SCAFFOLDING INTERNET READING: A STUDY OF A DISADVANTAGED SCHOOL COMMUNITY IN IRELAND

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ABSTRACT

The present study had three main purposes: first, to explore the baseline skills and strategies of struggling readers as they conducted online Internet inquiry; second, to scaffold these children to develop effective online reading comprehension and information seeking-skills and strategies in the context of an integrated curriculum; and third, to examine the affective, cognitive and social dimensions of learning in groups and the role of peer collaboration in developing online reading skills and strategies during Internet inquiry.

Three theoretical frameworks underpinned the study: a new literacies framework, a motivation and engagement framework, and a cognitive scaffolding framework. The study was conducted in a disadvantaged school in Ireland over an 18 month period with 3rd and 5th class cohorts. It employed a Formative and Design Experimental methodology to iteratively refine the study intervention, as barriers to implementation of the pedagogical goal of the study were identified and factors that enhanced effectiveness of the intervention were revealed. The study was conducted in three interlinked phases: a Baseline phase, a Reading Development and Critical Web Literacy (RDCWL) phase, and the Main Study phase. A range of essentially qualitative data sources was analysed, using inductive and deductive methodologies, to extract themes from the data.

Findings from the study suggested that (a) the development of an ecological learning community within the classroom coupled with an integrated curriculum enhanced engagement and motivated the pupils to develop online reading skills; (b) new literacies were acquired through explicit instruction, adaptive scaffolding and peer-to-peer collaboration; (c) developmental differences between children indicated the importance of nurturing self-regulatory reading processes and metacognitive knowledge in developing effective online reading comprehension and information-seeking skills and strategies.

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CHAPTER ONE

INTRODUCTION AND OVERVIEW OF THE STUDY

Introduction

The exponential growth of the Internet and the development of information and communication technologies (ICTs) have brought about fundamental changes to our working lives, our social lives, our ability to communicate with each other on a global scale, and our capacity to access information effectively, efficiently and speedily. The growth in access to the Internet over recent years has been unprecedented when compared to the adoption of earlier technologies, and almost one-quarter of the world's population are now 'on-line' (Internet World Statistics, 2009). The work place has also undergone fundamental change where the traditional hierarchical structure of the top-down model has been replaced by a more flattened model where one's ability to work as a member of a team, to take responsibility for decision making and to problem-solve, analyse and communicate with others on a global scale have become key skills in a knowledge based economic structure (Bruce, 1997; Friedman, 2005; Leu, Kinzer, Cammack & Coiro, 2004; The New London Group, 1996, 2000).

Governments around the 'developed' world have recognised the educational, social, political and economic implications of a globalised knowledge based economy and have reacted by providing funding to integrate ICT into the education system in order to prepare students for their future participation in a technological world. We need to support every student to develop the skills and strategies necessary to fully exploit the potential of the new ICTs so that they can reach their

potential and participate fully in society in an information age. Recent reports in the U.S. suggest that eight million American students in grades 4 to 12 are struggling with reading (Biancarosa & Snow, 2006). Reports in Ireland suggest that the reading achievement levels of pupils from disadvantaged communities are significantly below their peers in non-designated schools (Eivers, Shiel & Shortt, 2004). Despite government initiatives and the efforts of educators and communities these low levels of literacy have proved to be difficult to shift upwards. The Internet and other ICTs have the potential to engage and motivate these students to develop both reading and information-seeking skills (Dalton & Strangman, 2006). Conversely, the Internet may further compound the difficulties already experienced by these students with print-based literacies. Therefore, it is particularly important that we support those on the margins struggling with print literacy skills in the complex and often challenging environment of the Internet and other ICTs so that they are not further disadvantaged in an online environment thereby avoiding what might be termed a digitally determined Matthew Effect (Stanovich, 1986).

Statement of the Problem

The emergence of the Internet as a powerful communication tool and the defining technology of this generation have led to calls in the literature for a reconceptualisation of what literacy entails in the 21st century (Flood & Lapp, 1995; Hartman, 2000; Reinking, 1998). The nature of literacy is changing and higher levels of reading and writing strategies are required to fully exploit the potential of ICTs (International Reading Association (IRA), 2002; RAND Reading Study Group, 2002; Smolin & Lawless, 2003; Spires & Estes, 2002). Leu (2000) has argued that due to the deictic nature of literacy in the twenty-first century, where new literacies

are constantly evolving, the construct of 'being' literate is changing conceptually to one of 'becoming' literate in an information age (Leu et al., 2004; Reinking, 1998).

The assumption (Prensky, 2001; Tapscott, 1998) that most young people have highly developed technological and information-seeking skills on the Internet does not hold up to much scrutiny within the research-based literature (Bennett, Matton, Kervin, 2008; Livingstone & Bober, 2004; University College London CIBER Group, 2008;Williams & Rowland, 2007). For example, a number of studies attest to the difficulties which young people have in formulating search strings (Bilal, 2000, 2001, 2002; Kafai & Bates, 1997; Large & Beheshti, 2000; Nahl & Harada, 1996; Schacter, Chung & Dorr, 1998; Wallace & Kupperman, 1997). Similarly, young people are unlikely to be critical consumers of online information and have difficulty in evaluating online information for quality, credibility, authority, and reliability (Hirsh, 1999; Leu, Coiro, Castek, Hartman, Henry & Reinking, 2008; Lorenzon, 2002; Shenton & Dixon, 2004a; Schacter et al., 1998).

The focus of the 'digital divide' debate has shifted in recent times from discussion about patterns of physical access to the Internet between the 'haves and have-nots' (Warschauer, 2003) to debate about issues of equality of opportunity to develop skills and strategies during Internet access (Hargittai, 2002; Hargittai & Hinnant, 2008; Livingstone, 2003; Livingstone & Helsper, 2007). Surveys conducted in the U.S. (Becker, 2000) the U.K. (Livingstone, Bober & Helsper, 2004) and the Netherlands (Volman, van Eck, Heemskerk, & Kuiper, 2005) suggest differences according to Socio-Economic Status (SES) in the manner in which ICTs and the Internet are used in schools in terms of availability, quality of access, and the development of online skills. Children from disadvantaged communities have less

access to computers and the Internet in the home than their more affluent peers and therefore rely more on their schools for access to and use of ICT and the Internet. Middle class pupils are more likely to be engaged in challenging, creative and inquiry-based activities on the Internet, including the development of problem-solving and higher-order thinking skills. Children from disadvantaged communities are likely to be engaged in lower-order skills, such as repetitive activities involving drill and practice educational software (Becker, 2000; Zhao, Tan & Mishra, 2000/2001).

The instructional emphasis for students struggling with print-based literacies in disadvantaged communities has often been on the development of de-contextualised basic decoding skills, to the detriment of the development of higher level skills or reading comprehension (Allington, 1983; Allington & McGill-Franzen, 2009). This has led to a fear that technology use in schools will compound the difficulties experienced by students in print literacies, either through limited access to technologies (Karchmer, 2001) or by using technology largely to develop lower order skills (Au, 2006; Dalton & Strangman, 2006).

Significance of the Present Study

The Internet is becoming the defining technology of this generation. While online reading skills are built on foundational print based skills, online reading comprehension is not isomorphic with print-based literacies (Leu, et al., 2005) and presents both new opportunities and challenges within the classroom for students and teachers alike. The nature of reading comprehension may be more complex in an online environment and new skills, strategies and dispositions may be required to develop reading comprehension on the Internet (Afflerbach & Cho, 2009; Coiro &

Dobler, 2007; Kuiper & Volman, 2009; Leu, 2006). "New literacies" (Coiro, Knobel, Lankshear & Leu, 2008) are required to effectively search for, locate, transform, communicate and critically evaluate information online (Coiro & Dobler, 2007; Leu et al., 2004). Currently we know little about the instructional contexts in classroom environments which support the development of effective online reading skills and strategies or how to embed Internet literacies within an integrated classroom curriculum. Little research has focussed on instructional methods or instructional environments in authentic classroom contexts that would support the acquisition of these online reading skills and strategies (Castek, 2008; Dalton & Proctor, 2008; Dalton & Rose, 2008; Eagleton & Dobler, 2007; Larson, 2007; Leu et al., 2008; Rose & Meyer, 2002). We know even less about the skills and strategies of struggling readers from disadvantaged communities in conducting online Internet inquiry. Still less research has focussed on the development of an integrated curriculum which would seek to forge links between Internet technologies, literacy and content areas and embed the Internet in a meaningful way into the classroom curriculum (Wallace & Kupperman, 1997).

This present study seeks to support struggling readers in the complex and ill-structured environment of the Internet and to scaffold such pupils to develop online reading comprehension and information-seeking skills and strategies in the context of an authentic classroom-based Internet inquiry project. The purpose of the present study was threefold. Firstly, the study sought to investigate the baseline skills and strategies of struggling readers from a disadvantaged school community in conducting Internet inquiry. Secondly, through an iterative process of refinements in a linked series of interventions, it explored the instructional classroom-based

contexts which supported pupils in developing effective online reading comprehension and information-seeking skills and strategies within the context of an integrated curriculum. Thirdly, the study sought to explore the cognitive, affective and social dimensions of the support provided by peer collaboration in conducting online Internet inquiry.

Research Questions Underpinning the Study

1. The study asked the following question: What are the skills and strategies struggling readers use as they search for, locate, summarise, critically evaluate, transform, and communicate information gleaned from the Internet?

2. The study asked the following question: Could explicit strategy instruction scaffold these children to develop effective reading skills and strategies online in an authentic classroom-based Internet inquiry project?

3. The study asked the following question: What are the cognitive, affective and social dimensions of peer collaboration during online reading activity and what are the social aspects of learning in groups during Internet inquiry?

Background to the Study in Ireland

The performance of Irish students in reading literacy compares favourably with the literacy achievement levels of students in other nations in international studies. For example, in the recent 2006 Programme for International Student Assessment (PISA), (Organisation for Economic Co-Operation and Development (OECD), 2007) students in Ireland achieved reading achievement scores which were significantly above the OECD average (Brozo, Shiel & Topping, 2007/2008; Eivers, Shiel & Cunningham, 2007; Shiel, 2006).

However, recent reports in Ireland have highlighted a significant disparity between the literacy achievement scores of pupils attending schools designated as disadvantaged when compared to their peers in non-designated schools (Cosgrove, Kellaghan, Forde & Morgan, 2000; Department of Education and Science (DES), 2005a; Eivers et al., 2004; Hayes & Kiernan, 2001; McDonald, 1998; Weir, 2003; Weir, Milis & Ryan, 2002). This is in spite of a long history of state initiatives to tackle educational disadvantage dating back forty years to the Rutland Street project in 1969 (Holland, 1979, Kellaghan, 1977). Past initiatives to address educational disadvantage have included the Scheme of Assistance to Schools in Designated Areas of Disadvantage (1984); the Early Start Programme (1994/1995); Breaking the Cycle 1996/1997; and Giving Children an Even Break (2001). Evaluations of these early initiatives indicated that student achievement levels did not improve significantly (Weir, 2003; Weir et al., 2002). Weir (2003) conducted a meta-analysis of studies and reports conducted over this time frame of initiatives and found that pupils attending disadvantaged schools had reading attainment levels which were between one half and one full standard deviation below the national mean scores. She concluded that reading attainment scores had actually declined across the time frame of her review and she noted that attainment levels might even be poorer than reported. Weir cited evidence from the evaluation of the Breaking the Cycle initiative to support this view, where, for example, absenteeism of between eight and 15 per cent for some of the sub tests and exclusion of pupils (7.7%) deemed unable by their teachers to complete the test could have further lowered the achievement scores.

The report on Reading Literacy in Disadvantaged Schools (Eivers et al., 2004) conducted at first, third and sixth grade classes, showed that up to 30% of pupils in schools designated as disadvantaged had serious literacy difficulties (defined as scoring below the 10th percentile on a standardised reading achievement test). This contrasts with 10% nationally.

The Eivers et al. (2004) report was followed by an in-depth, observational, study in 12 schools, conducted by the Inspectorate of the Department of Education and Science (DES) focussing on teaching and learning within these schools. The Literacy and Numeracy in Disadvantaged Schools (LANDS) study, (DES, 2005a), while recognising the challenges faced by teachers in disadvantaged schools, again raised concerns about the low literacy achievement levels of these pupils in such schools. Further, the LANDS report showed that literacy levels declined as the children progressed through the primary school system. Almost 47% of pupils in 5th and 6th classes in the schools surveyed scored below the 20th percentile.

In the Eivers et al. (2004) report, pupils from the Traveller[1] community obtained considerably lower mean scores than their peers (almost one full standard deviation).The DES (2005b) Survey of Traveller Education Provision found that over two-thirds of Traveller children scored below the 20th percentile on standardised reading achievement scores.

The Eivers et al. (2004) and LANDS (DES, 2005a) reports made a number of recommendations to address the lower levels of literacy achievement within

[1] The Traveller community are an indigenous minority population with a long history in Ireland. 'Travellers' share a language, history, culture, tradition and a historically nomadic lifestyle. As a community they place particular emphasis of the importance of the extended family in their lives (Nolan & Maitre, 2008)

disadvantaged schools. These recommendations included an increased priority focus on the development of literacy within the curriculum, with an emphasis on more innovative approaches to pedagogy, professional development for teachers, and a higher realistic expectation for student attainment. Both reports represented a move from discourse around class size and allocation of resources to a discourse focussed more on pedagogy and assessment.

The latest policy initiative of the Irish government to address educational disadvantage is Delivering Equality of Opportunity in Schools (DEIS) (DES, 2005c). This multifaceted action plan, which is being implemented in a phased manner over a five year period, aims to bring a more coherent approach to tackling educational disadvantage. In relation to tacking low levels of literacy achievement it draws on the recommendations from the reports reviewed above (*Reading Literacy in Disadvantaged Primary Schools* and *LANDS an Evaluation of Curriculum Implementation in Primary Schools*) but is lacking in specific objectives for the development of English in primary schools. The DEIS plan (DES, 2005c) clearly links the development of literacy and Information and Communication Technologies (ICT) and imbues ICT "where correctly integrated" with the innovative power to develop student engagement and motivation:

> The development of ICT literacy has been shown to have a significant impact on literacy and numeracy generally....Where correctly integrated into educational settings, ICTs can enable students to learn in new and exciting ways, encouraging their engagement and making communication easier....There is evidence to indicate that the creative application of ICT in education can allow students at risk of early school leaving to connect with learning in new ways, resulting in improved motivation, attendance and application across subject areas (DES, 2005c, p. 45).

The Irish Government has made substantial investments in ICT infrastructure and Internet connectivity, including broadband, in Irish schools since the launch of the IT 2000 initiative in 1997. The then Irish Taoiseach (Prime Minister), Bertie Ahern, described the IT 2000 initiative as an "innovative plan, which will help to revolutionise our schools". However, despite the assumption that ICT would have a transformative effect on curriculum, pedagogy and schools, the evidence that this has happened is weak (Conway, 2000; Information Society Commission, 2002; Mulkeen, 2001, 2003). The discourse surrounding ICT in Irish primary schools has shifted slowly from quality of access to ICT (which remains an issue) to one which focuses more on the integration of ICTs within the curriculum (DES, 2008a; DES, 2008b; Information Society Commission, 2002; Shiel & O'Flaherty, 2006).

The 2005 census report for the National Centre for Technology in Education (NCTE), (Shiel & O'Flaherty, 2006) noted that although the student-computer ratio (SCR) at primary school level had improved from earlier census reports in 1998 and 2002 to a ratio 9.1:1 this was still well below the OECD average SCR of 6:1 . Moreover the number of 'ageing' (over four years old) computers was 51% in primary schools (60% in disadvantaged primary schools). This indicates that sustained investment is needed to maintain the ICT infrastructure in schools. The DES (2008a) report on 'Investing Effectively in ICT in Schools 2008-2013' called not only for high priority sustained investment in ICT infrastructure but also increased technical support and nationwide broadband connectivity. Many Irish teachers have attended professional development courses in ICT on a voluntary basis, (DES, 2008a) demonstrating a willingness to incorporate ICT into their teaching. Although examples of innovative practice in accommodating ICT into the

school curriculum exist (Galvin, 2002) the frequency with which Irish teachers incorporate ICT into their pedagogies lags well behind the European average (DES, 2008b). The Inspectorate's report on 'ICT in Schools' (2008b) noted that ICT usage in the curriculum was largely superficial with ICT used mainly for word processing purposes, and for consolidation and reinforcement of basic literacy and numeracy skills. The use of the Internet by teachers in school was 'limited' (DES, 2008b) to providing teaching resources. There was little evidence of using the Internet to develop higher level skills, problem-solving capabilities, communication or collaborative skills. This limited use of technology is unsurprising, given that recent guidelines on the incorporation of ICT into the curriculum from the National Council for Curriculum and Assessment (NCCA, 2007) lack specificity, leaving teachers to flounder in a policy vacuum (McGarr, 2008; Mulkeen, 2003). Research into the use of ICT in classrooms is necessary to provide exemplars for teachers about the generative possibilities of ICT as a catalyst for change within the curriculum (Au, 2006; Young, 2008).

Overview of the Study

This longitudinal study was carried out over an eighteen month period in an urban setting in Ireland in a school categorised as DEIS Band 1 (i.e. the most disadvantaged category) (DES, 2005c). Two class cohorts were tracked as they moved from 3rd to 4th and 5th to 6th classes respectively. The school had a large population of Traveller children. The study employed a Formative and Design Experimental methodology (F&DE) (Reinking & Bradley, 2008) to design an intervention which through a process of iterative refinements sought to develop online reading comprehension and information-seeking skills and strategies in the

context of an integrated curriculum which linked literacy, science and the Internet in an authentic classroom-based project. The study was conducted in three interlinked phases: the Baseline Phase, Reading Development and Critical Web Literacy (RDCWL) Phases 1a and 1b, and the Main Study phase. The pupils worked in mixed-ability triad groups during a series of Internet workshops conducted across the timeline of the study. The study monitored in-depth the progress of three triad groups within each class cohort during these Internet workshops and also in conducting a series of Internet Inquiry Progress Tasks across the study. Data were gathered from a range of sources, including semi-structured interviews conducted with the pupils and class teachers, conversations of the focal triad groups during Internet workshops, online Internet activity captured using Camtasia software, think aloud data (Pressley & Afflerbach, 1995) as the focal groups conducted Internet Inquiry Progress Tasks, and artefacts of the pupils' work. The data sources were transcribed and analysed by the researcher using the constant comparative methodology (Glaser & Strauss, 1967). The researcher iteratively coded the data using both inductive and deductive methods of analysis (Miles & Huberman, 1994; Patton, 2002; Robson, 2002) until patterns and themes emerged from the range of data sources.

Organisational Structure of Chapters in the Thesis

Chapter 1 of the thesis outlines the context in which the present study is framed. It develops an argument for the significance of the study and provides a brief overview of the design and the research questions underpinning the study. Chapter 2 reviews the literature pertaining to the theoretical frameworks on which the study draws and considers the literature pertaining to the skills, strategies and reader

characteristics in both print-based text and online text. Chapter 3 opens with a consideration of the conceptual framework leading to the research questions driving the study. This is followed by a discussion of the rationale for using the Formative and Design Experimental (F&DE) methodological framework. Issues relating to validity, creditability and trustworthiness in the study are discussed. Chapter 4 describes the procedures for sample selection and gaining access. Consideration is given to ethical issues. The chapter describes the qualitative and quantitative measures for data collection and analysis. A brief description of the design of the study as it evolved across the timeline of the study is presented in the final section. Chapter 5 presents analysis of the Baseline phase for both the 3rd/4th class and 5th/6th class cohorts. This is followed in Chapter 6 and Chapter 7 by analysis of the RDCWL phases of the study and the Main Study respectively in the 5th/6th class cohort. Chapter 8 provides an analysis of the parallel study conducted with the 3rd/4th class cohort and includes an analysis of the developmental differences between the 3rd/4th and the 5th/6th class cohorts. Chapter 9 provides a consolidated review of findings from across the three phases of the study for both class cohorts set against other relevant studies in the field. Chapter 10 discusses the implications of the study for classroom pedagogy, literacy theory development and future research. Consideration is also given in this final chapter to limitations of the present study.

Summary of Chapter

This chapter has attempted to outline the changes brought about to our social, working and academic lives by the exponential growth of the Internet and other ICTs. It sought to develop an argument for the importance of scaffolding students from disadvantaged communities already struggling with print-based literacies in the

complex environment of the Internet. The purpose of the present longitudinal study, conducted in three interlinked phases, was to scaffold struggling readers from disadvantaged school communities to develop effective online reading comprehension and information-seeking skills and strategies in the context of the learning ecology of the classroom.

CHAPTER TWO

REVIEW OF THE LITERATURE

Introduction

We live in a digital information age where one's ability to access, critically evaluate, synthesise and communicate information quickly, efficiently and effectively (Leu & Kinzer, 2000) are key components to active participation in a global society and success in the "Post Fordist" (The New London Group, 1996) workplace. The exponential development, growth and adoption of Information and Communication Technologies (ICT) over the past decade has been breathtaking. Few of us in 'developed' nations could now conceive of a world without Internet and email access. The emergence of the Internet as a powerful communication tool and the defining technology of this generation have led to calls in the literature for a reconceptualisation of what literacy entails in the 21st century (Flood & Lapp, 1995; Reinking, 1998).

The chapter opens with a statement of the research questions underpinning the study. This is followed by a consideration of the theoretical frameworks on which the study draws. Following this, the literature pertaining to the skills, strategies and reader characteristics in both print based text and online text will be considered.

Research Questions Underpinning the Study

1. This study explored the skills and strategies struggling readers use as they search for, locate, summarise, critically evaluate, transform and communicate information gleaned from the Internet.

2. The study investigated whether explicit strategy instruction could scaffold these children in developing effective reading skills and strategies online in an authentic classroom-based Internet inquiry project.

3. The study examined the cognitive, affective and social dimensions of peer collaboration during online reading activity and considered the social aspects of learning in groups during Internet inquiry.

Theoretical Perspectives Underpinning the Study

In light of the research questions driving the study and reflecting the multiple realities (Labbo & Reinking, 1999) in the learning ecology of classrooms, it will be argued that three theoretical lenses need to be brought to bear on this study. Firstly, a new literacies perspective (Coiro et al., 2008; Eagleton & Dobler, 2007; Leu et al., 2004) is dominant in the field and has been found to be valuable by a number of other scholars and therefore needs to be given serious consideration. Secondly, in the present study it will be argued that it is important to consider motivation and engagement because of the nature of the participant group (i.e. struggling readers from disadvantaged communities who are facing reading difficulties and the problems associated with low levels of literacy). Motivation and engagement frameworks are also important to consider when ICT meets disadvantage, as although such environments have the potential to motivate and engage these children, it is crucially important to support these children in such complex environments. Therefore, it will be argued that motivation and engagement, particularly in the way they are handled by Guthrie and colleagues (Guthrie & Wigfield, 2000; Gambrell, 1996) are important frameworks to consider. These scholars attempt to bring together the psychology of motivation and engagement and

the activity of learning in complex environments over extended and sustained projects, such as the one proposed in the present study. Thirdly, scaffolding theories (Wood, Bruner & Ross, 1976) relate to the two sets of theoretical lenses just presented for consideration. Research into the processes of scaffolded learning is broad and extends across all of the psychology of learning. All three theories are important to consider in the present study because of the particular attention paid to the conscious and intended gradual release of responsibility and transfer of authority, for the management of learning, from the class teacher to the student. Therefore, scaffolding theories deserve particular attention.

These diverse theoretical perspectives will allow for the consideration of "multiple perspectives from a constellation of theories and methodologies" (Harrison, 2008, p. 1292) in framing this study. Each affords a unique lens to explore the complexity of online reading comprehension as it plays out within the ecology of learning in classrooms from cognitive, affective and social dimensions.

A New Literacies Perspective

At present, there is no single unifying theoretical perspective in the literature to explain the changes brought about to literacy by the advent of the Internet and other ICTs. Indeed, various terminologies are used to describe changes to literacy within digital environments drawing on various perspectives. For example, the 'Multiliteracies' perspective (Cope & Kalantzis, 2000; The New London Group, 2000; Zammit & Wilson, 2006) draws on the changes to literacy within the multimodal nature of communication inherent within a global community. 'Critical literacies' perspectives (Fabos, 2008) refer to the ability of people to critically evaluate information presented on the Internet in terms of both author agenda and

bias; and reliability and accuracy of information presented. Other authors focus on sociocultural perspectives, such as popular cultures (Xu, Perkins, & Zunich, 2005), social linguistics and discourse (Gee, 2003), and social practices (Marsh, 2007; Marsh & Bearne, 2008; Pahl & Rowsell, 2005; Street, 1998). A 'new literacies' perspective (Leu et al., 2004) argues that new skills, strategies and dispositions are required to fully exploit the Internet's potential for reading, writing and communication.

Recent reviews (Coiro et al., 2008; Larson & Marsh, 2005) suggest that these various perspectives do, however, share some common ground. Firstly, literacy is transformed through the new technologies, and new skills, strategies, dispositions and social practices are required for effective use of the new literacies. Secondly, as new literacies are required for full participation in a globalised world, issues such as social inequality and social justice need to be addressed. Finally, as new literacies are deictic (Leu, 2000; Leu et al., 2004), we need to prepare students for their multimodal, digital futures and "enable children to learn how to learn" (Primary School Curriculum, DES/NCCA, 1999a, p. 7) and develop the metacognitive skills and strategies necessary to adapt to changing information technologies.

While Internet access in schools has grown exponentially (as discussed in chapter 1), research evidence (Karchmer, 2001; Madden, Ford, Miller & Levy, 2005) suggests that the potential of the Internet to transform instruction and become accommodated into the curriculum (Reinking, Labbo & McKenna, 2000) has not been fully realised. Leu et al. (2004, p. 1572) argue that new skills and strategies are required to "identify important questions, locate information, critically evaluate the usefulness of that information, synthesise information to answer those questions and

then communicate those answers to others". The present study draws on a new literacies perspective of online comprehension as it plays out in the ecology of learning in classrooms in an authentic inquiry-based integrated curriculum which seeks to forge links between literacy, science and the Internet. Emerging research suggests that online reading comprehension may introduce new complexities for the reader as they search for, locate, transform, communicate and critically evaluate information online. Coiro and Dobler (2007) argue that new skills and strategies may be needed to address these additional complexities. Such complexities may introduce additional difficulties for readers already struggling with print based text.

This review will examine some important studies which have contributed significantly to an increase in our understanding and knowledge of the development of reading comprehension and specifically online reading comprehension over the past number of years. Nevertheless, the proposed study seeks to address a gap in the literature pertaining to the development of online reading skills and strategies with struggling readers from disadvantaged school communities. It will look closely, in a detailed and multifaceted way, over a period of eighteen months, at the development of online literacies. It will use multiple lenses to track the growth of online reading skills and strategies with these children, the development of classroom pedagogies and contexts within an integrated curriculum and the transfer of responsibility from the class teacher to pupils for managing learning in an online environment.

The present study will focus on the development of online reading and developing online information-seeking skills and strategies. However, these skills cannot be developed in a vacuum. The study seeks to develop online literacies within a learning environment and task framework that is authentic, coherent, extended and

includes curriculum connections which extend across and integrate literacy, content areas and the Internet. In broadening the research lens to extend to pedagogic content that went beyond the development of Internet skills, the review of the literature is also broadened to include a serious account of the literature pertaining to children's learning within complex environments and how curriculum is constructed, understood and transferred in ways that build student motivation, self-efficacy, participation and ownership. For this reason, the next sections review the literature pertaining to motivation and engagement in relation to developing and sustaining reading in authentic contexts for authentic curricular goals. Likewise, the literature pertaining to scaffolding has important resonance for the present study, particularly in relation to the transfer of responsibility from teacher to student, the development of peer collaboration and the development of autonomy in group work. Thus, a briefer review of the literature pertaining to scaffolding theories is presented.

Motivation and Engagement for Reading

Guthrie and Wigfield (2000) noted that engaged reading is "strategic and conceptual as well as motivated and intentional" (p. 404). They located motivation, personal goals and social aspects alongside cognitive strategies when they proposed that engaged readers "coordinate their strategies and knowledge (cognition) within a community of literacy (social) in order to fulfil their personal goals, desires, and intentions (motivation)" (p. 404). The use of a wide angle lens on motivation and engagement permits us to view the complexity, and multidimensional interactions, and utilisation of cognitive and metacognitive reading strategies, both print and online, alongside the role of motivational aspects and the influence of social learning dimensions on the engaged reader.

In the "Principles of Engagement", Cambourne (1995) proposed that for engaged literacy learning, the reader must have confidence in their ability to perform an activity without anxiety, must value the purpose of that activity and must take responsibility for learning following demonstration. The engaged reader is strategic, has personal goals for reading, is self-efficacious, interested and self-regulated and has expectations of success.

The goals a reader brings to a task play an important role in developing and sustaining motivation for learning (McCombs, 1996). Goals may be either ego-performance-related or learning-mastery-oriented (McCombs, 1996; Oldfather & Wigfield, 1996). Students with ego-performance-related goals may focus more on obtaining higher grades and outperforming others. Students who have more learning-mastery-oriented goals are more self-regulated, effortful and oriented towards developing conceptual understanding and value learning as an end in itself.

Bandura (1977) defined self-efficacy as a process whereby people "process, weigh, and integrate diverse sources of information concerning their capability, and they regulate their choice behaviour and effort expenditure accordingly" (p. 212). These information sources include, for example, perceived accomplishments in past performances with regard to success or failure; observed comparisons to others; feedback and encouragement from peers, teachers and family; physiological states, such as anxiety, sweaty palms, etc. (Henk & Melnick, 1995). Judgements are made in specific activities based on these sources which enhance or inhibit the amount of effort expended, determine whether the task is undertaken or indeed the amount of persistence expended on the task goal (Bandura & Schunk, 1981; Miller & Faircloth, 2009; Oldfather & Wigfield, 1996; Schunk & Zimmerman, 1997). Bandura (1977)

stressed the link between the belief that one is capable of carrying out an activity and the completion of that activity. When children have high levels of self-efficacy with regard to reading competence, they expend greater energy on the reading task, read more widely and read with greater motivation, engagement and expected success (Guthrie & Wigfield, 2000).

Interest in reading leads to deeper processing of text and has both affective and cognitive dimensions, which are reciprocal in nature. Broadly, two types of interest are identified in the literature: situational interest and personal interest (Alexander & Kulikowich, 1994; Hidi & Baird, 1988; Hidi & Renninger, 2006; Schiefele, 1999). Personal interest represents a "stable evaluative interest towards a certain domain" (Schiefele, 1999, p. 258). It is typically self-generated and sustained. Readers with a well developed personal interest in a topic invest greater energy on demanding tasks, are more curious and ask more interesting questions. Situational interest is a more temporary and externally triggered state which may be sparked by interesting or surprising information (Garner, Gillingham & White, 1989) or hands-on activities (Guthrie, 2004). Situational interest may also be sustained over a period of time through meaningful activities, such as project-based learning (Hidi & Renninger, 2006).

Motivation for reading may be intrinsically or extrinsically driven. Intrinsic motivation for reading is self-determined and volitional (Oldfather & Wigfield, 1996; Ryan & Deci, 2000). Intrinsically motivated readers are positively disposed towards reading, are autonomous, read more frequently and experience what Csikszentmihalyi (1990) has referred to as 'flow', that experience of loosing oneself in a book. Extrinsic motivation is subject to a more externally driven outcome. Ryan

and Deci (2000) proposed a taxonomy of extrinsic motivation across a continuum. Extrinsic motivation may be *externally regulated,* focussed on rewards, compliance or fear of consequences. It may be *introjective,* focussed on gaining the approval of others. Extrinsic motivation may also involve *identification* or recognition of the inherent value of an activity which is somewhat more internally driven. Finally it may be subject to *integrated regulation,* where one assimilates externally imposed regulations, such as preparation for exams. Interventions focussed on developing intrinsic motivation in reading have shown that children are more involved, curious and have more preference for challenge (Wigfield, Guthrie, Tonks & Perencevich, 2004) and develop higher levels of conceptual learning (Pintrich, Marx & Boyle, 1993).

The engaged reader has both the "skill and will" to engage with self-regulated learning in a climate of "social support" (McCombs, 1996, p. 77). The literature notes the possible decline in motivation and engagement for some children as they advance through school (McKenna, Kear & Ellsworth, 1995; Wigfield et al., 1997). The reasons for this decline are complex. Guthrie and Wigfield (2000) proposed two possible explanations. Firstly, as children progress through school they become aware of their ability vis-á-vis others. Secondly, instructional practices and classroom cultures may impinge on children's motivation for reading.

A classroom culture which promotes a sense of community, develops self-efficacy, intrinsic motivation, learning centred goals, individual and situational interest within a self-regulated learning environment fosters engagement in learning and reading outcomes. These classroom cultures are developed through providing challenging and interesting activities, promoting student choice and autonomy, and

encouraging collaboration (Gambrell, 1996; Guthrie & Wigfield, 2000; Malloy & Gambrell, 2008; McCombs, 1996; Ruddell & Unrau, 1997; Turner, 1995).

Tasks should be moderately challenging with reasonable prospect of success (Miller & Faircloth, 2009). Tasks should be located at the edge of the student's zone of proximal development (Vygotsky, 1978) with clear and specific goals (Turner, 1995). Real world, authentic tasks and hands-on activities encourage problem-solving, active thinking, involvement, and interest (Guthrie & Wigfield, 2000).

Tasks should also promote student autonomy and the development of self-regulation and control, in what McCombs (1996) has referred to as developing the self-as-agent. Providing a student with a choice of activities is a "powerful motivator" (Turner & Paris, 1995). Initially the teacher should provide guidance for students in making choices (Guthrie, 2004). Students expend more energy and persist when tasks are personally relevant and interesting and this in turn engenders intrinsic motivation (Schiefele, 1999).

McCombs (1996) stressed the importance of social support as an "enabling interpersonal context for the empowerment of will and the development of skill, specifically through quality relationships and interactions with others" (p. 78). Social collaboration enables students to position themselves within a community of learners where the discourse between students facilitates an increase in both individual and group confidence to succeed, persist with tasks and socially construct meaning from text (Turner, 1995). Such social support can raise the bar for all group members by providing benchmarks of achievement and improvement within the group, can spark interest and curiosity and engender responsibility towards other group members

(Guthrie & Wigfield , 2000; McCombs, 1996; Oldfather & Wigfield, 1996; Turner, 1995),

It is particularly important to develop motivation and engagement among struggling readers from disadvantaged communities in ill-structured and complex domains, such as the hypertextual environment of the Internet (Spiro, Coulson, Feltovich & Anderson, 2004). The Internet can provide contexts for providing challenging tasks and opportunities for collaboration (Coiro & Putman, 2008). It can also provide access to a broader range of text formats and modalities and opportunities for self-selection (Gambrell, 2006). However, it can be a challenging environment where McCombs's notion of the agent-as-self is crucially important and where the reader must orient themselves (Hill & Hannafin, 1997), have high levels of self-efficacy (Tsai & Tsai, 2003), persistence (Bilal, 2000) and have an ability to flexibly adapt and take responsibility for their own learning in a dynamic and changing environment (Dalton & Proctor, 2008).

Guthrie, Wigfield and Perencevich (2004b) contend that it is possible to scaffold children to develop both cognitive strategies and motivation for reading. The next section considers scaffolding theories from the perspectives of expert-novice and peer-to-peer scaffolding.

Scaffolding Theories: Expert to Novice and Peer-to-Peer

The *gradual release of responsibility* model (Pearson & Gallagher, 1983) posits that the development of learning strategies within a task require different levels of teacher and student responsibility for successful completion of a task. Initially the teacher takes complete responsibility for a task by demonstrating and modelling a strategy. This is followed by guided practice and a gradual release of responsibility

to the student where the teacher scaffolds the development of autonomy within the student, as the student takes responsibility for both activating and monitoring the use of a particular strategy. The gradual release of responsibility model draws on *scaffolding theories* (Wood et al., 1976). Although the model refers to the expert-novice scaffolding process, it does not refer to what occurs within the zone of student responsibility when students could possibly scaffold each other in developing the autonomous use of strategies. This remainder of this section of the literature review draws on literature in both expert-to-novice scaffolding and peer-to-peer scaffolding within cooperative learning situations.

Wood et al. (1976) defined scaffolding as a "process that enables a child or novice to solve a problem, carry out a task or achieve a goal which would be beyond his unassisted efforts" (p. 90). As such, scaffolding draws on the Vygotskian concept of the *zone of proximal development* (ZPD) where the learner socially constructs knowledge with a more knowledgeable other. Vygotsky defined this ZPD (1978) as "the distance between the actual development level as determined by independent problem-solving and the level of potential development as determined through problem-solving under adult guidance or in collaboration with more capable peers" (p. 86).

Scaffolding involves functions, such as gaining and maintaining a child's attention, reducing the task to manageable components, accentuating relevant features of the task, reducing possible frustrations and demonstrating and modelling task components (Wood et al., 1976). In the classroom, scaffolding involves a delicate balancing act for the teacher where the teacher provides "just-in-time" assistance (Hmelo-Silver, Duncan & Chinn, 2007), through explicit strategy

instruction, modelling, demonstrating and thinking aloud in a task situation where the student is challenged. Azevedo, Cromley and Seibert (2003) described four levels of scaffolds - conceptual, metacognitive, procedural and strategic. Each of these scaffolds provides support to the student to develop self-regulation by providing hints and prompts on what to consider during problem-solving. Each scaffold also develops knowledge about underlying processes, provides guidance about how to perform tasks, and suggests what strategies to consider when performing tasks. Quintana et al. (2004) draw on Collins, Brown and Newman's (1989) cognitive apprenticeship model to note that students will develop problem-solving skills through a more knowledgeable other mentoring, guiding, coaching and structuring the task for the student, without explicitly giving students the answers. Such scaffolding is both generative and reflective (Collins et al., 1989; Daiute & Dalton, 1993). The goal is that teacher assistance will fade over time and the student will apply strategies to new situations and adopt a flexible, metacognitive approach which includes procedural, declarative and conditional levels of knowledge (Bereiter & Scardamalia, 2006). Scaffolding involves continuously monitoring the level of support needed and making adjustments accordingly. This kind of *adaptive* scaffolding leads to greater levels of self-regulated learning (Azevedo et al., 2003).

The Reciprocal teaching model (Brown & Palinscar, 1985; Palinscar & Brown, 1984) draws on Vygotskian perspectives, scaffolding theories (Wood et al., 1976) and proleptic teaching methods where assessment and instruction are aimed in "anticipation of levels of competence not yet achieved individually but possible within supportive learning environments" (Brown & Campione, 1986, p. 1065). Reciprocal teaching involves explicit strategy instruction in four *comprehension*

fostering strategies (predicting, questioning, clarifying and summarisation) and *comprehension monitoring*. The instruction occurs initially in teacher-led dialogue sessions where the instruction is overt, explicit and embedded in meaningful contexts. This is followed by a gradual release of responsibility to the students where the students take turns in leading the dialogue centred on portions of the text.

Rosenshine and Meister (1994) conducted a review of 19 research studies using the Reciprocal teaching (RT) model and found an effect size in favour of RT of .32 for standardised tests and .88 on experimenter designed tests, which indicated that RT increased student ability to apply these strategies.

RT provides an example of an instructional model where students can act as the "more knowledgeable other" (Daiute & Dalton, 1993; Goatley, Brock & Raphael, 1995) and can scaffold each other and co-construct knowledge within a zone of proximal development in peer-to-peer collaborative learning situations. The literature provides strong and robust support for the benefits for student learning within collaborative learning ecologies in classrooms (Cohen, Kulik, & Kulik, 1982; Barron & Darling-Hammond, 2008; Ginsburg-Block, Rohrbeck & Fantuzzo, 2006; Johnson & Johnson, 1981, 1989, 1999; Slavin, 1996).

There are a number of characteristics of the processes and outcomes of collaboration. Johnson and Johnson (1999) distinguished five basic elements, which they identified from extensive research as common characteristics of collaborative learning activities. These are positive interdependence, individual accountability, face-to-face promotive interaction, social skills, and group processing (pp. 70-71).

When students collaborate in constructing meaning from text, they have what Kucan and Beck (1997) refer to as "multiple resources at the reading construction

site" (p. 289). Processing moves from individual reader-text interactions to a situation where readers can draw upon not only the knowledge of others (both students and teachers) but also the "processes by which such knowledge is constructed". Therefore, as students interact in social settings, they are acquiring both knowledge and the processes by which knowledge is constructed (Putney, Green, Dixon, Durán & Yeager, 2000). This socio-constructivist perspective allows for a window onto the processes of others when constructing meaning through discourse in a social setting (interpersonal) which could later transfer to an internalisation of the strategic processes within an individual (intrapersonal) (Vygotsky, 1978). Knowledge is not merely "the sum of individuals' knowledge" but is rather "distributed among participants as the nature of their participation shifts" (Gutiérrez & Stone, 2000, p. 160). As such, the 'knowledgeable other' in a collaborative situation may shift. Daiute and Dalton (1993) in asking the question, "*can novices be masters?*" explored the complexity of collaboration among peers. They contended that in such a case the ZPD is dynamic and shifting as students draw on different levels of strengths and expertise within a task.

Barron (2000) cites Clarke's (1996, p3) notion of *ensemble* to capture the interdependence of student interactions in groups. Barron's (2000) research showed that more successful collaborative groups share a high level of "mutuality and consistent joint attention" (p. 432) which resulted in shared problem-solving activity and coordinated effort.

Successful collaborative processes encourage students to move beyond parallel and associative styles of collaboration to engage in self-reflections, particularly when providing instructions, and responding to questions and challenges within the group

(Foreman & Cazden, 1994, p. 175). Successful collaborative groups engage in "huddling" (Barron, 2003, p. 349), where group members pay attention to other points of view, listening, engaging and responding to ideas within the group. In co-constructing knowledge, group members examine their own knowledge and beliefs and develop a sense of agency, deeper engagement with tasks (Barron, 2000) equality (Daiute & Dalton, 1993) and consensus building (Palinscar & Herrenkohl, 1999) among group members and observation of the strategies of others (Azmitia, 1988).

In sum, this section considered three diverse theoretical frameworks which provide a backdrop for the remainder of the review of the literature. Firstly, a new literacies framework allows for the consideration of the development of cognitive skills and strategies as they play out during online reading comprehension. Secondly, motivation and engagement models permit consideration of the affective dimensions of the development of engaged readers in both print and online environments. Finally, scaffolding theories afford us a view of expert-to-novice and peer-to-peer scaffolding in the development of cognitive strategies and affective dimensions of engaged reading in a social setting.

