidance). Teachers do not need skills; rather they need the following:

- Time to look around, and greater awareness of what is available.
- Opportunities to try out software (time to preview software).
- Knowledge of how to link software to the NC requirements.
- Access to high quality reviews, and to experiences of other colleagues.

The preview process

Roughly half of teachers preview software before using it in their classroom. This study has argued that preview is a very essential process because it helps the classroom teacher to see the worth of the software, i.e. does it meet the classroom objectives, and how to use it with their pupils. Children should be involved in this process as participants who have many things to reveal about particular software. Educators though do not include children in this process. The thesis has argued for a number of factors that prevent teachers from previewing software, namely **a)** limited ICT resources, **b)** limited access to computers and limited use, **c)** poor teachers' and pupils' ICT skills, and **d)** lack of criteria for selecting software. This inquiry provides evidence that the preview process is significantly related to teachers' *ICT skills*, and to *teaching experience*. Namely, the confident in using ICT teachers tend to preview software more than their less confident colleagues. Similarly, teachers with more than 20 years of teaching experience preview software less than the "younger" in the profession colleagues.

In the same vein, half of the manufacturers do not "evaluate" their products projecting *time* as the main reason. In addition, half of companies include pupils in the "evaluation" process. A major implication of the above situation is that half of software available does not undergo any testing by developers and any trial by classroom teachers before entering the classroom. Important evidence is that there is a gap of communication between classroom teachers and developers. The former do not give, and the latter do not seek feedback on specific software. This though may well have a serious implication in improving the software design (see 1.4. and 4.6.).

Specific criteria for selecting initial literacy software (content-specific)

a)	Easy to use;
b)	Attractive motivating (to include technical features, but not sounds, as this is what young children prefer).
c)	Links to the NC / NLS objectives (include phonics, progression in phonics, alphabet concept,),
d)	Interactive (to include instructional characteristics, such as soft repetitions, awards); and
e)	To cater for different ability levels.

The thesis has argued for the above criteria and projected their justification (see 4.5.). Moreover, the study shows a congruence among the criteria suggested by the literature, the criteria already used by a few teachers (*existing criteria*), and the criteria emerged from this study (*ideal criteria*).

General influential factors in selecting educational software

- Software has been tried out with children.
- It caters for different ability levels,
- It is consistent with school's EO policy, and
- It is linked to the NC / NLS objectives.

Teachers find the above general factors highly influential for selecting educational software (see 4.6.). It is revealed that more experienced teachers find software that has been tried out with children more influential than the new in the profession colleagues. Moreover, developers find software that caters for different abilities more influential than teachers. The fact that teachers find highly influential software that is linked to the NC / NLS objectives and the fact that the same criterion is among the list of specific criteria (*ideal criteria*) above, then this thesis projects a strong argument: initial literacy software should match the NLS / NC requirements. Unfortunately, only half of the companies are found to link the material of their product with those objectives. This poses threats on the "pedagogical value" of half of the available software, and on whether software will be accepted by the educational community. Teachers will probably wonder how to integrate such programs in their teaching making the situation difficult.

The last aim of this inquiry was to explore:

C. Young pupils (KS1) thoughts on using initial literacy software and on software elements (technical and instructional).

KS1 pupils have used literacy software and find that such "games" help them with their reading. Particularly, such programs help them:

- It (literacy software) helps them to learn to read words (learning the letters of the alphabet), and it reads out words for them.
- It helps them to practice spelling words.
- It helps them write about something

- It helps them to make sentences.
- They listen to talking stories.

Children's confessions indicate that technology, and initial literacy software, have a significant role to play in their learning (see table 8-4). Young users, irrespective of gender, enjoy working on computers because of the games, which they characterise as being fun, good, nice, and interesting. They also like computers because of the literacy skills, because they discover things, and to a lesser degree because they work with friends. It is acknowledged by children that computers help them to learn because they use all these literacy software that help the to read (learn the alphabet letters, do spelling, write, listen to stories), but also to perform other curriculum activities. Internet can play an essential role in their learning especially when linked to classroom objectives. There is no doubt that young user acknowledge the pedagogical and motivational value of technology.

Young pupils prefer to work **in pairs** because groups become crowed, disruptive, annoying, and embarrassing when mistakes are made. Also, quite often time is not enough in groups for everybody to use the computer. Here again, the problem large micro-density figure emerges. In a way, young users verify that a group of children working on one computer causes antisocial behaviour (see 5.4., 5.5.). Young children face double difficulty when working on literacy software: **a)** to find their way around the program, and **b)** to provide the correct answers. It is deducted that working on computers takes more time than working on worksheets, therefore KS1 pupils need more time when working on literacy activities. The truth of the matter is that teachers and developers are well aware of the above difficulties since their opinions accord the opinions of the pupils (see table 8-5).

Software elements

<u>The content of software</u>

The content of literacy software should be appropriate to the age and reading level of the pupils, therefore it is expected to include activities that would help young pupils to acquire pre-reading skills (see 2.5.1.), such as activities that would help them with the letters of the alphabet, phonological awareness skills, onset and rimes, and sight words. The set of criteria found in the literature (*criteria suggested by the literature*), the criteria proposed by this study (*ideal criteria*) and the criteria adopted by a few teachers (*existing criteria*) all indicate that the content of initial literacy software should be appropriate for that age group.

What teaching method should software adopt? Software can adopt either DI, or holistic approach to teaching those skills just like it happens in traditional classrooms (see 3.7. the different kinds of software). This should not discourage educators since both types are useful depending on what s/he wants to teach. While structured approaches are appropriate for Yr2 pupils, for Yrl pupils, educators may well select from a variety of CD talking books. It really depends on what the teacher wants to teach and what is the level of beginning readers. For pupils with reading difficulties, the literature suggests more structured methods. If software introduces list of words, then these words should be taught in context, not in isolation.

<u>Technical features</u>

Certain technical features have divided the two age groups. KS1 pupils appreciate the colourful design and animation in literacy software because they make it attractive. Similarly, KS1 pupils like literacy software to include pictures, but for different reasons. Yr 1 group likes pictures mainly because of its aesthetic, where as the Yr2 group for the pedagogical value, this is:

a) Pictures help them as aids for word recognition;
b) Pictures help them with comprehension;
c) Pictures hold their attention and interest.

Sounds, though, have divided KS1 children. Yrl does not mind sounds because they enliven the text though they were sceptical about the loudness. On the contrary, the Yr2 group expresses serious reservations about their presence because:

a) They (sounds) are of poor quality (squeaky, buzzing, horrible noises).
b) Annoying and irritating (loud, noisy).
c) Distracting and interfering, especially they want to think or read.
d) They may cause headaches to some young children.