The Development of Reading Comprehension: Reader Characteristics, Skills and Strategies

As online literacies are built on the foundational skills of print literacies, it seems sensible to explore the literature on reader characteristics and the skills and strategies employed by readers of print based texts in the first instance. This is followed by a consideration of online reading comprehension and reader characteristics and the skills and strategies used by readers in an online environment. The next section

explores the characteristics of reading in print based environments and opens with a consideration of the development of reading comprehension.

Development of Reading Comprehension

Comprehension has been described as the 'essence' of reading (Durkin, 1993). While the importance of reading with 'meaning' and 'understanding' underpins comprehension these terms are imprecise and open to interpretation (Kintsch, 1998). Reading comprehension is a complex process to pin down involving as it does an interaction between the reader and the text in a variety of contexts and with multiple purposes (RAND Reading Study Group, 2002; Lipson & Wixson, 1986). Comprehension involves in the head processes, which are elusive and largely invisible, and products which are somewhat more visible (Harrison, 2004; Pearson, 2009; Pearson & Hamm, 2005). Pressley (2000, p. 551) drew elements of comprehension theory together when he described reading comprehension as beginning with:

> decoding of words, processing of those words in relation to one another to understand the many small ideas in the text, and then both unconsciously and consciously, operating on the ideas in the text and the reader's response to those ideas, responses that often depend greatly on the prior knowledge of the reader.

In this quotation, Pressley draws together much of emphases in the research literature on reading comprehension since the late 70's (for a recent review see Pearson, 2009). The metaphor of the reader as *"builder"* (Pearson, 2009) draws on schema theory where the reader draws on prior knowledge to make sense of the text (Anderson, 2004); the reader as *"fixer"*(Pearson, 2009) draws on the reader as a metacognitive problem solver, where the reader operates on ideas within the text (Baker & Beall, 2009; Baker & Brown, 1984; Paris, Lipson & Wixson, 1983); the

reader as *assembler* draws on cognitive models, such as propositional models (Kintsch, 1998; Kintsch & van Dijk, 1978) and cognitive flexibility theoretical models (Spiro et al., 1994); the reader as *responder* draws on reader response theory (Rosenblatt, 1978) where the reader transacts with the text adopting an efferent or aesthetic stance. Reader response, however, does not occur in a vacuum and social perspectives, such as sociocultural and socio-constructivist theories relate to the reader, the text, the activity and the context within which reading response occurs (Smagorinsky & O'Donnell-Allen, 2000; RAND Reading Study Group, 2002). In "extracting and constructing meaning through interaction and involvement with written language" (RAND Reading Study Group, 2002, p. 11) the good reader draws on a range of skills and strategies.

Reader Characteristics: Good Readers What We Know

Pressley and Afflerbach (1995) conducted a meta-analysis of over 63 think aloud studies which examined the verbal reports and subsequent protocol analysis of the strategies which readers use when reading text. Protocol analysis methodologies have some limitations, such as the extent to which a reader can articulate reading processes which often operate at the periphery of conscious awareness (this will be further developed in Chapter 3, Methodology). Nevertheless, the groundbreaking analysis conducted by Pressley and Afflerbach (1995) provided a lens onto the "constructively responsive reading comprehension strategies" of good readers. The processes which good readers use relate to three broad categories, which Afflerbach and Cho (2009, p. 77), in an update of the research conducted since the 1995 study, noted as including "identifying and remembering important information, monitoring and evaluating". As such, good readers are strategic, motivated and set goals for

reading. They are selectively attentive, make inferences, and integrate information across texts. Good readers interpret what the text means, moving beyond the surface code to the text base. They activate and connect with prior knowledge, attend to text structure, evaluate, ask questions of the text, determine importance and summarise as they read. Finally, they process text before, during and after reading (Afflerbach & Cho, 2009; Dole, Duffy, Roehler & Pearson, 1991; Duke & Pearson, 2002; Pressley & Afflerbach, 1995). Good readers are "active readers who constructs meaning through the integration of existing and new knowledge and the flexible use of strategies to foster, monitor, regulate and maintain comprehension"(Dole et al., 1991, p. 242).

The strategies which good readers use when reading text should inform our work with struggling readers. However, the literature suggests that work with struggling readers often focuses exclusively on the development of the subskills of reading, such as decoding or assigned workbook activities, with little or no emphasis on the development of reading comprehension. This is in spite of the fact that research has shown that teachers who emphasised the development of higher-order thinking skills in a meaning-based curriculum induced more powerful learning among struggling readers (Puma et al., 1997). Both research and reviews of studies on effective instruction with struggling readers note that teacher directed literacy programmes, implemented in classrooms, which were inclusive, principled, direct, extended, balanced and authentic were more successful. Such literacy programmes were underpinned by both formative and summative assessment practices, explicit strategy instruction and direct linkage of these strategies to texts (Duffy-Hester, 1999; Hiebert & Taylor, 2000; Hock, Brasseur & Deshler, 2008; Pikulski, 1994; Snow &

Biancarosa, 2003; Strickland, Ganske & Monroe, 2002). In a review of the literature Allington and McGill-Franzen (2009) emphasise the need to develop "powerful instruction matched to learners with different developmental needs" (p. 556) and stress the need to view struggling readers as a heterogonous group where poor decoders may have high comprehension ability and vice versa or may have difficulty with both decoding and comprehension. Instruction which focuses on the development of reading comprehension may indeed facilitate the development of sub skills.

The next section, firstly, considers the differences between reading strategies and skills and this is followed by a consideration of the four comprehension strategies of activating prior knowledge, asking questions, determining importance and summarisation.

Development of Reading Skills and Strategies

The literature seems to suggest that *reading strategies* and *reading skills* are at opposite ends of a continuum. Whereas strategies are effortful, deliberate, active, goal directed, conscious and purposeful actions on the part of the reader to construct meaning from text, skills are characterised by automaticity, fluency, effortlessness and effectiveness, often without the explicit conscious control of the reader (Alexander, 2006; Afflerbach, Pearson & Paris, 2008; Dole et al., 1991; Dole, Nokes & Drits, 2009; Pressley, 2000; Pressley & Harris, 2006). Reading strategies have been described as "skills under consideration" (Paris et al., 1983 p. 295). Furthermore, it appears that the good reader has the ability to "shift seamlessly" (Afflerbach et al., 2008, p. 371) between the automatic use of a reading skill to the effortful use of a reading strategy. What is perhaps a little more unclear in the

literature is where on the suggested continuum a strategy ends and a skill begins, how the reader moves between both and how skills and strategies complement each other. Therefore, one of the goals of this present study might be characterised as an attempt to give some attention to the development of skills and strategies and to externalise these skills and bring them under the conscious control of the online reader.

Strategic reading is both developmental in nature and open to instruction. Alexander (2003, 2006) distinguishes between surface level strategic processing (for example, altering the reading rate when problems occur), and deep level strategic processing where the reader transforms the text (for example, establishing intertextual (Hartman, 1995) links). Alexander (1997, 2003), in her Model of Domain Learning, contends that reading develops across the lifespan of the reader from "womb to tomb" (Alexander, 1997, p. 5) in three stages: acclimation, competence and expertise/proficiency. In the acclimation stage, reader knowledge is fragmented, piecemeal and naive and the reader uses surface level strategies, drawing on limited experiences and prior knowledge. This results in difficulties in distinguishing relevant from irrelevant, and accurate from inaccurate information. The competence phase is characterised by deeper processing strategies, drawing on a more cohesive and extensive prior knowledge base, individual interest in a topic and motivation, which is more intrinsic in nature. Finally, the proficient/expert reader draws on a highly principled and rich knowledge base with effective and efficient use of strategies and an individual rather than a situational identification and investment in domain knowledge.

Pearson and Gallagher (1983) also noted that there are developmental issues with regard to strategy use among older/younger and good/ struggling readers. These developmental issues related to connection to a greater level of prior knowledge, the range of general and specific vocabulary, the ability to determine importance, draw inferences, ask questions, monitor strategy use and summarise text. The literature attests to the fact that cognitive reading strategies can be taught (Duffy et al., 1987; Pressley, Johnson, Symons, McGoldrick & Kurita, 1989; Pressley et al., 1992; Rosenshine, Meister & Chapman, 1996) and that strategy instruction leads to a concomitant rise in achievement in reading comprehension (National Reading Panel (NRP), 2000)

Repertoire of Reading Strategies

Good readers orchestrate a repertoire of strategies when reading. The NRP (2000) considered some 203 studies (which met specific panel criteria) of comprehension instruction which led to achievement gains in reading comprehension. The NRP team subsumed these studies into 16 broad categories. The next section deals with some of these categories: prior knowledge, questioning (generation and answering), and summarisation including determining importance in text, as these categories relate directly to the present study.

Prior Knowledge

Schema theory is the theory of how knowledge is represented in memory. There are strong reciprocal relationships between the levels of prior knowledge a reader brings to a text and the reader's ability to construct a coherent model when comprehending text (Fielding & Pearson, 1994). Indeed, Johnson and Pearson (1982) found that prior knowledge was a stronger predictor of subsequent reading

comprehension than either IQ or reading achievement scores. Readers actively draw on prior knowledge to iteratively connect with, sift, refine and organise information to construct meaning from text (Anderson & Pearson, 1984; Pearson, Roehler, Dole, & Duffy, 1990). Readers draw on a range of prior knowledge sources in print based texts including world knowledge (Anderson & Pearson, 1984), domain and topic knowledge (Alexander, 1992; Alexander, Jetton & Kulikowich, 1995), informational text structure knowledge (Armbruster, 1986; Goldman & Rakestraw, 2000), and linguistic knowledge (Anderson, Spiro & Anderson, 1978).

Anderson (2004) proposed a detailed explanation of the role played by prior knowledge in the construction of meaning from text. Firstly, schemata provided "ideational scaffolding for assimilating text information"(p. 598) where the expectation on the part of the reader is that information will fill the schemata slots and that this information can then be more easily learned or remembered. Secondly, schemata help the reader to determine importance in text and to be selectively attentive to this information. Thirdly, an ability to determine importance allows the reader to edit and summarise the text, omitting irrelevant details and focussing instead on summarising important information. Fourthly, schemata allow the reader to draw inferences about what is not stated explicitly in text. Fifthly, schemata allows for "inferential reconstruction" (p. 599), where the reader can draw on schemata and information recalled from the text to reconstruct information missing from text. Finally, schemata permit "orderly searches of memory" (p. 599) where the reader can activate prior knowledge of a particular event or experience to recall the order in which those events occurred.

In sum, readers draw on prior knowledge, in an active metacognitive fashion, to make connections, determine importance, make inferences, monitor and repair comprehension, and derive summaries (Pearson et al., 1990).

Allington and McGill-Franzen (2009) noted that struggling readers often have limited prior knowledge to draw on, have difficulty with integrating text information within and across texts and with both making inferences and realising that inferencing is both permissible and possible. The instructional implications from schema theory include: the importance of helping children to activate and connect with relevant prior knowledge; the need to update schemata following learning; and the need to build prerequisite topic domain and text structure knowledge (Anderson, 2004).

Asking Questions

Teacher generated questions in the form of an initiation-response-evaluation (IRE) format have traditionally dominated the instructional landscape in classrooms (Fielding & Pearson, 1994). These questions have often taking the form of a gentle interrogation (Allington, 1994) rather than a carefully designed hierarchy of questions (including literal and higher order questions) intended to develop student understanding and help forge connection between elements within the text (Pearson & Gallagher, 1983).

On the other hand student-generated questions, particularly higher-order questions, lead to deeper processing of texts with a concomitant rise in reading comprehension (Dole et al., 1991; Pearson et al., 1990). In a meta-analysis of studies investigating instruction in generating questions, Rosenshine, Meister and Chapman (1996) found that teaching students to generate questions resulted in gains in

comprehension with a significant effect size of 0.36 on standardised tests and 0.86 effect size on experimenter designed tests when compared to a control groups. Taboada and Guthrie (2006) noted that self-generated questions resulted in a significant degree of variance in students' reading comprehension even after accounting for prior knowledge. The process of generating questions heightens students' awareness of reading comprehension in a number of ways. Students who generate questions are more active and more involved in the reading process than those who merely answer teacher generated questions (Singer & Donlon, 1982). Asking questions may sensitise the reader to pay selective attention in reading specific paragraphs and integrate information across texts read. The levels of questions asked enable students to build knowledge structures from text. Instruction in generating questions on narrative and informational texts has impacted positively on reading comprehension (Brown & Palinscar, 1985; Raphael & Pearson, 1985; Rosenshine et al., 1996; Scardamalia & Bereiter, 1992; Singer & Donlon, 1982).

The question-answer-relationship (QAR) model is one approach to instruction. Studies have shown that the QAR model helps students to articulate and identify the relationship between the question posed and the subsequent answer generated, has improved the quality of student answers including the ability of the student to evaluate their own question-answer behaviour and helped students to recognise and integrate information appropriate to the question (Raphael & Pearson, 1985; Raphael & Wonnacott, 1985). The QAR model provides a meta-language to help students share a common language of the processes involved in answering and posing questions (Raphael & Au, 2005). As the student asks *Right There* (text explicit), *Think and Search* (text implicit), *Author and Me* (script explicit) and *On my Own*

(script implicit) questions, they are involved in scanning to locate information, clarifying, monitoring, inferencing, making connections to prior knowledge, determining importance and summarising. Raphael and Pearson (1985, p. 233) suggested that the "awareness of the interplay among texts, background knowledge and types of comprehension questions" helped students to develop reading comprehension. Asking questions and activating of prior knowledge are facilitative rather than causative, i.e. both contribute to enhanced reading comprehension of text.

Determining Importance in Text

The ability to determine importance, in both identifying and recalling central elements in narrative and informational texts, are crucial skills in constructing meaning from text and are amenable to instruction (Baumann, 1984). Determining importance involves macroprocessing of the text in a process of deletion, construction and generalisation (Kintsch & van Dijk, 1978) to distinguish between author determined and reader determined importance. Dole et al. (1991) noted that good readers are often more able to distinguish author-signalled importance than struggling readers. They asserted that this is because good readers draw on a wider domain of topic knowledge to evaluate relevance. Good readers are more widely read and are more cognisant of author intentions and goals.

If trivial information in text is highly interesting it may interfere with normal processing of text (Hidi, Baird & Hildyard, 1982). Garner et al. (1989), in a study of skilled adult readers, found that the readers were distracted from macroprocessing by the presence of "seductive details" (p. 41). In a replication study conducted with children the authors found that macroprocessing was more difficult for children and the main idea was "remembered only if "shouted" rather than "whispered" and then

only if no "noise" was present to distract the student" (p. 52). This tendency to focus on salacious details can interfere with focussing on determining important central concepts in text (Oldfather & Wigfield, 1996).

Good readers activate their schema of text structure to determine importance in text and use skills and strategies accordingly. Children come to school with an awareness of the once-upon-a-time nature of narrative texts and a mental representation of the elements of narrative texts, such as characters, initiating events, plots and solutions. They make connections to narrative texts by drawing on connections to other texts, to life, and personal experiences, thereby recalling events in the text more easily. On the other hand, despite the fact that informational text is ubiquitous in society, there is a paucity of informational text in primary schools (Duke, 2000; Duke & Pearson, 2002; Ogle & Blachowicz, 2002). Authors have noted the importance of inclusion of such texts in classrooms (Shiel, 2001/2002; Wray & Lewis, 1997). Informational texts include domain specific vocabulary to convey concepts. Internal text cues, such as compare/contrast, generalisation/ example and problem/solution and external cues, such as table of contents, headings, visual images, and graphs may add to the complexity of reading informational texts if the reader is unaware of these text structures and the need to apply suitable skills and strategies in reading them (Kletzien & Dreher, 2004). Good readers are able to recognise cues in informational texts which signal importance. An additional complexity with reading informational text is related to locating specific information related to a goal rather than recalling or understanding entire texts.

Summarising

Summarising the information contained in a text entails "separating the wheat from the chaff" (Pearson et al., 1990, p. 12) to determine, encapsulate and synthesise the central concept in a passage, to identify supporting information for the central concept and to avoid the inclusion of unimportant information. As such, summarisation can involve organising, sifting, determining, generating, condensing, constructing and transforming information contained in a passage to capture concisely the essence of a text (Block & Pressley, 2002; Guthrie & Taboada, 2004; Pearson & Gallagher, 1983; Pearson et al., 1990; Pressley & Afflerbach, 1995). Clearly, summarisation is a "complex process involving interactions between readers and texts in various contexts for various purposes" (Pearson et al., 1990, p. 6). Summarisation is developmental in nature (Dole et al., 1991, p. 244) with clear distinctions between older and younger readers and good and struggling readers (Winograd, 1984). Brown and Day (1983) and Brown, Day and Jones (1983) produced a set of *macrorules* for summarisation which comprise deleting unnecessary, trivial or redundant information, followed by the creating superordinate lists and subordinate minor concepts, and finally selecting a topic sentence or inventing a topic sentence where none exists. These rules broadly correspond to the Kintsch and van Dijk (1978) model of deletion, generalisation, selection, invention and construction, and may be useful in instructional settings.

In sum, four strategies were considered in this section; activating prior knowledge; asking questions, monitoring and determining importance in both narrative and informational text, and summarisation.

Having looked in detail at the fine grain of teaching reading comprehension skills and strategies, the next sections considers a number of instructional print-based models as they play out in the ecology of learning in classrooms. In the case of the present study, the intention was to develop reading comprehension and information-seeking skills and strategies both in print-based and online Internet environments, within the context of an integrated curriculum in the ecology of learning in classrooms. Given the complex nature of the proposed study, it was therefore important to consider other important instructional models which have sought to support the development of reading comprehension and forge interdisciplinary links between literacy and science within the literacy field, as well as to tease out elements in these models on which the proposed study might draw. The next sections describe and review two such important instructional models: the Seeds of Science/Roots of Reading and CORI models.

Reading Strategy Instructional Models: Linking Science and Literacy

Science and literacy share a number of commonalities, such as thinking processes (e.g. observing, inferring and predicting) (Padilla, Muth & Lund Padilla, 1991) and metacognitive strategies (e.g. critical evaluation, systematic analysis and determining main idea) (Baker, 1991). The instructional models considered in this section seek to create a synergy between literacy and science, taking the view that each affords support to the other and that benefits, such as conceptual knowledge, reading engagement and enhanced comprehension, accrue from this synergy. This section considers two instructional models: the Seeds of Science/Roots of Reading (Seeds/Roots) model (http://seedsofscience.org) and the Concept-Oriented Reading Instruction (CORI) model (http://www.cori.umd.edu).

Seeds of Science /Roots of Reading Model

The basic premises of the synergy between literacy and science underpinning the Seed/Roots developmental inquiry model are that "comprehension strategies *are* inquiry strategies; words *are* concepts; science *is* discourse; and literacy *is* visual literacy" (Cervetti, Pearson, Bravo, & Barber, 2006, p. 226, italics in original).

Firstly, science and literacy share a number of cognitive functions and strategies for inquiry-based learning. These include creating and forming goals for learning, making predictions, activating prior knowledge, making connections and drawing inferences. Secondly, "words are fundamentally conceptual" (Cervetti, Pearson, Barber, Hiebert & Bravo, 2007, p. 164). Conceptual knowledge of a core scientific vocabulary is built where students become aware of conceptual connections between words, thus forming networks between concepts. Vocabulary is presented in a multimodal fashion where students "read it, write it, talk it and do it". Everyday language is used as a window to develop scientific language, for example replacing *clues* for *evidence* or *look* for *observe*. Thirdly, text is used in the Seeds/Roots model to support first hand investigation either before, during or after investigation. The Seeds/Roots team (ibid, 2006, ibid, 2007) argue that both text and experience have a role to play in the inquiry process. Although acknowledging that text cannot replace first-hand experience, the team argue that text can provide a route into the specialised language of the discipline, model scientific processes and present content which may not be observable first-hand. These arguments are similar to those presented by the Guided Inquiry Supporting Multiple Literacies (GIsML) team (Palinscar & Magnusson, 2001). Finally, science is a "discourse about the natural world" (Cervetti et al., 2007, p. 165) with its own vocabulary and organisational structures. The Seeds/Roots model provides structured supports for students to

engage in the discourse of the discipline in making claims, critiquing, communicating findings and presenting evidence-based arguments.

Research conducted on the Seed/Roots model (Barber, Catz & Arya, 2006) showed that students in the programme made significant gains across a series of measures including science content knowledge and literacy skills when compared to all other treatment groups (science-only, literacy-only and no treatment groups).

The CORI Model

In the CORI model Guthrie and his colleagues (see for example, Guthrie et al., 1996; Guthrie et al., 2006; Guthrie, Wigfield & Perencevich, 2004a; Swan, 2003) draw together principles from theoretical perspectives, such as intrinsic motivation (Ryan & Deci, 2000), interest (Alexander, 2006), self-efficacy (Bandura, 1977) and strategic instruction (NRP, 2000) to frame an instructional model which seeks to simultaneously support the construction of conceptual scientific knowledge, the acquisition of cognitive reading strategies and the development of engaged and motivated reading.

In brief (the reader is directed to Guthrie et al., 2004a), for a more detailed description), CORI list a number of classroom characteristics which support the cognitive and motivational aspects of reading: (a) scientific inquiry is developed across four strands (observe and personalise, search and retrieve, comprehend and integrate and communicate to others) where the students are involved in scientific activities, such as observing, hypothesising, collecting data and representing graphically; (b) a conceptual science theme is developed over a 12 week period which seeks to forge links between narrative texts and informational texts; (c) the children are offered choice and are immersed in a print rich environment with an

abundance of interesting texts which are designed to develop situational interest; (d) reading strategies drawn from the NRP (2000) report, such as activating prior knowledge, asking questions, searching for information, organising graphically, and summarising, which are explicitly taught and developed singly initially and then in tandem; (e) hands-on activities designed to develop situational interest precede instruction; and (f) collaboration is encouraged between students. In this way, CORI is designed to enable children to make connections between their hands-on experiences, the reading strategies they employ and the development of intertextual links across narrative and informational science texts. Again, the evidence for CORI significantly improving children's reading comprehension, motivation and engagement for reading and conceptual knowledge for science is substantial (Guthrie et al., 1998). Guthrie, Wigfield & Barbosa et al., (2004) compared the CORI model to two other instructional frameworks: a strategy instruction only (without motivational support), and a traditional instructional framework. Students in the CORI model again outperformed their counterparts in both. The aspects of motivational support offered by CORI and the degree to which specific aspects of CORI, such as autonomy, choice, hands-on activities or the provision of interesting texts impact on engagement, the development of reading comprehension and conceptual knowledge remain unclear and may warrant investigation (Miller & Faircloth, 2009).

Seeds/Roots and CORI models share some commonalities, such as that both are goal directed, strategy oriented, develop the language of science discourse and forge links between science and literacy. The differences between both relate to the support afforded by CORI for the development of motivation and engagement and

professional development for teachers using the programme. Another difference is the development of situational interest and the importance attributed to, and positioning of, first- and second-hand experiences. Neither the Seeds/Roots model nor the CORI models incorporate the Internet or other ICTs into their instructional models. This is surprising given that the Internet or other ICTs have, at the very least, the potential to develop situational interest by providing interesting text bases or virtual experiences for science learning.

The Development of Online Reading Comprehension: Reader Characteristics, Skills and Strategies

Emerging research suggests that print based and online reading comprehension are not isomorphic (Coiro, 2007, Leu et al., 2005) and therefore we need to consider the possibility that additional skills and strategies are needed to develop reading comprehension in an online environment (Coiro & Dobler, 2007). The interaction between the reader, text and activity (RAND Reading Study Group, 2002) may be more dynamic and more interactive in an online environment than in a print-based text (Alexander, Kulikowich & Jetton, 1994; McEneaney, 2006; Reinking, 1997).

The sections which follow examine the literature with regard to the characteristics of online hypertexts and reader characteristics and the deployment of skills and strategise in an online environment. The section concludes by reviewing emerging research from three Internet based inquiry instructional models. Firstly, however, consideration is given to a number of information-seeking models from both the user and reader perspectives.

Information-Seeking Models

The information-seeking models considered in this section of the review view information-seeking from either a *user perspective* in closed hypertext systems (Bates, 1989; Kuhlthau, 1991; Marchionini, 1992; Yang, 1997) or from a *reader perspective* in open information networks, such as the Internet (Eagleton & Dobler, 2007; Harrison, 2006; Harrison, Omar & Higgins, 2006; Leu et al., 2004). However, regardless of the perspective taken, each of these models provides insights into aspects of information-seeking and shares commonalities, such as recognising the complex orchestration of strategies in information-seeking and observing information-seeking as a problem-solving activity. All recognise the multifaceted, non-linear, iterative, dynamic and opportunistic nature of seeking information in a hypertextual environment.

In considering the cognitive processes involved in information-seeking in a computerised version of a text book chapter, Dreher and Guthrie (1990) noted that efficient location of information depended on speed and accuracy in the execution of the components of the information-seeking cycle which, they observed, included goal formation, category selection, extraction of information, integration of information (with prior knowledge), and recycling (until information requirements are satisfied). Their study found that the most efficient searchers optimised the time spent on category selection and therefore spent less time on information extraction.

Marchionini (1992) viewed the information-seeking model from a library science perspective, focusing on developing user interfaces which encouraged and supported the user to use the system effectively and efficiently to problem solve. He identified five areas related to the search process: defining the problem space; selecting the

resources necessary for the search; articulating the problem in terms of the search strategy; examining the results; and extracting the necessary information.

Bates'(1989) 'Berrypicking' model moved from the classic information retrieval model to view the search process as an evolving process where the query is not fixed but changes as the user adapts the strategies used to retrieve "bits and pieces of information" to satisfy the information need. Kuhlthau (1991) recognised also that the process of information-seeking is evolving but also noted that the user interest and state of knowledge is evolving rather than static and is influenced by previous search experience. Kuhlthau adopted a more holistic view of the information-seeking process, exploring the cognitive, physical and importantly, the affective dimensions of the information-seeking process from a user perspective across initiation, selection, exploration, formulation, collection and presentation. She charted how the knowledge state shifts as the affective state of the user changes within the search process. The user experiences emotions of uncertainty, confusion, and optimism as confidence is raised or dashed and the user is either satisfied or disappointed with the search results.

Yang (1997) examined the information seeking processes of six students on a closed Perseus hypermedia system. Building on earlier models, she viewed the information-seeking process as selecting the source of information; executing the search; interpreting information; judging the relevance of the information to task goal, and retaining or rejecting the information retrieved. She introduced user variables to the mix, noting that the information-seeking process calls into play a variety of "cognitive processes executive control (i.e. goal-setting, defining the task, reviewing and planning), reflexivity, intertextuality (i.e. cross-referencing the

resources within databases), reasoning and affective responses" (p. 79) as the learner reads links and composes in particular contexts.

The information-seeking models proposed by Eagleton and Dobler (2007), Harrison, (2006), Harrison et al. (2006) and Leu et al. (2004) see online reading as a cognitive reading comprehension issue and draw on various conceptual frameworks to describe *reader activities and perspectives* as they search for information in an open online Internet environment.

Eagleton and Dobler (2007) draw on constructivist (Bruner, 1986), sociocultural (Vygotsky, 1978) and semiotic (Labbo, 1996) discourses to describe the information seeking process during Internet inquiry. Their QUEST model views the information-seeking process as an active inquiry process where the child learns by doing in a collaborative environment. The model builds on what we already know from the literature on traditional literacy skills and learning, to view online information-seeking as a cyclical and recursive multi-step metacognitive and strategic inquiry process which leads to self-regulated learning. The stages in the model include forming questions to guide the task; understanding and determining appropriate resources needed for the task; evaluating the information retrieved for the task goal; synthesising and transforming information into knowledge; and communicating it to others in a meaningful fashion.

Harrison (2006), and Harrison et al. (2006) adopted a postmodern perspective which draws on conceptual frameworks, such as neo-Vygotskian activity theories (Engestrom, 2001; Lave & Wenger, 1991) and cognitive flexibility theory (Spiro et al., 2004) to describe the input-output process model of reading comprehension during Internet inquiry (drawing on the work of Omar et al., 2005). Although online

reading comprehension is the primary concern of the authors, they recognise the influence of inferred offline reading processes on online reading comprehension in a number of key areas. The cycles of information-seeking during Internet inquiry involve cycles of online and offline reading and comprehension procedures until the task is completed or the reader ceases the task. The reader determines the online search goal by calling upon their offline comprehension procedures, such as prior knowledge of the topic. Then the reader invokes online reading procedures by navigating the returned search list and selecting a web page to read. This is followed by reading the page (calling upon offline reading procedures, such as integrating and checking at the word, phrase and sentence level) and determining whether the content is sufficient for the search goal (again invoking the offline comprehension procedure) or whether the search goal needs to be modified before comprehension activity outputs, such as written artefacts are completed.

The new literacies framework (Coiro et al., 2008; Leu et al., 2004) is shaped by a number of guiding principles including that (a) literacy is shaped by historical, social, cultural and economic contexts; (b) the new literacies are central to participation in a global community; (c) the new literacies are multifaceted and multimodal; (d) new forms of strategic knowledge including critical literacies are fundamental to new literacies; (e) literacy transforms technology and vice versa in a transactional manner; (f) meaning is socially constructed; (g) the role of the teacher changes within the new literacies framework; (h) successful online readers access information speedily and efficiently; and finally (i) new literacies are constantly evolving and changing. The authors view online reading comprehension as an inquiry-based, problem-solving activity. They draw on and extend the RAND

Reading Study Group's (2002) heuristic of the text, activity and sociocultural context to include the reader's ability to navigate and construct an online reading path (Coiro & Dobler, 2007). The new literacies framework includes the skills, strategies and dispositions needed to identify important questions or problems to investigate; to locate information; to critically evaluate the information retrieved and finally synthesise and communicate online information to others.

The models reviewed provide important insights into the online information-seeking cycle from either a user perspective or a reader perspective. Influenced by consideration of the above models, the information-seeking cycle in this study is considered from both perspectives to include planning and goal formation to focus online tasks; generating and revising search terms; investigating search results; locating and critically evaluating the relevancy of the information retrieved for the task; and transforming, synthesising and communicating information.

A number of questions, however, remain unanswered about the online information-seeking cycle. Firstly, we need to ascertain how best to support readers both from a technological and a reader standpoint as they search for, retrieve, critically evaluate, transform, synthesise and communicate online information. Secondly, we need to determine what instructional practices would best support students online. Thirdly, we need to investigate the affective dimensions of the online seeking information process. For example, what dispositions are needed to persist with a task when the going gets tough? How do we support collaboration during the information-seeking cycle?

Afflerbach and Cho (2009, p. 81) believe that hypertext and Internet reading embody a "fundamental change in the architecture of acts of reading". The next

section opens with a consideration of what these changes may be, what the characteristics of online hypertexts are and what complexities hypertexts introduce for reading in an online environment. This is followed by a consideration of what is known from extant studies of the skills and strategies which readers use during the information-seeking cycle in an online environment.

Characteristics of Hypertext and Online Reading

Myers, Hammett and McKillop (1998, p. 63) refer to electronic hypertexts as hypermedia and note that these texts:

> require the author to create, and the reader to follow linked pathways through a whole collection of electronic "texts" presented as computer windows. Each window can present a multimedia experience of combined graphics, photo images, music, voice recordings, and video as well as words.

The Rand Reading Study Group (2002, p. 4) contend that reading hypertext on the Internet "make large demands on individuals' literacy skills; in some cases, this new technology requires readers to have novel literacy skills, and little is known about how to analyze or teach those skills". Reading online text requires the foundational reading skills required in print based texts (Eagleton & Dobler, 2007). However, reading comprehension of online text may make extra demands on the reader (Coiro, 2003; Coiro & Dobler, 2007; IRA, 2009; Leu, 1996; Leu, 2000; Leu et al., 2004; Spires & Estes, 2002; Sutherland-Smith, 2002; Yang, 1997).

The non-linear or multilinear (Bolter, 1998), multidirectional (Purves, 1998), n-dimensional (Harrison, 2008), post-textualist (Purves, 1998), multimodal (Kress, 2003; Synder & Bulfin, 2008), fluidity of online text changes the nature of the interaction between the reader and the text. The reader is more active and effortful in an online hypertextual environment and it is the reader rather than the author who

constructs a unique navigational path through the virtual structure by activating hyperlinks (Afflerbach & Cho, 2009; Lawless, Mills & Brown, 2003). The pace, content and order of viewing, whether linear or non-linear, is determined by the reader to a greater extent (Eveland & Dunwoody, 2000). The content of hyperlinks is obscured from the reader and the reader has fewer contextual cues to draw on and therefore the reader needs to make more forward predictive inferences in a hypertextual environment (Coiro & Dobler, 2007). The reader is required to be aware of their decision-making processes (Duke, Schmar-Dobler & Zhang, 2006) and, while navigating a path within and across nodes, must judge the relevance of the information retrieved, make intertextual links (Hartman, 1995), recall the information later as a summary, and must co-ordinate both the navigational path and informational retrieval in tandem, thus adding to the complexity of online reading processes (Alexander et al.,1994; Eveland & Dunwoody, 2000; McDonald & Stevenson, 1998). The higher level of self-regulatory processing required (Balcytiene, 1999) as the reader transacts with the text adds to the cognitive overload and disorientation often experienced by online readers (Foltz, 1996; Hill & Hannafin, 1997; Nachmias & Gilad, 2002; Rouet & Levonen, 1996; Sutherland-Smith, 2002; Treymayne & Dunwoody, 2000; Yang, 1997).

In sum, the reader actively constructs meaning in an online hypertextual environment by navigating a unique path between and across nodes. The content of hyperlinks is hidden and fewer contextual cues are available; therefore more predictive inferencing may be required. The reader must not only activate and connect with prior domain and topic knowledge, but must also draw on prior navigational skills, end-user application knowledge and prior knowledge of

informational text structures online. Hyperlinks are "constant decision points" (Kuiper &Volman, 2008, p. 249). Therefore self-regulatory reading skills are possibly more important in a hypertextual environment, such as the Internet.

The Online Information-Seeking Cycle: Reader Characteristics

The next sections consider reader characteristics during the online information-seeking cycle, as defined in the present study, under the headings of (a) planning and goal formation to focus online tasks; (b) generating and revising search terms; (c) investigating search results; (d) locating and critically evaluating the relevancy of the information retrieved; and (e) transforming, synthesising and communicating information.

Planning and Goal Formation to Focus Online Tasks

A number of studies have reported on the positive aspects of using the Internet as a source of information from the point of view of children (Hirsh, 1999; Kafai & Bates, 1997; Solomon, 1993). In these studies, children commented on the ease of access to information (Large & Beheshti, 2000; Shenton & Dixson, 2003); the availability of graphics and multimodal features (Bilal, 2000) and motivational aspects of searching for information online (Bilal, 1998). Conversely, authors have expressed concerns about the level of knowledge and understanding developed through online searches. While Birkerts (1994) worried about the impoverishment of the English language, Leu (1996) commented on the superficiality of learning in an online environment where "we may become familiar with much but understand little" (p. 163) and noted that the challenge for educators was to think and plan carefully for deep learning in a hypertextual environment.

The development of online reading comprehension is a "problem-solving inquiry process" (Leu et al., 2008, p. 323). For purposeful reading on the Internet, it is important that children formulate engaging questions to provide a purpose for their inquiry and set a goal for learning (Leu et al., 2008; Owens, Hester & Teale, 2002).

When students commence information retrieval on the Internet with a question (especially if it is a self-generated question) (Kuiper & Volman, 2008) their quest for information is more meaningful. Guthrie and Taboada (2004) (as previously outlined) have noted the difference when reading begins with a question, particularly when a question is self-generated, as it is then derived from the current topic knowledge and inquisitiveness of the children. Burke (2000) has noted the importance of developing an inquiring and thoughtful stance when reading on the Internet by developing habits of mind, such as articulating the goal of the search and constantly monitoring and matching the information retrieved to the search goal.

Studies have shown that children and adolescents rarely articulate or make explicit the goal of information-seeking in an online hypertextual environment. Likewise, they engaged in minimal planning (Fidel et al., 1999). Indeed Kafai and Bates (1997) noted that high school students engaged in minimal strategy formulation. The lack of planning in Internet searching adds to the feeling of frustration which people experience on the Internet, where the expectation is that the answer to a poorly formed question or search is a mere 'click' away (Kuiper & Volman, 2008; Nachmias & Gilad, 2002).

The feeling of disorientation experienced by readers on the Internet has been well documented in the literature, where readers become overwhelmed by the amount of information retrieved (Foltz, 1996 ; Hill & Hannafin, 1997; Nachmias & Gilad,

2002; Rouet & Levonen, 1996, Sutherland-Smith, 2002; Treymayne & Dunwoody, 2001; Yang, 1997). They are also hampered by weak end-user application knowledge, such as weak navigational ability. They become 'lost in hyperspace' (Edwards & Hardman, 1999) without a 'beacon light' to guide them back to where they want to go, or to retrace the path of where they have been, or indeed know where they are (Edwards & Hardman, 1999; Harrison, 2008).

A number of studies (see for example Anderson-Inman & Horney, 1998; Hill & Hannafin, 1997; Lawless et al., 2003; MacGregor, 1999; Wallace & Kupperman 1997) have investigated the navigational patterns and profiles of reader/user behaviour during online interaction. Although these authors draw on different metaphors to encapsulate these navigational patterns and profiles, the online interactions of users/readers can essentially be summarised as: firstly, those who approach the navigational space in a linear fashion drawing extensively on print based strategies; secondly, those who explore with little or no strategic plan attending to the 'bells and whistles' and interactive multimodal features of the domain; thirdly, those who navigate online with little evidence of engagement or apparent focus in an apathetic fashion; and the final navigational profile refers to those who navigate seeking conceptual understanding and knowledge.

The Fidel et al. (1999) study of high school students found that students had weak navigational skills, often backtracking by a novice use of the back button to navigate across nodes. Bilal's series of studies (2000, 2001, 2002) conducted with seventh-grade students found that the ability to navigate had a bigger impact than reading ability or domain knowledge.

The results of a study conducted by Lawless and Kulikowich (1998) suggest that prior domain knowledge underpinned both the participants' navigational styles and how they interacted with and processed information in online text. Prior domain knowledge may influence the reader's ability to navigate successfully in an online environment and to process pertinent information for the task goal (Lawless et al., 2003). These authors further argue that students should be properly exposed to domain knowledge before they interact with hypertext. Across several studies, cited in Alexander et al. (1994), a significant interplay between prior knowledge recall and interest was reported. In a counter argument, Coiro (2007) and Leu et al. (2009) argued that prior domain knowledge may have less of a contributory significance in an online reading environment as the reader can develop and acquire such prior knowledge as they navigate through the hypertextual environment. In studies conducted with adults (Calisir & Gurel, 2003) and elementary school children (Bilal, 2001), high levels of prior content knowledge had little impact on ability to conduct online inquiry.

Locating information on the Internet has been referred to as a "gatekeeper skill" (Henry, 2006, p. 616). Locating information involves both the generation and revision of search terms and the effective investigation of search results. Both are considered in the sections which follow.

Generating Search Terms

Students at lower primary (Kafai & Bates, 1997), upper primary, secondary (Bilal, 2000, 2001, 2002; Fidel et al., 1999; Large & Beheshti, 2000; Wallace & Kupperman, 1997), and high school levels (Nahl & Harada, 1996) have difficulties constructing effective search strings. Various factors compound the difficulties

experienced by students in generating search terms. These factors include the domain and topic knowledge of the students; their vocabulary and language skills; their ability to develop effective keywords; the nature of the inquiry i.e. whether open or closed, assigned or student generated; and finally prior knowledge of search engines.

Prior topic and domain knowledge enable readers to generate and revise keywords for search terms, to anticipate connections between terms used, and to create synonyms and superordinates (Hill & Hannafin, 1997). Studies conducted have shown that students use identical keywords repetitively (Wallace & Kupperman, 1997), with few or minor revisions based on their conceptual knowledge (Bilal, 2001), have weak use of Boolean logic to generate those terms (Kafai & Bates, 1997; Wallace & Kupperman, 1997) and are hampered in generating search strings by misspellings (Kafai & Bates, 1997; Kuiper & Volman, 2008). The search terms generated by students include using a dot com formula in the guise of mytopic dot com (Eagleton, Guinee & Langlais, 2003); single or multiple keywords based on their conceptual knowledge; or natural language phrasing (Bilal, 2000; Wallace & Kupperman, 1997). Bilal (2000), drawing on the work of Piaget & Inhelder (1969) suggested that the use of natural language phrasing reflected the developmental level of children when operating at a concrete operational level. Schacter, Chung and Dorr (1998) interpreted the use of natural language phrasing by students to suggest that students often draw on limited conceptualisations of search engines and the Internet in general and search engine algorithms in particular. Indeed Bilal (2000) found that children queried the Yahooligans search engine using natural language phrasing, an algorithm not supported by this search engine designed for children.

Borgman, Hirsh, Walter and Gallagher (1995) draw a useful distinction between keyword searching (*recall*) and browsing by category (*recognition*). Searching by keyword depends on recall of content knowledge and vocabulary from memory. Browsing, on the other hand, requires less well defined search objectives and involves the recognition of categories and their relevance to the search task, relying less on typing skills and spelling.

The literature appears to be divided about the propensity of children to browse rather than search by keywords. Schacter et al. (1998) and Large and Beheshti (2000) concluded that browsing in an ill-defined task, such as an open task was more suited to children. This contrasts with Bilal's series of studies which found that the nature of the task, whether self-generated or assigned, open or closed, influenced the use of browsing or keyword searching. In all of the studies cited the tasks were either experimenter assigned or to a very limited degree were self-generated.

In the studies reviewed thus far, many of the student tasks were not located within authentic class based projects. Therefore, it is unclear to what degree the strategies used by children in browsing or searching by key words were dependent on the difficulty, nature and location of the task. Studies looking at the nature of online tasks within authentic classroom-based projects appeared to warrant researcher attention and were important to consider as the detail of the proposed research study was clarified and the pedagogy that was brought to bear in developing the children's activities and tasks were developed. Such attention could explore the relationship between the level of situational interest in the topic, the nature of the task and the ability of children to generate and revise search strings.

Investigating Search Results

The ability to investigate search results with a critical eye on the task goal is a crucial Internet skill. Studies suggest that students adopt a random approach (Guinee, Eagleton & Hall, 2003), often appearing to utilise a "click and look" strategy with minimal reading of search results (Leu, Zawlinski et al., 2007). Eagleton and Dobler (2007, p. 165) observed that children use three strategies to investigate search results. Firstly, children adopt a *random* strategy where they 'snatch and grab' the first result shown without any evaluation of the relevance of that result. Secondly, children adopt a *numerical* strategy where they systemically work their way though each link in turn and finally, they adopt a *judicious* strategy where they assess the relevance of the result based on inference, prior knowledge and matching of the blurb and URL to the task.

Further it appears that students rarely venture beyond the first few results (Fidel et al., 1999; Hill & Hannafin, 1997; Large, Beheshti & Moukdad, 1999), scroll down the page of results quickly (Wallace & Kupperman, 1997), have difficulty with the level of abstraction from the search result paragraph (Bilal, 2000) and use the search result heading to assess the relevance of the search result to the task (Kafai & Bates, 1997). The Wallace and Kupperman (1997) study of 6th graders in an ecology task found that students used an inefficient strategy of reducing the number of hits until only a small number remained in an attempt to find the answer to their question.

Kafai & Bates (1997) suggested that children's reluctance to read or scan results returned may reflect the cognitive or developmental ability of the children. However, prior domain or topic knowledge may also impact on children's ability to select

appropriate hyperlinks or URLs and to judge the relevance of the search results returned to the topic.

The ability to generate effective search strings and investigate search results are crucially important skills on the Internet. In turn, both effective search string generation and skilful investigation of search results help online readers to locate information more easily. As such, the possible *interfacilitation* (a term used by Guthrie (1973) in reference to the interfacilitation of print-based reading sub skills and Coiro (2007) in reference to interfacilitation of offline and online reading strategies) between generating search terms, investigating search results and the locating of online information would also appear to be important to consider in framing the research focus in the present study.

Locating and Transforming Information

Locating information on the Internet has been referred to as a "nontrivial complex skill" (Nachmias & Gilad, 2002, p. 481). It involves components, such as locating, transforming, synthesising and evaluating of information. To construct meaning, one needs to orchestrate not only prior knowledge of reading comprehension and information-seeking skills from print-based texts, but also prior knowledge of navigational skills, the architecture of online informational text structures, prior world knowledge and online experiences, and online information seeking knowledge (Harrison, 2004; Hill & Hannafin, 1997; Nachmias & Gilad, 2002).

The cognitive processes involved in locating information are different than those required for recall of information (Dreher & Guthrie, 1990). Self-regulation in print based texts, as previously discussed, involves activating, monitoring, planning, and

questioning. Self-regulation in an online environment is more complex as the reader must filter information across multiple sites (Bulger, 2006) and synthesise that information (Kuiper & Volman, 2008) in a complex and ill-structured domain (Spiro et al., 2004). Self-regulation also involves not only monitoring the information retrieved, but also judging the relevance of the information to the topic goal and subsequently transforming that information into conceptual knowledge, which Guinee and Eagleton (2006, p.52) refer to as "spinning straw into gold".

Studies are divided on the ability of students to monitor information and separate the wheat from the chaff. A number of issues deserve attention. Dreher and Guthrie (1990) contended that efficient searchers for information on a book-based task will spend more time on category selection than information extraction. Wallace and Kupperman in their study of 6th graders during an ecology activity found that students spent 24% of the time reading content pages and 76% of time in searching behaviours. This finding was similar to those of Guinee (2004), and Large et al. (1999), and begs the question of how much information the children were retrieving, the quality of this information retrieved and how much conceptual knowledge they were gaining. Both the Jones (1996) and the Wallace and Kupperman (1997) study seem to confirm the assertion of Kuiper & Volman (2008, p. 261) who contend that the web is not designed for construction of deep and meaningful knowledge but instead "fits the consumerist attitudes of many students" in finding an acceptable answer to a question in the shortest possible time span. Agosto (2002a), drawing on the work of Newell and Simon (1972) and Simon (1955, 1956) (cited in Agosto, 2002a) examined adolescent decision-making in online Internet environments and found that the decision making processes were limited by "bounded rationality and

satisficing" (Satisficing is a blend of the words sufficing and satisfying). These concepts relate to finding information to satisfy information needs by, "choosing decision outcomes that are good enough to suit decision makers' purposes, but are not necessarily optimal outcomes" (Agosto, 2002a, p. 17). Observed satisficing behaviours include the reduction of the number of websites considered and termination of site selection, either through cognitive constraints, time constraints or physical constraints, such as boredom or physical discomfort.

A number of studies have sought the views of children and adolescents in relation to their use of the Internet as a source of information. Students in the Fidel et al. (1999) study were enthusiastic about searching for information on the Internet, clearly enjoying the ease of access to up-to-date information and the presence of multimedia features. Other studies pointed to the variable quality of information and readability issues online in an environment designed for adults and not for children (Kafai & Bates, 1997). Shenton and Dixon's (2003) study in England of students' attitude to retrieving online information also noted the amount of 'useless' information online, the time taken to retrieve information, the propensity of offensive pop-ups and the variable quality of the information retrieved.

Evaluation of Online Information

The penultimate stage of the information-seeking model, as defined in the present study, is the evaluation of online information. In a study conducted by Leu, Reinking, et al. (2007) adolescent students were asked to evaluate the reliability of the 'spoof' *Save the Pacific Northwest Tress Octopus* website (http://zapatopi.net/treeoctopus). Despite indicating in a prior interview that one should not trust online information, 87.5% of the students indicated that they thought

this site was reliable. Indeed when the researchers indicated that the site was indeed bogus, the students persisted in their belief that the site was reliable, citing reasons, such as the updated copyright date and links to the author in their reasoning. This indicates that critical evaluation of online information is an important online skill to develop and involves additional complexities for online readers as they source, corroborate and integrate information across multiple sources (Britt & Gabrys, 2001). Fitzgerald (1999) draws on Bloom's taxonomy (Bloom, Engelhart, Furst, Hill, & Krathworhl, 1956) model to note that evaluation is at the top of this hierarchical model, drawing on and exercising one's ability to comprehend, apply, analyse and synthesise information to evaluate that information. Leu (1997; Leu, Zawlinski et al., 2007) has urged that one adopt a "healthy scepticism" about information posted online. Previous studies have indicated that children have difficulties realising that incorrect, false or misleading information can be posted on the web (Schacter et al., 1998); do not challenge the authority and reliability of information presented (Hirsh, 1999; Lorenzon, 2002; Shenton & Dixon, 2004a; Wallace & Kupperman, 1997); equate the amount of information presented with the quality of that information i.e. quantity equals quality (Agosto, 2002b; Shenton & Dixon 2004a, 2004b); are often misled by the appearance of a website (Sutherland–Smith, 2002); and lack prior knowledge to assess the veracity of information presented and detect hidden author agendas (Burke, 2002; Fidel et al., 1999). An additional complexity with evaluating online information may relate to children's abilities to draw on limited prior experience and world knowledge to assess and evaluate online information.

Critical evaluation of online information encompasses critical thinking skills (Burke, 2002); critical reading skills (Leu, 2002; Sutherland-Smith, 2002); critical multimedia information literacy skills (Fitzgerald, 1999; Harris, 2007; Lemke, 2006); and critical literacy skills (Comber & Simpson, 2001; Fabos, 2008; Muspratt, Freebody & Luke, 1996)

These skills include the ability to question and analyse the reliability of the information presented with reasoned opinion; determine the accuracy and relevancy of the information based on forming judgements and making inferences; and evaluate websites for credibility, authority, reasonableness, believability, and author motive and bias.

Communicating with Others

The information-seeking cycle concludes with communication of information to others. The Internet introduces potential for expanding our vision of both an 'audience' and a 'community of learners' beyond the four walls of the classroom to the include the possibilities of reaching more audiences at both national and global levels (Windschitl, 2000). The use of online threaded discussion boards (Johnson, 2009; Larson, 2009; McVerry, 2007); blogs (Zawilinski, 2009); instant messaging (Lewis & Fabos, 2005); podcasting (Grisham & Wolsey, 2009) digitally composed texts (Condon & Harrison, 2009; Coyne, 2009), web quests (Lacina, 2008), nings ,wikis, and PowerPoint provide a shared writing space for students to communicate, to respond and transact with others in an online environment. The introduction of Web 2.0 technologies has added to the possibilities of learning and teaching using Internet technologies. Leu, O'Byrne, Zawilinski, McVerry and Everett-Cacopardo

(2009) argue that the changes from Web 1.0 to Web 2.0 are continuous rather than dichotomous, as technologies change and evolve.

In sum, this section has attempted to explore the literature pertaining to reader characteristics in an online environment and the skills and strategies employed by online readers within the information seeking cycle. The next section describes emerging research on class-based instructional practices aimed at developing effective online skills and strategies within an inquiry-based curriculum.

Studies Exploring the Development of Online Skills and Strategies During Internet Inquiry

The Hero inquiry project (Eagleton et al., 2003) was conducted with adolescent students who had learning disabilities and consisted of a six week instructional unit. The students were required to use print and Internet resources to conduct research on a self-chosen personal hero. The class teacher modelled skills and strategies at the outset of the class and this was followed by students applying knowledge developed through both guided and independent practice of skills. The study focussed particularly on the early stages on online information-seeking, such as choosing topics, asking questions and selecting search strings. Less emphasis was placed on transforming or synthesising information as the authors contended that these processes were similar to traditional based print research skills.

Results of the study showed that these students were weak at selecting appropriate search strings at the outset, choosing discrete terms or natural language phrasing. However, following instruction, they could narrow or broaden the search focus. There appears to have been little emphasis on peer-to-peer scaffolding within the study and the authors note that in retrospect they could have utilised the help of

'tech-savvy' students, but only in respect of providing technical assistance for other students with weak end-user application knowledge. Students needed additional assistance in investigating search results, evaluating the relevancy of information retrieved and documenting sources. The student also had difficulty with transforming and synthesising information and largely copied information verbatim from the screen. The students communicated the information to others via charts or multimedia presentations, such as PowerPoint presentations, attending largely to the 'bells and whistles' of these formats. Overall, the authors noted that despite the obvious engagement and motivation of the students to learn on the Internet the information generated lacked conceptual depth.

Castek (2009) explored the classroom conditions and variations in the levels of scaffolding which facilitated the development of online reading comprehension. The mixed methods study using an experimental and control group was conducted across a thematic 15 week instructional unit with 10 to 13 year old students. The findings from this study suggested, firstly, that students need to be challenged with activities which focus on problem-based inquiry type learning opportunities which are integrated into instruction. Secondly, students needed multiple opportunities to apply skills and strategies following teacher instruction. Thirdly, despite the need for teacher scaffolding early in the study while the students were developing online skills and strategies, the move from teacher scaffolding to peer-to-peer scaffolding was swift and students appeared to learn and develop skills from each other. Castek noted that questions remained about how best to facilitate peer-to-peer scaffolding in a new literacies classroom where the student's role changes and the student takes on the role of teacher. The study also explored the development of conceptual

understanding and content learning within the 15 week instructional unit. While statistically significant differences were detected between the experimental and control group on the inquiry project rubric scores across five of the eight dimensions explored, it appears that there was no significant difference on the gain scores on the concept map of content learning. This may suggest that in order to develop deeper conceptual knowledge, an extended unit of instruction or extended scaffolding may be required.

The Teaching Internet Comprehension to Adolescents (TICA) project (Leu et al., 2008; Leu & Reinking, 2005) is an ongoing study which is exploring the development of new literacies (Leu et al., 2004) with adolescents in one-to-one lap top classrooms. An F&DE experiment conducted in Year 2 of the project informed the design of an evolving Internet Reciprocal Teaching (IRT) model. This model consist of three phases which move gradually from direct whole class instruction of foundational Internet skills and strategies with high teacher involvement (phase 1) to application of skills in solving problem based questions which are aligned to curricular goals (phase 2) to solving self-generated Internet inquiry questions in phase 3. Phase 3 also involves communication of information on a more global scale via wikis, blogs and emails. There is a gradual release of responsibility from teacher to student in demonstrating and sharing strategies, particularly in phases 2 and 3. Peer-to-peer collaboration is encouraged in small group exchanges to share and refine strategies. Movement between phases is underpinned by an assessment checklist of skills. The team are also developing and refining a suite of Online Reading Comprehension Assessment (ORCA) tools to measure growing proficiency with new literacies among students. These assessment tools have the potential to

allow us to begin to assess the development of online reading comprehension proficiencies.

These studies (Eagleton et al., 2003; Castek, 2009; Leu et al., 2008; Leu & Reinking, 2005) offer useful insights into instructional contexts and pedagogies to develop online literacies with adolescents. The studies highlight the need to develop new literacies in classroom ecologies which provide students with opportunities to collaborate in undertaking challenging online inquiry activities. However, we need to build on emerging insights from these studies to explore the development of classroom conditions which encourage student motivation and engagement and peer-to-peer scaffolding and collaboration in an online environment. We need to determine what pedagogies are best suited to develop both online reading comprehension and information-seeking skills with struggling readers in the context of inquiry based activities within an integrated curriculum and in an authentic learning ecology of the primary school classroom.

Summary of Chapter

This chapter has attempted to span three decades of the literature pertaining to the skills, strategies, and characteristics of readers in both print-based and online reading environments. It presented an argument for the three theoretical frameworks underpinning the study; a new literacies perspective (Leu et al., 2004), a motivation and engagement framework (Guthrie & Wigfield, 2000), and cognitive scaffolding theories (Wood et al., 1976). Each of these theoretical frameworks affords us a lens to view the complexity of online reading comprehension from cognitive, affective and social dimensions. However, we know little of the instructional contexts and classroom pedagogies required to embed the new literacies within the curriculum.

We need to ascertain the optimal nature of scaffolding required to support both the acquisition of online reading comprehension and information-seeking skills and strategies and the gradual release of responsibility for learning from teacher to student. Finally, we need to determine how to develop and sustain reading engagement and motivation for struggling readers from disadvantaged communities in the complex environment of the Internet.

Windschitl (2000) has commented on the need to conduct research beyond what he terms the "black box" variety, where inputs, such as learner characteristics or interventions are defined and where outcomes are then measured. He argued that what "occurs *during* the learning activities should be of greatest interest and utility to researchers and would reveal *why* rather than simply *if* certain learning contexts are more robust than others" (p. 90, italics in original). The Formative and Design experimental methodological framework (F&DE) (Reinking & Bradley, 2008), which underpins the present study, is ideally suited to explore not only what occurs during the development of online inquiry but also why students use particular skills and strategies during information-seeking and how explicit instruction can scaffold these students to develop more effective online reading comprehension. This methodological framework will be developed to a greater extent in Chapter 3, Methodology: Conceptual and Methodological framework.

CHAPTER THREE

METHODOLOGY: CONCEPTUAL AND METHODOLIGCAL FRAMEWORK

Introduction

The chapter opens with a consideration of the conceptual framework leading to the research questions which guide the study. This is followed by a rationale for using the Formative and Design Experimental (F&DE) methodological framework in the study, including a discussion of its historical roots, tenets, characteristics and data collection methods. The concluding sections examine methods for establishing validity, creditability and trustworthiness in the study.

Conceptual Framework Leading to the Research Questions

In chapter 1 the context of the study was outlined. Recent reports in Ireland (Eivers et al., 2004; DES, 2005a) have highlighted the significant disparity between the literacy achievement scores of children attending designated disadvantage schools when compared to their peers in non-designated schools. The government's recent policy initiative, Delivering Equality of Opportunity in Schools (DEIS) (DES, 2005c), aimed at tackling educational disadvantage clearly links literacy and ICT. As noted in chapter 1 it is of crucial importance that children who struggle with print literacies are supported in complex online environments so that they are not further disadvantaged (Dalton & Strangman, 2006).

In chapter 2 a review of the literature pertaining to literacy and technology was presented. It is not the intention here to revisit the review of the literature; rather the

intention is to explore the focus, methodologies, and theories of selected studies and in light of these considerations to frame the research questions underpinning the current study, the methodologies used and the theoretical framework adopted.

Studies have focussed on in-depth measures of classifying online web use to capture, observe and evaluate online activity (Coiro, 2007; Hargittai, 2004; Harrison et al., 2006). Harrison et al. (2006) for example in a exploratory case study approach, the Intelligence Online Reading Assessment (IORA) project, focused on assessing online activity using Latent Semantic Analysis (LSA) drawing on postmodern perspectives in both science and literacy theory. Coiro (2007) has developed a measure of online reading comprehension (Online Reading Comprehension Assessment Scenario I and 11 (ORCA)) relating to student's reading ability in locating, evaluating, synthesising, and communicating information in a series of Internet treasure hunts. This builds on previous work of Leu et al. (2005).

Further studies have sought to explore online reading comprehension strategies, mostly focussing on adults, adolescents or skilled readers. These studies have sought to separate the processes of online reading into searching for and locating information, including search string generation, (Bilal, 2001, 2002; Guinee et al., 2003) and evaluating search results (Henry, 2006; Sutherland-Smith, 2002); critically evaluating information (Fabos, 2008; Leu et al., 2004); communicating information (Eagleton & Dobler, 2007) and synthesising information (Jones, 1996). Coiro and Dobler (2007), for example used methods, such as think aloud protocols, field observations and semi-structured interviews to capture the online reading comprehension of skilled readers. Hill and Hanafin (1997) and Schmar (2002) used case study approaches, again drawing on qualitative data, such as observations, think

alouds, post reading interviews, cross-case analysis and, in the case of Schmar, frequency matrixes to capture the online strategies used by readers online. Coiro and Dobler (2007) and Schmar (2002) drew on cognitive flexibility theory, schema theory and the New Literacies framework to theorise their work. Hill and Hanafin underpinned their work with reference to information and computer science, psychology and instructional system design.

Fewer studies have focussed on classroom pedagogies for teaching online strategies. Eagleton et al. (2003) based their Hero Inquiry Project curriculum on a Universal Design for Learning framework (Rose & Meyer, 2002). Eagleton and Dobler, (2007) drew on theories of learning, such as constructivism, socioculturalism and semiotics to develop their QUEST model. The studies conducted by Castek, (2006) and Leu et al. (2008), are informed by a New Literacies theoretical framework and have adapted research conducted in Reciprocal Teaching (Palinscar & Brown, 1984) to an online environment using both experimental and F&DE frameworks.

In light of the studies presented above, this present longitudinal study, conducted over an eighteen month period, sought to explore the skills and strategies used by struggling readers in conducting Internet inquiry. The present study sought to scaffold the development of effective online reading and information-seeking strategies with these pupils, within an integrated classroom curriculum, through a series of linked interventions. The interventions were underpinned by an iterative analytical refinement process. The study also explored the cognitive, affective and social dimensions of peer collaboration and working in groups. As previously developed in the Review of the Literature in chapter 2, three diverse theoretical

lenses were brought to bear on this study: firstly, the lens of the New Literacies framework (Leu et al., 2004); secondly, scaffolding theories from both expert-to-peer and peer-to-peer scaffolding (Wood et al., 1976) and finally, an engagement and motivation framework (Gambrell, 1996; Guthrie & Wigfield, 2000; Turner & Paris, 1995).

The F&DE framework is sympathetic to the multiple variables at work within the 'ecology of learning' in a classroom and was considered appropriate to explore the research questions which formed the basis of the study. The ImpaCT09 project which will be conducted on behalf of the British Educational Communications and Technology Agency (Becta) is drawing on the metaphor of the 'ecology of learning' to support their work and build frameworks to both theorise and elucidate the relationship between ICT and learning (C. Harrison, personal communication, August 7, 2009). Other authors (Brown, 1999; Luckin, 2008; Reinking & Bradley, 2008; Zhao & Frank, 2003) also use this metaphor to describe the complex, multilevel, dynamic, transactional interplay and interdependency, which is evolving rather than static, between multiple actors and multiple variables within the classroom learning ecology. The classroom learning ecology involves the classroom curriculum, teaching pedagogies, the relationship between students and teachers and students and their peers in a social learning environment. It also involves the relationships and social capital of the class teacher in his/her relationships with their colleagues, with school administrators, with parents and care-givers within a wider school and social and political community. Finally, it involves the infrastructure, the physical setting, the availability of resources (such as computers, ICT and books) and the availability of technical ICT support. Hatch (2009) notes that in order to

represent the complexity of teaching with ICT, multiple perspectives are required which are both principled and broad. In the present study, multiple theoretical perspectives were brought to bear on the study and multiple data sources were collected, analysed and triangulated. These data sources included Camtasia video files of online student activity; sound files of the classroom conversations and think aloud protocols of the children; student artefacts; and interview data with teachers and children.

The next section explores the historical roots and paradigms of formative and design experiments (F&DE). This is followed by a consideration of the tenets of F&DE. Following this, the defining characteristics of F&DE are developed in some detail. Finally, the rationale for choosing an F&DE framework is presented, including a consideration of the methodologies and approaches of emerging studies using this methodology.

Formative and Design Experiments (F&DE)

F&DE are designed to capture the "multiple realities" (Labbo & Reinking, 1999, p. 478) of classroom life and to examine and respond in careful and systematic ways to the challenges and forces inherent in the "blooming buzzing confusion" of classrooms (Brown, 1992, p. 141) through well designed interventions. The formative and experimental design methodology reflects a pragmatism and flexibility in methods and analysis. It is a methodology that is participatory and inclusive and recognises the professionalism of classroom teachers and involves researchers, class teachers and students in collaborative efforts designed to make firm research-to-practice reciprocal connections. The intervention is designed, and

implemented through a finely grained and iterative process, to engineer a valued and theoretically determined pedagogical goal.

Historical Roots and Paradigms of Formative and Design Experiments (F&DE)

The historical roots of F&DE can be traced to the concerns expressed by neo-Vygotskian scholars of the lack of "ecological validity" (Jacob, 1992, p. 320) in experimental studies. They further critiqued naturalistic studies claiming that such studies merely describe the status quo in schools. Neo-Vygotskian scholars argued that cognition is socially and culturally constructed and is a product of the social environment, the context for learning, and the cultural tools and activities within the environment enabling that development. Formative experiments, Jacob noted (1992), dealt with the limitations of both experimental and naturalistic studies and were interventions designed to achieve educational goals while also taking cognisance of the influence of social factors at work in learning ecologies.

The foundations for F&DE originated in the work of Brown (1992), Collins, (1992), and Newman (1990). These researchers in turn were concerned by what they perceived as a disconnect and lack of migration between research in literacy and practice within classrooms. They argued that the interplay between the 'variables' inherent within the learning environment of the classroom i.e. classroom pedagogies, children's learning, and the influence of school and community cultures could not be controlled and required a research framework that was sympathetic to the ecology of the classroom environment.

Brown's move from her roots as a researcher in laboratory settings to classroom settings was an attempt by her to contribute to both research and practice and to create "communities of learners" in which she would "engineer interventions that not

only work by recognizable standards but are also based on theoretical descriptions that delineate why they work, and thus render them reliable and repeatable" (Brown, 1992, p. 143). She called these interventions 'design experiments' although she credited the term to Collins (1992). Brown's concern in developing her conceptual framework for design experiments shown in Figure 3.1 lay with what she termed the "systematic whole" (1992, p. 143). Using an engineering metaphor for her research on metacognition within classrooms she saw her mandate as twofold; that of contributing to "learning theory" in the first instance and "dissemination" in the second instance. Her two way arrows in Figure 3.1 indicated the reciprocal contribution of both theory and dissemination to classroom practice and vice versa. She also commented upon 'input', the variables at work in classrooms and her *'etc'* may show that she was not entirely clear about the full extent or nature of the influences on classroom and cognition within those classrooms.

Figure 3.1. The complex features of design experiments: Source Brown (1992).

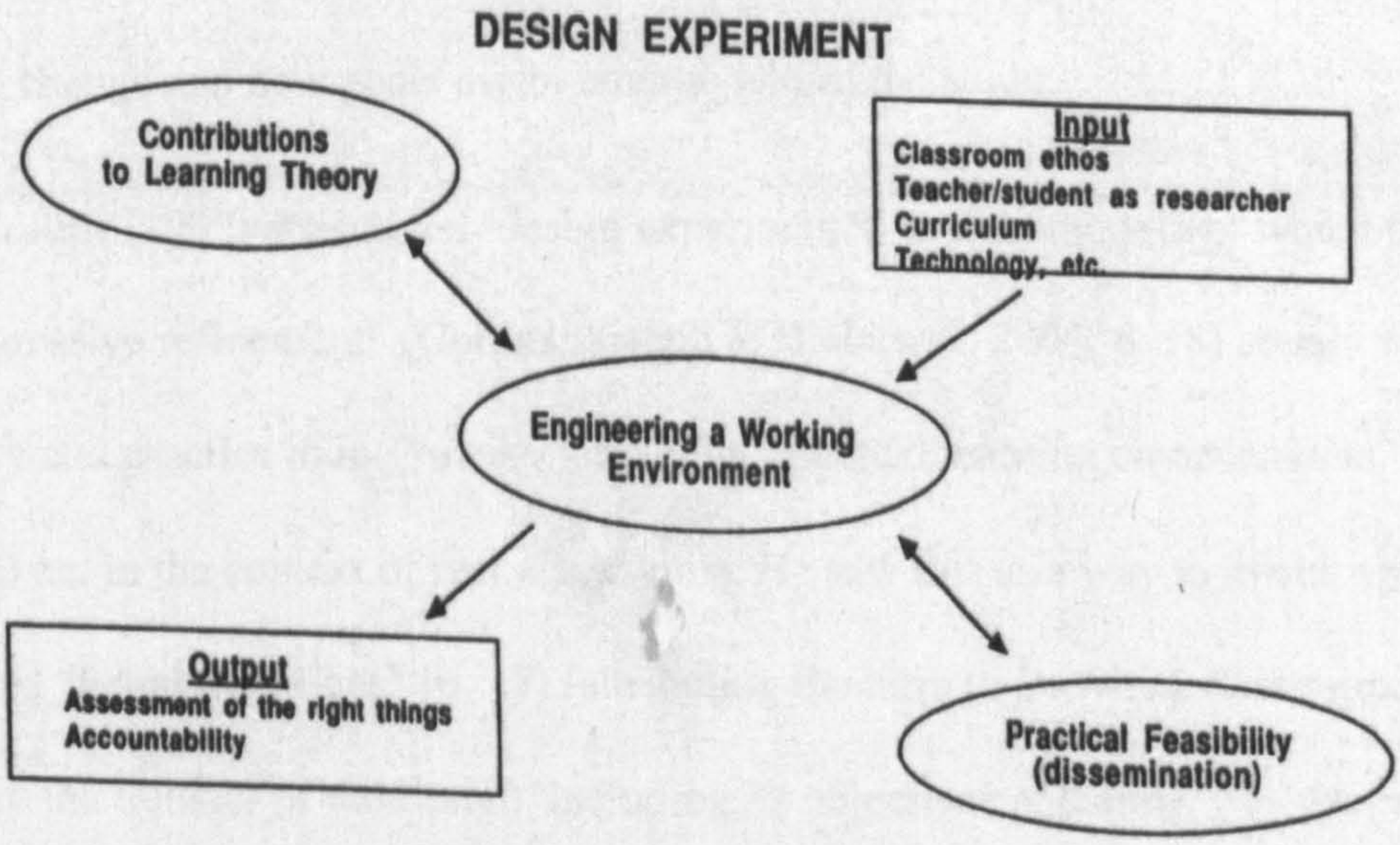


FIGURE 1 The complex features of design experiments.

Source: Brown, A. L. (1992)

Newman (1990) explored the opportunities for organisational change and transformation of the educational environment afforded by, and mediated through, the introduction of computers into schools in what he termed 'formative experiments'. He articulated a methodological framework for formative experiments adding to the conceptual framework of Brown's 'design experiments' described above. Newman drew on Vygotskian perspectives to derive a theoretical framework which considered the role of the social environment, and cultural tools within that environment, on the process of cognitive growth. Implicit in studying the organisational change afforded by computers in the classroom came the need to develop research methods to observe teaching methodologies, children's learning patterns, the social interactions within the classroom and the changing roles of teachers and children within the learning environment. In Newman's formative experimental framework one aims at a target a "pedagogical goal and finds out what it takes in terms of materials, organisations, or changes in the technology to reach that goal"(1990, p.10). However, given the nature of formative experiments, the goal could change and new goals might emerge within the study.

Collins (1992) articulated 'design experiments' as a methodology which through "progressive refinement" (Collins, Joseph & Bielaczyc, 2004, p. 18) sought to refine theory and practice in the "messy situations of actual learning environments" (ibid, p. 19) i.e. in the context of real classrooms. He saw this as a way to avoid what he termed "lethal mutations" (p. 17) (attributing the term to Brown & Campione, 1996) where the transfer of the design, including its objectives and aims, was washed out by the way the intervention was implemented in the classroom. Again, he was concerned with the nature of learning in the real world as opposed to laboratory

settings and the interplay of variables (p. 36) such as 'climate variables' (which he noted as engagement, student control, risk taking, and effort), 'learning variables' (content knowledge, skills, metacognition, learning strategies, and dispositions) and finally 'systemic variables' (which he noted includes sustainability, ease of adoption, cost, and scalability). Refinement and analysis was based on the formative evaluation of design elements, including the interplay of variables, conducted at each phase. Such design analysis also fostered theoretical refinement.

In sum, the work of Jacob, Brown, Newman, and Collins was foundational in developing a methodological framework that was sympathetic to how interventions played out in the real world in the ecology of learning in the classroom. Their work focussed on how, why and when interventions could transform the learning environment. Furthermore, they explored the social nature of learning within those classrooms.

The Tenets of Formative and Design Experiments (F&DE)

In describing what they term 'formative and design experiments' (F&DE) Reinking and Bradley (2008) draw on the foundational work of Brown and Collins. They are, however, particularly influenced by the work of Newman in relation to how technology might be "appropriated" (Newman, 1990, p. 8) within the educational environment and the possible subsequent changes to instruction and learning within those environments. The terminology of F&DE is derived from *designing* "an instructional intervention that works to achieve a valued pedagogical goal in an authentic classroom environment"(Reinking & Bradley, 2008, p. 14) and "modifying the intervention *formatively* in response to data suggesting factors that enhance or inhibit the intervention's effectiveness, efficiency, and appeal" (ibid, p.

15). This present study aligns itself with the Reinking and Bradley (2008) perspective of Formative and Design Experiments (F&DE) while also remaining cognisant of other design based research methodologies (Cobb, Confrey, diSessa Lehrer, & Schauble, 2003; Collins et al., 2004; Design-Based Research Collective (DBRC), 2003; Reinking & Bradley 2004; Reinking & Watkins, 2000).

The next section describes the defining characteristics of F&DE and this is followed by a discussion of the rationale for choosing this methodological framework and the section concludes by an analysis of the challenges faced by F&DE in the literature.

Defining Characteristics of Formative and Design Experiments (F&DE)

The F&DE methodological framework is an evolving methodology which is interventionist and iterative by nature and driven by a desire to achieve a valued theoretically determined pedagogical goal. In conducting an F&DE due care is given to factors that enhance or inhibit the implementation of the intervention; the modifications made to the intervention; and unanticipated effects, changes and interactions (both teacher-student interactions and peer-to-peer interactions) within the learning environment.

Interventionist by Nature and Driven by a Valued Pedagogical Goal in Authentic Learning Environments

In his presidential address, to the American Educational Research Association (AERA), Schoenfeld (1999) argued that a defining concept at the core of design based research was that, "Sometimes you have to build something to see if it will work.... and then you have to study the hell out of it."(p. 20). In looking at the challenges to educational theory and practice in the twenty-first century Schoenfeld

contended that research and practice need not be at two extremes on a continuum but rather should be 'synergistic' and in close interaction with each other to produce a 'productive dialectic' (p. 12). This debate would contribute to practice in the classroom, by looking closely at learning processes and social interactions at work therein, while at the same time challenging and contributing to theory. The interventionist nature of F&DE is fundamentally different to more naturalistic approaches, in that rather than describing what is occurring, F&DE seek to "engineer forms of learning" in carefully designed interventions in authentic settings, and implement modifications deemed necessary by the cycles of research.

F&DE are underpinned by the question of what intervention has the potential to achieve a valued and theoretically determined pedagogical goal (Reinking & Watkins, 2000). F&DE address important pedagogical goals within problematic or emerging fields of research. The pedagogical goal must be clearly articulated, and situated within and drawing from previous work conducted in this area. Kamil and Lane (1998) note that there is a dearth of research in the area of literacy and technology. Recent and emerging research in the area of adolescent online Internet literacy (Coiro, 2007; Coiro & Dobler, 2007; Leu & Reinking, 2005; Leu et al., 2008) suggest that online reading may require additional skills that are supplementary to those required for reading print text. Research is needed to explore and develop the skills and strategies used by primary school children, specifically struggling readers in disadvantaged communities, to locate, generate, evaluate, synthesise and communicate information retrieved from the Internet. The present study sought to explore these skills and strategies and in a researcher-designed intervention study to ascertain whether explicit strategy instruction could scaffold

these children to develop effective online strategies. The design of the intervention in F&DE is developed and underpinned by an extensive review of the literature within that area.

Underpinned by a Theoretical Framework

Reinking and Bradley (2004) contend that theory in F&DE is used to "justify the importance of the inquiry, to provide a rationale for the intervention, interpret findings, [and] contextualise conclusions" (p. 159). Cobb et al. (2003) argue that the purpose of design experiments is not only to utilise theory but also to put theory into 'harm's way' and in so doing to "develop a class of theories about both the process of learning and the means that are designed to support that learning"(pp. 9-10). Theory is challenged and possibly modified (Schoenfeld, 2006). Theories thus developed in design experiments are 'humble theories' that are context specific (Cobb et al., 2003; Schoenfeld, 2006). Reinking and Bradley (2008) note that a researcher using F&DE must be cognisant of "factors that enhance or inhibit the effectiveness of the instructional intervention in achieving that goal" (p. 18) thus creating a theoretical understanding of these conditions and generating "pedagogical understandings that generalise beyond specific instances and can specifically inform practitioners"(p. 19). In generating theory in this fashion the researcher must take both a "prospective and reflective stance" (Cobb et al., 2003, p. 10). *Prospective* where you are conjecturing (based on a synthesis of pertinent literature) about the implementation of a theoretically driven design at the chalk-face and *reflective* where you are observing and scrutinising the fine details of the design in action in a learning environment and making data driven adjustments in a careful and systematic way as the study proceeds.

Adaptive and Iterative

Collins (1999) asserts that design experiments "attempt to carry experimentation into real life settings in order to find out what works in practice. This means giving up the notion of controlling variables and necessitates the development of a new methodology to carry out research" (p. 290). In conventional experimental designs the researcher is at pains to control variables to ensure the fidelity and effectiveness of the intervention so how do F&DE contend with issues of fidelity, validity, credibility and generalisability? Reinking and Bradley (2008) argue that fidelity is the "antithesis" of F&DE:

> A researcher using this approach begins with the assumption that the intervention that is implemented at the beginning of the investigation may be substantially different by the end of the investigation, because the main goal of the research is to adapt the intervention to make it work better in response to the inherent variability within classrooms (p. 20).

The data analysis may suggest that certain elements of the design may not be working properly or in tandem with each other and the researcher, in collaboration with the teachers involved, may adjust and modify the intervention accordingly. The initial intervention might therefore be referred to as a 'prototype' (Reinking & Bradley, 2008). The intervention is modified through "continuous cycles of design, enactment, analysis and redesign" (DBRC, 2003, p. 5). In using such a flexible design, which permits organic growth, one has to guard against what Dede (2004) has referred to a "Swiss army knife" (p. 106) approach where an anything-goes approach is adopted. It is imperative that the researcher adopt a principled, robust approach where data collection and analysis is both rigorous and systematic.

In the Reinking and Bradley (2008) framework attention is paid to factors that enhance or inhibit the pedagogical goal of the intervention and the effects of

modifications made. Consideration is also given to unanticipated effects and changes occurring to the classroom environment. In the case of the present study the emerging data was analysed using Gravemeijer and Cobb's (2006) micro-and macro-cycles data collection framework. This entailed analysing data in micro-cycles on a weekly basis, and macro-cycles at the end of each phase of the intervention and modifications were made based on this analysis. Schoenfeld (2006) notes that "the development of theory and instruction [is] an iterative, self-conscious, and reflective process" (p. 195).

In F&DE the researcher is both designer of the intervention and observer of its implementation. This raises issues pertaining to objectivity. It is therefore important that the researcher is aware of the possibility of filtering analysis through ready-made researcher perceptions. The researcher needs to guard against bias and be mindful of a rose-coloured version of the analysis or results of the intervention.

One of the strengths of F&DE is that the intervention is finely tuned, through an iterative process, to the reality of classroom environments and learning within those classrooms and, as such is immediately sharable with teachers. However, the intervention could be classed as context specific and issues of generalisability and replicability arise. McGill-Franzen (2005) argue that many 'scientifically-based' reading interventions are also context specific and don't take account of the particular socio-economic contexts into which they are transferred, the professionalism of teachers using these programmes, or teacher effects in terms of classroom discourse and explanations given within classrooms. She further asserts that formative experiments are useful for "disambiguating instructional contexts in the service of student learning" (p. 369). Maxwell (2005) also points to the fact that

"face generalisability" may apply where there is no obvious reason to believe the results may not apply generally. Cobb et al. (2003) further insist that F&DE have been finely tuned to classroom environments and so have the "the potential for rapid pay-off because they are filtered in advance for instrumental effect. They also speak directly to the types of problems that practitioners address in the course of their work" (p. 10).

Issues, such as validity, trustworthiness, credibility and generalisability are common to all research methodologies and, as such will be elucidated in a more comprehensive fashion in later sections dealing with establishing validity, credibility and trustworthiness and also in chapter 4 within each of the sections dealing with data collection procedures.

Transformation of the Learning Environment

Reinking and Bradley (2008) assert that F&DE impact upon and transform the learning environment in some measure. This assumption is based on the premise that the pedagogical goal of the intervention in an F&DE is a worthwhile goal often responding to a particular emerging or problem area within the learning environment of the classroom. As such, in achieving that pedagogical goal or in moving towards achieving it (Newman, 1992) the educational environment will be transformed in some way either in terms of teaching, or learning. There is a further assumption that in transforming the classroom environment for teaching and learning that one would also contribute to theory building. The transformation in the learning environment is conducted in collaboration with teachers and children. Teachers and researchers work together "to produce meaningful change in contexts of practice" (DBRC, 2003, p.6). Reinking and Bradley (2008), citing the failure of the tightly controlled

Reinking and Pickle (1993) experimental study where one researcher in a debriefing session referred to the teacher as a "nuisance variable" (p. 3), note that the variability inherent within the complexity of 'messy' learning ecologies inherent in classrooms (Collins et al., 2004) is not factored out in F&DE but rather is welcomed and accommodated.

Methodologically Inclusive and Pragmatic in Orientation

Formative and Design Experiments (F&DE) are methodologically inclusive (Reinking & Bradley, 2008). The researcher may justify the use of any appropriate approach to data collection, whether qualitative, quantitative or mixed methods, (Tashakkori & Teddlie, 2003) as long as the methodology chosen can explicate analysis of the effects of the intervention, the theoretically driven, pedagogical goal underpinning the intervention and the research questions driving both. Reinking and Bradley (2008) argue that F&DE are forms of "systemic research" where "*patterns of interrelations*" among variables (Salomon, 1991 p, 16; italics in original) rather than single variables are examined in classroom environments to ascertain the effectiveness of the intervention. This exploratory study utilised predominantly qualitative methods for data collection in tandem with a small quantitative data collection element in a concurrent design.

Researchers conducting F&DE reject the notion of the '*incompatibility thesis*' of purists from both sides on the quantitative and qualitative paradigm debate. They see these 'paradigm wars' as being unproductive (Tashakkori & Teddlie, 2003) and instead adopt a middle ground drawing on the strengths of each methodology in achieving a valued pedagogical goal. F&DE are pragmatic in orientation (Reinking & Bradley, 2004, 2008). Patton (2002) notes that by adopting a pragmatic stance in

relation to methodology the researcher weighs up the "*methodological appropriateness*" (p. 72; italics in original) of the methodology rather than adhering rigidly to one methodology. The historical roots of pragmatism can be found in the work of Peirce, James and Dewey. Johnson & Onwuegbuzie, (2004) outline the characteristics of pragmatism. Firstly, truth is provisional and not absolute. Robson (2002, p. 43) notes that for these pragmatists "truth is what works". Furthermore knowledge is constructed in the reality of our lived in real world activities and experiences. Pragmatists look to the consequences of their actions (Dressman & McCarthy, 2004). Cherryholmes (1992) argues that:

> Pragmatic choices about what to research and how to go about it are conditioned by where we want to go in the broadest of senses. Values, aesthetics, politics, and social and normative preference are integral to pragmatic research, its interpretation, and utilisation (p. 13).

The values of F&DE are consistent with democratic values. It is important for society that all citizens can access and use digital technologies equally. The pedagogical goal of this study was to aid struggling readers from disadvantaged communities to develop effective reading skills and strategies in online Internet inquiry.

In summary, F&DE are underpinned by a theoretically determined and valued innovative pedagogical goal. They are conducted in authentic learning environments and are interventionist by nature and iterative by design. The refinements made to the intervention are clearly described, the barriers to implementation and unexpected outcomes are delineated and the changes to the learning environment are explained. Finally F&DE are pragmatically oriented and methodologically inclusive.

Rationale for Choosing a Formative and Design Experimental Framework

The F&DE framework was chosen for the present study for the following reasons. Firstly, the researcher wanted to explore the skills, strategies and dispositions of the participants as they conducted Internet Inquiry. Therefore, as the study was exploratory in nature, predominantly qualitative data collection methods, including interviews, online student activity captured by Camtasia software (www.techsmith.com), verbal protocols, participant observations, field notes and pupil artefacts, were utilised. Secondly, insights from analysis of a range of data sources were utilised to design a research-based intervention, which through an iterative refinement process, sought to develop more effective skills and strategies among the participants in online reading environments during Internet inquiry. Qualitative methods were used predominantly to chart the intervention although they were supplemented by a small range of quantitative methods. The F&DE framework is a methodologically inclusive framework and, as such is sympathetic to the use of both qualitative and quantitative methodologies.

The F&DE framework is an emerging and relatively young methodological framework but is appropriate in the context of the present longitudinal study because it allowed the researcher to be guided by new insights to consider what classroom interventions have the potential to achieve the pedagogical goal of the study. It also provided an opportunity to evaluate progress towards achieving that goal by developing a deeper understanding of theory and the theoretical framework that established the value of the pedagogical goal. F&DE also allow the consideration of factors that enhance or inhibit the effectiveness of the intervention and how the intervention might be modified in order to achieve the goal more effectively. It

allows examination of the positive or negative effects that the intervention produces, including unanticipated findings. The F&DE methodological framework provides a principled fluidity that is sympathetic to the provisionality of a rapidly changing and emerging research area, such as one that examines children's learning and the Internet.