From the above, it is concluded that Yr2 children take serious the work on the computer, and they regard that they perform an academic task similar to a traditional activity.

<u>Instructional characteristics</u>

KS1 pupils patently prefer positive feedback (praises, encouraging comments) to negative (critical comments, notices about various mistakes). The reasons why they like praises are:

a) It lets them know how well they are doing;
b) It creates a nice feeling of success that boosts their self-esteem.

Negative feedback has divided the two groups. Yr1 does not really mind to be informed of their mistakes, because:

- It shows them how well they are doing.
- They do not have to repeat the activity because they learn it.
- They can move on to another task.
- They learn from their mistakes.

On the contrary, Yr2 group disregards it, because:

- It hurts their feelings.
- It annoys them.
- It makes them feel incompetent.
- It leads to more repetitions and then much talking is taking place.
- It does not allow them to discover.

It is noticeable that critical comments cause discomfort to young pupils and software designers should be very careful of how feedback on errors should be provided. Computers are capable of giving both immediate and delayed feedback. In chapter3 (see 3.8.3.), I have argued that the most appropriate way in teaching reading is not to give the word immediately, rather to give hints to the reader until s/he succeeds. Software should allow several tries and guide the child to the correct solution. It seems that children want exactly this kind of feedback since they claim that the opposite does not allow them to discover.

In similar vein, having to repeat an activity has divided the two level groups. Yr1 pupils do not mind repeating the activity, because then the activity becomes easier, because they learn from repeating, and they find it fun. In contrast, Yr2 pupils find that repetitions cause:

- It makes pupils impatience, and boredom.
- It is annoying and frustrating.
- It is time consuming.

An interesting evidence of this study is that a significant difference was found between gender and repetitions: boys are less tolerant than girls when they have to repeat the activity.

Young pupils do not mind to work on activities related to textbooks used in the classroom. The do appreciate and find helpful programs that read out words in the text with the difference that some of the Yr2 pupils want to be given the chance to try first. Equally, children find helpful when computer games read out the instructions for them, but nearly half of the Yr2 pupils expressed their reservation that this might actually cause disruption because of the noise and poor quality.

The issue of elements in educational software (technical and instructional) was compared from all three stakeholders' views to see how differently each stakeholder views those elements. This study has found that:

- Pictures are more influential to pupils and less to teachers.
- Sounds are more influential to teachers and less to pupils.
- Animation is more influential to teachers and less by developers.

It is noticeable that teachers are more attractive to animated characters and sounds than children. The evidence of this study is that children are cautious of sounds something that educators are not aware of. It seems that teachers cannot avoid the "fun syndrome", but pupils who are the users after all are very concerned.

9.3. Recommendations

To KS1 teachers

The study has found congruence among the *criteria suggested by the literature*, the criteria used by few teachers (*existing criteria*), and the criteria found by this study (*ideal criteria*). Therefore, appropriate criteria for KS1 classroom teachers to select software designed to support children' pre-reading skills are the following:

- Software should be easy and pupils should be able to use it independently. Difficult to use software may well be abandoned by pupils.

- It should be motivating and interesting (pictures, colours, animation). Young children find that pictures serve motivational and pedagogical purposes. They make software attractive, but at the same time images help pupils to read and understand words, or stories. Basic literacy software should have a colourful design. Pupils appreciate animation, but the literature suggests that is should serve a purpose. On the contrary, sounds are a thorny issue. Though speech facility is welcomed as an aid to read words, or stories, or to read the instructions for using the game, it should be of good quality, and if possible the volume to be low, or easily controlled. Children (Yr2) are apprehended of sounds because they are distracting, annoying, and interfering with their work. Such games (literacy) are not "fun" for those pupils because they demand some kind of academic work and concentration. One thing that has to be stressed here is that sounds can be interfering with the rest of the classroom.

- The content of literacy software is linked to the NC / NLS objectives. In chapter 2 (see 2.5.1.), I have discussed thoroughly the skills beginning readers should acquire, which in turn match the above objectives. The content of initial literacy software should include activities, such as the alphabetical principle, phonological awareness, onset and rimes, and sight vocabulary. Only then software has pedagogical value and is easily integrated with the ongoing curriculum. KS1 pupils do not mind if activities in literacy games are similar to the activities found in textbooks. If software does not indicate any links to the above objectives, think of possible uses to integrate with the ongoing classroom activities before using / purchasing it. If this is not possible, abandon it.

- Software should provide rewards (positive feedback) preferably in verbal format, but it should not provide critical comments (negative feedback). Yr2 pupils in particular are very conscious of critical points emphasising their mistakes. They feel incompetent, annoyed, hurt when things go wrong. Similarly, Yr2 boys are not thrilled with software that asks them to repeat the activities. Therefore, software should allow pupils to have several tries first, and then to provide the appropriate word. To put it differently, it should allow children to discover the correct answer – or guide them through with cues. Too repetitive programs are not appropriate especially by boys. Educational software should include a record keeping system to monitor pupils' progress.

- Software should cater for pupils with different ability levels. By providing a variety of activities from lower to higher competencies, and presenting it in sequential order, you guarantee that the software can be used by pupils with learning difficulties. To remind here, there not many specifically designed software for learning difficulties.

- ➢ Purchase software that has been tried out with pupils and look for written appraisals, where teachers report their experiences. Make always requests for software that have been tested with pupils.

- ➢ The content of software should be sensitive to Equal Opportunities principles of your school just like any other material (gender, race, religion, special needs, anti-social behaviour).

General assumptions about ICT

Currently, computer access is not regular at schools, evidence that inhibits any valid assumption about the outcomes of this access on pupils' learning. Schools' policies emphasise mostly how to acquire and how to manage the ICT resources and not so much on selecting appropriate computer programs. Purchasing appropriate educational software must be part of the key elements in school's ICT policy. Among the important factors that may affect, to the better or worst, the school's ICT application, apart from ICT school policy, resources and their management, and teachers' training, is the quality of good software. In order to improve the quality, the gap of communication between teachers and developers should close. Developers can get essential information about their product only when this is used in real educational settings (in classrooms) with pupils.

Therefore, teachers are advised to write descriptive reports with their personal judgment of how pupils react to specific programs. But listen carefully to what pupils say. Observe them discretely and listen to their comments. Always observe pupils of different abilities. Such reports may well have dual purposes **a)** it should be kept in the school's files for other colleagues to view, and **b)** this report can also be sent to developers. Your insights are priceless pieces of information for them to consider for any future upgrade, or new productions. This ensures that the channels of communication between classroom teachers and developers are open.