F&DE: Data Collection Methodologies

Reinking and Bradley (2008) suggest that F&DE are methodologically inclusive and flexible. As such, the crucial issue is not whether quantitative or qualitative data collection methods are employed, but rather that the data collected in real world contexts can address the research questions while simultaneously informing both theory and practice. F&DE in the area of literacy have been conducted across a diverse range of contexts from comprehension strategy instruction among Latina/o middle school students (Jiménez, 1997); summer school programmes designed to accelerate reading growth among struggling readers, (Duffy, 2001); interventions designed to increase the diversity of reading through the use of multimedia (Reinking & Watkins, 2000); facilitating the development of reading among English Language Learners (ELL) (Ivey & Broaddus, 2007); vocabulary development (Baumann, Ware & Edwards, 2007); Internet Reciprocal Teaching (IRT) (Leu, Reinking et al., 2007) and improving the early literacy of disadvantaged preschool children (Neuman, 1999).

Reinking and Bradley (2008) provide guidelines drawn from their own work, and that of others, which they contend focus on the goals of such data collection. Firstly, there should be a thick description of the context of the study drawn from interviews and observations. In this present study interviews were conducted with the teachers

at the outset of the study about current reading methodologies in the classroom, current uses of ICT within the curriculum and the dispositions of the children towards reading as perceived by the teachers. Initial interviews were also conducted with the children to ascertain their perceptions of and attitudes towards reading, writing and ICT.

Secondly, the baseline performance of the participants should be established. In the present study questionnaires surveying the children's perceptions and attitudes towards reading and ICT were utilised, standardised assessments of reading achievement were gathered and finally a baseline online inquiry task, the Sick Rabbit Task (SRT) was conducted with the focal groups prior to the design of the intervention.

Thirdly, there should be adequate time allocated for the research so that factors that enhance or inhibit the achievement of the pedagogical goal, including unanticipated effects, can be considered. Ivey and Broaddus (2007) conducted their study of ELL learners over a period of one school year. This allowed for time to make changes to the instructional environment, consider unanticipated effects, and transformations to the learning environment. This present study was conducted over an eighteen month period.

Finally, F&DE integrate both design and analysis through an iterative cycle of phases involving instructional moves and modifications designed to "enhance the effectiveness, efficiency and appeal of the instructional intervention" (Reinking & Bradley, 2008, p. 49) and guide and concurrently inform both practice and theory. In the present study data was analysed using Gravemeijer and Cobb's (2006) micro-and macro-cycles data collection framework where data sources were reviewed on a

weekly basis (micro-cycle) and at the end of each phase (macro-cycle) of the study and adjustments were made based on this analysis.

Establishing Validity, Credibility and Trustworthiness

In quantitative research, validity relates to the construction and administration of appropriate and validated testing procedures and instruments. In qualitative research the "researcher is the instrument" (Patton, 2002, p. 14), and the validity of the study rests with the researcher's skills, ability and knowledge to competently conduct and report on an in-depth inquiry with an appropriate level of objectivity and detachment.

Silverman (2005) argues that "validity is another name for truth" (p. 210) and cites Hammersley (1990, p. 57) in adding the proviso "interpreted as the extent to which an account represents the social phenomena to which it refers". Maxwell (2005) takes a 'commonsense' approach noting that validity relates to the "correctness or credibility of a description" (p. 106). Validity then relates to the researcher's ability to lessen any threats to the credibility of the account. Threats to validity can never be totally erased. Cohen, Manion and Morrison (2003) contend that you can "minimise invalidity and maximise validity" (p.105) of the account given, by the approaches you employ to rule out conflicting explanations and give credence to your conclusions. In arguing that the emphasis in research should move from "verification to falsification", Kvale (1996, p. 240) contends that the "stronger the falsification attempts a proposition has survived, the more valid, the more trustworthy the knowledge. Validation comes to depend on the quality of craftsmanship during investigation, continually checking, questioning, and theoretically interpreting the findings" (p. 241).

Miles & Huberman (1994) provide guidelines for what they have referred to as the "four Rs" (p. 262) of establishing quality and validity in qualitative research: reactivity, representativeness, reliability, and replicability. The following sections address each of these issues in turn.

Reactivity

Reactivity refers to the effects of the researcher on the study, the participants in the study and the study site and vice versa. The researcher needs to be aware of what Miles and Huberman (1994) refer to as "researcher-native relationships" (p. 265). In the first instance the researcher needs to safeguard against their existing preconceptions, assumptions and biases (Robson, 2002) through a process of "conscious and committed reflexivity" (Patton, 2002, p. 570) and monitor the impact of these preconceptions both in drawing conclusions and establishing the trustworthiness of the findings. The researcher's antennae needs to be mindful of, and open to, multiple and conflicting explanations within the study. The effect of the researcher on the participants in the study includes what Robson (2002) has referred to as the "good bunny" (p. 172) effect where participants are mindful of the presence of the researcher and act in artificial ways or say what they hope the researcher wants to hear them say. The effect of the researcher on the site can be alleviated by a prolonged period in the field where you can become a trusted part of the landscape (Patton, 2002). Long term involvement also provides more opportunities to explore rival explanations and lessens the degree of dependence on inference made by the researcher (Maxwell, 2005). Reinking and Bradley (2008) argue that in "engineering a pedagogical goal within a learning ecology" (p. 57) adequate time is needed to conduct F&DE. The present study was conducted over an eighteen month period. It

is also important that the chosen group represents the study group as a whole. In the present study the triad focus groups chosen represented the top, middle and bottom ability groups within the class. While it is important to consider the effect of the researcher on the site it is also important not to overinflate the importance of your presence in the field (Miles & Huberman, 1994). Patton (2002) drawing from anecdotal evidence of working with children in the field, suggests that any artificial effects produced by the researcher would be quickly diminished as children would "rapidly revert" (p. 568) to habitual patterns of behaviour within a short time.

Representativeness

Researchers often work alone as a "vertical monopoly" (Miles & Huberman, 1994, p. 262) within a field of study. How can they then ensure that the findings of the study as presented are a fair, complete and representative account of the phenomenon under study? Firstly, a researcher can adopt a rigorous approach to collecting a "rich data set" with multiple data sources (Silverman, 2005). Secondly, the purpose of the study, the procedures for selection of the site and participants in the study, the methods for data collection and analysis should be clearly delineated so that the reader is presented with a clearly recognisable audit trail of how you arrived at your findings (Maykut & Morehouse, 1994; Miles & Huberman, 1994). Thirdly, the researcher needs to "bracket" their own preconceptions and biases when analysing the data and use inductive methods of analysis, such as the constant comparative methodology (Glaser & Strauss, 1967) to discover patterns within the data, deductive methods of analysis (drawing on theoretical frameworks used within the study) and abductive methods (abstracting the best explanation for understanding one's study results) (Johnson & Onwuegbuzie, 2004).

"Respondent validation" (Cohen et al., 2003, p. 116) was used throughout the study where feedback was sought on a weekly basis from "key informants", for example the teachers involved (Miles & Huberman, 1994, p. 275), before adjustments were made to the intervention. At key stages of development, the study was also presented at a number of International conferences: The United Kingdom Literacy Association, (UKLA, 2006); the National Reading Conference (NRC, 2006, 2007, 2009); The Centre for Literacy Research (Nottingham, 2008) and The International Reading Association, (IRA, 2009) where feedback and response from practitioners and researchers was sought and acted upon.

Finally, the temptation for a researcher is to avoid considering negative cases or what Miles & Huberman (1994) refer to as "outliers". However, by examining and analysing negative cases the researcher can consider "rival explanations" (Patton, 2002, p. 553) thus testing and strengthening the validity and credibility of findings.

Reliability

"Triangulation is a way to get to the findings ... by seeing or hearing multiple *instances* of it from different *sources* by using different *methods* and by squaring the findings with others it needs to be squared with"(Miles & Huberman, 2004, p. 267; italics in original). Denzin (1970) (as cited in Cohen et al., 2003) extends the notion of triangulation beyond methodological considerations, multiple data sources, and researchers to include both theoretical and time triangulation (both diachronic and synchronic reliability). Triangulation, therefore, has the twofold effect of reducing the risk that your conclusions are invalid and increasing confidence in your findings. Maxwell (2005) argues that triangulation provides a method to weigh the evidence, thereby, giving a fuller and more truthful account (p. 94). It is not, however, a

panacea and Patton (2002) contends that triangulation is a "*test* for such consistency" (p. 248; italics in original) and not simply a way of looking for the same results. Fielding & Fielding (1986) note that the biases and threats to validity present in single data collection procedures, such as the difficulty with self-report in surveys, are still present when you triangulate the data.

Further elaboration of specific procedures used to triangulate data sources will be presented within each of the sections dealing with data collection methods in chapter 4.

Replicability

External validity refers to the generalisability of the study to other settings. As discussed earlier the humble theories (Cobb et al., 2003) generated by F&DE are more context specific, although Bannan-Ritland (2003) argues that the primary goals of F&DE are the "creation of products, artefacts or processes that leverage learning and teaching by making insights usable, actionable, and adoptable" (p. 24). However, in another sense F&DE have as Hoadley (2004) contends *systemic validity* where there is close interaction between theory, practice and research and where ideas are carried "all the way from explanation to prediction to falsification to application [and this] seems like the missing link in educational research that will ensure our theories have practical implications" (p. 205). Lincoln & Guba (1985) reject the notion of generalisability in qualitative research and refer instead to the "transferability" between study sites and the "fittingness" (p. 124) of the contexts of those sites. These concepts seem to relate well to F&DE.

Summary of Chapter

This chapter explored the conceptual framework leading to the research questions which underpin the present study. It situated the study within the Irish context where concerns about the low levels of literacy achievement among pupils attending designated disadvantaged schools have been raised by recent studies. It also established the need to support these struggling readers to develop effective online skills and in the complex environment of the Internet. It briefly outlined the focus, methodologies and theories underpinning other emerging studies in the area of technology and literacy. Following this, a rationale for employing the F&DE methodological framework was described. This section included an outline of the historical roots and origins of F&DE, the tenets of this design framework and defining characteristics of F&DE. The chapter concluded with the literature pertaining to establishing validity, credibility and trustworthiness within a research study.

CHAPTER FOUR

METHODOLOGY: RESEARCH DESIGN

Introduction

The chapter opens with a description of the procedures for sample selection and gaining access. Consideration is subsequently given to ethical issues. The penultimate sections of the chapter describe the qualitative and quantitative measures for data collection and analysis. The chapter concludes by presenting an overview of the research design as it evolved through a process of micro-and macro-analysis across the 18 month timeline of the study. The present longitudinal study was conducted in three integrated phases which linked together in a spiral fashion. They were the Baseline Phase; Reading Development and Critical Web Literacy (RDCWL) Phases 1a and 1b and the Main Study phase.

Sample and Gaining Access

Purposeful sampling was employed to carefully select the school and participants involved in this study. Patton (2002) contends that purposive sampling permits "inquiry into and understanding of a phenomenon in-depth" (p. 46) and continues that in using "information-rich cases" one can learn a great deal about issues that are central to the focus of the study. Maxwell (2005, p. 89) notes that there are four goals for purposeful sampling: the representativeness of the setting, participants and activities selected; capturing the heterogeneity of the population satisfactorily; consciously selecting cases that are crucial for the theories you are studying; and

finally allowing for "particular comparisons to illuminate the differences between settings or individuals".

The purpose of the present study was to explore and scaffold the development of online reading strategies among struggling readers in disadvantaged schools. The study was conducted in an urban setting in a Band 1 designated disadvantaged school (DES, 2005c). Band 1 indicates the highest level of social disadvantage in Ireland. The Hasse Index of relative affluence and deprivation indicates that in 2000 the catchment area has an index of ten making it one of the most disadvantaged areas in the locality. The school, St. Pio's National School (all names used in this research study are pseudonyms) is an all girls' school, reflecting an historic norm of single sex schools in older urban areas in the catchment area of the study. The school was built in the 1960's and is an imposing two storey school surrounded by a high corrugated iron fence. The school is a vertical school catering for 107 pupils from junior infants to sixth class. In 2006, 57 of the 107 pupils were children of Traveller origin. The school has an administrative principal and sixteen teachers.

The study was conducted in a series of Internet workshops in the computer room in the school. In 2006 the computer room had fifteen workstations with Gateway computers, running Windows 98 Operating System, and with a RAM ranging from 32 MB (seven computers) 64 MB (seven computers) and 152 MB (one computer). The computers were networked and connected to the Internet via an Eircom high speed Broadband connection. In addition there were single computers in each mainstream and special needs classroom operating with a similar configuration to that just outlined.

Following a meeting with the principal the researcher was invited to address the whole staff about the focus of the study at a staff meeting. The study focussed on senior class levels in the school for the following reasons. Firstly, the report on Literacy and Numeracy in Disadvantaged schools (Department of Education and Science (DES), 2005a) indicated continuing concern over levels of reading achievement as children progress through school where 47% of children at fifth and sixth grade levels were functioning at or below the twentieth percentile. Secondly, there is a move from learning to read to reading to learn in the English curriculum (DES, 1999) with more emphasis on informational reading in content areas, such as Social, Environmental and Scientific Education (SESE), as children progress through school. Thirdly, there is evidence in the literature (McKenna et al., 1995; Wigfield et al., 1997) that the motivational levels of struggling readers decrease as they progress through school. Finally, as the research was conducted over an 18 month period the study was able to track children's development in online reading activity over the entire span of the senior primary school system from third to sixth class.

Further meeting were held with teachers of third and fifth classes (N=2) to discuss their participation and the participation of their classes in the study. This process is outlined in greater detail in the Ethics section. The study was conducted over an eighteen month and so the children were monitored from third to fourth class (N=25) and from fifth to sixth class (N=16). The total number of pupils involved in the study was 41.

The study monitored in depth the progress of three groups of three within each class who acted as representatives of each class cohort. Each of these focal groups was of mixed ability, containing children across the ability range. The mixed ability

grouping met several criteria determined by standardised reading test scores, Internet computer usage, teacher observations and school attendance.

Ethics

In the present study the researcher adhered to the British Educational Research Association's Revised Ethical Guidelines for Educational Research (BERA, 2004). Particular attention was paid to articles fourteen and sixteen as they relate directly to conducting research with children. Article fourteen relates to articles three and twelve of the United Nations Convention on the Rights of the Child (1990) which gives primacy in the first instance to the best interests of the child in all actions with them and secondly due consideration to the views of the child in accordance with age and maturity. Article sixteen (BERA, 2004) relates to seeking approval and consent from parents or guardians of children for any research undertaken with them.

Informed consent as defined by Diener and Crandall (1978), cited in Cohen et al. (2003, p. 51) relates to "procedures in which individuals choose whether to participate in an investigation after being informed of facts likely to influence their decision". Cohen et al. (2003) note that this definition consists of four aspects: "full information, voluntarism, competence and comprehension" (p. 51). In the first instance participants need to be fully informed about the nature of the research. The researcher was invited, following initial consultation with the principal of the school, to address a full meeting of the staff where the nature of the research was explained and the possible educational benefits of the study were outlined. The researcher also provided detailed information at this meeting about her background and experience as an educator both across all class levels of the primary school system as a class teacher and learning support teacher, in disadvantaged and non-disadvantaged

schools, and at third level as a lecturer in literacy education. Further meetings were held with the individual class teachers who had been invited to participate directly in the study. Details of data collection procedures were explained, likely discomforts and risks were discussed, possible expected benefits were outlined, questions were encouraged and answered, and finally a clear indication of the right to withdraw from the study at any time was offered (Cohen et al., 2003). All of these issues were subsequently outlined to the teachers in a letter of consent which they were asked to consider and sign. This letter of consent is presented in Appendix A. Permission for the study was also obtained from the board of management of the school.

To obtain informed consent from the children a number of approaches were adopted. Firstly, the class teachers met with the parents or guardians of the children at parent-teacher meetings where information about the study was given. Questions were encouraged and the possible benefits of the study were explained. The parents were also encouraged to discuss the study with the school principal. The researcher was also available to answer any possible questions they had. The class teachers also explained the nature of the project to the children and invited the researcher to answer any questions they had in informal class meetings. The children were informed that participation in the study was entirely of a voluntary nature and that they could withdraw from the project at any stage. Letters of consent and an information sheet were then sent to the parents which the parents and children were asked to discuss together and to sign if willing to participate (Appendix A). Morrow (1996) draws the distinction between consent and assent in relation to obtaining informed consent with children. She argues that parents give consent on behalf of their children based on a full disclosure of information pertaining to the study, while

engaging in a parallel process of assent where the child agrees to partake in the study following discussions with their parents. Issues of anonymity were ensured by protecting the identity of the school, the teachers and the children through the use of pseudonyms in reporting and presenting the study.

Finally, approval was sought and granted by the School of Education research committee at the University of Nottingham. The ethics approval process at the University of Nottingham consists of submitting, for consideration and approval, a statement of research ethics, a statement of the research aims and proposed methods of data collection, a statement on how access to prospective participants will be gained, and finally draft consent forms and information sheets provided for participants.

Qualitative Data Sources

This section describes the qualitative data sources collected through think aloud interviews and protocol analysis, Camtasia online activity recording, interviews and observational field notes. The section concludes with a consideration of the methods of qualitative data analysis.

Think Aloud Interviews

In the present study the six focal triad groups were asked to think aloud as they completed a series of researcher-determined Internet Inquiry Progress Tasks conducted at key stages across the three interlinked phases of the study. Table 4.1 summarises the Internet Inquiry Progress Tasks given to the focal groups.

Table 4.1 *Internet Inquiry Progress Tasks Conducted at the Baseline, RDCWL Phase 1b and the Main Study*

Internet Inquiry Sick Rabbit Task (SRT) *Conducted at the Baseline Phase*	Imagine your friend has a sick rabbit. Can you go onto the Internet and find information to help your friend with the sick rabbit?
Internet Inquiry Progress Task 1 *Conducted at the end of RDCWL Phase 1b*	Find out how animals have adapted to living in the Antarctic (6th class). Find out how penguins live in the Antarctic (4th class).
Internet Inquiry Progress Task 2 *Conducted during the Main Study.*	6th class: Find out what you can about how a named animal (chosen from the biome of the group) adapts to where it lives. 4th class: Find out what kind of food does a (chosen bird) eat.
Internet Progress Task 3a, 3b, 3c *Conducted at end of the Main Study.*	(3a) Investigate where an unknown animal (6th class, wallaroo) or bird (4th class, macaw) lives; what they eat; and how they adapt to where they live. (3b) 6th class: Find out why the corncrake is endangered and what can be done to save the corncrake. 4th class: Find information on taking care of a pet macaw (3c) Critique an Internet inquiry simulated search, related to questions about burmese pythons (6th class) or barn owls (4th class) conducted by 'Mary', based on search terms generated and the search results investigated. Find information to answer Mary's questions.

The Internet Inquiry Progress Tasks enabled the researcher, as a non-participating observer, to monitor the ability of the focal groups to independently seek information during Internet inquiry. Analysis of the Internet Inquiry Progress Tasks enabled the researcher to design the instructional content of subsequent Internet workshops formatively, drawing on key issues which emerged from analysis

of these series of tasks, which is in line with the iterative nature of the F&DE framework.

The think aloud data was captured on a digital voice recorder and subsequently transcribed by the researcher; the online activity was captured using Camtasia software and again was transcribed by the researcher onto Camtasia activity record sheets. Researcher protocol for Internet Inquiry Progress Tasks 1, 2, 3 is presented in Appendix D.

Think Alouds are a way to capture a person's thoughts while they are reading or problem solving. Ericsson and Simon (1993) note that there is a dramatic increase in the amount of behaviour that can be observed when a subject is performing a task while thinking aloud compared to the same subject working under silent conditions (p. xiii). Think aloud data and subsequent protocol analysis of the transcripts can be useful in developing an understanding of the cognitive, reasoning and affective processes of a person (and any possible interplay between these processes) as they problem solve (Ericsson & Simon, 1993) or read a text (Pressley & Afflerbach, 1995). As such, they provide a window into these processes which might otherwise only be investigated indirectly or inferred. Pressley and Afflerbach (1995) in an extensive review of studies into expert adult reading processes found that expert readers are particularly active, responsive and cognitively aware while reading.

Kucan and Beck (1997) note that think aloud studies have not only been used as a window onto the processes of expert readers (Collins, Brown & Larkin, 1980; Wyatt et al., 1993) and struggling readers (Olshavsky, 1976-1977) but also aid decision making into the comprehension strategies that need to be taught through teacher think alouds while modelling and demonstrating reading strategies (Bereiter

& Bird, 1985; Duffy & Roehler, 1987; Paris et al., 1983). Spires & Estes (2002, p. 123) assert that the findings from verbal protocol analysis offer the possibility to "uncover potential cognitive processes inherent in web-based reading environments that have not yet been articulated" and thus may contribute to our understanding of online reading strategies.

More recently, the focus, in think aloud studies, has moved to the social support provided by other readers, to what Kucan and Beck (1997) refer to as "multiple resources at the reading construction site" (p. 289), where the individual reader is potentially helped by accessing the reading processes of other readers. Kucan and Beck (1997) argue from a social constructivist perspective that the:

> potential result of participating in a social situation involving reading and thinking about texts is that individual students can draw upon the teacher and other students to help them construct not only an understanding of text ideas but also an understanding of what it means to read and think about text (p. 289).

Although it is well established in the literature (Pressley & Hilden, 2004) that people are able to report the contents of short-term memory a number of challenges to think alouds and protocol analysis remain. Pressley and Afflerbach (1995) see the "constructive nature of language comprehension" (p. 2) as the greatest challenge to protocol analysis. This challenge relates to how the researcher's worldview and language variation can shape the analysis and interpretation of the verbal reports generated. Related to this challenge are the directions given by the researcher to participants. Ericsson and Simon (1993) contend that the researcher should interpret and explain the cognitive processes at work rather than encouraging the participants to do so and this would hamper or interfere with future processing. Pressley and Afflerbach (1995) argue that our current understanding of metacognition and its role

in reading processes shows that the person's ability to be metacognitive while reading demonstrates the degree of sophistication and awareness they have of the strategies they are using. A third challenge relates to the ability of adults and children to verbalise their processing while reading or problem solving (Pressley & Hilden 2004, p. 312). The final challenge relates to what is requested (the nature of the task ranging from simple to complex), how it is requested (the directions given to participants), and when requested (whether concurrent or retrospective). As verbal reports relate to the contents of short-term memory, Pressley and Afflerbach (1995) note that the "recency of verbal reports of cognition and response to their actual occurrence is vital" (p. 3), therefore a time delay increases the chance of "embellishment or decay of the information" accessed through short-term memory.

Think Aloud Protocol Methods

Afflerbach (2000) urges methodological rigour in the use of verbal reports including the necessity of full reporting of methods employed in their generation. Directions given to the participant should be open ended and the researcher should avoid directing the reader towards reporting particular strategies while reading. For example, in the present study, the children were asked to tell what they were thinking and what they were doing as they searched for information on the Internet. A standard protocol was developed and followed during each Internet Inquiry Progress Task. (See Appendix D for the researcher protocol for conducting these Internet Inquiry Progress Tasks). Ericsson and Simon (1993) contend that thinking aloud is a natural process and, as such, requires no prior training. Prior explanation of think alouds through modelling may also encourage the participants to "do as I do" (Pressley & Hilden, 2004, p. 319). Non-directional prompts were provided by the

researcher to the children after a short time lapse (Wyatt et al., 1993) when no think alouds were occurring. Non-directional prompts were offered at key moments within the Internet Inquiry Progress Tasks, such as when the children were entering a search string, choosing a hyperlink, or reading a web page. Prompts included, "why are you clicking there?", where do you think that link is going to lead you? ", and "how did you select the search terms?" These prompts were designed to be as unobtrusive as possible so that they minimised interruptions to the reading process (Olshavsky, 1976-1977, p. 662). The directions given also precluded asking participants to infer or explain the processes they use as these inferences may affect subsequent processing (Ericsson & Simon, 1993). The task or text used should be challenging without being overwhelming to encourage the reader to be strategic and active (Coté & Goldman, 2004; Pressley & Afflerbach, 1995). Think alouds can be conducted both concurrently and retrospectively. However, as they reflect the extent of short-term memory they should be conducted as someone is reading or completing a task. Concurrent think alouds were captured in this study. The researcher also conducted exit interviews with the children immediately after the completion of each Internet Inquiry Progress Task where they viewed Camtasia recording of their online activities. The children were asked to verbalise what their thinking had been retrospectively while they were completing the task, and to comment on the skills and strategies adopted by them during Internet inquiry.

Interviews

The purpose of interviews according to Cohen et al. (2003) is to allow participants to discuss their interpretations of the world in which they live (p. 267).

Kvale suggests that interviewing is the "inter change of views between two people" (p. 2) and explains that interviews are:

> A move away from obtaining knowledge primarily through external observation and experimental manipulation of human subjects, towards an understanding by means of conversations with the human beings to be understood. The subjects not only answer questions prepared by an expert, but themselves formulate in a dialogue their own conceptions of their lived world (p.11).

A number of interview formats are discussed within the literature. They range from informal conversational interviews, general interview guides, standardised open-ended interviews and closed quantitative interviews (Patton, 2002). These correspond broadly to the interview typology distinguished by Robson (2002) as unstructured, semi-structured and structured interview formats. Kvale (1996, pp.126-127) helpfully discusses interviews along a continua depending on the level of structure, openness of purpose, whether exploratory or hypothesis testing, descriptive or interpretive and finally whether focussed on emotional or intellectual response. A semi-structured interview approach was adopted in this study. This allowed the researcher to explore a range of pre-determined questions and topics with the flexibility to add supplementary questions, explore issues in-depth as they arose and change the sequence of questions as needed within each interview. A number of different types of interviews were conducted in the study as shown in Table 4.2.

Table 4.2 *Interview Sequence With Allocated Codes*

Type of Interview	**Date Conducted**	**Code Assigned Followed by Transcript Page Number (p)**
Individual child pseudonym Initial interview	December 2005-January 2006	Child pseudonym/IntI/p
Individual child pseudonym Post interview	June 2007	Child pseudonym /PostInt/ p
Camtasia exit interview group/ Internet Inquiry Progress Task 1, 2, 3	(Task1) 10/01/07 (Task 2) 14/02/07 (Task 3) 21/05/07-07/06/07	CInt/group number/T number /p
Teacher Initial interview	January 2006	Assigned teacher code/IntI/p

Interviews conducted with the teachers involved in the study ranged from semi-structured interviews to informal conversational interviews. The semi-structured interviews were conducted at the beginning of the project and focussed on the teachers' perceptions of the children as readers and writers, the social interactions within the class, the reading methodologies employed by them and the use of ICT in the classroom. Informal conversational interviews in the form of debriefing sessions were employed within each Internet workshop to supplement field notes.

Individual interviews were conducted with the focal group children at the beginning and end of the study. These interviews focussed on a range of issues including the children's perceptions of themselves as readers and writers, their

dispositions towards reading and their use of reading strategies in both print and online formats and their interactions with their peers. Group exit interviews were conducted with the focal group children as they viewed the Camtasia recording of their online activities after each Internet Inquiry Progress Task. The exit interviews provided a retrospective view of the thought processes of the children as they conducted the online Internet task and were analysed with the concurrent think alouds.

Developing an Interview Schedule

The interview schedule was developed using the framework suggested by Maykut and Morehouse (1994). Firstly, the focus of the inquiry was established. For example, in the initial interviews with the individual children the focus of inquiry was on the use of reading strategies and the perceptions and dispositions of the children towards reading, writing and ICT. The researcher brainstormed possible ideas, concepts, and questions related to the field of inquiry drawing on the researcher's knowledge and literature within the field (for example Gambrell, Palmer, Codling & Mazzoni, 1996; Leu, Leu & Coiro, 2004; Wigfield & Guthrie, 1997). Therefore, the questions were arrived at inductively from the ideas, knowledge and professional experience of the researcher and also deductively from a review of the literature. These questions were then examined for similarities and categorised into areas of inquiry and an interview schedule for each type of interview conducted was developed. Sample questions of the interview schedule conducted with the children are contained in Appendix B.

Question Typology

Cohen et al. (2003, p. 276) draw a distinction in categorising questions between *substance* type questions and *process* type questions. Substance questions relate to facts (the knowledge the person has), behaviours (what they do), beliefs (what they think) and attitudes (what they feel about something) (Robson 2002, p. 272). Patton agrees and extends this list by adding two further types of substance questions; those relating to sensory questions and background demographic questions. Background knowledge questions were not asked as part of the Interview schedule as they have been ascertained in survey data. Likewise sensory type questions, for example relating to what was seen were ascertained by direct observation on the part of the researcher. Kvale (1996) notes that researchers should also be mindful of subsequent analysis of the interview and in order to "obtain a disambiguation of the statements made" (p. 132) should also ask process oriented questions, for example, questions that introduce the topic; follow up on questions asked; probe answers given; ask for specific details; ask for direct information or conversely ask indirectly for information; and interpret responses to questions.

Table 4.3 *Example of Substance Questions*

Robson (2002) Typology of Questions (p.272)	**Example Questions from Post Interview Schedule of Individual Focal Group Children**
Facts	*What do you use the Internet for outside of school?*
Behaviours	*When you are searching for information on the Internet can you describe how you do it?*
Beliefs	*Is there a difference between reading a print text like a book and reading on the Internet?*
Opinions	*How good do you think you are at searching for information on the Internet?*

Patton (2002) suggests that the interview should commence with "non-controversial" questions which ask for straightforward descriptions, minimum recollection and interpretation and aim to settle the interviewee. For example, in the initial individual child interviews the children were asked initially, "How good do you think you are at reading?". The interviewee should be asked if they wish to add additional comments at the end of an interview.

Conducting Interviews with Children

Initial individual interviews were conducted with the focal group children to triangulate with other data sources, such as the ImpaCT2 (Harrison et al., 2002) and the Pupil Attitude Questionnaire (Eivers et al., 2004). They also provided a "richer description" of the perceptions of the children of themselves as readers and writers and included questions related to self-efficacy and motivation; the challenges of reading; the social aspects of reading with peers at home in the community; and Internet and ICT usage outside of, and in, school. Interviewing children presents the interviewer with challenges and considerations which are supplementary to conducting interviews with adults (Greig & Taylor, 1999). Both types of interview require a number of interviewer qualifications (Kvale, 1996, pp. 148-149.). These include knowledge of the subject matter at hand, an interview structure, the use of clear and unambiguous questions, developing a sensitive rapport with the participant, and an active listening mode to ensure interpretation of answers.

Simons (1982) and Mc Cormick and James (1988) as cited in Cohen et al. (2003) comment that particular emphasis needs to be placed on establishing rapport with children when interviewing them. The researcher had visited the classes on a number of occasions and had held informal conversations with the children to establish trust

and rapport before the study commenced. Indeed the children were on a first name basis with her. The interviews were held in surroundings familiar to the children, such as the school library, and the interviewer ensured that the interviews were conducted with an air of informality ensuring that the individual children were at ease at all times. The questions asked in the interview had been piloted on children not involved in the focal groups and had been tweaked to remove ambiguous or difficult vocabulary and this ensured that the vocabulary used in the question format was at an appropriate developmental level for the children. In addition the researcher was mindful of non-verbal cues and awkward silences on the part of the individual child, realising that these could indicate that the child might not have an answer to a question, might not be able to articulate an answer or might be tiring. Appropriate actions, such as the use of a process probe, rephrasing a question or stopping the interview were then taken. The interviews were digitally recorded and transcribed by the researcher. The children were asked for permission to record each interview before it commenced.

Group interviews were also held with the focal groups. These consisted of exit interviews conducted in the computer room after completion of the Internet Inquiry Progress Tasks, and selected workshops, where the triad groups viewed a video recording of their online activity, captured on Camtasia software, and were asked to comment retrospectively on their online activity. Lewis (1992) argues that "all aspects of the child's development are influenced by the child's social world" (p. 413). Firstly, group interviews with children have the potential to reveal consensus views held across the group thus complementing or contrasting with individually held views and providing a more comprehensive understanding of the research topic.

Secondly, group interviews offer the possibility of a breadth and depth of response where individuals within the group may challenge viewpoints, elaborate on points made or trigger additional responses.

Validity of Interviews

Cohen et al. (2003, p. 122) note that the "interview is a shared, negotiated and dynamic social moment". Issues of validity which relate directly to interviews include issues of bias and objectivity on the part of the interviewer, the interviewee and the questions asked. Issues of bias and objectivity relating to the interviewer include the ability of the interviewer to bracket their preconceived ideas, expectations and attitudes when listening to or seeking answers to questions posed (Cohen et al., 2003). The influence of the interviewer on the interviewee relate to issues of power which Kvale (1996) describes as asymmetrical. The interviewer decides on the parameters of the interview, the topic, the questions and the course of the interview. The interviewer needs to be aware of non-verbal cues given by them which may influence the responses provided by the interviewee. Likewise, in asking questions the interviewer needs to be mindful of leading question although Kvale (1996, p. 158) contends that leading questions may be deliberately posed where the interviewer suspects that information is being withheld by the interviewee. The interviewer needs to create an atmosphere where the interviewee feels safe and can therefore talk freely. Finally, interviews should be one of a range of measures utilised and crosschecked with other measures to ensure "convergent validity" (Cohen et al., 2003, p. 121).

Generating Field Notes: Methods and Strategies

In the present study, field notes were generated from a number of sources using different methods. Firstly, the researcher acted as a participant observer in the field. The descriptive content of the field notes included onsite observations made by the researcher during the Internet workshops. These observations included (a) observations made by the teachers in informal conversations with the researcher; (b) the non-verbal behaviours of the children as they worked; and (c) occurrences in the immediate surroundings of the Internet workshops. Secondly, the introduction, guided instruction, and group responses in each of the 25 Internet workshops conducted over an 18 month period were digitally recorded and transcribed by the researcher. Thirdly, artefacts of the children's work were collected. Finally, the conversations of the focal group children were digitally recorded, and their online activity was captured using Camtasia software as they worked in groups in the Internet workshop.

These data were then transcribed and analysed by the researcher. The ongoing data gathered as field notes should, Patton (2002, p. 302) contends, include descriptions of what was experienced and what was observed in the setting; quotations of what people said to provide an insider account; the observer's own feelings and reflections on observations made; and finally, field-generated early analysis of what it all means written as memos (Miles & Huberman, 1994).

Participant observation was used by the researcher in this study to enter into the lives of the participants, to "indwell" (Maykut & Morehouse, p. 69) and observe directly *in situ* what was occurring, the participants' conversations, reactions and actions within the Internet workshops. Bogdan and Biklen (1992, p. 79) caution that

while one enters the "subject's world" one must "remain detached". Robson (2002) advises that the researcher should be aware of selectivity in observation leading to issues of bias in three areas. Firstly, *selective attention* may be due to the researcher's expectations, interests, and experiences and therefore you should ensure that you spread your attention as widely as possible when observing. Secondly, *selective encoding* where your written field notes are coloured by your expectations and hasty judgements. Finally, *selective memory* where the accuracy and depth of the account is affected due to a time lapse in writing the field notes. Fieldnotes based on researcher observations were written as soon as possible after returning from the field.

The researcher guarded against the "partialness of the observer's view of a single event" (Cohen et al., 2003, p. 313) in the following ways. The Internet workshops and lessons and the conversations of the focal groups and their online activity as they worked were digitally recorded, listened to on a weekly basis, and transcribed as soon as possible by the researcher. The children's work samples were also collected. All of these data sources were used to heighten the researcher's own observations and to expand the field notes. A journal was also kept by the researcher throughout the study. Memos based on the expanded field notes were written using Richardson's (2000, p. 941) categorisation approach as cited in Silverman (2005, p. 251). These categories included *Observational notes* (ON), *Methodological notes* (MN), *Theoretical notes* (TN) and *Personal notes* (PN).

Qualitative Data Analysis

Miles and Huberman (1994) recommend interlacing data collection and data analysis throughout a research study from its earliest stages. This early analysis, they

contend, helps the researcher to "cycle back and forth between thinking about the existing data and generating strategies for collecting new, often better data" (p. 50) from the very start. As such, data collection and analysis is an iterative and continuous process. Early analysis is an essential feature of an F&DE framework due to the iterative nature of the methodology. Wolcott (1994) argues that the transformation of qualitative data into a meaningful written account consists of what he terms a 'dialectic' between three elements: description, analysis and interpretation. The descriptive element refers to letting the data "speak for themselves" (p. 10) and considering "what is going on here" (p. 12). Analysis addresses "how things work" (p. 12) and looks in a careful and systematic way at identifying salient features and the interrelationships between these features. Finally, interpretation considers the question of what it all means and extends analysis to "reach out for understanding or explanation beyond the limits of what can be explained with the degree of certainty usually associated with analysis" (p. 11).

The range of data sources utilised in the study were transcribed by the researcher thus immersing the researcher in the data and generating early emergent insights (Patton, 2002, p. 441). The data sources included transcripts of think aloud protocols, Internet activity captured on Camtasia software, interviews, field notes and student artefacts. The 'constant comparative methodology' (Glaser & Strauss, 1967) was used to analyse the data. In the first instance, an inductive approach was used to sensitise the researcher to discover patterns within the data; secondly deductive methods of analysis drawing on theoretical frameworks used within the study were adopted; and finally, abductive methods, abstracting the best explanation for understanding one's study results were utilised (Johnson & Onwuegbuzie, 2004).

Coding the Data

To underpin trustworthiness in a research study Maykut and Morehouse (1994) recommend a clearly presented "audit trail" (p. 146) through the procedures of data collection, analysis and interpretation. The data transcripts were transferred into the middle column of a three column table via a Word processing package on the computer. The data transcript pages were coded to their sources to provide an audit trail to the original transcript sources. For example, as presented in Table 4.4, the code (MS,T2,G3,p3) refers to Main Study (MS), Internet Inquiry Progress Task 2 (T2) for group 3 (G3), and transcript page 3. Therefore quotes and online activity could be easily identified back to their original transcript sources.

The next stage consists of unitising the data (Lincoln & Guba, 1985) into identifiable units of meaning and attaching codes to these units. Miles and Huberman (1994) note that the "challenge is to be explicitly mindful of the purpose of the study and the conceptual lenses you are training on it - while allowing yourself to be open to and reeducated by things that you didn't know about or expect to find" (p. 56). Coding of data consists of three elements. Firstly, codes range across different levels of analysis from descriptive to inferential, secondly they can be revised or added to during analysis, and finally, they are "astringent" (Miles & Huberman, 1994, p. 58) in that they pull data together and empower data analysis.

The development of coding categories consists of first level open codes (generally concerned with description and attaching labels to groups of words) and second level codes or pattern codes (which group first level codes together into themes and recurring patterns) (Miles & Huberman, 1994, p. 57). First level open descriptive codes were assigned to the first column of the three column table. The

transcript data was placed in the middle column. Further reflection and analysis resulted in second level inferential coding which sought to extract patterns in the data and were more explanatory and inferential; this was placed in column three. See Table 4.4 for example of coding analysis of a transcript. Miles and Huberman (1994) and Robson (2002) recommend the use of memos throughout the data analysis stage. Memos were written and dated in the third column of the three column table and were often revisited, revised and expanded into separate files during the study. Memos are a way of conceptualising the data, clarifying and linking ideas, capturing analytic thinking and intuitions relating to research questions, observations, methodologies and theoretical frameworks.

Table 4.4 *Sample Transcript Showing First and Second Level Coding*

1st Level Descriptive Coding	**Transcript of Data**	**2nd Level Inferential and Interpretive Pattern Coding**
Monitoring Navigation skills Navigator role Planning Search String generation Navigation skill Monitoring Monitoring information Summariser role Planning Questioner role Generate information Summarisation	L: *Look at all the hits* J: *Yeah, there's too many* E: *Right. What could we do to narrow it down?* L: *We could put in home. Adapt plus home* J: *Search* E : *We're after typing in home now* L: *Oh my God. It's actually after going up* (Referring to number of search results) J: *They're not coming up with all brown bears they're just coming up with all bears of the world* E: *Is there anything else that we might do that would make it smaller* J: *Look girls! Here look! A bear can adapt to the environment because it has very thick fur.*	Peer collaboration: Use of reciprocal roles. ((Peer collaboration linked to active construction of meaning)) Development of online information-seeking skills: Generating search terms, monitoring search results Development of self-regulatory reading processes: Monitoring, planning, questioning, summarising.

Note. Data transcript source (MS,T2,G3,p3)

Camtasia videos were also transcribed by the researcher onto Camtasia activity record sheets to recreate in a step-by-step fashion the online activities of the focal groups in the Internet inquiry tasks. An Elearning incident as defined in Table 4.5 broadly corresponds to a 'mouse click' and includes *navigational moves,* such as backtracking, looping and back button activation; *exploratory moves* including scrolling and cursor movement indicating reading activity; *entering* and *activating search terms*, and *investigating search results,* such as hyperlinks, blurbs and URLs. The online activities were time stamped into actions usually corresponding to generation or revision of search strings or navigational decisions. Navigational decisions were captured by charting the group's keystrokes and cursor movement activities. The Camtasia transcripts, in the form of a Camtasia activity record sheet for group 3 in Internet Inquiry Progress Task 2 were then combined with the transcripts of the think aloud data and an example of this data display can be found in Table 4.5. As such, this was an attempt to contextualise the focal groups' online activities by combining multiple data sources, such as online activity with verbal protocols, thus providing a means of data triangulation and transformation (Kvale, 1996).