The preview process

Before selecting software, teachers should always preview it with a small number of pupils (even 3 pupils), but of different ability levels. While previewing initial software including pupils, they have to consider the following: **a)** the number of computers, **b)** the difficulties young pupils encounter when working on literacy games (navigation and providing the correct answer), **c)** their own confidence in using ICT; and **d)** the appropriate criteria to select initial literacy software. A large group of pupils using one computer will not reveal much about the quality of the program. Educators have always to consider pupils' difficulties, as well as their low confidence before deciding on the quality of software. The preview process will not be effective unless teachers use criteria that would enable them the see the educational value. All the above should be considered before deciding on the quality of the program.

Working mode

Teachers should know that young children like to work on computers in pairs with their friend, and they should arrange pupils' access to computer games to be in couples of their (pupils) choice. But at the same time, computers are excellent tools for one-to-one teaching. Therefore there are suitable to provide ample opportunities for practice, especially for low ability readers. Able readers do not need practice, or repetitive programs. In addition, the various forms of CAI (see 3.7.) can deliver both types of teaching instruction, namely direct instruction and whole – language. It depends on the teacher to decide what method would be the most appropriate according to the skill they want to teach. Computers can "teach" the codes, but they are not so successful, at least not yet, in teaching comprehension mostly because comprehension requires higher order, namely word meaning and background knowledge. Therefore, we should teach young pupils words that are familiar with.

The content of basic literacy material (print or electronic)

I have mentioned the appropriate literacy skills for beginning readers, as well as pupils with reading difficulties (see 2.5.1.). Though the concept of literacy has not been investigated on empirical grounds, this thesis can offer some tips based on research findings, which are appropriate not only for CAI, but also for conventional methods for teaching reading.

The alphabetical principle: recognising fast the letters of the alphabet helps young pupils to read without difficulty. The order for introducing the letters is not clear, but it is suggested that the letters should be introduced in context, not just using rote memorisation. Knowing the letters helps pupils acquire phonological awareness skills.

Phonological awareness: Phonological awareness or sensitivity skills help children understand the segmental structure of spoken words, namely to isolate individual phonemes or to combine a sequence of isolated phonemes together. The alphabetical principle and phonological sensitivity skills should be taught in parallel, not as separate identities. Also, phonological skills and writing should be taught concurrently, not only as an oral analytic skill.

Onset and rime: Onset and rime activities help beginning readers to understand the syllabic structure of language. Onset is the opening consonant of consonant cluster and rime is the following vowel and end consonant, if there is one. Rhyming helps children to categorise words by rime and identify the odd words out of a list. It makes pupils sensitive to both regularities and irregularities in orthography. Such activities also help readers to spell, and to use analogies in their reading, but they presuppose phonological awareness skills and an extensive sight vocabulary. Therefore, onset and rime is not suggested for Yr1 pupils.

Sight words: It is very common beginning readers to use *sight* as a reading strategy, namely they read words as a whole. The literature suggests that sight words should be introduce in context, and not in isolation. Sight vocabulary and good decoding skills contribute to fluency (accuracy and speed). Fluency is achieved through ample opportunities of practice.

Comprehension: it involves a combination of skills, and requires decoding skills, vocabulary, word meaning and background knowledge. In order to help young readers with comprehension, it is suggested that words in text or stories are familiar to children's experience because they draw inferences of "unknown" words. Reading many stories assists beginning readers with comprehension.

9.4. Research limitations

The study attempted to address issues of using and selecting basic literacy software in early primary classrooms, as well as to investigate the opinions of young pupils in relation to using such packages. It addressed the above problems by investigating the three stakeholders perspectives: teachers, developers, and KS1 pupils.

The research has been limited by several factors, which are mostly related to methodological issues. First, teachers' survey used a convenience sample. As such, it is assumed to be the opinions of those surveyed are not indicative of the entire population of teachers. The return rate is not easy to define. Also, the facts depicted by the survey are "snapshots" unique to the time and place that data was collected. The predominance of quantitative questions, and the fact that teachers answered "telegraphically" to the open-ended questions did not allow "richer" analysis. Due to time, money and other constrictions I did not proceed to interviews with some of the teachers that would illuminate many aspects of the issues in concern. Therefore, the study is broad, but not deep.

The same limitations apply to developer's questionnaire. Regarding the sample, an effort was made to include all companies in UK that design basic literacy software. Although the research instrument represents a company, there are reasons to believe that among the team who design software are disparities in opinions. The number of companies is small (n=10) and prohibited any statistical tests. Moreover, designers did not answer many of the questions. The problem, the questions, and the design of this research were perceived by a foreign classroom teacher, who lacks experience of what is taking place in English schools. The study does not include views of instructional technology specialists. It is acknowledged that designing software is not an easy task and needs the participation of many specialists.

Lastly, my inexperience as an interviewer plus my difficulty sometimes to understand young children's talk prevented me from probing further. Though Allerton (1993) found that children respond differently to different kind of questions (open, close questions), a more experienced and native interviewer would have gathered more information than I did. The semi-structured interview as an instrument has its own limitations (see 6.8.5.), but at the same time it has the dual advantage of the interviewees to express their views in their own words and the interviewer to ask determined question. Though the validity and objectivity is questioned – the researcher being present asking the child's views – I align with Silverman's (2000) position who believes that all what is desired is the interviewee's opinion, and this should be seen as a good tool for discovering the beliefs of others. I believe that what is important in interviewing young children is the interviews be conducted according to the codes of research for children.

9.5. Contributions of the research

This study looked at issues concerning the use and the selection procedure of software designed to support the development of initial literacy skills, in UK. This investigation provides empirical evidence, for the first time, that primary children in this country do not have regular access to ICT resources (only 29,5% of the sample said that their pupils have 10 minutes daily access to computers). But the novice of this study is the estimation of young pupils' access to initial literacy software. The majority of teachers' sample (55,4%) indicated that such access is occasional.

Similarly, this study verified the findings of the literature, this is classroom teachers have no criteria whatsoever to select computer programs designed to support the development of literacy skills, or other software. It is important to emphasise here that criteria to select software for children started to emerge in the literature since 1997 and onwards, but they were general in nature, and not based on empirical findings. This piece of research provided criteria / recommendations directly from classroom teachers, and has consolidated the existed criteria found in the literature. Further more, the provided criteria are focused for selecting basic literacy software that classroom teachers may employ for school practice.

This research did not stop at the teachers' perspectives on the issue of literacy software. It sought the thoughts of designers, and contrasted the views of teachers and software developers. A major contribution of this inquiry is the gap of communication between the two groups in relation to feedback. Teachers said that they never give, or at least they have never been asked to give feedback to developers, where as half of the companies indicate the opposite. An intriguing issue revealed in this thesis is that educational software does not undergo any kind of evaluation process (formative evaluation done by developers, or previewing by classroom teachers involving children). Such evidence raises educational concerns about quality and appropriateness. Another issue of similar importance is that teachers clearly indicate that among the factors that would influence their choice would be software that its content is linked to the NC / NLS objectives, where as only half of designers develop computer packages the content of which is linked to the above explicit objectives.