Table 4.5 *E-Learning Incident with Combined Digital Transcript and Camtasia Coding*

Time Stamp	E-Learning Incident	Cursor Activity	GST	Reading Strategy	Researcher Observation	Digital Voice Recording Transcript
06:09	Cursor moving around page indicating reading activity	N/D/L/ R/R/D/ U/N/U/ L/R/D/N		Reading information Using informational text structure. Monitoring task and understanding. Generating information	Cursor hovers over image at the end of this sequence. [Some broken images not available]	*Jane :Scan the page and see would that be useful* *Eileen: There. The Kodiak bear [Jane joins in reading)] can adapt in his environment because of his very thick fur. The bear can swim so it can catch fish.*
08:40	Hit back button	L		Revision of search strategy	Google search box brown bears +adapt +home	*Leona: will we try another search term?* *Eileen :oh, that the bear can swim so it can catch fish. Jane : That page is a good page isn't it* *Eileen Yeah. Researcher: What makes that a good page?* *Jane: Because it automatically tells you [overlapping speech separated for transcription]* *Eileen: It tells you, it has them all separated into different parts.* *Jane: yeah and it says adapt in one part and that's what we were looking for. Researcher: ok. Jane: We don't need to use the edit-find don't we not? We can just scan the page and we found it. Researcher: Ok*
08:48	Hit back button again	L			Then brownbears +adapt [did not activate these search strings] Activated brown bears + adapt	
09:29	Hit enter activate search string		brown bears +adapt (S5)	Evaluating information Evaluating text structure Reading strategy Informational text structure Monitoring understanding Online strategy Edit-find Planning	Discussion of strategy use Use of Informational text structures	

Note. Cursor activity legend: Up/Down/Left/Right/None; *Note*.GST: generating search terms; Data transcript source: (MS,T2,C,G3,p4*)*

Data analysis continues through a process of open first level descriptive coding, second level inferential or pattern coding, and the development of themes and category systems. Categories are developed by seeking *recurring regularities* (Patton, 2002, p.465, italics in original) in the data. These pattern regularities can then be sorted into converging categories. Patton (2002) notes that categories should have "*internal homogeneity*" and "*external heterogeneity*" (p. 465). In the first instance the data should gel together in each category in a meaningful way and in the second there should be clear differences between categories. Lincoln and Guba (1985) have referred to the 'look/feel' criteria in developing categories, where the researcher examines the data to ascertain if the data fits into a particular category, and if not, if it belongs to another new category. This process of analytic induction continues through a progressive refinement of categories. Guba (1978, p.53), as cited in Patton (2002), argues that "the existence of a large number of unassignable or overlapping data items is good evidence of some basic fault in the category system". Lincoln and Guba (1985) recommend that the characteristics or properties of each category be written with clearly defined *rules of inclusion* written as *propositional statements.* Maykut and Morehouse (1994) suggest that a propositional statement is one "that conveys the meaning that is contained in the data...gathered together under a category name" (p.139). Separate files were created for each category in a Word processing package. The researcher then moved between the data sets copying and pasting the analysed data into assigned categories. Patton (2002, p.466, italics in original) suggests that at this point the researcher should analyse for *divergence.* This entails "fleshing out", extending, and making connections between categories until the researcher is faced with category saturation and redundancy, when as Patton suggests "clear regularities have emerged that feel integrated, and when the analysis

begins to "overextend" beyond the boundaries of the issues and concerns guiding the analysis" (p.466). The data set were examined for patterns, similarities, developments, and differences between the focal groups across the phases of the study. Analysis proceeded inductively in the first instance and deductively in the second. The deductive analysis drew on theoretical frameworks, such as the New Literacies (Coiro et al., 2008) framework, a motivation and engagement framework (Guthrie & Wigfield, 2000) and scaffolding theories (Wood et al., 1976). In line with the formative and design experimental (F&DE) methodological framework of the study, the data was also examined for evidence of factors that enhanced or inhibited achieving the pedagogical goal of the study including unanticipated factors.

Quantitative Data Measures

A small number of quantitative data measures were employed throughout the study. Standardised reading achievement scores were obtained for all of the children in the study at the baseline phase, midpoint and at the end of the intervention. A Pupil Attitude Questionnaire (Eivers et al., 2004) and a computer usage questionnaire (ImpaCT2, Harrison et al., 2002) were employed at the baseline phase.

Reading Achievement Tests

The Drumcondra Sentence Reading Test (DSRT) and the MICRA-T are norm-referenced tests and are designed to provide information on the reading performance of children relative to their peers nationally.

The Drumcondra Sentence Reading Test (DSRT)

The DSRT was chosen as it had been standardised nationally on a representative sample of pupils from first to sixth class in Irish primary schools in May 2002. The

DSRT had also been utilised at first, third and sixth class levels in the Reading Literacy in Disadvantaged Primary Schools survey (Eivers et al., 2004). As such, the use of this test would allow for comparisons of reading achievement with pupils at the same class levels and also pupils in disadvantaged schools.

There are six levels of the test corresponding to classes from first to sixth class. At each level there are two forms, form A and form B, consisting of forty items in a cloze sentence multiple choice format testing word recognition and reading comprehension. The timed test lasts for 20 minutes. The DSRT was administered on three occasions in the study at baseline, midpoint and end of the intervention. The children's raw scores were converted into standard scores and percentile ranks. For each level of the test the mean of the scale is 100 and the standard deviation is 15. Technical data for the DSRT is available in Appendix C.

MICRA-T

The MICRA-T test (Wall & Burke, 2004) was the standardised test of reading achievement for all children from first to sixth class which was administered annually in May by the study school. Scores for the participating children were obtained and the results were compared with the DSRT results at the baseline, mid-point and end of the study. Level 2 of the MICRA-T corresponds to 2nd /3rd class, level 3 to 4th class, and level 4 to 5th/6th classes respectively. There are two parallel forms within each level; form A and form B. The test is timed for completion in between 30 and 50 minutes. At level 3, for example, there are 64 test items, using a cloze procedure format, testing reading comprehension and word recognition skills.

Raw scores for the MICRA-T are converted into standard scores based on class-based norms and age-based norms. Both types of standardised results (class-based

and age-based) can also be expressed in terms of percentiles and STEN scores and reading ages. The manual, however, comments that reading age scores should be interpreted with caution as they are "crude indicators of performance" (p. 15). For each level of the test the mean of the scale is 100 and the standard deviation is 15. Technical data for the MICRA-T is available in Appendix C.

Analysis of the Pupil Standardised Reading Achievement Scores

The DSRT and the MICRA-T test data were entered on the computer into the statistical package of the University of Pittsburgh Statistical Package for the Social Sciences (SPSS 14.0 for Windows) for data analysis. Descriptive statistics were computed for the data set including measures of central tendency (e.g. mean) and measures of dispersion (e.g. standard deviation). A one-way repeated measures ANOVA was conducted to compare the mean scores at pre-, mid- and post-time periods on both the DSRT and the MICRA-T tests. A paired-samples t-test was also used to compare mean achievement at pre, mid and post time intervals to determine if differences in pupils' achievement were statistically significant.

Baseline Data Collection: Use of Questionnaires

Two questionnaires were used with the children at the beginning of the study for the following reasons. Firstly, the Pupil Attitude Questionnaire (Eivers et al., 2004) was used to ascertain the children's attitudes and perceptions of school and reading. This data was then triangulated with the initial individual interviews with the focal groups to provide a more in-depth view of the children's perceptions and attitudes. Secondly, the ImpaCT2 (Harrison et al., 2002) questionnaire was used to provide data on current uses of ICT and the Internet among the children. It was also used in

the selection of children for the focal groups where each group had a child with some level of self-reported computer usage and Internet access at home.

Pupil Attitude Questionnaire

The Pupil Attitude Questionnaire (Eivers et al., 2004) was developed for use with children at third and sixth class level. The pilot survey for the questionnaire was conducted in January and February, 2002. In all five schools and 200 pupils, not involved in the Reading Literacy in Disadvantaged Primary School study, participated in the pilot study of the questionnaire. Following the pilot survey modifications were made to test items to increase item clarity. For example, as some pupils had had difficulty understanding and responding to negatively keyed items, these items were re-worded in positive terms.

The questionnaire looked for background information on the children. Questions were asked related to issues, such as academic self-perception, including pupils' perceptions of themselves as readers, writers and spellers. Other items related to children's motivation to read, use of metacognitive strategies while reading, homework habits, and leisure reading habits. Finally, items relating to satisfaction with school and hoped for, and expected, level of educational attainment were asked.

ImpaCT2 Questionnaire

The ImpaCT2 student questionnaire (Harrison et al., 2002) was designed to evaluate the impact of ICT in schools and homes and illustrate the influence of ICT on the activities of pupils and teachers. The survey was conducted in 60 schools, 30 of which were at primary level. Schools were selected according to a number of criteria including the availability of monitoring data from the Centres for Evaluation

and Monitoring (CEM), such as Key Stage 2 assessments; school attainment and IT provision ratings obtained from the Office for Standards in Education (OFSTED); and geographic and demographic spread. The questionnaire was piloted in four schools where the participants were interviewed and the research team checked for readability, layout appeal and reliability and validity issues related to the questionnaire.

The pupil questionnaire consisted of three sections. The first section related to the availability of computer hardware outside of school, specifically in the home. The second section explored the pupils' use of computers outside of lesson time, including home usage; and the final sections is concerned with the use of computers in specific subject areas.

Both the Pupil Attitude Questionnaire (Eivers et al., 2004) and the ImpaCT2 (Harrison et al., 2002) questionnaires were coded and entered into an SPSS statistical for analysis.

Research Design

The present longitudinal study, using predominantly qualitative methods, was conducted over an eighteen month period in three phases. The three phases as they *evolved* were (1) the Baseline phase; (2) Reading Development and Critical Web Literacy (RDCWL) phases and (3) the Main Study phase. In line with the formative and experimental design framework utilised for the study, modifications were made to the design on an iterative basis drawing on evidence and analysis from the range of collected data sources. Adjustments and modifications were made on a weekly basis (micro-cycle) and at the end of each phase (macro-cycle) (Gravemeijer &

Cobb, 2006). Factors that enhanced or inhibited achieving the pedagogical goal of the intervention, including unanticipated effects and barriers in the learning environment, were considered. Analysis of each phase informed the design of the next phase. The integrated nature of the curriculum was constructed in a spiral fashion building on lessons learned from and analysis of previous phases. The sections which follow briefly outline the design of these phases as they evolved and the data sources collected in each phase. In turn chapters 5, 6, 7, will return to an analysis of the Baseline, RDCWL and Main Study phases of the study with the 5th into 6th class cohort and chapter 8 will present analysis of the three phases of the study with the 3rd into 4th class cohort.

The Baseline Phase

The baseline phase consisted of gathering a "thick description" of the site and participants. Data collection procedures are detailed in Table 4.6. They included gathering baseline information of the children's offline reading abilities using two standardised reading measurements scores, the Drumcondra Sentence Reading Test (DSRT) (Eivers et al., 2004) and the Micra-T test (Wall & Burke, 2004). The ImpaCT2 (Harrison et al., 2002) questionnaire was employed to determine current Internet and technology usage at home and in school. The Pupil Attitude Questionnaire (Eivers et al., 2004) was utilised to ascertain the children's dispositions towards reading and school. Triad groups were chosen as representatives of each class cohort. Each of these six focal groups was of mixed ability, containing children across the ability range. The questionnaires were followed by a semi-structured interview of each child in the six focal groups to provide more in-depth responses about the children's perceptions of themselves as

readers, writers and users of ICT. The class teachers were interviewed to gather background details of the reading methodologies they employed in the class, student's reading behaviours, and computer usage.

Table 4.6 *Baseline Phase: Data Collection Instruments*

Baseline Phase	Data Sources	Purpose
Quantitative measures	Pupil Attitude Questionnaire (Eivers et al., 2004)	To ascertain the children's attitude towards school and offline print reading
	Internet and computer usage questionnaire (ImpaCT2, Harrison et al., 2002)	To ascertain the children's current computer and Internet usage
	Standardised Reading Achievement scores • Micra-T • Drumcondra Sentence Reading Test (DSRT)	To ascertain the children's standardised reading achievement scores
Qualitative measures	Individual pupil semi-structured interviews	To ascertain the children's dispositions/engagement/motivation towards reading and ICT
	Individual teacher semi-structured interviews	To ascertain current reading methodologies and computer usage in the class /dispositions of the children towards reading.
	Internet inquiry Sick Rabbit Task (SRT) Digital recording of think aloud data as children conducted SRT Online Internet activity captured with Camtasia software	To ascertain the baseline online reading skills and strategies of the pupils (cognitive and affective)

A baseline Internet task was given to the focal groups to assess their online skills and strategies. The Sick Rabbit Task given to the children was to go onto the Internet and find information to help a friend with a sick rabbit. The children were asked to

think aloud (Pressley& Afflerbach, 1995) and tell what they were thinking and what they were doing as they tried to complete this task. The children's online activity was captured using Camtasia software which is essentially a video recording of the screen. Data from the baseline phase was analysed to identify both barriers to implementation and factors likely to enhance implementation of the pedagogical goal of the study. The information gathered from the baseline phase was used to inform the second stage of the study.

The Reading Development and Critical Web Literacy (RDCWL) Phase 1a, 1b.

The RDCWL phase 1a and 1b consisted of two inter-related phases conducted in a series of Internet workshops in the computer room of the school. The Internet inquiry project was integrated within the classroom curriculum and links between literacy, science and the Internet were forged in a series of project based themed units.

RDCWL Phase 1a

A series of eight workshops was designed, by the researcher, in consultation with the class teachers, drawing on an extensive review of the research literature. The workshops in Phase 1(a) were designed drawing on the New Literacies framework (Leu et al., 2004) to develop the children's ability to (a) identify important questions, (b) locate information, (c) critically evaluate information, (d) synthesise information (e) communicate information to others. The workshops are summarised in Table 4.7.

Table 4.7 *Reading Development and Critical Web Literacy Development Phase 1a Internet Workshops*

Reading Development and Critical Web Literacy Phase 1a	Internet Workshop Dates	Data Sources
Hands-on activity 5th class theme: "Life in the Undergrowth"; mini-beast hunt /science experiments. 3rd class theme: "Our Pets" Digital cameras given to children; followed by show and tell.	08/01/06	Field notes Artefacts Photographs
Internet Workshop 1 "Starchild" Questioning and navigational skills	01/03/06	Fieldnotes Teacher informal conversation interviews (debriefing sessions) Work samples Digital recording of focal groups' conversations while they conducted Internet inquiry Camtasia recording of online Internet activity in focal groups Lesson plans Explicit strategy instruction digital recording of lesson
Internet Workshop 2 "Starchild Columbia" Inferential questioning and navigational skills	08/03/06	Same range of sources as listed for 01/03/06
Internet Workshop 3 Web quest class theme	14/03/06	Same range of sources as listed for 01/03/06
Internet Workshop 4 Web quest class theme	21/03/06	Same range of sources as listed for 01/03/06
Internet Workshop 5 Narrowing search terms	28/03/06	Same range of sources as listed for 01/03/06
Internet Workshop 6 Summarisation: 'Shocking Sharks'	04/05/06	Same range of sources as listed for 01/03/06
Internet Workshop 7 Summarisation: Titanic	11/05/06	Same range of sources as listed for 01/03/06
Internet Workshop 8 Critical Evaluation: Dog Island	17/05/06	Same range of sources as listed for 01/03/06

RDCWL Phase 1b

In year 2 of the study the children moved from 5th to 6th class and 3rd to 4th class respectively. Once again links were forged between the science theme (chosen in consultation with the class teachers), literacy and the Internet. This phase of the project was based on an analysis of RDCWL Phase 1a.

Table 4.8 *Reading Development and Critical web Literacy Development Phase 1b Internet Workshops*

6th Class Year 2 Internet Workshops 1-5	**4th Class Year 2 Internet Workshops 1-5**	**Dates**	**Data Sources**
Hands-on activity Class visit to zoo Animal adaptations theme activities with zoo keeper	**Hands-on activity** Visit by birder to class Bird watching in school garden Viewing video cam of nestlings	Various dates/10/06	Fieldnotes photographs
Workshop 1 Year 2 Informational text structures in print versus website informational text structures.	**Workshop 1** Year 2 Informational text structures in print versus website informational text structures.	08/11/06	Fieldnotes Teacher informal conversation interviews Work samples Digital recording of focal groups' conversations while they conducted Internet inquiry. Camtasia recording of online Internet activity of focal groups Lesson plans Digital recording of lesson
Workshop 2 Animal adaptations general	**Workshop 2** All about birds	15/11/06	Same range of data sources as above
Workshop 3 Animal adaptations to habitat	**Workshop 3** What makes a bird a bird?	22/11/06	Same range of data sources as above
Workshop 4 Animal Adaptations camouflage	**Workshop 4** Birds of prey	28/11/06	Same range of data sources as above
Workshop 5 Animal Adaptations hibernation	**Workshop 5** Flightless birds	18/12/06	Same range of data sources as above

The Internet workshops, as described in Table 4.8, were designed to develop the children's navigational skills and end-user application knowledge, their ability to retrieve information on closed questions on Internet inquiry searches on specified websites, and finally, to build prior domain knowledge on the themes of each project.

The Main Study Phase

The Main Study phase consisted of 12 Internet workshops again integrating themes in science, literacy and the Internet. Details of the Internet workshops are contained in Table 4.9.

Table 4.9 *Main Study Internet Workshops*

Generating Search Terms	**Investigating Search Results**	**Independent Work**
Internet Inquiry Progress Task 1 *10/01/07*	**Internet Inquiry Progress Task 2** *14/02/07*	*MS workshop 9 (21/03/07)*
MS workshop 1 (17/01/07)	*MS workshop 5 (28/02/07)*	Reale book
Good and bad search terms	Understanding URLs	*MS workshop 10 (30/03/07)*
MS workshop 2 (24/01/07)	*MS workshop 6 (07/03/07)*	Reale book
Narrowing focus of a search	Understanding URLs	*MS workshop 11 (02/05/07)*
MS workshop 3 (31/01/07)	*MS workshop 7 (14/03/07)*	Reale book
Planning research	Reading URLs with a critical eye	*MS workshop 12 (09/05/07)*
MS workshop 4 (07/02/07)	*MS workshop 8 (21/03/07)*	Reale book
Formulating questions	Choosing search results	**Internet Inquiry Progress Task 3 (a) (b) (c)** *Week of May 21/05/07*

Three Internet Inquiry Progress Tasks were conducted at key points of the Main Study phase. Analysis of these Internet Inquiry Progress Tasks assessed the development of online skills and strategies in each of the focal group. Analysis also

focussed on each focal group's progress across the tasks and permitted cross group analysis both within each class cohort and across both class cohorts. Think aloud protocols were digitally recorded and the focal group's online activity was captured using Camtasia software. Exit interviews were also conducted with the focal groups where they viewed their online activity retrospectively. Finally, analysis of field notes of each Internet workshop and the Internet inquiry tasks informed the focus of and development of subsequent Internet workshops. There were three areas of focus within the Main Study phase workshops: Generating Search Terms; Investigating Search Results and the application of skills in Independent work.

Summary of Chapter

The chapter described issues related to the selection of the study school and participants. It considered ethical issues in conducting the study. Following this, data collection measures and analysis procedures for both qualitative and quantitative data were explained. Finally, the chapter concluded with a brief overview of the design of the study as it evolved through an iterative process across the timeline of the present study.

CHAPTER FIVE

ANALYSIS OF THE BASELINE PHASE

Introduction

Reinking and Bradley (2008) note that typically Formative and Design Experiments (F&DE) include "the systematic collection of data that provide what is often called a *thick description* of the instructional environment before an intervention is introduced" (p. 48, italics in original). This is supplemented by establishing a baseline performance of participants, so that any possible progress made in relation to achieving the pedagogical goal of the intervention may be charted and monitored. In the case of the present study the pedagogical goal was to enable struggling readers from disadvantaged communities to develop effective online reading and informational skills and strategies during Internet inquiry. In providing a thick description of the instructional environment prior to the intervention and establishing baseline performances in reading and in conducting an online reading task, it is also possible to identify factors which may impinge upon, or enhance, successful implementation of the intervention.

Part 1 of the chapter provides an analysis of the ecology of learning within the classroom and the instructional environment prior to the intervention. The baseline reading achievement scores of the children in standardised reading tests are presented. This is followed by a consideration of the expectations, aspirations and attitudes of the children towards school, reading, and ICT. Part 2 of the chapter considers the baseline performance of the children in an online reading task; the Sick Rabbit Task (SRT) and the themes emerging from analysis of the SRT data including

themes relating to Internet end-user application knowledge; the use of new literacies skills and strategies during online information-seeking cycles; and the employment of reading strategies in an online environment. As such, Part 2 of the chapter investigates Research Question 1 (RQ1) of the study at the baseline stage; to explore the strategies struggling readers use as they search for, locate, summarise, communicate, and critically evaluate information gleaned from the Internet.

Data Transcript Source Codes Used in Chapter Five

As described in Chapter 4, codes were assigned to the transcripts of both the digitally recorded interviews conducted with the focal group children and teachers, the Camtasia online activity records and the verbal protocols of the children as they conducted the SRT. These codes provided an audit trail back to the original transcript data. Table 5.1 provides examples and details of the data sources with assigned codes used in this chapter.

Table 5.1 *Codes Assigned to Transcript Data and Camtasia Online Activity Records*

Data Source	**Code Assigned to Data Source Followed by Transcript Page Number (p)**	**Example**
Initial teacher interview, Teacher A, Teacher B	TA; TB,IntI, p	(TA,IntI, p.6) refers to transcript page 6 of the initial interview with Teacher A
Initial individual interview focal group children	Assigned pseudonym for child,IntI, p.	(Katie, IntI, p.6) refers to page 6 of the transcript for Katie in the initial interview
Sick Rabbit Task, verbal protocol data, Focal group number 1-6	SRT,G number, p	(SRT,G5,p.5) refers to transcript page 5 of the verbal protocols of the Sick Rabbit Task for group 5.
Sick Rabbit Task, Camtasia online activity record, focal group number	SRT,C,G number, p	(SRT,C,G6,p3) refers to page 3 of the Camtasia activity record sheet for group 6

Note. Abbreviations in the middle column will be used in the chapter to identify the source of the transcript data.

Part One: The Instructional Environment Prior to the Intervention

This section opens with a consideration of the reading methodologies employed by the classroom teachers at the start of the present study. This data analysis is drawn from analysis of the initial interviews conducted with the classroom teachers and is interwoven where appropriate with observations from the children drawn from the initial interviews conducted with the focal group children. The data is also triangulated with questionnaire data obtained from the Pupil Attitude Questionnaire (Eivers et al., 2004).

A Balanced Literacy Framework: Reading and Writing Methodologies at the Baseline Phase

Teacher A, the 5th class teacher, had twenty eight years teaching experience including ten years as a special class teacher for Traveller children. Teacher B, the 3rdclass teacher, had been teaching in the school for the three years since graduating from teacher training college. The section which follows describes the reading and writing methodologies employed by the class teachers at the Baseline phase.

Teacher A typically spent forty minutes on a reading lesson for four days a week. Teacher B spent twenty to thirty minutes every day. The format of a typical reading lesson in both classes could be summarised in the comments of Teacher A as, "explanation of the written work, written work, reading out loud, questions during it and then I correct the written work" (TA,IntI,p.17). The reading lesson in both classes consisted of 'round robin reading' followed by questions. Oral reading was conducted because as Teacher A stated:

> Teacher A: I know according to the reading and everything that people read quicker when they read silently but I find some of the children, especially the

Travellers, because the sentence structure is different they have to read aloud to understand what they are saying.

Researcher: Ok, to actually hear it maybe?

Teacher A: Yaeh, you know the way when you read something technical you might mutter it to yourself' (TA,IntI,p.6).

In the before reading stage the children were sometimes asked to make predictions as Teacher B explained:

Well, saying that now, I wouldn't be brilliant for every single day doing this d'ya know. Some days I feel I just have to get the reading done, but on the ideal days I would literally start with the like the title and right what do we think the story is going to be about maybe look at the pictures, that kind of thing, and then go into from there (TB,IntI,p.2).

The questions formulated by the class teachers during a reading lesson were mostly of a literal nature with some higher order questions included. The questions were used to assess if the children "understood what they read" (TA,IntI,p.5).

Teacher A observed:

They're quite good at the higher order, what will happen next or why do you think, they love them, why do you think they did that, and you know what should he have done. They're very enjoyable for them but the literal ones are how I find out if they understood what they read (TA,IntI,p.5).

Summarisation of text was challenging for the children as Teacher B commented:

Teacher B: They don't know what information to be taking out of texts... or the words they write down, stuff that they just don't understand, so you're going to get all sort of stuff.

Researcher: So they're just copying?

Teacher B: Yeah, all the time yeah (TB,IntI,p.7).

The children did not engage well with independent reading. Teacher A observed, "When we do independent reading a lot of the time all they want to do is chat and

I'm standing over them saying I want to see you reading, get a book" (TA,IntI, p.5). The children chose fiction texts for independent reading. Diana explained "I don't really read books like that [informational texts] I normally read books like them story books" (Diana,IntI,p.2). Informational texts were challenging for the children because as Teacher B remarked "they just they don't have the language, they just don't know what the words are, they can't even say half the words, the lot of them, so definitely they are challenged by it" (TB,IntI,p.7).

"Creative writing" was conducted by Teacher A on Friday and a typical writing lesson consisted of, "I name the topic and give children the choice of three topics. Remind them of beginning, middle and end. Write out roughly and then copy onto the computer" (TA,IntI,p.12). Teacher B had started to use the Writing Workshop and the children she noted:

> ....absolutely love it. Some of them struggle with coming up with their own ideas so it's like having to be giving them topics and stuff like that for it. In the beginning, with spellings, they wanted you to correct everything for them, but they're slowly beginning to do that for themselves (TB,IntI,p.12).

Project work undertaken towards the end of the school year and was challenging because as Teacher A observed:

> Because they do it in school, you know yourself in a middle class area you could just give out a project and it would be done with the parents and the computer at home and it would be wonderful. A good half the class don't have computers and wouldn't really do much at home and the challenges are that there are probably girls who would benefit hugely from projects but you're not as inclined to do them (TA,IntI,p.9).

The use of ICT Within the Instructional Environment at the Baseline Phase

The teachers' personal use of ICT within the instructional environment included the use of a Word processor to communicate with parents and to develop worksheets

for the class. In addition, the Internet was used to plan for projects and download lesson plans.

Each class teacher in the school had access to the computer room, for one hour per week, to work there with their class group. The Internet connection had recently been upgraded to a Broadband connection in the school but neither class teacher was using the Internet extensively as Teacher A explained, "I just find it very hard with 25 of them to try to explain how it actually works and stuff, do you know, so I haven't done a lot with that" (TA,IntI,p.8). Both teachers used educational software with the pupils, such as Encarta kids (www.microsoft.com), Wordshark (www.numbershark.co.uk), 'Phonic spelling', and 'English skills' software.

Availability and Usage of ICT by the Pupils in the Home Environment

The results from the ImpaCT2 (Harrison et al., 2002) questionnaire, analysed in the SPSS statistical analytical programme, of the availability of ICT in the home environment are reported in Table 5.2. These results showed a high level of games console ownership at 86.4% at 3rd class level and 81.3% at 5th class level. Computer and Internet access at home was less prevalent. Computers were more available outside the home or in school although again Internet access was limited. Less than a third of children had access to email. 63.6% of children at 3rd class and 50% of children at 5th had mobile phones. Very few children had created their own websites.

Each focal triad group, within the present study, had at least one child with self-reported computer or Internet access at home. The initial interview data with the individual children in the focal groups revealed that the Internet was used to access popular sites, such as Nickelodeon (www.nick.com), play games, such as 'paper doll heaven' or to send emails to friends or relatives (often with parental help).

Computers were also used to "type stories". Several of the children in 3rd class indicated that they were not allowed to access the Internet by their parents or guardians.

Table 5.2 *Percentages with Access to ICT at Each Class Level (ImpaCT2, Harrison et al., 2002)*

Question	**Percentage at Each Class Level with ICT Availability**	
	3rd Class (*n*= 25) (missing =3) **Valid %**	**5th Class (*n*=16)**
Games console?	86.4%	81.3%
Computer at home?	50%	50%
Internet at home?	36.4%	37.5%
Computers away from home?	77.3%	43.8%
Internet away from home?	40.9%	31.3%
E-mail address?	31.8%	31.3%
Create web page?	13.6%	6.3%
Mobile phone?	63.6%	50%

Standardised Reading Achievement Scores of the Pupils in 3rd and 5th Class

Table 5.3 presents the percentages of children at or below key percentile markers as determined by the Drumcondra Sentence Reading Test (DSRT) standardised reading achievement test. Five key benchmarks are utilised: the 10th, 25th, 50th , 75th, and 90th percentiles. 56% of the children at 3rd class and 50% of the children in 5th class were at or below the 10th percentile in the DSRT indicating serious literacy difficulties. None of the children were above the 75th percentile indicating that none of the children were high achieving readers. The reading achievement scores of the children determined by the Micra-T standardised reading achievement test are

presented in Appendix C. The Reading Literacy in Disadvantaged Primary Schools report (Eivers et al., 2004) found that at 6th and 3rd class levels, 30% and 27% of children, respectively, scored at or below the 10th percentile. In the same report at both class levels, 91% scored below the 75th percentile. In this study 100% of the children at both class levels scored below the 75th percentile. The Eivers et al. (2004) report also noted that children of the Traveller community attained significantly lower mean scores than children from settled communities (almost one full standard deviation).

Table 5.3 *Percentages of Pupils at or Below key Percentile Markers in 3rd and 5th Class as Determined by the DSRT (Eivers et al., 2004)*

Class Level	**Percentile Score from the DSRT**				
	≤ 10th	**≤ 25th**	**≤ 50th**	**≤ 75th**	**≤ 90th**
3rd class	56%	84%	96%	100%	
5th class	50%	64%	93%	100%	

The following sections describe the expectations of the teachers of the educational attainment of the pupils. This is followed by a description of the aspirations, expectations and attitudes of the children towards school attainment, reading and ICT.

Aspirations and Expectations of Educational Achievement: Teachers and Children

Both of the class teachers had positive expectations of the children's ultimate school attainment feeling that the majority of pupils would complete the secondary school system as Teacher A explained, "most of them, three quarters would go past the Junior Cert [Junior Certificate State examination] anyway and I probably say three quarters would do the Leaving [Leaving Certificate State examination] but I

don't know after that. I can't see, well I can see maybe three of them going on to third level" (TA,IntI,p.15).

The children were asked in the Pupil Attitude Questionnaire (Eivers et al., 2004) both how far they would like to go in school (*aspirations*), and how far they thought they would go (*expectations*). The majority at 3rd class (72.7%) indicated that they would like to go to college while 50% of 5th class expressed similar aspirations as shown in Table 5.4.

Table 5.4 *Pupils' Aspirations and Expectations for Educational Attainment From the Pupil Attitude Questionnaire (Eivers et al., 2004)*

	3rd Class *n*=25 (missing =3)	**5th Class *n*=16**		**3rd Class *n*=25 (missing =3)**	**5th Class *n*=16**
"How far would you *like* to go in school?"	Valid %	%	"How far do you *think* you will go in school?"	Valid %	%
Finish primary school	0	0	Finish primary school	0	0
Do the Junior Certificate	0	18.8	Do the Junior Certificate	4.5	6.3
Do the Leaving Certificate	13.6	18.8	Do the Leaving Certificate	0	43.8
College	72.7	50	College	68.2	31.3
Don't know	13.6	12.5	Don't know	27.3	18.8

As indicated in Table 5.4 the *expectations* of the pupils for going to college in 5th class was 31.3% which was lower than their *aspirations* for going to college. In 3rd

class the percentage of 'don't knows' rose to 27.3% and the percentage of expectations of college rose slightly to 68.2%. The ambiguity in the results in 3rd class may be due to the younger age of the children or confusion in their minds over the meaning of the question. The positive aspirations and expectations of the pupils towards educational attainment differ sharply with the reality of Traveller educational attainment in Ireland (DES, 2005b; Nolan & Maitre, 2008. The highest level of educational attainment for over two-thirds of Travellers aged 15 or over in the 2006 census of population report (Central Statistics Office (CS0), 2006, 2007) was the completion of the primary school system. 3.7 % completed the secondary school system and 0.3% attained a third level qualification. This contrasts sharply with statistics from the general population where 28% and 19% completed secondary school and attained a third level qualification respectively.

Pupils' Attitudes Towards School

Table 5.5 indicates that 54.5% of pupils at 3rd class level but only 6.3% of pupils in 5th class agreed a lot with the statement that they liked school. When the percentages in 5th class of those agreeing a lot and agreeing with the statement (50.1%) are compared to those who disagreed a lot, disagreed or were not sure (50.1%) it becomes evident that the 5th class group are evenly divided in whether they like school or not.

Table 5.5 *Percentage of Pupils Agreeing with the Statement "I like school" From the Pupil Attitude Questionnaire*

"I Like School"	**3rd Class (*n*=25) (missing =3) Valid %**	**5th Class (*n*=16) %**
Agree a lot	54.5	6.3
Agree	18.2	43.8
Not sure	18.2	6.3
Disagree	0	6.3
Disagree a lot	9.1	37.5

Attitudes of the Children Towards Reading

Responses to the question 'I like reading' in the Pupil Attitude Questionnaire (Eivers et al., 2004) elicited a strong positive response in both 3rd and 5th class. 81.8% in 3rd class and 75% of 5th class respondents agreeing or agreeing a lot that they liked to read as shown in Table 5.6.

Table 5.6 *Attitude to Reading: Percentages in Agreement with the Statement 'I like reading' from the Pupil Attitude Questionnaire*

'I Like Reading'	**3rd Class (*n*=25) (missing =3) Valid %**	**5th Class (*n*=16) %**
Agree a lot	68.2	50
Agree	13.6	25
Not sure	9.1	12.5
Disagree	0	0
Disagree a lot	9.1	12.5

In the initial interviews conducted with the focal group children they were asked how they would feel if they got a book as a Christmas present. The responses

were very positive. For example, Diana said, "I'd love it" (Diana IntI, p.1). Leona would, "actually enjoy it" (Leona, IntI, p.1). Chrissie would like it as long as it was a "mystery book you have to figure out" (Chrissie, IntI, p1). Nicky expressed the view that she would be "very gracious.[It would be] about me [my] second favourite present me favourite one is a phone (Nicky, IntI, p.1) and finally Bridie, "it helps you to learn so actually I'd like a book"(Bridie,IntI,p.1).

While some of the children's parents read magazines or the daily newspaper it was clear from the children's responses in the initial interviews that there was a paucity of books in their homes. Diana's response was typical "I wouldn't really have any 'cause like if I had got any they'd be old from when me ma and da [my mother and father] used to read them. I've only the three that me ma got me 'cause I only started reading a while now" (Diana, IntI, p. 3). Only one of the focal group children had a library card for the public library and so access to books was limited to the books they borrowed from the school library. Several expressed the opinion that they would like to visit the public library as Bridie explained, "I'd stroll and look around, take me time and see if there's any good books instead of the Jacqueline Wilson. I have to get to know new books. (Bridie, IntI, p3)

Perceptions of the Children of Themselves as Readers

The individual interviews with the focal group children and responses from the Pupil Attitude Questionnaire (as shown in Table 5.7) indicated that overall they had a positive perception of themselves as readers. In the interviews the children saw themselves as "very good" "good" or "alright" at reading.

Table 5.7 *Pupils' Self-Ratings of Their Achievement in Reading when Compared to their Classmates, Correlated with Pupils' Mean Achievement Standardised Scores From DSRT (Eivers et al., 2004)*

	3rd Class (*n*=25) (missing =3)			**5th Class (*n*=16)**		
	Valid %	Mean	SE	%	Mean	SE
Better than most (high)	40.9	83.00	3.62	18.8	81.33	8.96
About the middle of the class (mid)	36.4	85.13	3.15	68.8	86.33	3.32
Not as good as most (low)	22.7	69.00	2.47	12.5	75.00	1.00

Teacher A expressed surprise and pleasure that the children had such positive perceptions of themselves as readers. She felt that it was:

> great to see because I would have thought they would have seen themselves as lower. But no, a lot of them would be quite confident in their ability, it's great because at least if they have that it's something to work on isn't it? (TA,IntI,p.12).

A small minority of children felt their class mates would express negative comments about their reading ability. This is typified in the following comment from Leona, "They'd say actually bad. Like sometimes I get nervous when I'm reading out loud, and then and I don't really, I get nervous, and then I keep stopping through the sentence" (Leona,IntI,p.1).

In sum, both class teachers had positive expectations of the ultimate level of educational attainment achievable by the children. It was clear that the current use of ICT within the instructional environment was limited. The children also had limited

access to ICT in the home environment. Those children with computer or Internet access mainly used the technology for word processing, playing games or accessing popular websites. In terms of the range of reading methodologies employed by the teachers it was apparent that both teachers were largely hearing reading rather than teaching reading. The results of the DSRT indicated very low levels of reading achievement in both classes. The children had good expectations of and aspirations towards school attainment. They had an overall positive attitude towards school, although 5th class were a little more ambivalent in their attitude. Although they conveyed a very positive attitude towards reading narrative texts they had very limited access to books in the home. Finally, the children had positive perceptions of themselves as readers. Part 2 of the chapter charts the progress of the focal groups as they conduct an online Internet inquiry task.

Part Two: Analysis of the Sick Rabbit Task (SRT)

The triad focal groups in both 3rd and 5th class were asked to conduct an untimed, Internet inquiry task. They were asked to imagine that their friend had a sick rabbit. Their task was to find information on the Internet to help this friend with the sick rabbit. Data sources for this online inquiry task as previously described in chapter 4 included verbal protocols (Pressley & Afflerbach, 1995) captured on a digital recorder as the children conducted the task. These were subsequently transcribed by the researcher. Online activity was captured using Camtasia software and subsequently transcribed by the researcher on a Camtasia activity record sheet to reconstruct the online activity of each group. The Camtasia activity record sheets were then combined with the transcripts of the think aloud data to contextualise the focal group's online activities (as described previously in Chapter 4).

The transcripts of the verbal protocols and Camtasia online activity records from each focal group were coded, using the constant comparative methodology (Glaser & Strauss, 1967), drawing on both inductive and deductive analysis techniques, through a reductive process, using open coding and patterns coding until categories emerged, and category saturation occurred (Miles & Huberman, 1994). The emerging themes from this data analysis are developed in the following sections.

The themes which emerged from analysis of the SRT included (i) comfort levels with Internet usage associated with the level of end-user application knowledge; (ii) the ability of the groups to engage in an information-seeking cycle during online inquiry; and (iii) the use of reading strategies in an online environment. Aspects of each of these themes are considered in turn in the sections which follow.

Comfort Levels with Internet Usage Associated with the Level of End-User Application Knowledge

Analysis of data sources related to aspects of this theme included frustration with and fear of technology associated with low levels of application knowledge; disorientation on the Internet; and the ability of the children to communicate with each other using an Internet vocabulary during the task.

Low Levels of Application Knowledge Resulted in Frustration with Technology

The limited experience the children had of using the Internet had been gained in the home rather than school environment. Chrissie, in group 1 explained, "I didn't really learn this in school. I learned it at home off me da [my father] 'cause he goes to college and learns about computers" (SRT,G1,p.3). Although the children engaged with the Internet task and seemed to enjoy the novelty of online searching ("that's a deadly yoke", SRT,G4,p.6) there were instances of frustration both with the time

taken to find any relevant information, "that's weird it takes you ages to get any [information]" (SRT,G5, p.5) and with the technology. The groups had novice levels of application knowledge, both in relation to launching Internet Explorer, and in navigating within and between websites. This resulted in instances of frustration with the technology. In third class the focal group children had minimal experience of using the Internet. Miriam explained her frustration to Katie, " I don't know how to get on it. All I know how to do is click it". (SRT,G4,p.1). The focal groups engaged in minimal scrolling on web page search results and were impulsive in activating these results. They also approached the task of reading online information in a linear fashion and did not appear to have any knowledge of the architecture of online informational text features, such as the menu, glossary or hyperlinks on websites.

The 3rd class focal groups showed a reticence in using computers which was absent from the 5th class cohort. This is typified in Katie's comment, "I'm not clicking on the www. I don't want to break this computer" (SRT,G4, p.2). The third class group were also distracted from the task by colourful images, such as a Bambi image and advertisements on the Yahooligans website for popular musicians.

Disorientation on the Internet

All of the focal groups showed a novice awareness of how they had navigated to a website or how to navigate their way back to a previously visited website. They traversed the web by repeatedly activating the back button. The expenditure of cognitive energy on orienting themselves online may have reduced the availability of cognitive energy for accessing and connecting with prior knowledge or locating online information in relation to the task focus. Group 4, for example, displayed high

levels of disorientation during the task, and if considered in tandem with their novice use of searching strategies, may explain why they were hampered in finding relevant information for the SRT. The type of disorientation experienced across the focal groups is exemplified in the following exchange between the children in group 4:

> Miriam: Katie, where are you after going?
>
> Nelly: Where are you after going?
>
> Katie: I haven't a clue.
>
> Nelly: Ah, my god Katie.
>
> Katie: Now, rabbits (pause) now.
>
> Miriam: Will you wait a minute, while I think. (SRT,G4,p.7)

Knowledge of Internet Language and Vocabulary

In order to communicate with one another during the process of Internet searching the children needed a common "common searching metalanguage" (Henry, 2006, p. 616) and knowledge of an Internet vocabulary. There were some instances in the SRT task of the children using an Internet vocabulary. For example, Eileen noted that she was "going to click on the Internet Explorer (SRT,G3,p.1) and again asked "will we go into the rabbit care main page"? (SRT,G3,p.4). In general, however, the children had a limited command of Internet language. Mary Margaret, for example, in group 6, when asked to describe what was happening on screen, as Sally was entering a search string observed, "she went *up* and she clicked on the *thing* and then she came to this big white *yoke* and she went to that"(SRT,G6,p.1).

In sum, the focal groups, in both 3rd and 5th class, had a novice level of Internet end-user application knowledge and weak navigational skills. This resulted in the

groups becoming disoriented during the online task. It was clear from the SRT transcripts that the children needed to develop their knowledge of both the architecture of online informational text structures, and their knowledge of Internet browser tools and navigational skills. They also needed to develop an Internet language vocabulary to enable them to plan together and to communicate about online activities.

The Capacity of the Children to Conduct Internet Inquiry During the Information-Seeking Cycle

In the review of the Literature, presented in chapter 2, the information-seeking cycle process was discussed from both a *user* (Bates, 1989; Kuhlthau, 1991; Marchionini, 1992; Yang, 1997) and *reader* (Eagleton & Dobler, 2007; Harrison, 2006; Harrison at al., 2006, Leu et al., 2004) perspective. The information-seeking model used in the present study, draws on both on these perspectives to describe the online information-seeking cycle as (a) goal formation, understanding the task; (b) generating and revising search terms; (c) investigating search results; (d) locating and critically evaluating the relevancy of the information retrieved to the task focus and (e) transforming, synthesising and communication of information. The sections which follow draw on this information-seeking model to present analysis of aspects of the theme relating to the capacity of the children to conduct Internet inquiry under stages of the online information-seeking cycle. The aspects of the themes that emerged from analysis included (i) the ability of the focal groups to articulate the task goal and understand the task; (ii) the capacity of the groups to generate and revise search terms; (iii) their skill in investigating the relevancy of search results; (iv) their ability to locate and evaluate information retrieved for the task, and finally,

(v) their expertise in transforming, synthesising and communicating information related to the task question.

Goal Formation and Understanding of Task

The focal groups neither articulated the goal of the task, nor did they engage in any level of planning in how they would proceed in conducting the SRT before they launched into conducting the online inquiry search. There was no discussion of how they should approach the task, why they would use the chosen search strings or indeed how they would evaluate success or recover from an unsuccessful search based on the SRT. Locating information involves an orchestration of the "gatekeeper" skills (Henry, 2006, p. 616) of generating and revising search terms and assessing the relevancy of the returned search results to the task focus. The next section considers the capacity of the focal groups' skills in both of these areas.

The Capacity of the Groups to Generate and Revise Search Terms

Analysis of the data from the SRT suggested that the children drew on a limited repertoire of strategies to create key terms for generating and revising search strings. As shown in Table 5.8 the children engaged in minimal revision of search terms within the task.