But what makes this study unique is the involvement of young children of all abilities in issues related to initial literacy skills. In particular, for the first time children were asked directly to express freely the views not only about computers in general, but about particular characteristics, such as technical features, and instructional characteristics in literacy software. Children formed their own "criteria" that teachers and software developers must consider, if they want computer packages to be appropriate for that age group and for that subject. Adopting the constructivist paradigm provided a useful tool to explore the stakeholders' views, or else the multiple "realities", and also to give voice to the less power, the children. It has highlighted claims, concerns and issues among the three stakeholders who share common interests in producing literacy software. Seeking the views of the different groups filled in some of the gaps and presented thus a more comprehensive picture (bricolage). By no means it suggests that the issue of software has been thoroughly researched, but because of its originality in planning and execution, it provides the basis for further research.

9.6. Suggestions for further research

This research has raised interesting questions that merit possible exploration in the future:

- To examine urgently why primary school teachers do not use computers more frequently than this study has revealed. Also, to examine why they do not use often use initial literacy programs (is it the poor quality, as the literature suggests?). Why the purchase of software is not among the key elements in schools' ICT policies?

- How teachers and children prefer to use computers in ICT suites or classroom based, and how this affects the use of ICT and the software selection process?

- To investigate further the skills that would make teachers confident in selecting educational software.

- To explore further why educators do not preview software before classroom use involving children and how the channels of communication between teachers and developers will remain open.

- To explore deeper instructional design issues but from the children's perspectives (why boys do not like to repeat activities). Comparison studies between traditional and computer-mediated instruction can be useful.

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Appendices

Appendix 1. High Frequency words in KS1*

Reception year

I	go	come	went
up	you	day	was
look	are	the	of
we	this	dog	me
like	going	big	she
and	they	my	see
on	away	mum	it
at	play	no	yes
for	a	dad	can
he	am	all	
is	cat	get	
said	to	in	

Years 1 to 2

about	first	make	saw	where
after	from	man	school	what
again	girl	many	seen	when
an	good	may	should	where
another	got	more	sister	who
as	had	much	so	will
back	half	must	some	with
ball	has	name	take	would
be	have	new	than	your
because	help	next	that	
bed	her	night	their	
been	here	not	them	
boy	him	now	then	
brother	his	off	there	
but	home	old	these	
by	house	once	three	
call(ed)	how	one	time	
came	if	or	too	
can't	jump	our	took	
could	just	out	tree	
did	last	over	two	
do	laugh	people	us	
don't	little	push	very	
dig	live(d)	pull	want	
door	love	put	water	
down	made	ran	way	

* High frequency words to be taught as "sight recognition" words through YR 1 to Yr 2 (DfEE, 1998, p. 60-61).

Appendix 2. List of Literacy Software for KS 1

The list that follows was selected from the resources below:

a) "Recommended software" and all the software have been evaluated. Online. Available: http://cambridgelearning.com/catalog/sch05lit.html for language and literacy KS1 {21/11/02}

b) BECTA – Technology, Advice Information – CD ROM Reviews. Online. Available: http://becta.org.uk/information/cd-roms/cd-rom-eval.html {29/11/20}

c) Educational Software: the complete guide. Yearbook 1999.

d) SpotPages.co.uk – KS 1ICT IDEAS – Early Years. Online. Available: www.hants.gov.uk/school/ranvilles/ranvilles2/ict7.html {21/11/02}

e) Parents Information Network (PIN) Software and Web Site Evaluations. Online. Available: http://fmpro52.red.net:8080/parinfontwk/dbsearch.htm {21/11/02}

f) MAPE Supporting Effective Use of ICT in Primary Education. Online. Available: wysiwyg://80http://www.mape.org.uk/curriculum/reviewsoftware/reviews.htm {21/11/02}

Oxford Reading Tree – Talking Stories Stage 2

The program is produced as part of the "Oxford Reading Tree" reading scheme, and it is a very popular scheme since it is used in over 14,000 UK primary schools. It is consisted of 18 talking stories graded into three categories according to difficulty. The stories involve the activities of two families in everyday situations with which children will easily identify. Each book has related activities, which are brief but serve to support and consolidate learning. It suits the needs of the NC. It helps children develop their vocabulary according to their stage. Icons are large and clear. Children choose the pace at which they read by selecting individual sentences or individual words. Pupils can also activate simple animations. If they choose to listen to a story they press the "ear" icon or they may just see the story by pressing the "eye" icon. "Arrows" help users change the pages. Pupils can listen to the whole story by choosing the "autoplay" option that uses both adult and child voices. Teachers can download a child's activity, such as the number of times s/he visited any particular word.

Sherston Talking books (KS 1)

Naughty Stories are ideal as an extension to the school's reading scheme and can be used at home. The playbook system uses recorded human speech to produce talking books that children will want to listen to over and over again. It allows children to ask the computer to speak any word they cannot read. To encourage independent reading a teacher can turn off the whole page option. The stories are short and beautifully illustrated and some can be used for discussion of moral issues affecting young children.

My First Word Book (KS 1)

It features alphabetical lists of words, each accompanied by a short animation and a spoken sentence. It is aimed at 4-6 year olds and is clearly designed for one-to-one use with a parent at home. The child may select a letter or activate a random choice. The emphasis throughout is on initial sounds and recognition of the letters of the alphabet. While it offers valuable experience in associating sound with letter, it does not provide combination of sounds and of letters.

ABC CD Talking Animated Alphabet (KS 1)

A very simple program concentrating on letter sounds and shapes which would be of particular relevance in the Nursery or early Foundation class. Children are encourage to recognise the sounds of initial letters and are rewarded for their achievements. There is a simple menu and children progress by means of icons. Letters are selected by using the mouse and simple instructions are given. The program is very attractively presented using bright colours, interesting graphics and simple animation. Alphabod is their guide throughout the program. Accompanying the disc is are three record sheets, which concentrate on visual and aural discrimination and on letter recognition.

Broderbund Living Books (KS 1)

They are interactive storybooks that bring children's literature to life with memorable characters, engaging puzzles, and lively songs. The point and click interface is easy to use for even the youngest child. Exploration of the story is encountered through click-able hotspots. Reading skills grow through word recognition. The computer will read and sometimes spell words aloud as they are highlighted. Additional activities develop phonic skills and improve memory and observation skills whilst increasing the child's understanding and appreciation of rhyming and word play. It is accompanied by a teachers' guide.