Table 5.8 *The Search Terms Generated by the Focal Groups for the SRT*

Group Number	Search String	Search String	Search String
Group 1	<www.rabbits.co.uk> (discussed not entered) (1:16)	<sick rabbits> (2:21)	
Group 2	<www.animals.com> (discussed not entered) (1:42)	<rabits> (2:34)	
Group 3	<Rabbits> (0:45)		
Group 4	<Rabbits> (2:24)	<rabbits> (6:32)	<rabbits> (7:12)
Group 5	<Rabbit> (1:55)	<rabbits> (2:50)	
Group 6	<Rabbits>(4:43)		

Note. Time stamp from Camtasia online activity record sheets indicated in brackets.

The keywords generated by the focal groups as search terms included single concepts <rabbits>, multiple terms <sick rabbits> and the use of a dotcom formula <www.animals.com> where they substituted the research focus into the search string. There was little evidence of the revision of search strings or the generation of additional search terms in terms of broadening or narrowing the search focus. Indeed group 4 persisted with the re-use of the same search string <rabbits> throughout (minus the capitalisation) even when this did not prove effective. The group adopted this strategy due to the unhelpful nature of the error message generated by the Yahooligans search engine, <no matches found. Try again> which the group interpreted at a literal level.

Although Fidel et al. (1999) found that high school students had problems with spelling of key words there was only one incident of misspelling during the SRT, 'rabits' in group 2. However, the group initially missed the error message from Google <did you mean> thereby ignoring a valuable online help feature.

Investigating the Relevancy of Search Results

The investigation of the relevancy of search results returned by a search engine or by browsing categories of information on Yahooligans depends on one's ability to analyse the search results. There was limited evidence from analysis of either the Camtasia activity record sheets, or the transcripts of the verbal protocols of the children, that they were reading the description of the abstract blurb and assessing or inferring the relevance of the description to the task focus. There was no evidence that the children were reading the URL for clues based on the domain name prefix and suffix.

Analysis of the data indicated that the focal group children used a random strategy (Eagleton & Dobler, 2007, p. 165) *snatch and grab* approach to investigating search results. Table 5.9 provides an extract from a Camtasia activity record sheet showing the activity of group 2 in investigating search results.

Table 5.9 *Extract from an SRT Camtasia Activity Record Sheet*

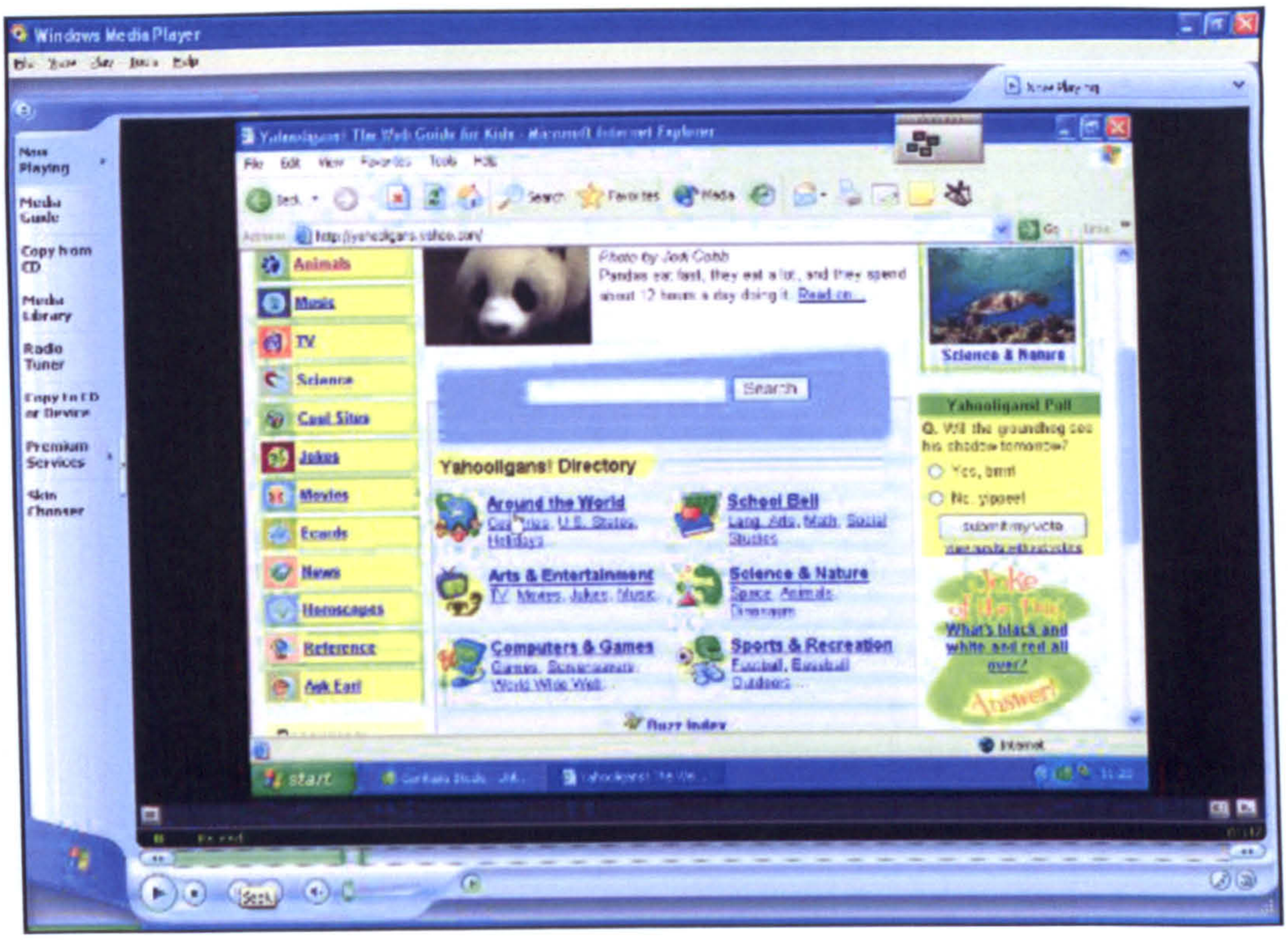
Time Stamp	E-Learning Incident	Cursor Movement	Search String Entered	Investigating Search Results	Reading Strategy	Code
2:47	Search results page loads	ULRDL	<rabits>	Cursor movement on search result	Ignore spelling error message <did you mean>	Spelling: error
2:59	Click on <did you mean rabbits> prompt					Spelling: monitoring
3:07	Result page loads					
3:13	Click on 2nd result	N		No scrolling FAQ about rabbit care		ISR: Relevant result

Note. Up (U) down (D) left (L) right (R) none (N). Extract from Camtasia activity record group 2 (SRT,C,G2,p.1)

Focal groups 1-3 in 5th class and focal groups 5 and 6 in 3rd class engaged in minimal scrolling of the returned search results and activated, either the first or second, results with a limited amount of discussion. Group 4 in 3rd class never activated any search results. This suggested that the children had little prior knowledge of how to evaluate the relevance of search results returned to the task focus and this may have added to the frustration of the children in conducting this task. The 5th class focal groups used the Google search engine (www.google.ie) to conduct the SRT. The Google search engine utilises a complex page rank algorithm technology coupled with hypertext matching analysis to rapidly parallel process and retrieve ranked search results from a vast database. The displayed search results contain a hyperlink with a short description of the information contained on the website. It also incorporates a spell-correcting system.

The 3rd class focal group utilised the Yahooligans search engine for the SRT. Yahooligans! web guide search engine (www.yahooligans.com) is a browsable (by subject categories) and searchable (by keyword) directory of Internet sites which is designed for children aged 7 to 12 years of age. On the day the SRT was conducted the Yahooligans site (displayed as a screen saver in Figure 5.1) contained other features, such as a joke of the day.

Figure 5.1. Screen shot of Yahooligans! Directory and side bar categories menu.



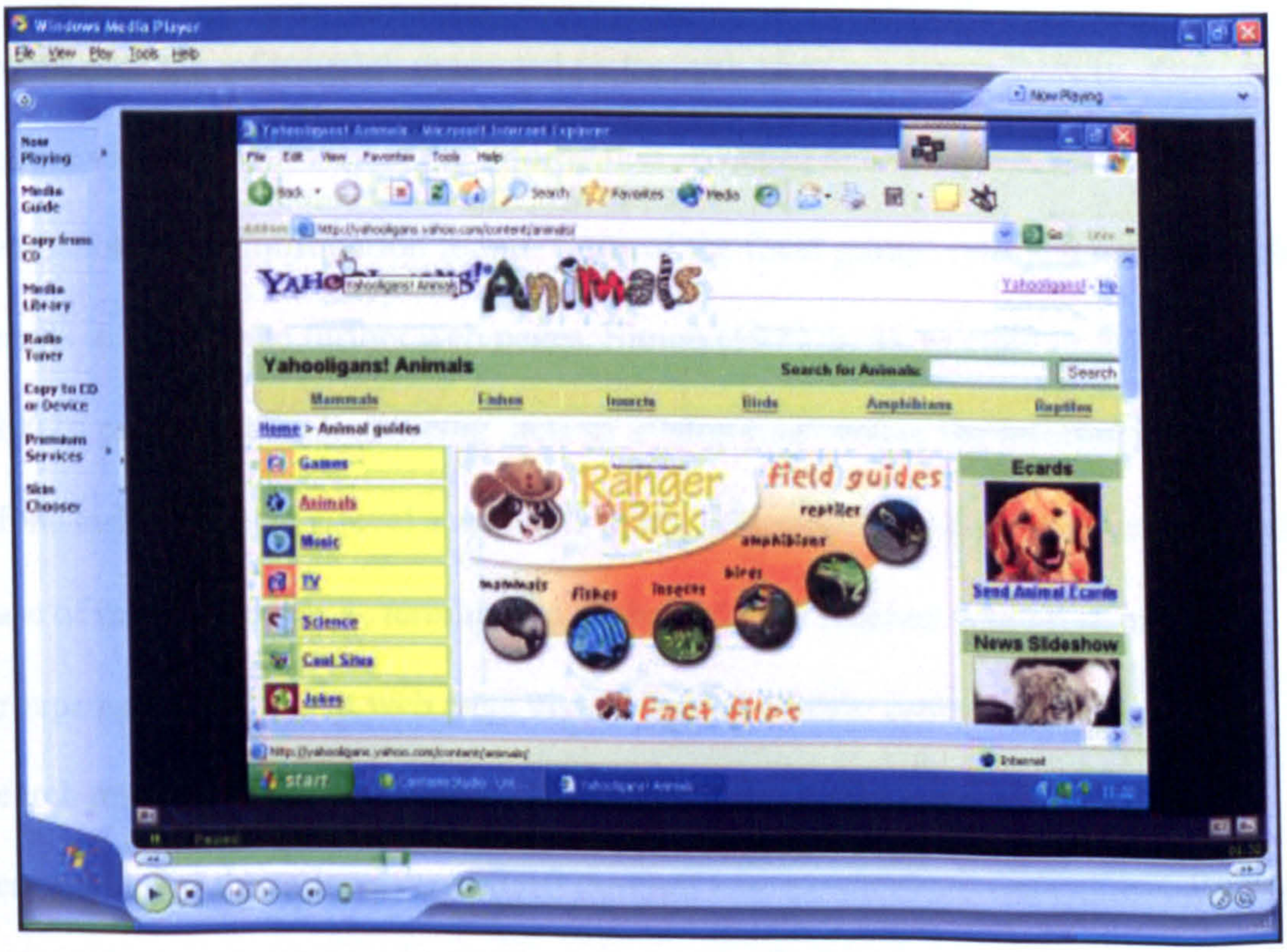
The 3rd class focal groups (groups 4 to 6) used a variety of searching strategies on the Yahooligans website. Analysis of the online activity captured by Camtasia suggested that group 6 browsed (64%) and searched by keyword (36%) of the time respectively. Group 5 browsed briefly (5%) under the animals subcategory and changed to searching by keywords (95%) for the rest of the time spent. Group 4 used a combination of searching (56%) and browsing (44%) by undertaking each approach in turn.

As discussed previously in the review of the literature searching by keyword depends on *recall* of vocabulary from prior topic or domain knowledge. Browsing on the other hand can proceed with less well defined search objectives and requires recognition of the relevance of categories to the search task. Browsing also relies less on typing skills and spelling (Borgman et al., 1995). Both recognition of browsing

categories and recall of key words for searching were hampered by the limited level of vocabulary of the children. For example, in the extract which follows, group 4 were unaware that the sub category 'mammals'(which they referred to as 'mangeals') was the appropriate category to explore for information on rabbits from a choice of mammals, fishes, insects, birds, amphibians and reptiles (see Figure 5.2 for Yahooligans interface).

> Nelly: Would they be in?
>
> Katie: Oh look, that's so cute ok. (Referring to the image of a panda) Go down (giggles)
>
> Nelly: What would rabbits be on?
>
> Katie: Dogs (extends word) penguins (says slowly) we're not looking for penguins keep on going down
>
> All speaking together: eh….dinosaurs?
>
> Miriam: Will it be in insects? (SRT,G4,p.5).

Figure 5.2. Yahooligans interface screen shot showing side bar menu and categories during SRT.



Locating and Critically Evaluating the Relevancy of the Information Retrieved to the Task

The groups (disregarding group 4 who did not find any information related to the task) spent on average 27 % of the task time reading on websites (see Table 5.10).

Table 5.10 *Time Spent on Reading Information on Websites as a Percentage of the Total Time Spent on the Task*

Time in minutes	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
SRT task length	7:29	7:01	6:24	8:46	7:30	7:30
Time spent reading information content on web page	2:01	2:45	1:42	0:00	1:08	2:08
Time spent reading web page content as a percentage of total time spent on task.	27%	39%	27%	0	15%	28%

Note. Time stamps from Camtasia activity record sheets of the SRT.

This indicates that the majority of time was spent on the process of Internet searching rather than the product of such a search i.e. the information found. The groups read the information presented on the web page in a linear fashion. They did not question the authority of the information retrieved and there was no critical evaluation of the information found. None of the focal groups returned to the search results to investigate further web pages. Simon (1979, p. 4), as cited in Agosto (2002), proposes that *'satisficing'* acts as a "stop rule" where the information needs of the task are met at a level acceptable to the information seekers' aspirations. In the case of the untimed SRT, termination of the task was reached when five of the six groups had read the first web page visited (group 4 never proceeded beyond the search results) and conveyed the information found orally to the researcher. The termination of the task was conveyed through non-verbal signs, such as stopping and

looking at the researcher, or through long pauses which indicated that the focal groups were finished the task.

Transforming, Synthesising and Communication of Information

The groups had limited success in generating information to help a friend with a sick rabbit. Their limited advice ranged from watching for symptoms of illness, such as infections "in its nose or its eyes or nails" (group 2), or a "rattling sound in its lungs" (group 5). Environmental factors mentioned included having "food or water nearby" (group 1) or keeping the rabbit outdoors "if its fur gets warm.... he needs enough shade" (group 6). Group 3 recommended that if the rabbit was sick "it has to go to the vet" drawing on general 'common sense' world knowledge.

Finally, group 4 was unable to find information to help the friend with the sick rabbit because as Katie explained in the following illustrative vignette from group 4:

Katie: There's no rabbits on the Internet.

Researcher: No rabbits?

Miriam: No.

Katie: That's gas, we'll try and look for rabbit and they better get a rabbit.

Nelly: They don't have any rabbits...

Katie: Look they're only, what they have, all [they] have [is]a mangeals [mammals]

Nelly: (Interrupts) Mammals, fishes, insects, birds, I don't know what that says, and reptiles.

Miriam: Amhibions [amphibians] or something? So go down, no, it isn't on that...

Katie: I haven't got a clue (Long pause 15 seconds).You should have rabbits on the Internet. They do with dogs.

Miriam: Is that the way the Internet works?

Katie: Ah yeah. That's what the Internet is all about (SRT,G4, p7-8).

In sum, the focal groups encountered a number of difficulties in conducting Internet inquiry. They engaged in a minimal level of planning and revision in generating search terms. The focal groups used single, multiple or a dot-com formula for generating broad search terms. Overall, the groups were impulsive in their decisions of which search result to investigate adopting a *snatch and grab* approach. 3rd class in particular were hampered by a limited vocabulary range and poor indexing and abstraction of hyperlinks on the Yahooligans search engine. The focal groups spent most of the time in the SRT on the process of Internet searching and generated limited information for their friend with the sick rabbit. There was no critical evaluation of the information retrieved in terms of credibility or reliability.

The Use of Reading Strategies During Internet Inquiry

The area related to the range and use of a repertoire of reading strategies is enormously important to consider and was a primary focus of attention in analysing and considering the data sources in the SRT. The researcher remained open to categories and themes that could emerge inductively from the data, but was also cognisant of the literature pertaining to the strategies of good readers previously reviewed in chapter 2. A number of aspects of the theme related to the reading strategies employed by the children in the baseline phase of the study, from careful analysis of the data sources, included (i) their ability to decode, judge readabilty levels, and fluently read the content of web pages retrieved; (ii) their ability to acativate prior knowledge related to the task topic; and finally, (iii) their ability to self-regulate and monitor the relevance of the information retireved to the task purpose. Each of these aspects will now be considered.

Ability of the Children to Decode, Read Fluently, and Judge Readability Levels on Websites

The focal groups encountered a significant number of decoding and vocabulary difficulties which hampered their reading fluency in reading online. For example, they had difficulty decoding the following words (children's pronunciations are in brackets), in group 1, incapacitated (im-plic-lication); group 2, symptoms (sign-toms); group 3, provision (provi); group 4, mammals (mang-eals); group 5, common (coming) and group 6, ventilation (vent.til.iation). In general, the decoding strategies employed by the children were "breaking up the word" or "sounding it out"; or asking an adult, such as a parent, older sibling grandparent or their teacher. Miriam in 3rd class explained her use of decoding strategies as "sometimes I break it up, guess it and then read the rest of the sentence and probably get it" (Miriam,IntI, p.1). The children did not appear to monitor their understanding of what they were reading and did not have a repertoire of strategies available to them when meaning broke down (La Berge & Samuels, 1974). In relation to the strategies used by the 5th class cohort in comprehending text Teacher A commented in the initial teacher interview, "I don't think they have a strategy. I think they're quite used to not understanding what they're reading and they just leave it and go ahead (TA,IntI,p.2).

The websites chosen by the children to locate information related to the task presented readability difficulties for them. Five of the six groups, of their own volition, read the content of the website aloud (group 4 did not find any information to read). It was therefore possible, to conduct a running record based on listening to and transcribing the content read and matching the content to the original information as viewed on the saved Camtasia files. Reading accuracy rates (Shiel & Murphy, 2000; Clay, 2002) were then calculated for each focal group based on the

continuous text read. The criteria used in identifying the reading levels of the pupil in the Shiel and Murphy (2000) framework included a reading accuracy score at the independent level (99-100 %); instructional level (95-99%) and frustrational level (below 90%). Clay (2002) used reading accuracy scores of easy text (95-100 %), instructional text (90-94%) and hard text (below 90%). The reading accuracy score is based on the ratio of error words to running words in the text calculated as a percentage. Error words which are scored include omissions, mispronunciations, substitutions, and non-responses. Non-scorable errors include self corrections, repetitions, hesitations and transpositions. Running records were not conducted for group 4 as they were unsuccessful in finding information related to the task. As shown in Table 5.11 the reading accuracy scores of the focal groups in the passages read aloud indicated that groups 1 and 3 were reading at a frustrational level in both the Shiel and Murphy (2000) scale and the Clay (2002) scale. Groups 2, 5, and 6 were reading at the low end of instructional level scale (Clay, 2002) and bordering on the frustrational level in the Shiel and Murphy scale (2000). None of the groups were operating at the independent level on either of these scales.

Table 5.11 *Reading Accuracy Scores of the Focal Groups in Reading Continuous Online Text*

	Group 1	**Group 2**	**Group 3**	**Group 5**	**Group 6**
Total number of words in passage	107	139	136	51	133
Scorable errors	13	13	17	4	12
Reading accuracy as a percentage	87%	91%	88%	92%	91%

Note. Group 4 omitted as they did not read any online content information.

Activating a Range of Prior Knowledge Sources

There was very little overt reference by the focal groups to either activating or connecting with prior knowledge of the topic in the SRT task. This was surprising given that a number of the children had family pets, including pet rabbits. There was some evidence that the 5th class focal groups activated their knowledge of search engines (for example Chrissie in group 1 looked for the Google search engine from the drop down cache memory in Internet explorer). There was also limited evidence that the groups used prior knowledge of online informational text structures. When group 2 explored the side bar menu looking for categories of information Aileen wondered if, "it'd be health or go to care, go to care and after care click here. Check both of them and see? (SRT,G2,p.3).

The Ability of the Focal Groups to Self-Regulate

Coiro and Dobler's (2007) study of online readers found that good online readers use a range of self-regulated reading processes including planning, prediction, monitoring, and evaluation of information found. There was no evidence of planning a search strategy at the beginning of the SRT task beyond looking for Internet Explorer. There was some limited evidence of planning and discussion of search terms among the groups. Nelly in group 4 urged the group to "go into search and go to rabbits" (SRT,G4,p.3), while Bridie advised Chrissie to enter the search string, "sick rabbits, sick rabbits dot ie" (SRT,G1,p.4). There was little evidence that the groups were monitoring the relevance of returned search results to the task. Monitoring of search results was also restricted to the first five results with most of the groups monitoring the relevance of only the first two results to the task focus.

Finally, the focal group children did not engage in any evaluation of the information found.

In sum, reading fluency was hampered by significant problems with judging readability levels on websites, decoding, and a limited vocabulary range. The focal groups made limited connections to their prior knowledge of the topic, informational text structures, both print and online, web based search engines and general knowledge. Self-regulated reading processes, such as planning, prediction, monitoring and evaluation of information found were largely absent in the focal groups.

Summary of the Chapter

This chapter provided a thick description of the learning ecology in the instructional environment at the baseline phase. Analysis of a range of data sources suggested both factors likely to enhance or inhibit implementation of the pedagogical goal of the study. The pedagogical goal of the study was to scaffold struggling readers to develop effective online reading comprehension and information-seeking skills and strategies during Internet inquiry.

The study was carried out over an eighteen month period. Chapter 6 and chapter 7 concentrate on the 5th class cohort as they progress from 5th class into 6th class. Chapter 6 provides analysis of the Reading Development and Critical Web Literacy (RDCWL) Phase 1a and 1b. Chapter 7 presents analysis of the development of online reading comprehension and information-seeking skills and strategies in the Main Study. There are a number of reasons why these two chapters concentrate on the 5th class cohort. Firstly, the children are older and, as such possess greater prior

knowledge overall and are therefore better able to generate "more spontaneous inferences" (Pearson & Gallagher, 1983, p. 323). Secondly, they are able to draw on a more extensive vocabulary. Thirdly, they have a greater reading ability overall and finally, there is also considerable variation within the group.

However, the 3rd to 4th class study continued in parallel to the 5th to 6th class study. Chapter 8 will provide a constrained account of the 3rd/4th class study but will nevertheless provide some insights into the similarities, differences, and parallels between the two cohorts.

CHAPTER SIX

ANALYSIS OF THE READING DEVELOPMENT AND CRITICAL WEB LITERACY PHASES OF THE STUDY IN THE 5TH/6TH CLASS COHORT

Introduction

This chapter presents analysis from the reading development and critical web literacy (RDCWL) phases of the study with the 5th/6th class cohort. The chapter is divided into two sections. Part One of the chapter describes the RDCWL Phase 1a of the project theme '*Life in the Undergrowth'* conducted in year one of the study when the children were in 5th class. Following this, Part Two of the chapter describes the second phase of RDCWL Phase 1b and the project theme of '*Animals and Adaptations to their Environment'* as the children progressed into 6th class.

The series of Internet workshops, conducted with the class, across the timeline of the study in the RDCWL phases, are presented in chronological order. Analysis of a range of data sources previously described in chapter 4 (see Table 4.7 and Table 4.8 for a summary of data sources) was undertaken drawing on both on synchronic micro-analysis at the end of a particular Internet workshop, or diachronic macro-analysis at the end of each phase (Gravemeijer & Cobb, 2006; Gutiérrez & Stone, 2000). Inductive and deductive coding techniques, as previously described in the Methodology: Research Design in chapter 4, were used to derive codes, categories and themes (Miles & Huberman, 1994; Bogdan & Biklen, 1992).

The RDCWL phases of the study sought to explore, analyse and chart the development of online reading comprehension, information-seeking skills and strategies and end-user application knowledge, including online navigational skills, used by the focal groups across the time line of the study.

Data Transcript Source Codes Used in Chapter Six

In this series of Internet workshops, RDCWL Phase 1a workshops were coded (RDa), and RDCWL Phase 1b workshops were coded (RDb). Fieldnotes (FN) were coded according to the series number of the workshop (W#), the focal group involved (G#), and the page of transcript (p#) to which they referred. For example, (RDa,FN,W6,G3,p14) refers to page 14 of the transcript of the field notes for group 3 in RDCWL Phase1a workshop 6. Such coding provided an immediate audit trail to the original transcribed data.

In all, eight Internet workshops were conducted on a weekly basis in the computer room, with the 5th class cohort, in RDCWL phase 1a, and five workshops were conducted in RDCWL phase 1b, giving an approximate total of 39 hours of digital recordings of the children's conversations, and 26 hours of Camtasia online activity recordings, of the three focal groups as they conducted their Internet inquiry. In addition artefacts of the children's work were also collected.

The next sections describe in turn, each of the eight Internet workshops developed in RDCWL phase 1a. Firstly, a brief description of the RDCWL phase 1a project theme, the hands-on activity related to this theme and the changes made by the class teacher to the teaching of reading and writing in the classroom are presented. This is followed by a short account of the instructional content of each

Internet workshop. Then, aspects of the themes which emerged from careful analysis of the data from each workshop are described.

Part 1: Reading Development and Critical Web Literacy Phase 1a

Phase 1a Project Theme: Life in the Undergrowth

In consultation with the class teacher, a thematic unit of study, for this phase of the project, was developed which integrated science, literacy and the Internet. The chosen theme was *'Life in the Undergrowth'* and involved a study of minibeasts in the environment drawing on the strand 'Living Things' and the strand unit 'Plants and Animal Life' from the 5th class Science curriculum (DES/NCCA, 1999b). A series of hands-on activities, such as minibeast hunts and science experiments, were used to develop situational interest in the theme. The class teacher undertook a number of professional readings in the area of reading development, focussing primarily on the development of reading comprehension strategies, and following discussions with the researcher, a number of changes were made to the teaching of reading in the classroom. These included the explicit instruction of strategies using the gradual release of responsibility model (Pearson & Gallagher, 1983). Reading strategies taught included activating prior knowledge, making connections, asking questions, determining importance, and summarisation in both narrative and informational text. A class novel, Charlotte's Web (White, 1952) was introduced which linked with the project theme (Guthrie, 2004). (See Appendix H for a reference list of children's novels utilised in the study). Finally, approximately 30 books relating to minibeasts were borrowed from the local public library and added to the class library for the duration of the thematic unit of study.

Format of the Internet Workshops

Eight Internet workshops were conducted with the 5th class group based around the theme of '*Life in the Undergrowth*'. The instructional activities developed by the researcher for the eight Internet workshops drew on the researcher's own teaching experiences and literature and research in the field (for example, Armstrong, 2000; Eagleton et al., 2003; Leu, Leu & Coiro, 2004). The focus in the Internet workshops, following careful examination of field notes, moved progressively through examining online informational text structures; asking and answering both researcher- and self-generated questions or problem-solving activities; locating information; summarisation; critical evaluation of information; and finally, communication of information to others. The Internet workshops progressed gradually into more complicated tasks as the children became more proficient with navigational skills, website structures and seeking online information.

Each Internet workshop, throughout the series of workshops, was similar in format and followed the gradual release of responsibility model (Fielding & Pearson, 1994; Pearson & Gallagher, 1983). The researcher explicitly modelled skills and strategies for the whole group in the form of a brief mini-lesson. Each mini-lesson focussed on developing a particular skill or strategy in the areas of online information-seeking, online reading comprehension, end-user application knowledge or peer-to-peer collaboration. For example, a mini-lesson was conducted on narrowing a search focus using the 'theme, topic, focus, question' strategy (adapted from Eagleton et al., 2003). A list of the mini-lessons conducted across the study is available in Appendix F. The mini-lesson was followed by guided practice and independent practice where the class teacher and researcher worked closely with the

children to provide them with extensive practice of the skills and strategies taught. The level of scaffolding provided was adapted to the needs of the individual triad groups (Azevedo et al., 2003). Finally, the whole class group reflected on the process and product of online-inquiry and what they had learned in the Internet workshop on that day.

Table 6.1 presents the framework of this series of Internet workshops in RDCWL Phase 1a, in a condensed format, providing an overview of the instructional content, skills development and aspects of themes and areas of focus emerging from analysis of a range of data sources within the classroom learning ecology. Micro-analysis of these workshops was ongoing throughout the study and the researcher in line with the iterative nature of F&DE analysed areas of focus which were problematic for the children or areas of potential development and tried in subsequent workshops to deal with these issues.

Table 6.1 *RDCWL Phase1a Instructional Content, Skills Development and Aspects of Themes Emerging from the Ecology of Learning in the Classroom*

RDCWL Phase 1a Internet Workshops	Instructional Content	Skills Development	Aspects Emerging from the Ecology of Learning
Workshop 1 and 2 Starchild Internet workshops	Online informational text structures End-user application knowledge Scavenger hunt for researcher-posed questions	Recognising online informational text structures Developing Navigational skills Formulating questions 'right there'; 'think and search' Predictive inferencing	*(i)* Familiarity with the architecture of online informational text structures. *(ii)* Role of prior knowledge in making predictive inferences on the Internet. *(iii)* Peer collaboration supports active construction of meaning.
Workshops 3 and 4	Web quest 'Life in the Undergrowth'	Accessing Prior knowledge Formulating questions to focus online activity Generating information	*(iv)* Ability to formulate questions. *(v)* Importance of prior domain knowledge. *(vi)* Ability to generate and revise search strings.
Workshop 5	Effective search term generation	Activating prior knowledge Summarising: Concept mapping Generating Search terms Evaluating Search terms	*(vii)* Levels of knowledge within the groups in formulating and revising search strings.
Workshops 6 and 7	Summarisation of information for informational and narrative text	Vocabulary development Formulating questions Summarising	*(viii)* Ability to connect with prior knowledge sources. *(ix)* Ability to formulate questions. *(x)* Peer collaboration facilitates a deeper processing of texts. *(xi)* Capacity to summarise information.
Workshop 8	Reliability of information online	Evaluating Analysing Critiquing	*(xii)* Ability of the focal groups to judge the reliability of information on the Dog Island website.

The instructional content of the Internet workshops and skills development is presented first in each of the sections which follow. This is followed by consideration of aspects of the themes emerging from data analysis. The overarching themes, emerging from careful analysis of the data sources, included the development of online reading comprehension; the capacity of the children to conduct the online information-seeking cycle; and the role of peer collaboration in an online environment.

Instructional Content of Workshops 1 and 2: Online Informational Text Structures and Locating Information Online

Workshops 1 and 2 had two main foci: the promotion of the children's skills in navigating through, and recognising online informational text structures; and the development of the children's ability to locate information to answer researcher-generated questions in a scavenger hunt. The children's ability to identify online informational text structures, and contrast the differences in form and function of text structures in informational text, both in print and online, was developed by adapting a lesson from the IRA read write think website (http://www.readwritethink.org/lessons/lesson_view.asp?id=98). Scavenger hunts based on the Starchild NASA website (http://starchild.gsfc.nasa.gov/docs/StarChild/StarChild.html) involved searching for answers to closed questions (drawing on the QARs model (Raphael & Pearson, 1985; Raphael & Wonnacott, 1985; Raphael & Au, 2005) and questions requiring inferential prediction. The questions were graded and necessitated navigating through a multilayered website from the home page to linked pages using hyperlinks to locate specific answers.

Aspects of the Themes Emerging from the Learning Ecology in Internet Workshops 1 and 2

The next sections describes aspects of the themes, that emerged in Internet workshops 1 and 2, related to the capacity of the children to conduct the online information-seeking cycle; the development of online reading comprehension; and the role of peer collaboration in an online environment from careful examination of the data sources. The aspects which emerged from careful analysis of the data sources included the (i) importance of familiarity with the architecture of online informational text structures; (ii) the role of prior knowledge in making predictive inferences on the Internet; and finally (iii) peer collaboration supports active construction of meaning.

Familiarity with the Architecture of Online Informational Text Structures

Analysis suggested that children's knowledge of print informational structures did not transfer automatically to an online environment and required explicit strategy instruction so that the children could access information more easily online. For example, group 1 had difficulty in finding a 'table of contents' in an online 'menu' format. The class teacher provided guided assistance for the children and noted that the 'menu' was "like the beginning of a book where you're looking to see what you have". Kylie then spotted the menu for teachers on the Scoilnet site (www.scoilnet.ie), "so the teacher's [menu] is first level, second level and special needs right?"(RDa,FN,W1,G1,p2). Later in the same workshop, Chrissie accessed her prior knowledge of print based organisational features when she noted that, "a graphic is an illustration like in a book illustration". Similarly Bridie observed, "if you want a page you press the arrow like this" (RDa,FN,W1,G1,p3). Across all three

groups the children independently used the 'Glossary' hyperlink to answer the question 'What is a comet' suggesting a growing level of knowledge of online informational text structures across these Internet workshops. Familiarity with online informational text structures permit the reader to access information more easily (Alexander & Jetton, 2000) and expend less cognitive energy in navigating through hypertext in doing so (Alexander et al., 1994).

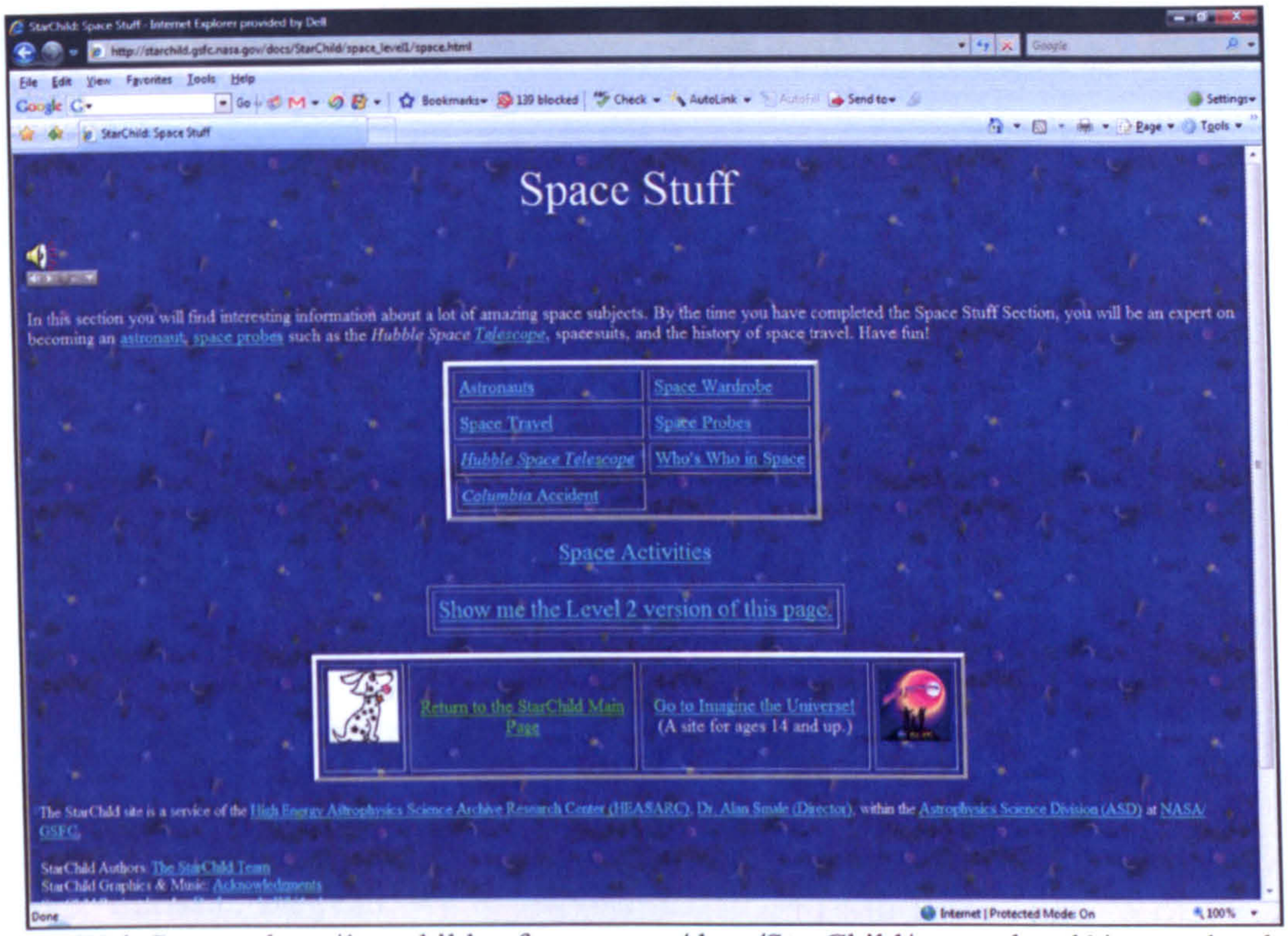
The Role of Prior Knowledge in Making Predictive Inferences on the Internet

Analysis suggested that predictive inferencing of hyperlinks was problematic for these children as they were drawing on a somewhat limited topic, vocabulary and world knowledge. The questions in workshop 2, required more predictive inferencing around hyperlinks, and encouraged the children to discuss and predict as a group, a possible answer before accessing the information. For example, the question 'what will the hyperlink: Columbia accident be about?' required the children to draw both on prior topic knowledge of the Columbia space shuttle accident in 2003, and prior vocabulary knowledge (see Figure 6.1 for a screen shot).

The children predicted that the Columbia accident hyperlink was "all the ships and things crashing" (RDa,FN,W2,G1,p2) and "people from Columbia went into space and crashed" (RDa,FN,W2,G2,p5). In the case of the Columbia accident hyperlink, the content was hidden beneath the hyperlink (which was essentially a label), and there were few context cues for the children to draw on. The children did, however, draw on their vocabulary knowledge of 'accident' but had no prior knowledge of the topic of the Columbia space shuttle disaster to draw on. Hyperlinks may often require more predictive inferencing, based on current vocabulary, topic or world knowledge, as the reader has not only fewer surrounding contextual clues to

draw on, but is often drawing inferences based on partial information presented on a website (Coiro & Dobler, 2007; Foltz, 1996).

Figure 6.1. Screen shot of Starchild Space Stuff website with Columbia Accident hyperlink on submenu.



Note. Web Source: http://starchild.gsfc.nasa.gov/docs/StarChild/space_level1/space. html

Peer Collaboration Supports Active Construction of Meaning

The focal groups remained engaged and motivated throughout the online scavenger hunts and their success in independently generating information developed self-efficacy within the groups. As Internet 'novices' the children were able to converse and argue as equals (Daiute & Dalton, 1993) and peer collaboration appeared to support the children in actively constructing meaning together (Hacker, 1998). The following vignette illustrates the children in group 1 engaged in expanding and co-constructing knowledge, as the group engaged in self-regulated

reading processes, such as planning, monitoring and trying to access prior knowledge for the question *'Can you name the nine planets?'* from the Starchild website as shown in Figure 6.2.

The vignette opened with a "playful generativity" (Daiute & Dalton, 1993, p. 285) when Kylie questioned Chrissie's knowledge of the answer in a playful manner.

Chrissie: Yeah I can!

Kylie: Chrissie says she can but is it true? You're probably wrong!

[Camtasia activity record (RDa,W1,G1); use back button twice to go to Starchild home page →CM Hover over menu at bottom of page → Then over menu 1 Space Stuff →enter Space Stuff →enter Who's Who in Space→ Page loads →navigate quickly back to home page using back button twice]

Chrissie: Venus, Earth, Mars, oh I forget them!

Kylie: Universe? [From side bar menu]

Chrissie: No, universe is the world. The glossary, no

Kylie: Space travel no, who.... space stuff, no solar system?

Chrissie: Oh yeah. We're clicking into the solar system.

Bridie: The planets?

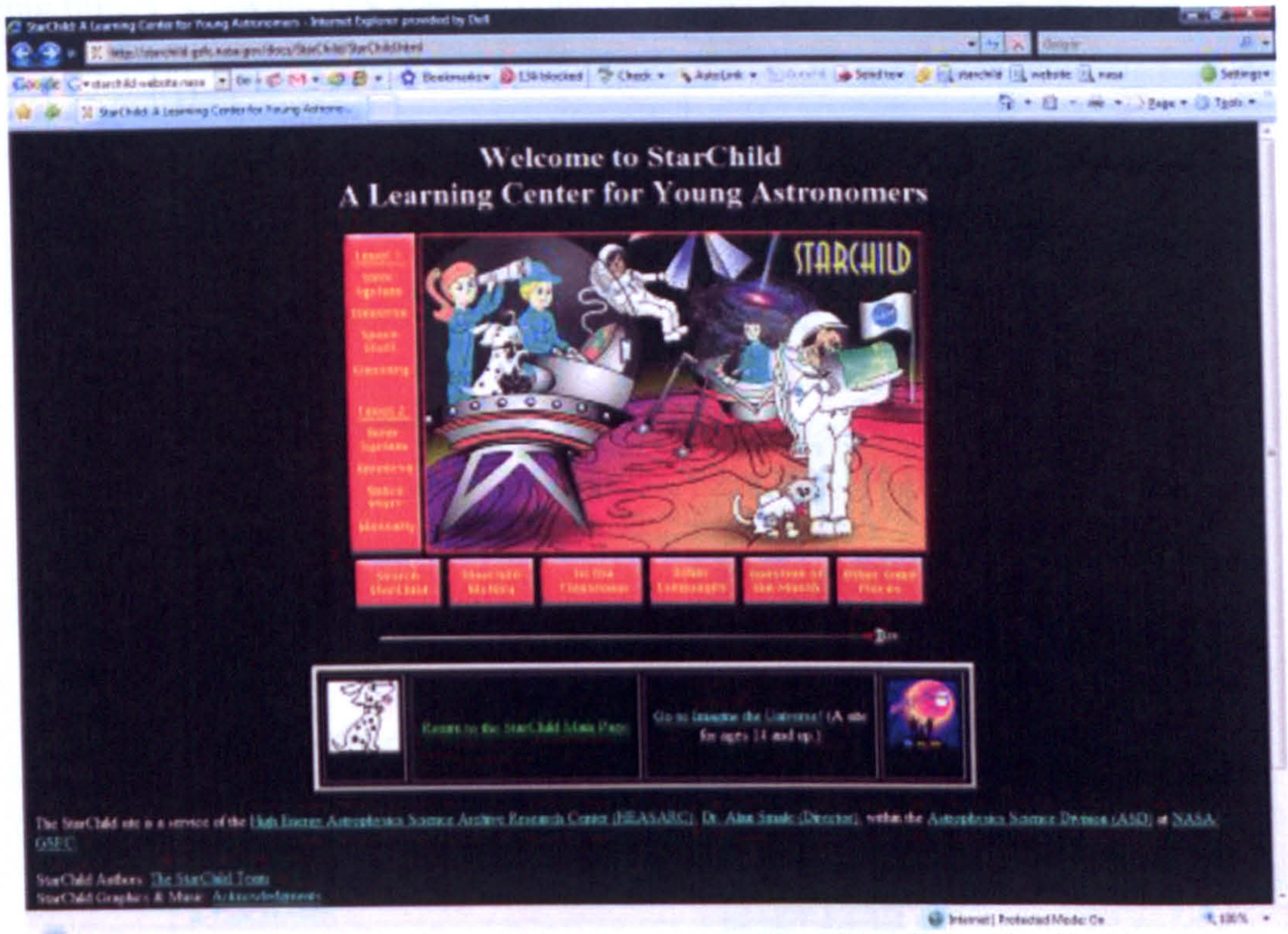
Kylie: Bridie is clicking into the planets [Camtasia activity record (RDa,W1, G1), Navigate to solar system web page →activate hyperlink to planets] eh inner planets, outer planets?