Nursery Rhyme Time (KS 1)

This is a collection of 11 well known traditional nursery rhymes enlivened by animation and sound. The three levels allow the user to "watch and hear" the rhyme, "sing along" to the text given one phrase at a time, and "let me play" where s/he can choose between listening to the music or the text. It employs a wide ranging and extensive vocabulary. Easy navigation using large original and distinctive icons which are animated. Appealing illustrations, very clear, well drawn and very modern in style and colour. The accompanying guide gives useful advice on possible worksheets, aural games and activities to reinforce the learning opportunities. It can be incorporated by any literacy program.

Rhyme & Analogy: Vol A (KS 1)

A collection of 36 delightful talking and animated activities to young children based on the Story Rhyme Photocopy Masters by Dr Clare Kirtley, and 12 story Rhymes by Roderick Hunt. Easy to use, colourful graphics, speech animation and sound effects further support children's phonic learning. The talking and animated activities cover 48 key rhyme families and both teach and practice phonological skills.

Speaking Starspell (KS 1 – 2)

A spelling program ideal for home and school. Every word is spoken using a real English voice and many are illustrated. The program features over 300 word lists and uses the "Look-Cover-Write-Check" strategy. Speaking Starspell has a friendly way of correcting spellings, and draws attention to how words are built so that the learner can apply what knowledge to her/his writing. Ideal for supporting a key skill in the NC. The program features in the British Dyslexia.

Structured Spelling

It contains a range of spelling games with different levels of difficulty, which can be selected by the player. It covers basic spelling rules using rhyme and a controlled phonic environment. The games offer several approaches to reinforcement, but mostly through picture / word match. It reinforces learning through practice and revision. The program is not suggested for SEN pupils since it requires a sophisticated motor control (Driller)

Textease Primary (KS 1 - 2)

It is a talking word processor specially designed to meet the requirements of primary school children. It is flexible and easy to use.

Textease 2000 (KS 1 - 4)

It is a word processor and a desktop publisher that includes a powerful set of features that enable it to be used from the youngest child to the older: completely configurable windows allowing multimedia authoring and presentations, extensive web page creation facility, send directly as e-mail (requires Outlook version 5 or later), record voices or music, DTP newspaper creation, flow text around a graphic, create simple animations and full network capabilities.

Clicker 4 (KS 1 to 2)

It is an extremely powerful literacy tool. It can be used in the mainstream classroom to support writing and vocabulary development across curriculum areas. It also enables children to read and write when they are struggling with these skills wither this is because they are still young or because they are experiencing difficulties. Also children are able to write whole words with one click which makes this software ideal for those with physical disabilities. It comes complete with its own child-friendly talking word processor that lets you write with pictures as well as words. Clicker grids, displayed under Clicker Writer, give children instant access to words, pictures and sounds. These can be read to them with a right mouse click or selected for writing with a left click. Version 4 is even easier to use, it comes with many ready-made grids, and you can create your own in seconds. When you have finished, you can print out your document with a single click.

Microworlds (KS 1)

Based on the house and garden, Microworlds gives children a range of activities from design and exploration to early reading exercises. The pupils can feed the birds and water the flowers in the garden, have a bath or make a cup of tea in the house. Microworlds has building, matching and recognition games using speech.

All My Words (KS 1 to KS 2)

Designed by teachers for teachers. All My Words is aimed at learners across a wide ability range. Simple to use for a wide range of activities, it is an ideal tool for the Literacy Hour. Fiction, non-fiction, poetry – you can use whatever text your are working on or choose a simple ready made text. Children can practice spelling, word and letter matching, cloze activities, writing from memory and phonic skills. It is quick and easy to create attractive material that children enjoy using as they learn.

WordShark 2L (KS 1 to 4)

It is a major teaching resource used widely in schools. Based on Alpha to Omega, Beve Hornsby's classic text, WordShark incorporates her clearly grouped and structured word lists for teaching, practicing, overlearning and developing automaticity in reading and spelling words. It is cleverly designed by providing 26 games that can all be played by with any one chosen word list. The games use sound, graphics and text to teach and reinforce the words in each list. It can be used in a highly structured way, crossing off each word list as one goes, making it an ideal resource for home as well as school. It is fully configurable, includes the Literacy Hour word lists and a facility to record each child's own word lists.

Tizzy's Toybox (KS 1)

It is a bright and cheerful program designed to explore early numeracy and literacy skills together with visual discrimination. These are encountered through simple enjoyable games, which can be differentiated. Children are offered support and encouragement as they proceed through the activities and the accompanying manual offers may useful extension activities together with photocopiable resource sheets. Tizzy the clown accompanies the user throughout the program offering instruction, advice encouragement and reward. The graphics are bright and the sound is clear. Simple animations are used to entertain the user.

Matti Mole's Language Skills "Summer Holiday" (Years 3 to 4)

Sixteen carefully thought out language activities connected with a delightful story, perfect for individual and group work in the Literacy Hour. Full of stimulating and challenging activities to help young pupils to come to grips with important language skills. Matti like all moles lives in her cold, underground home. She yearns to go somewhere sunny and hot for the summer holidays. In order to buy the ticket for the beach of her dreams she tries to earn enough money. Matti's exploits trying to raise the cash are presented with: 16 different language activities all at three levels of difficulty, punctuation, tenses, plurals and parts of speech.

Literacy Bank series (Years 3 to 6)

Four separate CD ROMs for Yr 1, Yr 4, Year 5 and Yr 6. The literacy bank has been developed in conjunction with the National Literacy Association. It contains over 700 short, structured, interactive activities, each with its own NLS code to show exactly where it fits into the National Literacy Strategy framework. Each CD contains six different activity types: close, check, comprehension, identification, quiz and text editing.

The Spelling Show (Years 5 to 6)

It is set in the familiar format of a children's TV show. Feature packed, it makes learning the essentials of spelling ingenious and fun. It includes a spell checker, which not only tell the children whey they have made a mistake, but where exactly they went wrong.

The Punctuation Show (Years 5 to 6)

Like the Spelling Show, the Punctuation show is an exiting CD ROM that teaches, tests and consolidates children's understanding and use of punctuation in a unique and stimulating way.

Leaps and Bounds (Ages 3 – 6)

The Leaps and Bound series has been receiving excellent reviews. The CD ROMs are ideal for early years, encourage the understanding of cause and effect and are highly suitable for special needs. They use bright and colourful characters to stimulate the imagination of young children and encourage the development of early learning skills. The discs aim to develop pre-reading skills, lengthen concentration span and encourage decision-making skills.

The Grammar Show (Years 5 to 6)

The CD ROM makes difficult grammatical concepts easy to understand and fun to learn. Making good use of the power of multimedia, the CD ROM teaches, practices and tests children's understanding of grammar.

English Keywords, Words and Sentences (Years 3 to 6)

This CD helps children to understand essential language and teaches valuable retrieval skills. Ideal for the Literacy Hour, it is easy to use, with colour coded icons, narrated help, simple indexes and word speech facilities. All keywords have clear, straightforward explanations for children to read or listen to, and are enhanced by superb photographs and stunning artwork.

Story Maker (Years R to 6)

It is about making active animated speaking and "sounding" stories. You can make a story where figures move across the screen, appear and disappear, cause other things to happen, speak to you and more. It is simple enough for even young children to have a go. It positively ecourages children to write stories for others to read and play with.

Wellington Square – Level 1 (KS 1)

These interactive five CD ROMs (Wellington series) develop and extend pupils' reading skills. Based on the popular Nelson reading scheme, the program was designed for pupils in primary who are experiencing reading difficulties. The content is aimed to interest the older child with a lower reading level. Feature include talking books, word hunts, word games, alphabetical order, phonic exercise, sequencing activities, word classification and rhyming activities, spelling passages, and cloze procedure.

Young Writers Workshop (Years 3 to 6)

The CD provides a unique environment in which pupils can develop their writing skills. It has two major sections, where young writers take part in journalistic assignments that provide stimulation for factual and imaginative writing. Writers Block and Newsgroup. These include different text types with models, scripting and recording, creating characters from photos, and writing newspaper articles.

Speaking For Myself (children with learning difficulties Downs Syndrome)

Early communication skills, literacy and speech development. Originally designed for very young children with Downs Syndrome, the activities and resources on the CD are useful for any early years children who are having difficulties with reading or communicating at school or home. Includes Makaton sign language a pictorial symbols as bridges to the written and spoken word. Includes: flash cards which talk and write and will reinforce basic sight vocabulary of everyday words and encourage speech by imitation, talking stories which use only two or three words about everyday things, talking nursery rhymes which include songs, animations and jigsaws and activities designed to reinforce listening, shape recognition and other skills using interactive multimedia.

Appendix 3. Research Tools

3A. Questionnaire distributed to KS 1 teachers

A Survey on ICT aspects. Use and selection of software for initial literacy in primary / nursery schools

For completion by Key-Stage 1/ Foundation Teacher

Initial literacy software: any reading software used in the classroom for supporting literacy activities for Yr1 and Yr2 pupils as well as for pupils with reading difficulties

If you wish to receive a summary of the results, please tick the box ☐

School address: ....

....

....

Section A.

a) Information about the respondent

1.Gender:

01☐ Male
02☐ Female

2. Age:

01☐ Under 25
02☐ 25 - 30
03☐ 31 - 40
04☐ 41 - 50
05☐ 51 – 60

3.Years of teaching experience:

01☐ Up to 10 years
02☐ 11 – 20
03☐ More than 20 years

4. What stage are you with your ICT New Opportunities Fund training?

01☐ Planning to commence
02☐ Half way through
03☐ Completed

b) Information about your school

5. What is the classification of your school?

01☐ Infant & Nursery
02☐ First & Nursery
03☐ Infant, Junior & Nursery
04☐ Primary
05☐ First
06☐ First & Middle

6 i) Does your school have a written ICT policy?

01☐ Yes
02☐ No

ii) If yes, what are the key elements of the policy? (*please specify*)
……………………………………………………………………
……………………………………………………………………

7 i) Which of the following do your pupils have routine access to?
(*multiple responses possible*)

01☐ Desktop computer(s)
02☐ Colour printer
03☐ Scanner
04☐ Portable computers
05☐ Internet access
06☐ Variety of literacy software
07☐Other (*please specify*) ....
....

ii) Do you have computer in your classroom?

01☐ Yes
02☐ No

iii) If yes, what is the computer to student ratio? ....
(*for example, 1:6, one computer for 6 pupils. Also, tick the appropriate box below*)

01☐ 1: 5 (one computer for up to 5 pupils)
02☐ 1: 10 (one computer for up to 10 pupils)
03☐ 1: for more than 10 pupils

8 i) Is it necessary to timetable pupil access to aspects of ICT provision in your school?

01☐ Yes
02☐ No

ii) If yes, please explain the nature of the timetabled resource:

....
....
....

9. What other responsibilities does the ICT-Coordinator of your school have?

01☐ Classroom teacher
02☐ Deputy Head teacher
03☐ Head teacher
04☐ Other curriculum responsibilities

Section B.

a) The use of initial literacy computer packages

10 i) How much time daily do your pupils have access to computers:

01☐ 10 minutes
02☐ Approximately 15 minutes
03☐ 20 to 30 minutes
04☐ Other (*please specify*)................................

ii) To what extent does your school use software package(s) to support initial literacy? (*please tick one*)

01☐ Nearly every day
02☐ Once a week
03☐ Occasional use of such software
04☐ Not at all

11. What difficulties do pupils encounter when using literacy packages? (*please specify*)

....
....
....

12 i) For children in your class who show reading difficulties, do you purchase specific software?

01 ☐ Yes
02 ☐ No

ii) If yes, what programs have you found helpful? (*please specify*)

....
....
....
....

13. How influential do you find the following before using software in classroom? (*Please rate each of the following from 1= not at all influential, 2= a little influential, 3=fairly influential, and 4= very influential*)

1 It has been tried out with children	1	2	3	4
2 It caters for different ability levels	1	2	3	4
3 It covers NC/NLS objectives	1	2	3	4
4 It is consistent with school's policy on equal opportunities	1	2	3	4
5 Other (*please specify*)				

....

Section C.

a) **The selection process**

14 i) Does your school have written guidance for selecting educational software?

01☐ Yes
02☐ No

ii) Please specify the key elements of the guidance:

....
....
....
....

15. How valuable do you find technical features and instructional characteristics when previewing software? (*Please rate each of the following from 1= not at all valuable, 2= a little valuable, 3=fairly valuable, and 4= very valuable)]*

Technical features

1 Still pictures	1	2	3	4
2 Colourful design	1	2	3	4
3 Sounds	1	2	3	4
4 Animation	1	2	3	4

Instructional characteristics

5 Positive feedback	1	2	3	4
6 Negative feedback	1	2	3	4
7 Repetitions when errors	1	2	3	4
8 Related off-computer activities	1	2	3	4
9 Material presented in sequential order	1	2	3	4
10 Record of achievement	1	2	3	4

16 i) To what extent do you feel that you have been sufficiently trained to use ICT? (*please tick*)

01☐ Completely
02☐ Adequately
03☐ A little
04☐ Not at all

ii) What skills do you feel you need to select software? (*please specify*)

....
....

b) <u>The review process</u>

17 i) Do you review the software before using it in your classroom?

01☐ Yes
02☐ No

ii) If yes, do you involve pupils in the review process?