Bridie: Oh we're nearly finished! One more question, oh!

Chrissie: This is great isn't it? [List correct answer to planets question on the planets on worksheet](RDa,FN,W1,G1,p5).

This vignette demonstrates the power of peer collaboration to expand an individual's ability to generate, contest, examine, and evaluate their own ideas with those of others within a group.

Figure 6.2. Screen shot of the Starchild website homepage showing side bar menu.



Note. Web Source URL:http://starchild.gsfc.nasa.gov/docs/StarChild/StarChild.html

Instructional Content of Internet Workshop 3 and 4: Web Quest

Workshops 3 and 4 developed the children's ability to conduct online inquiry in a number of areas, such as engaging as a group in planning online activities; activating prior knowledge; formulating self-generated key questions; and generating information. A web quest (http://webquest.org/index-create.php) entitled, 'Life in the Undergrowth: Creating a Buzz Around Minibeasts', was developed online at the *Filamentality* website (http://www.kn.sbc.com/wired/fil/index.html). The children investigated minibeasts under the key science concepts (shown in Figure 6.3) drawn from the science curriculum (NCCA/DES, 1999b). The web quest provided links to specified websites about each mini-beast.

Figure 6.3. Sample page from the web quest work sheet for the strand 'investigating living things' showing key science concepts under investigation by the children.

Diet *Feeding* *Prey*	
Breathing *Respiration*	
Moving *Locomotion*	
Reproduction *Having babies* *Mating*	
Growing	
Adapting to habitat *Survival*	
Using senses *Communication*	

Note. Synonyms in italics

The web quest provided a bounded choice (Guthrie, 2004, p. 2) for the 5th class cohort to choose, as triad groups, among a number of minibeasts, such as millipedes and centipedes; woodlice and earthworms; earwigs and grasshoppers; slugs and snails; and beetles.

The prior topic knowledge of the children was developed in a number of ways. Firstly, the class watched the DVD of "*Life in the Undergrowth*" (BBC, 2005) with their class teacher. Prior to the viewing of the DVD the class teacher posed a number of self-generated 'I wonder questions' (McLaughlin, 2003), such as "I wonder why doesn't a spider's web break when he walks on it?" and encouraged the children to do likewise ("I wonder why do spiders make webs?"). Secondly, a hands-on activity, to encourage direct observations, investigation, hypothesis testing, and the formulation of self-generated questions, was devised in the form of mini-beast hunt in the schools grounds. This was followed by a number of scientific experiments conducted in the classroom setting around the topic of minibeasts. As such, the hands-on activities were designed to develop situational interest in the topic and to engage and motivate the children (Guthrie et al., 2004a).

In the web quest which followed, the children were encouraged to access their prior knowledge using a KWL (Ogle 1986) strategy and to formulate the questions they wished to investigate. They were provided with reminder prompts to 'stop, think and talk' (Figure 6.4) to discuss their activity at key moments within each workshop. These prompts were intended as a way to encourage and scaffold peer collaboration.

Figure 6.4. Stop think and talk: Discussion prompts to scaffold peer collaboration.

Aspects of the Themes Emerging from the Learning Ecology in Internet Workshops 3 and 4

Following analysis of data sources from workshops 3 and 4, three aspects emerged related to the themes of the development of online reading comprehension and the capacity of the children to conduct the information-seeking cycle. These aspects included (iv) the children's ability to formulate different kinds of questions; (v) the importance of prior topic knowledge and its relationship to decoding and vocabulary; (vi) the ability of the children to generate and revise search terms.

Formulation of Questions: Types and Kinds of Questions Formulated by the Focal Groups

In workshops 3 and 4 there was a progression from answering questions which were researcher/class teacher generated to formulating and answering self-generated questions. The questions framed before Internet inquiry are important to direct online activity (Leu et al., 2008). Table 6.2 shows the restricted nature of the level of prior topic knowledge across the groups, which is limited to general information of the minibeasts under investigation. The samples are drawn from group discussions and work sample evidence. Group 1 displayed the greatest prior topic knowledge referring both to physical characteristics of earwigs and grasshoppers and the biomes in which they live.

Table 6.2 *The Prior Topic Knowledge of the Focal Groups and the Focus Questions Formulated by Each Focal Group Prior to the Web Quest*

What do I Know? (Written work sample)		
Group 1 Earwigs and grasshoppers	**Group 2** Beetles	**Group 3** Millipedes and centipedes
[2]Grasshoppers have two big legs behind and they can jump. They can jump real high from the back when they push. Earwigs live mostly under the ground under leaves and stuff. Earwigs are small and brown and have two horns sticking out the back of their head.	Some are black. Some are scary. Some are big. They have legs. They move quickly. They live outside. Ants eat beetles.	Lots of legs. They are fast There **(sic)** legs are so small. They are very thin. They live outside. They can't fly. They hive **[hide]** underground.
What do I Want to Know?(Written and Oral sample)		
• What were earwigs called before? • Wondering do earwigs go in your ears? • Why do earwigs have two big horns on the side of their head? • Why are earwigs brown? • How do earwigs breathe? • What do they feed on? • With grasshoppers where do the babies come out from?	• Do beetles have wings? • How do they catch their prey? • Do beetles hop or fly on walls? • How do they have babies? • How do you know if it's a girl or a boy? • What do beetles eat? • How do they breathe? • What do they eat?	• Why do they have lots of legs? • What colour are they? • What do they eat? • What are millipades?**(sic)** • How many legs do they have? • How can they move so fast? • Are they the same **[as centipedes]**? • How do they have babies?

[2] The written work samples of the children are presented in Bradley Hand ITC font throughout the thesis. This is to distinguish the children's written work samples from their verbal comments.

Table 6.2 also shows the questions formulated by each focal group prior to commencing the web quest. Drawing from the questioning rubric framework developed by Guthrie and Taboada (2004), the questions generated by the children were either *factual information,* Level 1 type questions (p. 301), such as "What do beetles eat?" requiring a simple concrete answer or *simple classification*, yes/no answer questions, such as "Do beetles have wings?"; or Level 2 "*simple description*" (p. 302), questions focussing more on concepts and descriptions of the interaction between organisms and their biomes. For example, "Why do earwigs have two big horns on the side of their head" or "How do [millipedes] they have babies?" The self-generated questions were derived from the current topic knowledge and inquisitiveness of the children, and, as such, they formed "a bridge between the children's interests and curiosity and the new knowledge contained in the text" (Guthrie & Taboada, 2004, p. 294). In formulating the question, "why are earwigs brown?", the following illustrative extract from a conversation in group 1 suggests that peer collaboration can help children to heighten their awareness of their own prior topic knowledge, and make connections between this knowledge and the knowledge of others within the group, as the group members affirm, challenge and extend one another's contributions:

> Chrissie: And I'm wondering why earwigs are brown?
>
> Bridie: I think I can answer that question Chrissie, because they can hide in muck.
>
> Kylie: Yeah, they can camouflage themselves in the dark places.
>
> Chrissie: Well, what if there was green grass and they were lying in it?
>
> Bridie: They'd go down into the muck.

Kylie: Yeah, they'd stand on the back of them and they'd dig themselves down with their two big horns.

Bridie: That's a very good question though Chrissie. (RDa,FN,W3,G1,p1)

As the groups generated information in the web quest they created further questions to investigate. When group 3 investigated the question of 'how millipedes have babies' they ascertained that "millipedes lay eggs". This then led Jane to wonder, "yeah, but how do they lay eggs?" (RDa,FN,W4,G3,p2).

The Relationship of Prior Topic Knowledge to Decoding and Vocabulary

Field note evidence revealed that difficulties persisted with micro-level processing relating to decoding words and reading vocabulary knowledge throughout the web quest. For example, confusion over homonyms, such as breed/breathe; vocabulary specific to the topic, such as thorax and abdomen; confusion over the meaning of words for instance the meaning of 'superstition'. In retrospect, the assumption that these struggling readers would possess prior vocabulary knowledge related to the topic domain of 'minibeasts' was risky at best and pointed up the need to develop some vocabulary knowledge related to the domain theme prior to the commencement of any project. The children overcame some of these vocabulary difficulties with guided support by the researcher and class teacher. Further, there was some evidence that the children were beginning to self-monitor these difficulties and adapt strategies to overcome them. For example, in workshop 3, group 1 encountered the unknown word 'omnivorous' and Chrissie urged the other group members to "let's try and work it out". They used surrounding contextual information to agree that 'omnivorous' means to "eat live or dead insects as well as live or dying [decaying] vegetation" (RDa,FN,W3,G1,p2).

The groups continued to generate information for their chosen minibeast, in the independent practice section of the remaining Internet workshops. They communicated the information they generated, in the form of a PowerPoint presentation, at a gathering of their parents and guardians in June 2006. These presentations will be discussed in a later section.

The Ability of the Focal Groups to Generate and Revise Search Terms

Following explicit strategy instruction, in a brief mini-lesson, on a number of search engines and the use of the topic and focus strategy (Eagleton et al., 2003), the children were encouraged to independently search for answers to their self-generated questions based on the topic theme. The children persisted with the use of *natural language phrases in question format,* such as <how do centipedes give birth> or *multiple terms*, such as <grasshoppers mating> and had difficulty revising these search strings displaying a novice level of understanding of search term generation. This resulted in frustration across the groups as they had difficulty generating information and is exemplified by Jane wondering, "what are we supposed to do we can't find anything?"(RDa,FN,W4,G3,p3).

Following a formative review of these workshops and in line with the iterative nature of the F&DE framework of the study, workshop 5 sought to address some of the difficulties encountered by the groups related to generating search strings and using search engines.

Instructional Content of Internet Workshop 5: Planning an Online Search

Workshop 5 sought to develop the children's ability to search for information independently focussing on three planning issues related to generating search terms:

brainstorming and connecting with prior topic knowledge; evaluating search strings; and narrowing a search focus using the 'theme, topic, focus, question' (Eagleton et al., 2003) strategy.

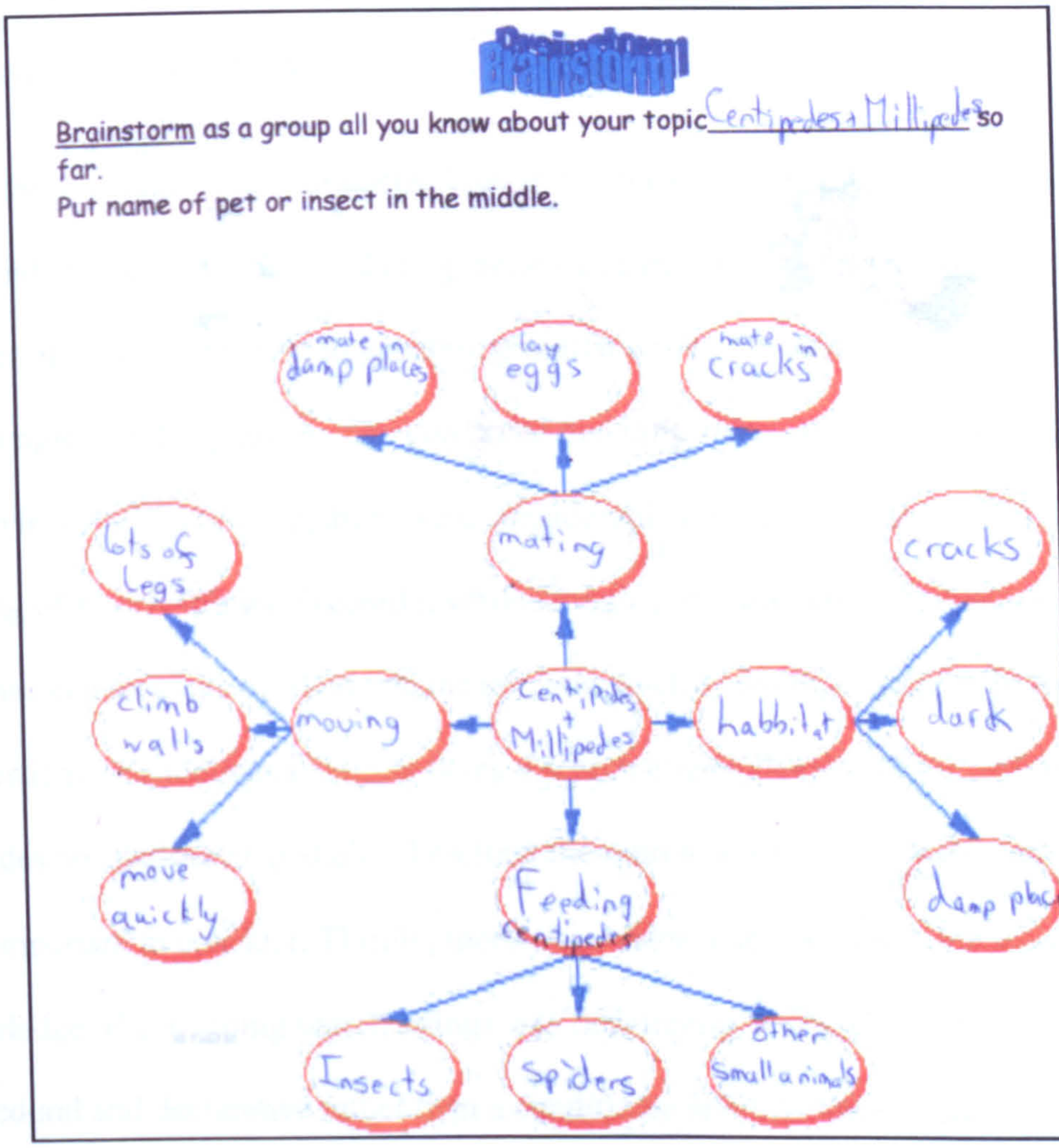
Aspects of the Themes Emerging from the Learning Ecology in Internet Workshop 5

Analysis of the data suggested that the aspect of the themes emerging from this workshop concerned; (vii) the ability of the children to generate and revise search strings and the levels of procedural, declarative, and conditional knowledge with which they did so.

Ability of the Focal Groups to Generate Effective Search Strings

Brainstorming and activating prior knowledge of a topic could possibly aid in generating keywords for search strings for an online search. Figure 6.5 provides a work sample produced by group 3, but illustrative of growth across the class cohort, of a concept map based on millipedes and centipedes. The detailed nature of the group's level of prior knowledge suggests considerable growth and development in the group's prior knowledge and vocabulary in relation to the topic following the web quest when compared to the group's prior knowledge preceding the web quest (shown previously in Table 6.2).

Figure 6.5. Group 3 concept map work sample demonstrating prior knowledge of centipedes and millipedes.



Analysis of data suggested that the children had developed procedural knowledge of how to narrow a search focus, using the theme, topic, focus, question strategy (Eagleton et al., 2003) but persisted in formulating literal type questions to focus online inquiry. For example, group 3, for the *theme* 'my country', chose 'Ireland' as the *topic*; 'Dublin' as the *focus* ; and 'how old is the GPO?' [General Post Office] as the focus *question*. The children were also asked to evaluate a number of search terms as to whether they were '*good* or *bad'* and to give reasons for their choices. For example, group 3 evaluated the search string <animals> as bad because "ther'd

be loads of them that would come up all the animals". <Animals and lion cubs> on the other hand was good because "it'd give you more about less things, more about lion cubs"(RDa,FN,W5,G3,p2).

In the scavenger hunt, conducted later in the Internet workshop, the children independently applied their skills in generating search terms. Analysis suggested a number of issues in relation to generating search terms. These issues are charted, as an example, for the question '*can you name two films that Colin Farrell acted in'* as shown in Table 6.3. Firstly, there were considerable difficulties with spelling and spacing of search strings. Secondly, while Google provides help with spelling, with the onscreen message of <Did you mean>, and Askfor kids provides a <spelling suggestion>, Yahooligans, despite being a search engine developed for children, provides no spelling help at all. Therefore, the search engine used by the children was important to consider. Thirdly, there was evidence that although the level of knowledge of generating search strings was developing, it was clear that it was at a procedural and declarative rather than a conditional level. Groups 2 and 3 lapsed back to using *single search strings,* such as <actors> or using *natural language phrase in question format,* such as <what films did colin act in> when they encountered difficulties. Finally, the speed with which the groups generated an answer differed across the group. The speed with which group 1 generated an answer depended less on the effective use of search strings by this group (<two films that colin farel wrote>) and more on a random use of the <I'm feeling lucky> and the search engine used. The Google search engine utilises a hypertext matching analysis in a very large database, and so the group were successful in retrieving an answer to the question in 1 minute and 20 seconds. Groups 2 and 3 however, despite taking

more time to generate an answer, showed greater flexibility in generating search terms, both in terms of revision of search strings, and in their ability to navigate between multiple search engines.

Table 6.3 *Search Strings Generated and Search Engine Used for the Scavenger Hunt Question*

Question: 'Name Two Films Colin Farrell Acted in'					
Group 1		**Group 2**		**Group 3**	
Search string generated	Search engine used	Search string generated	Search engine used	Search string generated	Search engine used
<Two films that Collin farrel wrote>	Google	<Colin farrel> <Colin farel> <Colin farrell> <actors> <movies> <Movie stars>	Yahooligans	<Colin farrel/flims> <Colin farrel and flims> <What films did colin act in> <What films did colin farrell act in>	AskforKids (www.askforkids.com)
		<Movie stars +colin farrell>	Address bar MSN	<Colin Farrell> <Films colin farrell>	Yahooligans (www.yahooligans.com)
		<Colin farrell>	AskforKids	<Colin farrel and flims>	Google (www.google.ie)
		<Colin farrell>	Google		
Time in minutes to answer question	**1:20**	**Time in minutes to answer question**	**8:30**	**Time in minutes to answer question**	**7:34**

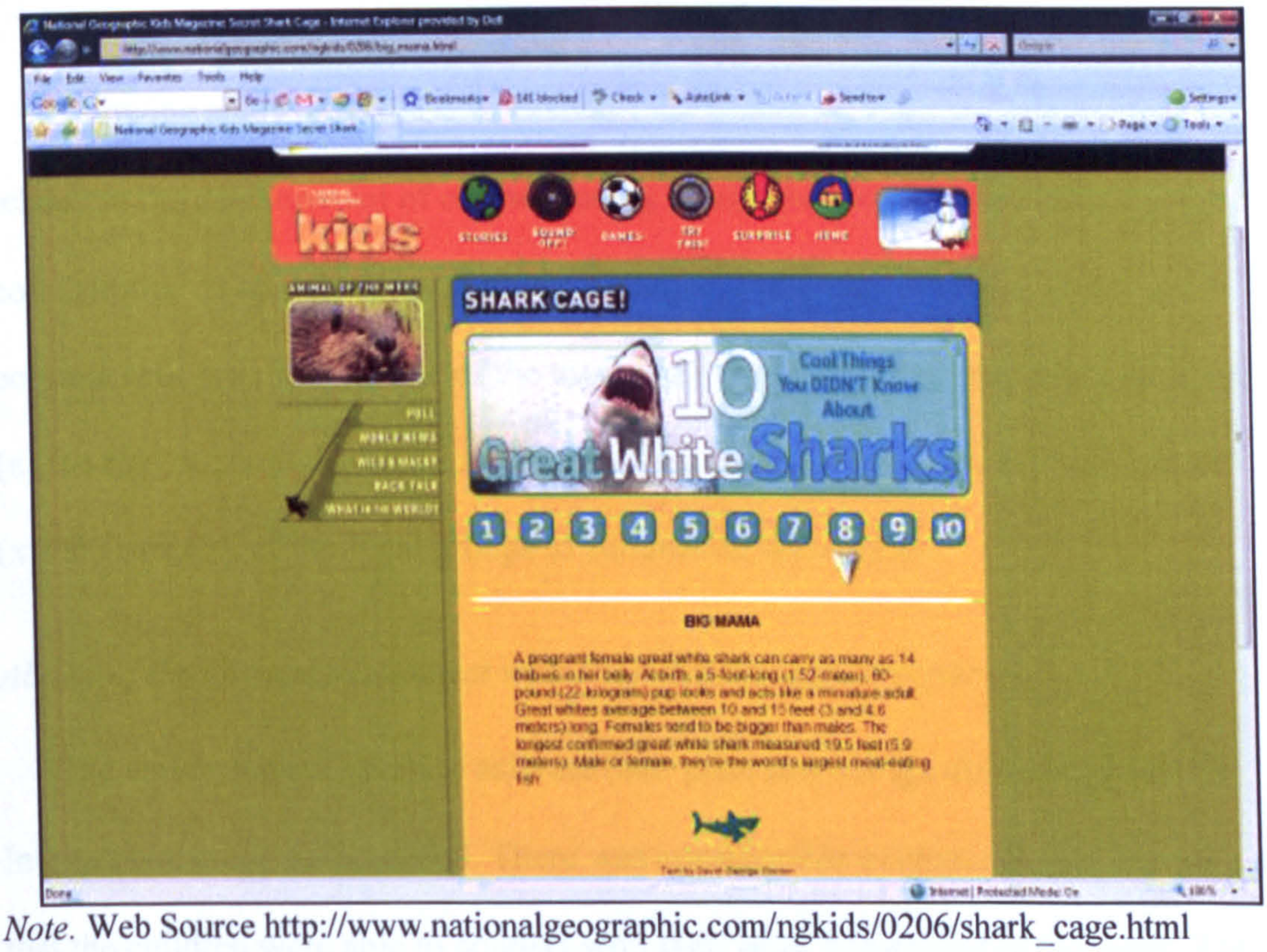
Note. The total time in minutes in finding answers to questions was determined by triangulating the time stamps from the Camtasia activity record of online activity with the transcript of the focal groups' conversations.

Instructional Content of Workshop 6 and 7: Summarising Information

Workshops 6 and 7 built on skills acquired in earlier workshops, such as developing the children's ability to access prior knowledge and formulate questions. Further, these workshops developed the children's ability to summarise (locate and transform) information.

In workshop 6 the children were asked to explore the National Geographic for kids website (http://www.nationalgeographic.com/ngkids/0206/shark_cage.html) about '10 cool things about Great White sharks' as shown in Figure 6.6.

Figure 6.6. Screen shot from the National Geographic for kids website: 10 cool things you didn't know about great white sharks.



Note. Web Source http://www.nationalgeographic.com/ngkids/0206/shark_cage.html

Workshop 7 was based on an informational narrative text of the real life story of Ruth Becker, a survivor of the Titanic (http://www.nationalgeographic.com/ngkids/9607/titanic.html). Both workshops

were structured around the same activities which the children discussed as a group. For example, in workshop 6, after they were finished reading each 'cool thing' about great white sharks, the children discussed the following questions (adapted from Pearson, 2006)

- Suppose you have a friend who doesn't know these cool things about sharks. What cool things would you tell your friend? Talk about this together.
- What is a question about each cool thing that you could ask your friend to see if they understood what you told them
- What words do you think would cause your friend difficulty?

Aspects of the Themes Emerging from the Learning Ecology in Internet Workshop 6 and 7

Following analysis of these workshops, the following aspects of the themes related to the development of online reading comprehension and the role of peer collaboration in an online environment emerged; (viii) the ability of the groups to connect with prior knowledge of the topic; (ix) their ability to formulate questions; (x) the role of peer collaboration in facilitating a deeper engagement with text and (xi) the capacity of the focal groups to summarise information.

Ability of the Groups to Connect with Prior Knowledge of Topic

The children were asked to activate their prior knowledge about sharks as the Internet workshop commenced. There was considerable evidence across the groups that the children were able to connect with their prior knowledge of the topic. For example, the following extract from a longer conversation in group 1 shows the group's prior knowledge of sharks from multiple sources:

Chrissie: Well, I know that a shark can never swim backwards; it'll kill itself if it does.

Bridie: And I know that there's some sharks that have no teeth. They eat other sorts of stuff, they do eat other sorts of stuff than blood (pause) and flesh.

Kylie: Oh, and if a shark tries to attack you and nearly has your legs, hit it in his gills and he'll swim away 'cause that's how he breathes. (pause) And some sharks eat other sharks' babies... I heard one time, and I don't know if it's true, that some sharks are vegetarians.

Bridie: That's true 'cause some sharks don't eat meat (RDa,FN,W6,p17).

This suggested some growth in the ability of the children to not only activate prior knowledge of a topic domain from various sources, but also their ability to connect their prior knowledge with the topic at hand.

Ability of the Groups to Formulate Questions

Formulating questions had emerged as an aspect in earlier workshops in RDCWL Phase 1a, where the class groups persisted in formulating literal type questions. In order to develop the children's ability to generate and discuss questions, multisensory and kinaesthetic dimensions were added to the QARs model (Raphael & Au, 2005;Raphael & Pearson, 1985; Raphael & Wonnacott, 1985). For example, text explicit, 'right there' questions were colour coded green (go) with a hand signal pointing directly at the text. The colour codes introduced a metacognitive dimension to formulating questions where the children used a structured and shared language to think and talk about the types and kinds of questions formulated. It also enabled them to discuss where answers to questions might be sourced within a text.

The data in Table 6.4 provides evidence that there was some growth across the groups in their ability to formulate questions. Even though groups 1 and 2 mainly asked text explicit 'right there' or text implicit 'think and search' questions, (roughly related to level 1 and 2 questions on the Guthrie and Taboada (2004) questioning rubric), there is evidence that the questions formulated drew on a more conceptually developed prior domain knowledge, which is reflected in the vocabulary employed by the children to formulate questions. However, group 3, as indicated in Table 6.4, formulated more scriptally explicit, 'author and me' and 'on my own' type questions which required drawing on prior topic knowledge at a conceptual level and combining that knowledge with information contained in the text.

Table 6.4 *Sample Questions Across the Three Focal Groups, with Font Colour Code Indicating the Type of Question Formulated*

Group 1	**Group 2**	**Group 3**
How long would a shark be at birth?	**What blends with the murky sea floor?**	**How do you think they can fit so much babies in their belly?**
Do you think that females tend to be bigger than males?	**Are all sharks man eaters?**	**How long do you think it will take the shark to grow to its normal size?**
How long can a shark hear?	**How long was a baby shark**	**How does a shark loose all its teeth?**
Do you think that sea lions taste better than people?	**Name some of the things that a great white shark can swallow?**	**How come they have back teeth there and humans don't?**

Note. Font colour green relates to right there 'go' questions; orange to think and search 'slow down' questions; red relates to author and me 'stop' questions and black relates to on my own 'race-flag' questions (Adapted from Hollas, 2004).

Peer Collaboration Facilitates a Deeper Processing of Text

The type and kinds of questions formulated facilitated a deeper processing of the text (Alexander, 1997). The children in group 3, in the example which follows, engaged in the collaborative use of a range of reading strategies, including monitoring and evaluating information and activating prior knowledge, while reading the paragraph displayed in Figure 6.7.

Figure 6.7. Text of Big Mama from the '10 cool things about great white sharks.'

<A pregnant female great white shark can carry as many as 14 babies in her belly. At birth, a 5-foot-long (1.52-meter), 60-pound (22-kilogram) pup looks and acts like a miniature adult. Great whites average between 10 and 15 feet (3 and 4.6 meters) long. Females tend to be bigger than males. The longest confirmed great white shark measured 19.5 feet (5.9 meters). Male or female, they're the world's largest meat-eating fish>

Web source Big Mama URL:
http://www.nationalgeographic.com/ngkids/0206/big_mama.html

Eileen: Whoy! I wonder how a pregnant female can hold…

Eileen and Jane (together): 14 babies in their belly!

Jane: And they're nearly the same size as the shark. Her belly must be seven foot or something...

Leona: No, I'd say like probably a size of a minicar like, know a little 'luv bug' car like.

Jane: But how can, that would be like a human holding 14 babies in their stomach. How?

Leona: Yeah, that'd be like a whole big car like (FRDa,FN,W6,G3,p4).

The focal groups viewed the Camtasia recorded file of their online Internet activity immediately following workshop 6. They were given a structured probe by the researcher to ascertain what they were thinking while they were reading the paragraph. This provided further evidence of the cognitive strategies they were using

and their response to text. Again, in group 3, we can see evidence of a deeper processing of the text and evidence that the children continued to process and make inferences about the text after finishing reading it.

> Researcher: What were you thinking about as you were reading?
>
> Eileen: How can a ma [mother] hold that many babies in their stomach?
>
> Jane: And they're five rulers long.
>
> Eileen: And they're the same size as our teacher.
>
> Researcher: Oh right
>
> Leona: She told us
>
> Eileen: 'Cause she said she was five foot, she told us.
>
> Researcher: Ok, so she's five foot too and you thought, gosh that's the same size, so you were kind of comparing it...
>
> Eileen: And would she not sink down to the bottom like and there's 14 of them in her stomick [stomach] (RDa,FN,W6,G3, p8).

As illustrated in this vignette, the children continued to draw on prior general knowledge and to make connections between this knowledge and the information contained in the text (the sharks are 5 rulers long, the same size as teacher).

Summarisation of Information: Locating and Transforming Information

In workshop 6, the focal groups were asked to discuss the '10 cool things about great white sharks' and provide an oral summary of information of what they would tell their 'friend' about what they had read. In retrospect, this could possibly have encouraged the children to focus on the more salacious details of what was interesting to them, rather than what was important within the passage, in providing a summary for their friend, although in reality this did not occur. The short paragraphs of information contained in the cool things about great white sharks

eliminated the need to combine information across websites, or multiple paragraphs, thereby reducing the processing load. An oral summary also had the possibility of providing insights into the thinking processes of the children as they discussed their summaries. The text was present on screen, thereby eliminating the need to access information from memory or recall. Finally, the children provided a "reader based" text (Hidi & Anderson, 1986) for a friend rather than a "writer based" text (such as note-taking).

The children used a number of strategies to summarise the information for their friend. Some differences emerged between the 'weaker' and 'better' readers in each focal group. Firstly, the weaker readers tended to use what Garner (1987), has referred to as "strategic deficiency" (p. 303) where the approach to summarisation was haphazard, no attempt was made to restate information in their own words and minimal integration of information occurred. Typically, the children restated the final sentence of the paragraph as a summary. The second approach used was the "copy-delete" strategy (Brown & Day, 1983, p. 2) referred to as "strategic inefficiency" by Garner (1987, p. 304). Using this approach the children adhered mainly to the original wording of the text, deleting some information judged as unimportant, but often repeating verbatim the wording contained in the original text. The children, as such, selected topic sentences to represent the ideas contained in the text but did not deviate from the surface features of the original text. There was no evidence of superordination of lists. Finally, there was limited evidence that the 'better' readers in groups 1, 2 and 3 (Kylie, Aileen and Eileen) clustered and integrated information within the paragraph presented. Eileen (group 3), for

example, also inferred causation as to why sharks prefer seals to humans in the summary she provided:

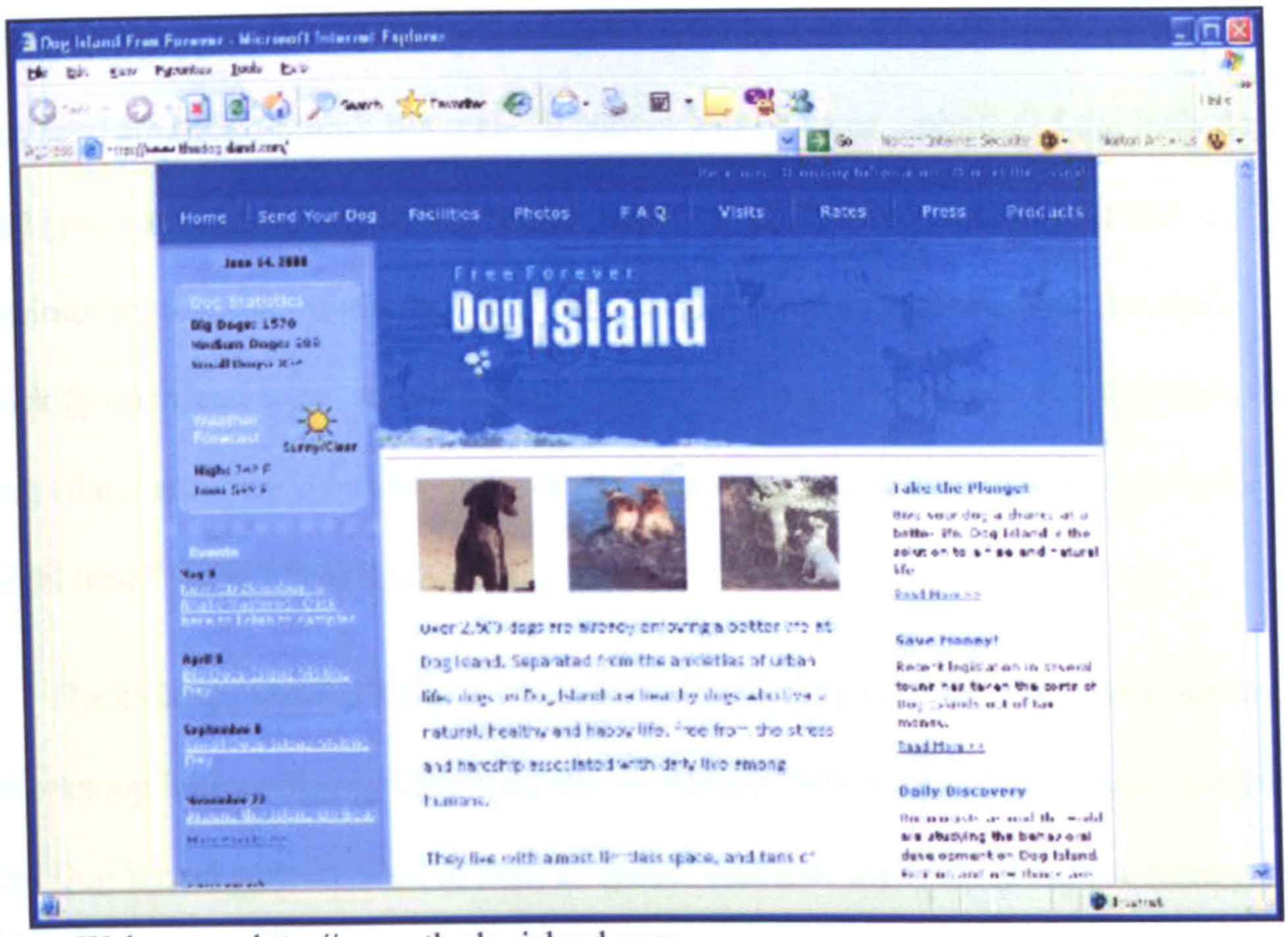
> They're saying that they only take one bite of people because they don't like people that much. They don't taste as good as sea lions and seals...because the seals and sea lions are mostly in water they probably taste better 'cause like humans are mostly out in the air... That they're not really man eaters they don't really eat a whole person. (RDa,FN,W6,G3,p9)

The children did not question the reliability of the information presented on the National Geographic website, nor did they discuss the authority of the information contained there. There was no critical evaluation of the information presented. The Internet is an open access media and is open to any individual to publish any information (Leu, 1997) therefore critical evaluation of online information is crucial (Synder & Bulfin, 2008). Workshop 8 explored the ability of the children to evaluate the reliability of information on websites.

Workshop 8: Evaluating the Reliability of Information Presented on Websites

Internet workshop 8 opened with a class discussion of the children's understanding of reliability. As part of the workshop 8 the children were given an activity which involved evaluating a 'spoof' website, displayed as a screen shot in figure 6.8, and through collaboration, provide a reasoned opinion of whether they thought the information provided was '*reliable*' '*somewhat reliable*' or '*not at all reliable*' (adapted from TICA, Leu & Reinking, 2005).

Figure 6.8. Screen shot of the Free Forever Dog Island website.



Note. Web source http://www.thedogisland.com

Aspects of the Themes Emerging from the Learning Ecology in Internet Workshop 8

Data analysis indicated that the focal groups had difficulty with aspects of evaluating the reliability of online information presented on websites.

Ability of the Focal Groups to Judge the Reliability of Information on the Dog Island website

The children judged the reliability of information on the 'spoof' Dog Island website as 'very reliable' (groups 2 and 3) and 'somewhat reliable' (group 1) basing their opinions solely on the home page (as indicated by the Camtasia activity records). The children formed their perceptions of reliability on a number of factors, such as: (a) their past experiences and prior knowledge of the domain topic: "dogs would be happy if they're with their friends together in a family...and when they have their babies; their babies aren't going to be taken away from them. They're just

going to leave them there with their family" (RDa,FN,W8,G3,p3); (b) signals on the website: "they couldn't make up a thing 'cause they have an email yoke and all. You can send emails so I think it's real... It shows you pictures ...photos of the little dogs and [you can] check out the dog island products" (RDa,FN,W8,G1,p18); and (c) desirability that the information was true:"because some dogs are stuck out their back [garden]and some are very small and they'd [owners] be able to bring them to dog island and they'd be able to have a proper sleep like if their dog always barks at night time" (RDa,FN,W8,G2,p11).

The children viewed a Camtasia captured recording on their online activity in Workshop 8 immediately following the workshop. When told by the researcher that the Dog Island website was, in fact, a 'spoof' website, the focal groups reacted with disbelief. Chrissie was indignant "How dare they... trying to fool us" (Rda,FN,W8,G3,p21).

However, the focal groups' comments, when viewing the Camtasia file after the activity, suggested a growing awareness that one needed to be more reflective towards online information. Eileen commented that it was better to "read it and think a while. Yeah, stop and think, is it real or not and see if they're selling anything on it"(RDa,FN,W8,G3, p6) while Nicky on reflection felt that "you wouldn't be able to have a dog island 'cause like nearly everywhere on earth someone lives on it" (RDa,FN,W8,G2,p14). Aileen remarked that, "somebody wouldn't be able to owned [own] over 2500 dogs" and continued that one needed to check the veracity of information:

> You kinda' have to look more, and check whether it's real or not... you'd have to check answers, see whether the information was true or not. You'd

> have to go to a different website and see whether there like, that a dog island was real (RDa,FN,W8,G2,p15).

In sum, children in this study, on this activity, had difficulty recognising the signals that something could be wrong with the information presented on a website. The children were drawing on a limited range of past experiences and prior knowledge including domain, topic, and world knowledge.

Communication of Information Generated to Others

The 5th class children presented a PowerPoint presentation of the Internet Project 'Life in the Undergrowth' to their parents and guardians in June, 2006. Sample slides from these PowerPoint presentations are presented in Appendix K. The children presented with confidence, and fielded questions with ease from the audience, showing that perhaps the PowerPoint presentations were a poor representation of the knowledge they had gained. A number of unanticipated outcomes emerged from these presentations. The Principal of the school and the class teacher had noted, in informal conversations with the researcher, the reluctance of some of the parents to visit and engage with the school community. However, a large number of parents, both mothers and fathers, attended the presentations and reacted enthusiastically to the project. Afterwards the parents engaged in fund-raising activities to purchase lap-tops for the project (thus alleviating the difficulties presented by old and often unreliable computers in the computer room). A number of the parents also subsequently enrolled in computer technology classes in the school to develop their own computer and Internet skills.

A primary aim of the Science Curriculum (DES/NCCA, 1999b) is the development of conceptual understanding and knowledge of the biological and

physical aspects of the world. The development of conceptual knowledge (Barbosa & Alexander, 2004) in science represents a move away from seeing science as a series of fascinating facts, to developing an understanding of the interrelationships and interactions of organisms within their environments. A qualitative review of the PowerPoint presentations, adapting the Guthrie and Taboada framework (2004), revealed that the presentations contained substantially more factual statements and simple description statements than complex explanations. For example, 10 *factual statements,* such as "Ladybirds eat green fly's" [sic] (group 2); 24 *simple descriptions*, such as "They lay there [sic] eggs in small cracks and damp places"; (group 3) and 5 *complex explanations,* such as, "The grasshoppers mate and when they do if the lady is finished and she is very hungry she may eat his head off" (group 1).

Summary of Aspects of Themes Emerging from RDCWL Phase 1a

In sum, in RDCWL Phase1a, explicit strategy instruction was followed by guided and independent practice of the skills and strategies developed in particular Internet workshops. The class teacher and researcher provided just-in-time scaffolded assistance to the triad groups. Aspects of themes, which emerged, related firstly, to the importance of peer collaboration in developing active construction of meaning and a deeper engagement with text. Secondly, aspects of themes related to the development of online information-seeking skills included the importance of familiarity with the architecture of online informational text structures; the development of levels of knowledge in relation to generating search terms; and difficulties related to evaluating the reliability of online information caused by limited prior topic, domain, world and Internet knowledge. Thirdly, in relation to the

theme of online reading comprehension, aspects which emerged related to the importance of prior knowledge in an online environment, especially in relation to predictive inferencing of hyperlinks and prior topic knowledge; the ability of the children to formulate deeper level of questions to focus online activity; and their capacity to summarise information beyond a copy and delete strategy.

Summary of Macro-Analysis Pertaining to RDCWL Phase 1a

A macro-analysis of the aspects emerging from Phase 1a of the project, in line with the iterative nature of F&DE, sought to identify factors which were impeding movement towards the pedagogical goal of the study. The pedagogical goal of this study was to aid struggling readers from a disadvantaged community to develop effective reading skills and strategies in online Internet inquiry. The intervention was then formatively modified, in consultation with the class teacher, and a number of instructional moves and adaptations were made. These modifications included the promotion of reading fluency; the development of prior domain knowledge; additional development of online informational text structure and navigational skill knowledge; and the development of print and online reading comprehension strategies. The modifications made are presented in the following sections which chart the development of RDCWL Phase 1b of the study conducted prior to the commencement of the Main Study phase.