01 ☐ Yes
02 ☐ No

iii) Do you communicate the outcomes of your review to the software publisher? (*please tick one*)

01☐ I have done it a couple of times
02☐ I have never done it
03☐ Other (*please specify*) ....

c) <u>Teachers thoughts about elements in the software designed for initial literacy</u>

18. What are the most important aspects that would appeal to you as a teacher and you would expect software designers to consider? (*please specify*)

i)

ii)

iii)

iv)

Your comments (if any):

....
....
....

Thank you very much

3B. Developers' Questionnaire

Name of the company: ....
Date: ....

a) <u>Information about your product</u>

1. What experts are usually involved in designing software for initial Literacy? (*multiple responses possible*)

01☐ Classroom teacher
02☐ Reading specialist
03☐ Early Years specialist
04☐ Special Needs teacher
05☐ Software designer
06☐Other (*please specify*) ....

2. What is the purpose of your product? (*please specify*)

....
....
....

3. Is your material linked to the National Curriculum / National Literacy Strategy objectives?

01☐ Yes
02☐ No

4. On average, how long does it take for each literacy activity to be completed by young children?

01☐ Up to 5 minutes
02☐ Between 5 - 10 minutes
03☐ More than 10 minutes (*please specify*) ....

5. How often does your product need to be upgraded?

01☐ Up to 12 months
02☐ 13 to 24 months
03☐ 25 to 36 months
04☐ Over 36 months
05☐ Other (*please specify*) ....

b) <u>The evaluation process</u>

6 i) Does your product any trial process before it is promoted in the market?

01☐ Yes
02☐ No

ii) Who carries out the above process?

01☐ Classroom teacher(s)
02☐ Professional reviewer(s)
03☐ It is undertaken by University staff
04☐ Other (*please specify*) ....

iii) Do you involve pupils during the trial?

01☐ Yes
02☐ No

7 i) Do you seek feedback from teachers after using your product in their classroom?

01☐ Yes
02☐ No

ii) If you do not seek feedback, what is the reason? (*Please specify*)
....
....
....

c) <u>Software developers' perception of teachers' and pupils' ICT skills</u>

8 i) What assumptions do you make about teachers' confidence in using ICT products? (*Please specify*)

....
....
....

ii) What difficulties do you think young pupils encounter when using software for initial literacy? (*Please specify*)

....
....
....

d) <u>General influential factors for selecting/purchasing educational software</u>

9. How influential do you find the following before using software in classroom? *(Please rate each of the following from 1= not at all influential, 2= a little influential, 3= fairly influential, and 4= highly influential)*

1 It has been tried out with children	1	2	3	4
2 It caters for different ability levels	1	2	3	4
3 It covers National Curriculum objectives	1	2	3	4
4 It is consistent with school's policy on equal opportunities	1	2	3	4

5 Other (*please specify*) ....

e) <u>Technical features and instructional characteristics in reading software</u>

10. How valuable do you find the following in software? (*Please rate each of the following from 1= not at all valuable, 2= a little valuable, 3= fairly valuable,* and *4= very valuable*)

<u>Technical features</u>

1 Still pictures	1	2	3	4
2 Colourful design	1	2	3	4
3 Sounds	1	2	3	4
4 Animation	1	2	3	4

<u>Instructional characteristics</u>

5 Positive feedback	1	2	3	4
6 Negative feedback	1	2	3	4
7 Repetitions when errors	1	2	3	4
8 Related off-computer activities	1	2	3	4
9 Material presented in sequential order	1	2	3	4
10 Record of achievement	1	2	3	4

Thank you very much for your cooperation

3C. Pupils' scaled questions

School: ……………………………
Pupil: ……………………………
Year: …………………………..
Date: …………………………..

I like the computer programs to have:

	Not at all	A little	Fairly	Very much
1.Pictures	–	♥	♥♥	♥♥♥
2. Colourful design	–	♥	♥♥	♥♥♥
3. Sounds	–	♥	♥♥	♥♥♥
4. Motion	–	♥	♥♥	♥♥♥

I like the computer game to:

	Not at all	A little	Fairly	Very much
5. Praise my work	–	♥	♥♥	♥♥♥
6. Tell me when I am wrong	–	♥	♥♥	♥♥♥
7. Repeat the work until I am successful	–	♥	♥♥	♥♥♥
8. Give exercises that are similar to the reading book used in the classroom	–	♥	♥♥	♥♥♥
9. Read out difficult words	–	♥	♥♥	♥♥♥
10. Read out the instructions of how to use the program	–	♥	♥♥	♥♥♥

3D. Questions of Pupils' Interviews

1. Do you have a computer at home? Do you use it?

2. Do you like to use the computer in the classroom? Why?

3. Have you used games that help you with your reading / spelling? Do they help you? In what ways?

4. How do you prefer to work on literacy games: Alone; in pairs; or in small groups? Why?

5. Do you have any difficulties when using reading games? What are they?

6. Technical features

- i) Pictures: Do you like them and why?
- ii) Colourful design: Do you like it and why?
- iii) Sounds: Do you like sounds and why?
- iv) Animated characters: Do you like them and why?

7. Instructional characteristics

7. Do you like the literacy games to:

- v) Praise you when you do the activity right (well done, good try)? Why?
- vi) Tell you when you have made a mistake? Why?
- vii) Ask you to repeat the activity when you are wrong? Why?
- viii) Have similar activities found in textbooks?

8. Do you like the literacy games to:

- **i)** Read out the words for you?
- **ii)** Read out the instructions how to find your way around the game?

9. Do you think that the computer helps you to learn? How?

Appendix 4. Cover letter to Head teachers

June 1, 2001

Dear Head teacher:

The University of Brunel is conducting a survey of Primary teachers in order to gather data on attitudes and opinions regarding software use and selection of initial literacy software.

To support initial literacy software products, teachers face the challenge of choosing software among the vast number of computer programs. The literature indicates that there are no criteria for teachers to employ leaving thus educators squandered. It is safe though software to match the schools own policy on literacy and ICT. This study aims to suggest guidelines that can be adopted by schools as criteria in order *to select software for basic literacy. The study also* aims to find the extent to which primary teachers use such software.

The name of your school was drawn in a systematic sampling procedure from the Educational Directory. I am writing to invite you and colleagues to assist the inquiry by completing the enclosed questionnaires addressed to the ICT Coordinator, one KS1 classroom teacher, the SENCO, and you personally. If you agree to participate it would be most helpful if each questionnaire could be completed and returned by the 20th of June, 2001.

You may be assured that your school's responses will remain completely confidential and anonymous. If you are interested in receiving a summary of the results, please tick the appropriate box in the front page.

If you have any questions about the study, please call on xxxxx xxxxxx, or write to the address below. The research is supervised by Prof. Roy Evans in the Department of Education.

Your cooperation is greatly appreciated

Yours truly,

Evangelia Papadimitriou (Ph. D Research Student)
Brunel University
300 St Margaret's Rd. G/H
Twickenham, Middlesex, TW1 1PT
E-mail: xxxxxxx@brunel.ac.uk

Appendix 5. Reminder Letter to Head teachers

July 1, 2001

Dear Sir / Madam

This is to serve as a polite reminder that the first days of June an envelop with four questionnaires was sent to your school with the request to be completed and returned by the 20^{th} of the same month. The study is a survey of Primary teachers in order to gather data on attitudes and opinions regarding using and selecting software designed to support the development of basic literacy skills. It was requested to be completed by the Head Teacher, ICT Coordinator, SENCO and Reception / Key Stage 1 classroom teacher. Your response is very important to completing the study. I do realise the load of work of this time of the year, and for that reason I have extended the return date to the 15^{th} of July. I would appreciate a lot your voluntary participation without which this study can not be completed.

If you have already completed and returned the envelop with the questionnaires, please ignore this reminder. In case of the envelop being misplaced or never received I could send you another set of 4 questionnaires.

Your cooperation is greatly appreciated.

Evangelia Papadimitriou (Ph. D Research Student)

Brunel University
300 St Margaret's Road (G / H)
Twickenham, Middlesex
TW 1 1PT
Tel: xxxxx xxxxxx
E-mail: xxxxxxx@brunel.ac.uk

Appendix 6. Cover Letter to the "Brunel group"

June 26, 2001

The name of the student

Dear colleague:

My name is Evangelia Papadimitriou and I am a Ph D research student at the Brunel University. I am conducting a survey of Primary teachers' views on using and selecting software to support the development of basic literacy skills. My study is supervised by Prof. Roy Evans.

I am at the stage of data collection of my research. Unfortunately the number of responses from primary schools are not satisfactory. Trying to find new sources for data collection, it was suggested by my two supervisors to approach the APD group of the University.

As researchers yourselves, you understand my feeling and despair. I do realise that teachers are busy people with a lot of responsibilities. You of course even more because at the same time you are studying, but I hope that you will devote no more that 10 minutes of your valuable time to fill in my questionnaire. Your understanding and participation will enable the completion of this inquiry.

Please, do not feel uncomfortable of your name written on the top of this letter. I want to assure you that your name and any information provided will be kept confidential. For any further information, do not hesitate to call me on xxxxx xxxxxx or conduct me in the following address.

Your cooperation is greatly appreciated.

Evangelia Papadimitriou (Ph. D Research Student)

Brunel University
300 St Margaret's Road (G / H)
Twickenham, Middlesex
TW 1 1PT
E-mail: xxxxxxx@brunel.ac.uk

Appendix 7.

A. Software reviews

http://becta.org.uk/information/cd-roms/cd-rom-eval.html
http://fmpro52.red.net:8080/parinfontwk/dbsearch.htm
wysiwyg://80http://www.mape.org.uk/curriculum/reviewsoftware/reviews.htm
http://www.childrenandcomputers.com
http://www.datec.educ.cam.ac.uk
http://superkids.com
http://www.TEEM.org
http://www.hitchams.suffolk.sch.uk/foundation/foundation_ict_reviews.htm

Articles that present software reviews

Computer Education
Mape
Young children

B. Websites for Early Years

ABC Toon Center: http://www.abctooncenter.com/journal.htm
BBC Games: http://www.bbc.co.uk/cbbc/games/index.shtml
Berits Best Sites: http://www.beritsbest.com/
Disney Online: http://www.disney.com
Enchanted Learning Online:
http://enchantedlearning.com/categories/pre-school.shtml
Kids@National Geographic: http://www.nationalgeographic.com/kids
Kids Domain: http://www.kidsdomain.com/
Kid's Wave: http://www.safesurf.com/kidswave.htm
Knowble Now: http://www.knowble.com
Lulu: http://www.perso.wanadoo.fr/jeux.lulu/english.htm
Micrsoft Kids Website:
http://kids.msn.com/kidz/dept.aspx?id=/kidz/content/games/
Peter Rabbit: http://www.peterrabbit.com/
PBS Kids: http://pbskids.org/
Teletubbies: http://www.bbc.co.uk/cbeebies/teletubbies
The Place For Kids In The Net: http://www.mamamedia.com/
Thomas the Tank Engine:
http://www.thomasthetankengine.com/home/homepage.html
Travel inTime with Uder: http://www.uder.co.uk/udermain.html
Up to Ten: http://www.boowakwala.com/
Wicked4kids: http://www.wicked4kids.com/play/index.shtml
Winnie the Pooh: http://www.worldkids.net/pooh/welcom.html
Yahooligans: The Web Guide for Kids:
http://www.yahooligans.com/content/games/

The above websites have been viewed by Siraj-Blatchford & Whitebread (2003, p. 124), and have been found safe. The authors though express their reservations for the future.

Also, Poulter & Basford (2003, pp. 72-75) offer websites for Foundation stage children, which they have classified them according to the six areas of learning. Because of the nature of the study, only the related to the subject of Literacy will be shown:

C. Communication Language and Literacy

Tiger Aki: http://www.asiabigtime.com/storybooks/aki_menu.html
Words and Pictures: http://www.bbc.co.uk/education/wordsandpictures/
Fimbles Comfy Corner:
http://www.bbc.co.uk/cbeebies/fimbles/comfycorner/index.shtml
The Hoobs: http://www.channel4.com/learning/microsites/H/hoobs/activities/archive.cfm
Ladybird: http://www.ladybird.co.uk
The Little Animals Activity Centre: http://www.bbc.co.uk/education/laac/
Tweenies: http://www.bbc.co.uk/education/tweenies/index.shtml
Bob the Builder: http://www.hitentertainment.com/bobthebuilder/
Plannet Wobble: http://www.planetwobble.com

Other Websites:

Baby Workshop: http://www.sesameworkshop.org/babyworkshop
Child line: http://www.childline.org.uk
Yuckiest Site On The Internet: http://www.yacky.com
Funbrain: (simple grammar activities and quizzes)
http://www.funbrain.com/grammar/

D. ICT and Literacy

http://www.mape.org.uk
http://www.naturegrid.org.uk
http://www.bc.org/au/montage
http://www.becta.org.uk
http://www.angliacampus.co.uk
http://www.kn.pacebell.com

E. Special Needs

http://www.dyslexic.com
http://www.bda-dyslexia.org.uk
http://www.semerc.co.uk/
http://www.opengov.uk/dfee/sen/senhome.htm
http://www.left-handeducation.co.uk