Part 2: Reading Development and Critical Web Literacy Phase 1b

Phase 1b Project Theme: Animals and Their Adaptations to Their Environment

The thematic unit, integrating science, literacy, and the Internet, for this phase of the study, developed in consultation with the class teacher, was '*Animals and their*

adaptations to their environment'. The hands-on activity engaged in by the children, preceding commencement of RDCWL Phase 1b, was a visit to Dublin Zoo, where the children worked on a range of activities with the zookeeper, around the area of animal adaptations.

Literature circles (Daniels, 2002) were introduced to encourage the children to engage in wide reading (Allington, 1998) and to develop reading fluency. The children worked in group of four, adopting and alternating the roles of Artful Artist, Passage Picker, Connector, and Question Asker as shown in Figure 6.9. They conducted most of this reading at home followed by discussion in literature circles in school. The novels adopted by the class teacher as the class reader to develop reading strategies were "*The Butterfly Lion*" and "*Kensuke's Kingdom*" (Morpurgo, 1996; Morpurgo, 2005) again linking to the Internet project theme (Guthrie, 2004).

Figure 6.9. Group roles for literature circles.

The prior domain knowledge of the children in relation to *animal adaptations* was developed in a number of ways. Firstly, the number of books in the class library was extended to include a range of levels of informational texts on animals and their adaptations to the environment (see Figure 6.10 for the range of approximately 80 informational texts added to the class library). Secondly, the class teacher adopted the National Geographic Reading Expeditions "*Animals and their adaptations*" (Jerome, 2006) as the class text in Social Environmental and Scientific Education (SESE). Finally, a series of five Internet workshops, using a format which developed a gradual release of responsibility from teacher to pupil (Pearson & Gallagher, 1983), were conducted in RDCWL Phase 1b prior to Christmas 2006. The purpose of these workshops was threefold. Firstly, to expand the children's end-user application knowledge, including navigational skills and knowledge of online informational text structures. Secondly, to develop the online reading strategies of the children including their abilities to activate and connect with prior knowledge; make inferences; formulate questions; determine importance and summarise information. Thirdly, these Internet workshops sought to develop the children's domain knowledge, around the theme 'animals and their adaptations to their environments'.

Prior domain knowledge (as discussed in the review of the literature in chapter 2) was important to develop as it generated situational interest (Alexander, 1997; Hidi, 1990); helped the children to ask more interesting questions (Scardamalia & Bereiter, 1982); influenced the nature of strategic processing (Alexander, Kulikowich, & Jetton, 1994); helped with determining importance in text (Hidi et al.,

1982); and finally, aided the children in both generating and revising search terms and investigating search results with a critical eye.

Figure 6.10. Informational texts in class library pertaining to the project theme of animal adaptations to their environments.

Reading Development and Critical Web Literacy Phase 1b: Internet Workshops

The five Internet workshops in RDCWL Phase 1b were more integrated in nature and wove together and reinforced strands of the curriculum which had been more separate in the Internet workshops in Phase 1a. For this reason, aspects of themes which emerged from these workshops are considered across the series of workshops in RDCWL Phase 1b in the sections which follow. Table 6.5 provides an overview of the framework of RDCWL Phase 1b, including the instructional content, skills development and aspects of themes emerging from analysis of a range of data sources.

Table 6.5 *RDCWL Phase1b Instructional Content, Skills Development and Aspects of Themes Emerging from the Learning Ecology in the RCDWL Phase 1b Internet Workshops 1 to 5*

Phase 1b RDCWL Internet Workshop	Instructional Content	Skills Development	Aspects Emerging from the Learning Ecology
Workshop 1 ***Online informational text structures***	Online informational text structures. End-user application knowledge.	Developing navigational skills. Using online help features. Developing skills related to location of information. Reflecting on process and product of online inquiry.	*(i)* End-user application knowledge: *Development of navigational skills*
Workshop 2 ***General adaptations of specific animals: Behaviour, Prey, Diet, Habitat***	Development of prior knowledge sources. Summarisation. End-user application knowledge.	Connecting with prior knowledge. Summarising: 321 strategy. Formulating questions. Developing vocabulary skills.	*(ii)* Development of reading skills: *Accessing prior knowledge;* *Formulating questions;* *Determining importance;* *Developing vocabulary strategies;* *Locating and summarising information.*
Workshop 3 ***General adaptations of specific animals: Behaviour, Prey, Diet, Habitat***	Development of prior knowledge sources. Formulating questions. Summarisation. End-user application knowledge.	Connecting with prior knowledge. Locating information. Generating thick and thin questions. Summarising: Concept map. Using online dictionary.	

Workshop 4 ***Animal adaptations: Camouflage and Hibernation***	Development of prior knowledge sources. Formulating questions. Summarisation. Strategies for vocabulary development. End-user application knowledge.	Connecting with prior knowledge. Generating information. Formulating levels of questions. Summarising: 321 strategy Locating words which would cause difficulty for a 'friend'. Activating hyperlinks. Navigating between websites. Reflecting on process and product of online inquiry.	*(iii)* Peer collaboration supports social learning
Workshop 5 ***Animal adaptations: Migration***	Development of prior knowledge sources. Formulating questions. Summarisation. Strategies for vocabulary development. End-user application knowledge.	Making connections with prior knowledge. Types and kinds of questions asked for a 'friend'. Locating information. Develop strategies to predict meaning. Online informational text structures: skimming and scanning.	

Instructional Content of Internet Workshops 1 to 5

The instructional content of RDCWL Phase 1b Internet workshops developed the children's prior domain knowledge of the adaptations made by specific animals in various biomes in relation to behaviour, habitat, diet, camouflage, hibernation and migration. The workshops also developed the children's online navigational and reading skills. Each of the Internet workshops in RDCWL Phase 1b followed a similar framework, and built on knowledge developed in previous Internet workshops in the series, building towards an integrated spiral curriculum. This framework consisted of:

- Group discussion of prior knowledge about animal adaptations.

- Assigned questions including text explicit (right there), text implicit (think and search) and predictive inferencing questions used to develop factual and conceptual knowledge. (workshops 2 and 3)

- Formulating self-generated questions (workshops 3, 4, and 5)

- Developing strategies for vocabulary development.

- Summarisation of information located.

- Reflection on the process and product of online Internet inquiry.

Aspects of the Themes Emerging from the Learning Ecology in RDCWL Phase 1b Internet Workshops

The aspects emerging from careful analysis of the field notes pertaining to workshop 1 to 5 in RDCWL Phase 1b centred on three thematic areas: the development of end-user application knowledge; the development of online reading comprehension skills and strategies; and the role of peer collaboration in developing online skills. Aspects of each of these thematic areas are presented across the five workshops in the sections which follow.

The Development of Navigational Skills: "It's a bit hard but not as hard as it used to be"

Analysis of the data sources, across the five Internet workshops, suggested growth in the development of the children's online navigational skills. There was less evidence of the disorientation (Hill & Hannafin, 1997) experienced by the groups and reported previously in Chapter 5 'Analysis of the Baseline phase'. Leona

explained that navigation around and between websites was "a bit hard but not as hard as it used to be" (RDb,FN,W2,G3,p13). These workshops necessitated navigating through multilayered websites using hyperlinks and navigational tools from the home page to specified linked pages. The speed and efficiency of navigating from website to website also increased as the children developed proficiency in firstly, recognising hyperlinks ("if the hand is held up it means that there is more information under it"); secondly, using the browser toolbar ("you can click on the little arrow beside the back [button] then you can go onto all the websites that you have been in and found"(RDb,FN,W1,G3,p6); thirdly, recognising online icons, such as the home page icon ("the little house picture"); fourthly, using online supports, such as Google image search for unknown animals or vocabulary or electronic spelling supports ("we right clicked [on the mouse]and then we found the right spelling (RDb,FN,W2,G3,p12) and finally, independent use of the 'edit-find' feature to skim and scan for online organisational features. The development of navigational skills on the Internet, with these struggling readers, was important because such skills reduce the expenditure of effort of a limited cognitive capacity as the user orients him/her-self on the Internet (Afflerbach & Cho, 2009; Eveland & Dunwoody, 2000; Treymayne & Dunwoody, 2001; Yang, 1997).

The Development of Online Reading Comprehension Skills and Strategies

Aspects emerging from analysis of the data of the thematic area of developing online reading comprehension concerned accessing prior knowledge, formulating questions, clarifying difficulties with vocabulary, determining importance in text and summarisation. Although the aspects issues pertaining to these skills and strategies are discussed separately in the sections which follow it is important to note that

'interfacilitation' (Guthrie, 1973, p. 11) of skills and strategies was occurring; for example, formulating questions, accessing prior knowledge and determining importance in text facilitated summarisation.

Accessing prior knowledge: "Out of our head". At the commencement of each Internet workshop, the children discussed their prior knowledge of the project domain topic 'Animal Adaptations to their Environments' in the form of a KWL. As shown in Table 6.6 there was some growth not only in the level of prior domain knowledge (as one would expect) but also in the ability of the children to connect with this prior knowledge in their discussions. Eileen explained how the group listed their prior knowledge of adaptations. "We discussed it and picked the best ones out of our head. We found them like, last time on the Internet, and the DVD we watched" (RDb,FN,W5,G3,p5). Initially the prior knowledge of the children was confined to factual type knowledge. For example, "A squirrel can climb" (RDb,FN,W2,G2,work sample). In workshop 5, as shown in the written samples in Table 6.6, there was some growth in the level of conceptual knowledge across the groups. For example, in relation to 'camouflage' group 3 in a written work sample provided a conceptual explanation of camouflage with examples, "Some animals hide where they think they can hide without being seen. For e.g. some lizards hide in trees and this is how they camouflage". The development of factual versus conceptual knowledge is facilitated by the types and kinds of questions formulated.

Table 6.6 *Accessing Prior Knowledge of Animal Adaptations to Their Environment*

Workshop 2 prior knowledge from written work samples of focal groups

Group 1	Group 2	Group 3
Lions grow bigger so they can hunt Cheetas[cheetahs] grow fast and get faster to hunt Crocodiles grow bigger to hunt	An adaptation means to change A squirrel can climb	We know they change their ways Some animals are cavers [carnivores] Some are heavers [herbivores]

Workshop 5 prior knowledge from written work samples of focal groups

Group 1	Group 2	Group 3
Behaviour Some animals are vicious. And some are caring. Some animals eat each other. Food Some animals eat meat and some just eat grass Prey is an animal that eats its preditor [predator] Camouflage is a way of tricking its preditor and hides itself from getting killed.	Behaviour Scorpions find a mate by dancing. Birds get girlfriends by singing. Worms find a mate by glowing. Deers [deer] find a mate by fighting with his antlers. Food Lions lick the fur off their prey with their hard tongues Prey Lions eat deers. .Birds eat worms. Cheetahs run fast to catch prey Camouflage Polar bears camouflage in the snow.	Behaviour Scorpions dance to find a mate. They fight to find a mate. Food Some animals eat meat and some eat plants. Some even eat each other. A lion has sharp teeth so he can eat animals Prey is what the animal hunts. For example lions eat deers ,zebras ect [etc] Camouflage Some animals hide where they think they can hide without being seen. For eg some lizards hide in trees and this is how they camouflage

Types and kinds of questions formulated: "Talking loads ...and wondering". The children were successful in finding the answers to the closed questions posed in these Internet workshops. The theoretical note (TN) written by the researcher in the memo, (Richardson, 2000), for workshop 3, expressed concerns about the

'satisficing behaviour' (Agosto, 2002a) of the children in approaching closed questions:

> The children were easily satisfied in finding the information ("that's enough") to answer closed questions (similar to the finding by Agosto, 2002). In looking for answers to questions, the children are copying answers directly from the text and the knowledge gained does not transfer to developing conceptual knowledge so the children are not conceptualising what 'adaptations' means. The types and kinds of questions asked and generated are crucial to develop conceptual knowledge (RDb,FN,W3,p5).

In workshop 4 and 5 the questions were both researcher-driven and self-generated by the children. The addition of a multisensory element to the QARs model provided not only a language for the children to discuss the types of questions formulated but also helped the children to formulate deeper kinds of questions. For example, in reading about the migration patterns of monarch butterflies the 'right there' question asked by group 3 was 'can they survive the long winter?' and the 'think and search' question was 'how do they survive in Winter without any food? In the Camtasia exit interview, conducted after workshop 5, the children showed both an emerging awareness of different question structures and how the types of questions formulated influenced subsequent reading processes. Jane commented, "the green ones have the answer there and so do the orange ones but you have to think as well, you have to think them over and you have to work hard" (RDb,FN,W5,G3,p4). The 'orange, think and search' questions encouraged conversations and deeper processing because as Aileen, in group 2 explained," you'd be talking loads 'cause you'd be wondering what the answer is" (RDb,FN,W5,G2,p13).

Developing vocabulary strategies. There was evidence emerging from the data that the children were monitoring vocabulary and developing some strategies to

construct vocabulary meaning. The children were asked to monitor words which might cause difficulty for a 'friend'. This enabled the children, especially the 'weaker' readers in each focal group, to reflect on words, which in fact were possibly causing them difficulties, without fear of ridicule from the others. It also enabled the groups to discuss the strategies used to decode and construct meaning for these words. Field note evidence suggested that the strategies used included accessing prior knowledge (Eileen explained 'tawny' as "brownie gold, mostly the colour of lions" [RDb,FN,W2,G3,p14]); Google image search for 'abalone'(RDb,FN,W2,G2); using semantic knowledge which Jane described as "say what it means and then read the sentence to see does it make sense"(RDb,FN,W5,G3,p6); or finally, using an online dictionary which was the least preferred option of the groups as Aileen noted that it " takes ages"(RDb,FN,W6,G2,p13).

Summarising: Locating and transforming information. The children had difficulties in condensing the amount of information located on a website into a summary and in distinguishing what was important from this information versus what was interesting to them. The 321 strategy adapted from the Florida Online Reading Professional Development (FOR-PD) (http://www.forpd.ucf.edu/strategies/strat321.html) was used to allow the children to begin a conversation about distinguishing what was important from what was interesting in an online text.

The ability to summarise depends on "sensitivity to importance" in text (Winograd, 1984, p406) and is difficult for struggling readers. Eileen in group 3 explained the difficulties in determining importance as "well, there could be loads of important bits and one could be more important than the other bits so it's hard to find

out which one is more important" (RDb,FN,W5,G3,p5). The class discussion at the end of workshop 2 suggested that the children had two approaches to determining importance in text. Firstly, author signalled cues in informational text structures, "if it's important it's going to be in bold writing or underlined and if it's interesting it would be wrote [written] down with all the others". Secondly, importance determined from a reader perspective as Aileen described "something is interesting you like it but something that's important it matters like" (RDb,FN,W2,p9).

In workshop 5, the children were asked to summarise an information section on whales. Written work sample showed a persistence of the copy-delete strategy across the focal groups with some development in the ability of group 3 to determine importance and summarise information.

Peer Collaboration: Social Learning and Social Support

The aspects emerging from the Internet workshops pertaining to peer collaboration were threefold and included (i) the active construction of knowledge as negotiated within the group; (ii) the ability of the group to expand an individual's personal understanding as a member of a group; and (iii) resolving conflict through negotiation within a group.

The class teacher and researcher, through a process of adaptive scaffolded support, gradually released responsibility for the activities within the workshops to the triad groups so that the ability of the groups to engage in peer collaboration was important. Daiute and Dalton (1993) in asking the question 'Can novices be Masters?', contended firstly, that with peer collaboration "children examine their own knowledge and beliefs as they require each other to repeat, clarify, expand, and justify their proposals and evaluations of text sequences"(p. 285) and secondly, that

when novices are collaborating the zone of proximal development (Vygotsky, 1978) is "relative and dynamic"(p. 289) as the "more knowledgeable other" changes within the group as children draw on their own different levels of knowledge and expertise within the group to share the activity.

The active construction of knowledge as negotiated within the group. The focal groups engaged in the workshops by actively constructing their knowledge as a group while planning, activating prior knowledge, monitoring, and evaluating the online information generated. Analysis of the transcripts of the focal groups' conversations, drawing on the frameworks suggested by Daiute and Dalton (1993) and Goatley, Brock and Raphael, (1995), suggested that the members of the focal groups assumed various changing stances within the group, such as adopting leadership roles, and initiating, explaining and responding within the group.

For example, in workshop 5, group 3 were attempting to answer the question 'What does the word *migration* mean?' The work sample written answer was *"When the place their* **[they're]** *in is cold they fly to somewhere that is hot and when it's cold over there they fly back"*. This work sample was constructed, as the following vignette illustrates, by group members initiating, responding, contesting and explaining. Eileen adopted a leadership role by directing activities within the group, reading screen text aloud for the group and focussing group members on the task. Codes adapted from Daiute and Dalton (1993) and Goatley et al. (1995) are included in square brackets.

Jane: My brother used to have a migration [initiate dialogue]

Leona: A migraine [respond with own suggestion]

Jane: Oh yeah, a migraine [respond repeat suggestion verbatim]

Eileen: We have to predict first together and then read the first section to make sure you know the meaning. Right, have a guess what migration means. [leadership role direct activity]And no it's not a migraine. [contest disagree]

Leona: I think it's pain [respond with suggestion]

Eileen: I think it's when they're moving around or something [respond, with suggestion]

Jane: Yeah I think it's when you're moving around [respond, repeat suggestion]

Leona: Yeah [agreement]

Eileen: Right we have it [affirmation of group]

Jane: Do we have to write it down? [Initiate with question]

Eileen: No, write the meaning here [respond, suggestion with explanation] 'some animals that migrate fly to where they are going but some do have to walk or even swim. You're probably wondering why these animals don't just turn on the heat or put on a jacket, but they aren't as lucky as YOU and I!' [adopt leadership role, reading aloud information from screen] Wait don't click on that.[issue instruction] I think it's when they're cold, when the summer turns cold they fly away to go to a hot place and when it's cold over there they fly back to the hot place.[respond, suggestion with explanation](RDb,FN,W5,G3,p1)

Leadership roles included reading information aloud for other members of the group, offering explanations, engaging and keeping members focussed on the task activity, writing summaries for the group, and directing the activity within the group. For example, in the following exchange in group 1 Chrissie is sharing her knowledge of a hyperlink with Kylie by explaining and demonstrating:

Chrissie: You don't know about a hyperlink do you? Hold on I'll show you.

Kylie: Chrissie just tell me.

Chrissie: No, you have to see me. [shows hyperlink on screen].That's a hyperlink when that hand comes up, it's a hyperlink. So that means there's stuff inside it (RDb,FN,G1,W4,p8).

Summary of Aspects of Themes Emerging from RDCWL Phase 1b

There was growth in the ability of the children to use online informational text structures, such as the 'edit-find' feature. This enabled the children to navigate their way to online information with increased efficiency and speed. The children's ability to self-regulate developed across this series of workshops. There was more evidence that the children monitored difficult vocabulary, formulated higher levels of questions and activated and connected with a growing domain knowledge of the project theme of animal adaptations to their environment. Although there was more awareness of determining importance in text, difficulties with summarisation persisted. Peer collaboration enabled children to extend individual knowledge as group members affirmed, contested, extended and challenged knowledge and strategy use within the groups.

Summary of Macro Analysis in the RDCWL Phases

A qualitative analysis of the data of the RDCWL series of Internet workshops at this stage of the study revealed issues relating to end-user application knowledge, deployment of online reading and information-seeking skills and strategies and the influence of peer collaboration in an online environment.

In relation to end-user application knowledge data suggested the need to (a) explicitly teach online informational text structures to aid easy access to online information and (b) develop navigational skills to enable readers to access information with speed and to help orient struggling readers online. Well developed navigational skills reduce the expenditure of cognitive processing capacitates on navigation through a complex domain as the reader/user orients him/herself on the Internet.

The online reading comprehension strategies used by the children included activating prior knowledge, inferencing, formulating questions, determining importance, monitoring, summarising, and critical evaluation of information. The children had little prior knowledge of minibeasts to draw on in the web quest conducted in RDCWL Phase 1a. This limited their capacity to draw on prior vocabulary knowledge to formulate questions; generate search strings; or determine importance in text. The series of five workshops conducted in RDCWL Phase 1b attempted to develop the prior domain knowledge of the children of the project theme of animals and adaptations to their environments prior to commencement of the Main Study in year two. There was evidence that the children were independently accessing and forging connections with a range of prior knowledge sources as the study progressed. The children had difficulty with predictive inferencing of hyperlinks in an online environment. Predictive inferencing is more complex in an online environment as readers have few contextual cues to draw on when activating hyperlinks. There was some growth in the ability of the children to formulate questions with suggested growth from literal type questions to more conceptually challenging questions as the study advanced. The ability to formulate

questions is important in an online environment as such questions drive the search for information. Difficulties with summarisation proved more difficult to rectify. The children persisted in using a copy-delete strategy as a summarisation technique. There was some growth in the ability of the 'better' readers in each group to rephrase, cluster and integrate information as a summary. It was difficult for these children to differentiate between reader determined importance and author determined importance in text. This compounded the difficulties the children experienced with summarisation. Critical evaluation of information online also presented difficulties for these children because they were drawing on limited past online experiences and domain and topic knowledge to evaluate credibility, authority, reasonableness, believability, and author motive.

Peer collaboration supported the children to engage in self-regulated reading processes, such as planning, monitoring and accessing prior knowledge to actively construct knowledge and meaning within the group. It also facilitated a deeper processing of texts. Peer collaboration helped to increase awareness of prior knowledge and strategy use within the triad groups as group members affirmed, challenged and extended one another's contributions. Finally, such collaboration appeared to engender motivation, self-efficacy and engagement where group members conversed as equals with changing levels of expertise in undertaking Internet workshop activities.

CHAPTER SEVEN

ANALYSIS OF THE MAIN STUDY WITH THE 5TH /6TH CLASS COHORT

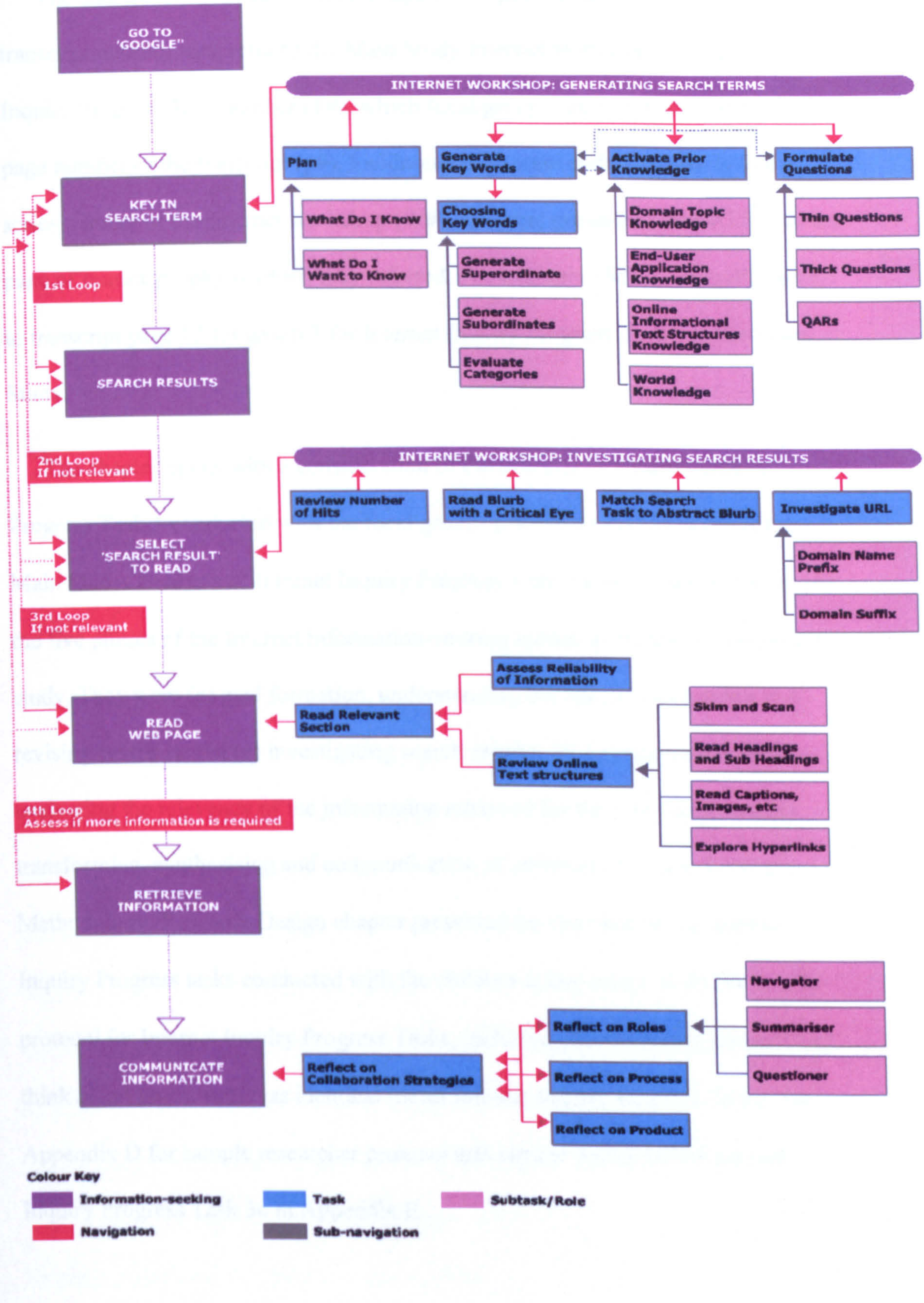
Introduction

This chapter presents analysis of the Main Study phase of the present study conducted in the second year of the study, when the class cohort was in 6th class. The Main Study phase continued on from the series of Internet workshops conducted in Phase 1a and Phase 1b of the Reading Development and Critical Web Literacy Phases (RDCWL). The chapter is structured chronologically using the timeline of the study as its organisational structure. The design of the intervention evolved formatively, underpinned by the iterative nature of the F&DE framework. The Main Study consisted of a series of (a) Internet Inquiry Progress Tasks conducted at key stages of the Main Study with the focal groups; and (b) 12 Internet Workshops conducted with the class cohort in the computer room. Analysis was conducted at a macro-level (Internet Inquiry Progress Tasks and at a micro-level (Internet Workshops) to capture the complexity of the learning ecology in the classroom. This analysis allowed the researcher to explore the progress of the children in conducting Internet inquiry (and adjusting the instructional content of the Internet workshops accordingly) and to assess the development of online reading and information-seeking skills and strategies among the children within the context of an integrated curriculum.

The intervention, which evolved over the course of the Main Study, is presented in Figure 7.1. This schematic representation presents key dimensions of information-

seeking and reading comprehension during Internet inquiry and is meant to guide the reader of this thesis in indicating areas of focus that were present all the way through the work, and which represent the overall scheme for what was done, what we wanted the reader to be doing during Internet inquiry, and as an overview of the Internet workshop curriculum that was guiding the work. Generating Search Terms workshops relate to Main Study Internet workshop 1 to 4, and Investigating Search Results refers to Main Study Internet workshops 5 to 8, where the focus was on these key dimensions of Internet inquiry. However, it is important to note that the skills and strategies related to generating search terms and investigating search results were not developed as isolated skills, but rather, were developed in an authentic Internet inquiry project, within an integrated classroom curriculum framework. Furthermore, elements of the Main study design, were informed by analysis of the RDCWL phases of the study, and built on developing and deepening the online skills and strategies developed in the earlier RDCWL phases in a spiral fashion.

Figure 7.1. A schematic representation of key aspects of information-seeking during Internet inquiry: Design of the Main Study.



Data Transcript Source Codes Used in Chapter Seven

The data transcript codes used in Chapter 7, to provide an audit trail to the transcript data sources, refer to the Main Study Internet workshops (MS), the Internet Inquiry Progress Task number (T#), which focal group was involved (G#), and the page number of the transcript (p#). Fieldnotes (FN) were coded according to the series number of the Internet workshop (W#), the focal group involved (G#), and the page of transcript (p#) to which they referred. For example, (MS,T3,G3,p12) refers to transcript page 12 for group 3 for Internet Inquiry Progress Task 3 in the Main Study.

The chapter opens with a consideration of the analysis of Internet Inquiry Progress Task 1 conducted with the focal groups prior to commencement of the Main Study. Analysis of Internet Inquiry Progress Task 1 is discussed in relation to the five phases of the Internet information-seeking model, as defined in the present study. They were (a) goal formation, understanding the task; (b) generating and revising search terms; (c) investigating search results; (d) locating and critically evaluating the relevancy of the information retrieved for the task focus; and (e) transforming, synthesising and communication of information. Table 4.1 in the Methodology: Research Design chapter presented an overview of the Internet Inquiry Progress tasks conducted with the children at key stages of the study. The protocol for Internet Inquiry Progress Tasks, including the researcher protocol and think aloud procedures was identical for all Internet Inquiry Progress Tasks. See Appendix D for sample researcher protocol and sample worksheet for Internet Inquiry Progress Task 3c in Appendix E.

Internet Inquiry Progress Task 1 Analysis

The analysis of the pupils' information seeking processes in conducting Internet inquiry for this task suggested that the pupils' approach to information-seeking during Internet inquiry was recursive and opportunistic. Selecting search terms, investigating search results and selecting and extracting information occurred in cycles and interfacilitation between these processes occurred. For the present study, one cycle of information-seeking was delineated when the groups changed and revised the search string used. Recursion back to the search results page could occur a number of times within one information-seeking cycle. Internet Inquiry Progress Task 1 (*Find out what you can about how animals have adapted to living in the Antarctic)* was conducted with the focal groups in January 2007.

Goal Formation and Planning: Internet Inquiry Progress Task 1

At this stage in the Internet inquiry project, the pupils did not have a clear notion of how to plan and approach goal formation. In their discussions, group 1 focussed on micro-elements of the task "like how they [animals] change and like where they live and those sorts of things" and whether the Antarctic was a "sea" or "desert lands" (MS,T1,G1,p1). Group 2 focussed on key terms within the task like "animals and how they live in the Antarctic" or "animals in the Antarctic" (MS,T1,G2,p1). Group 3 took a more holistic view of the task "we have to look up what life is like on the Antarctica [for] animal adaptations" adopting a broad sweep approach followed by a narrowing of focus as Eileen explained, "I'd put in Antarctic and then when you get the thing about Antarctic you put in animal adaptations" (MS,T1,G3,p1) There was no overt reference to prior domain knowledge of the task focus. This was surprising given the hands-on activity undertaken with the zoo-keeper prior to the

Main Study and the five Internet workshops based on building domain knowledge of animal adaptations. This may suggest that although the children had prior knowledge of the domain topic of animal adaptations, they did not have the self-regulatory strategies to invoke this knowledge and lacked the metacognitive awareness to apply this prior domain knowledge to the task at hand (Hacker, 1998).

Generating and Revising Search Terms

The ability of the focal groups to generate and revise search terms depended on their ability to discuss and plan revisions together. The search terms used across the groups as shown in Table 7.1 were broad terms, either *single* or *multiple terms*, or *natural language phrases* based on the focal groups' understanding of the task. For example, when group 3 decided to "go back to the beginning and try again" Lara wanted to try Google images and <adaptations>, however, Eileen noted that they were "not looking for pictures" and the group decided to use the search string <Animal adaptations in the Antarctic> because "it might give a better response like" (MS,T1,G3,p5). Group 1 meanwhile, persisted with broad, single term search strings, with limited revision, and based loosely on micro-elements within the task, disputing the task focus with each other. Bridie wondered "lands would it be?" while Chrissie thought "seas" then "animals" before deciding on "seals". Both of them ignored Kylie who thought they should use the search string "animals and adaptations" (MS,T1 G1,p8). This suggested limited levels of collaboration within the group. Groups 2 and 3 also used the online spelling help offered by Google <did you mean> to revise their incorrect spelling of search strings.

Table 7.1 *Search Strings Generated by Focal Groups for Internet Inquiry Progress Task 1*

Search String Code	Group 1	Group 2	Group 3
S1. Single term	<lands> (S1)	animals in their antarctic (S3)	<antartic> (sp) (S1)
S2. Multiple terms based on the task	<antartic> (sp)(S1)	<animals and their adaptations to the antarctics> (S3)	<animal adaptations> (S2)
S3. Natural language phrase			
S4. Natural language phrase in question format	<seals>(S1)	<antarctic animals>(S2)	<animal adaptations in the antartic>(sp) (S3)
S5. Topic plus focus			
S6. Topic plus focus multiple terms	<animal lands> (S3)	<animals in the antarctics> (S3)	<antartic >(sp)(S1)
S7. Topic plus focus (synonym(s)/ subordinates)	<antartic animals> (sp)(S2)	<the antarctic> (S3)	**STOP**
S8. Topic plus focus (superordinate(s),		**STOP**	
S9. Dot com	<antartic desert>(sp) (S3)		
S10. Other	**STOP**		
(Coding adapted from Guinee et al., 2003)			
Cross group comparison of search string generation: Researcher's overview of group activity.	Group 1 used broad search terms either *single, multiple terms or natural language* phrases.	Group 2 used mostly *natural language phrases* based on their understanding of the task.	Group 3 used *single, multiple and natural language phrases* based on their understanding of the task.

Note. Sp refers to a spelling error in the search term generated

Investigating Search Results

The focal groups adopted two strategies at this stage of the study to investigate search results. Firstly, as shown in Table 7.2 a '*snatch and grab'* approach, which in the present study refers to clicking on the first or second result displayed, with little

comment and without scrolling down the page of results ("Will we go into this one? Yeah, go on" (MS,T1,G3,p1). Secondly, a '*limited strategic scrolling'* approach at two levels referring to (a) clicking on each result in turn or (b) choosing a result with limited self-regulated monitoring of the hyperlink heading or the descriptive paragraph abstract under each result commonly referred to as the '*blurb*'. Overall, there was no investigation of the search results with reference to the URL domain name prefix or suffix. There was some evidence from the data suggesting that groups 2 and 3 were monitoring the search results for relevance to the task. For example, Aileen noted, "we're looking to see if there is anything about the Antarctic…we're going to the next page of Google, because we can't find anything on the first page….we're going down to Antarctic and fur seal. This? Will we read it?" (MS, T1, G2, p3)

In group 3, Eileen in reply to a researcher question, "What are you thinking now?" showed some level of monitoring of results when she replied, "that the ones at the end are all nearly projects, different types of animals … and that will tell you facts about the Antarctic. You may have homework to do, so you need facts about Antarctic and its animals" (MS,T1,G3,p13). In the Camtasia exit group 3 reflected on how they had conducted Internet Inquiry Progress Task 1 with regard to investigating search results:

> Lara: We could have like, went into more like.
>
> Jane: Yeah, we could have gone into loads of them little things that you can click on.
>
> Eileen: Yeah, before we went in, we should have read what was underneath them… before you click it tells you the stuff that is going to be in it (MS,CInt,G3,p4).

These comments suggest that the groups were developing an awareness of the need to pay attention to the information contained in search result blurbs.

Table 7.2 *Actions of the Groups in Clicking on Search Result in Each Cycle of Information-Seeking in Internet Inquiry Progress Task 1*

Cycle of Information Seeking	Group 1	Group 2	Group 3
1st cycle	Click 2nd result (0)	Click on 1st result (0) Click on 1st result (0) (Google results page 2 pages 11-20) Click on 6th result (1) then (2) 10th result (2)	Click on <I'm feeling lucky> Click on 3rd result (1) then (2)
2nd cycle	Click 2nd result (0)	2nd result (0) 1st result (1) then (2)	Click on <I'm feeling lucky> Click on <did you mean> Click on 1st result (0) Click on 2nd result (1) Click on 3rd result (0) Click on 6th result (1) then (2) Click on 10th result (2)
3rd cycle	Click on 2nd result (1)	Click on 0 results (Error message displayed on Yahooligans search engine screen <no matches for your search query>)	Click on 0 results (Error message displayed on Yahooligans search engine screen <no matches for your search query>)
4th cycle	Click on 1st result (0)	2nd result (1) 1st result (1) 3rd result (1)	Click on 1st result (2) then (1) **STOP**
5th cycle	Click on 1st result (1)	2nd result (1) **STOP**	
6th cycle	Click on 1st result (0) **STOP**		

Note. Scrolling activity determined from Camtasia activity record indicated in brackets. (0) refers to no scrolling; (1) scrolling down (2) scrolling up.

Note. One cycle of information-seeking is completed when the search string is revised or the group finished searching for information.

Locating, Transforming and Communication of Information

The success of the groups in locating relevant information for Internet Inquiry Progress Task 1 depended on how effectively they planned, generated and revised search terms for the task; their ability to monitor and choose search results; and their ability to skim and scan web pages efficiently and judge and evaluate the relevance of information found to the task. Their success was also underpinned by their ability to collaborate and help one another with the task.

In brief, the researcher made a judgement on how successful each of the groups was based on three types of evidence. Firstly, group 1 generated a list of animals living in the Antarctic as a result of their Internet search. They didn't have any references to adaptations and as this was a requirement of the task they were deemed to be *least successful* of the three groups. By contrast, Group 2 did ascertain some adaptations related to penguins living in the Antarctic, although there was no sense of audience in the written information on the work sample. For example, they wrote *"they can dive deep so they can live in extreme places"* without conveying that this information was related to penguins. Aileen commented in the Camtasia exit interview "it doesn't have anything about adaptations it is just telling you about penguins" (MS,T1,CInt,G2,p2). Group 2 were *somewhat successful* by comparison to Group 1. Group 3 were the *most successful* group in generating information mostly using a copy-delete (Brown & Day, 1983) strategy with some evidence of rephrasing and summarisation of information. They generated information of four physical adaptations made by a number of animals living in the Antarctic. For example, they generated information on the work sample related to penguins, whales and seals *"Penguins have four layers of feathers. Whales, seals and penguins have*

thick fur layer. An elephant seal can live off their fat reserves during summer. Penguins recycle their own body heat" (MS,T1,G3,worksample).

The children were reading the content of the websites more fluently when compared to the baseline Sick Rabbit Task (SRT). However, it was obvious that the amount of information and the density of information on online websites were still problematic for the children. An important aspect of locating, transforming and communicating information in Internet inquiry relates to the issue of information overload. This is particularly difficult for struggling readers. Reading is hard work for these struggling readers as the following illustrative interchange between Jane and Lara in group 3 suggests; "Oh my god, look at all that writing, do we have to go reading all that? (Jane) Yeah, reading all that and there might even be anything on it" (Lara) (MS,T1,G3, p10). The children, however, were developing more understanding of online informational text structures and features. For example, they strategically used the 'edit-find' feature to good effect to skim and scan the document for keywords as Eileen explained, "because you click and type in a word and you click on 'find next' if the words on the page that will highlight it and then you read that part" (MS,T1,G3,p10). They also used the Google online help feature <did you mean> to monitor and help with spelling difficulties as "if you spell it wrong it comes up...and it gives you the right spelling, ...so you did know the word 'kids' and didn't know how to spell it, and you typed it in and we can't spell it, it will come up" (MS,T1,CInt,G3,p2).

In sum, the analysis of Internet Inquiry Progress Task 1 suggested significant development in the children's end-user application knowledge and their ability to navigate between and within websites. There was little evidence of the disorientation

experienced in the earlier SRT Internet inquiry task. The degree of success with which the focal groups conducted Internet inquiry, was dependent on the level of end-user application knowledge, the online reading strategies employed, and the degree of collaboration between members of the focal groups. Evidence emerging from the data suggested that developmental differences were beginning to appear between the three focal groups. These differences related to (a) use of self-regulatory reading processes; (b) flexibility in generating search terms and recovering from unsuccessful searches; and (c) the levels of metacognitive knowledge at a declarative, procedural or conditional level i.e. knowing what, when, how and why to use a particular strategy (Paris et al., 1983).

The children needed to develop their abilities to connect and engage with their prior knowledge of the domain topic and discuss their plans for acquiring new information. In order to locate information efficiently, they needed to acquire more effective skills and strategies in generating search terms and investigating search results. The instructional content in the first four workshops in the Main Study focussed on developing skills and strategies in terms of 'Generating Search Terms'.

Main Study Internet Workshops 1-4 with Focus on Generating Search Terms

This section will report on the Internet workshops 1 to 4 with a primary focus on Generating Search Terms. Table 7.3 provides a condensed overview of the instructional content, skills development class discussions and reflections on the aspects of themes that emerged from a range of data sources (previously described) for Main Study Internet workshops 1 to 4.

Table 7.3 *Instructional Content, Skills Development, Reflection by Class Cohort and Aspects of Themes Emerging From 'Generating Search Terms' Internet Workshops 1 to 4*

Generating Search Terms	Instructional Content	Skills Developed	Reflection by Class	Aspects Emerging from the Learning Ecology
Workshop 1	Planning search terms. Narrowing focus of inquiry. Critiquing search terms. Generating effective search strings.	Formulating questions. Accessing prior knowledge. Assessing search strings. Using the 'Theme, topic focus, question' strategy.	*Final reflection class share*	• Use of self-regulated online reading strategies
Workshop 2	Planning for Internet inquiry. Brainstorming questions for Internet inquiry. Categorising questions under superordinate terms.	Formulating questions. Developing vocabulary knowledge. Creating synonyms and superordinates.	*Initial class share* at beginning of workshop *Quick share* in middle of workshop	• Role of teacher as co-learner and mediator of online Internet skills development
Workshop 3	Introduction of the roles of Questioner, Navigator and Summariser to the class.	**Questioner role** Planning, monitoring and revising search terms.	*Initial class share*	• Role of peer and social collaboration in online Internet-inquiry
Workshop 4	Consolidation of the roles of Questioner, Navigator and Summariser with the class. Introduction of prompt cards for roles.	**Navigator role** Developing end-user application knowledge. **Summariser role** Clarifying vocabulary, synthesising information.	*Initial class share*	

Main Study Internet Workshops 1-4 with Focus on Generating Search Terms: Instructional Content, Skills Development and Class Reflections

Instructional Content and Skills Development

The explicit strategy instruction conducted in the form of a mini-lesson in Main Study workshop 1 focussed on planning, evaluating and critiquing search terms for Internet inquiry. (See Appendix F for list of mini-lessons and Appendix G for sample Internet worksheets). The 'theme, topic, focus, question' strategy (Eagleton et al., 2003; Eagleton & Dobler, 2007) was introduced for narrowing a search focus. Explicit strategy instruction in workshop 1 was followed by a gradual release of responsibility, where the children applied the skills introduced in the workshop with scaffolded help from the researcher and the class teacher.

The instructional focus in workshop 2 moved to planning Internet inquiry by brainstorming and categorising possible focus questions in a topic domain. The skills developed included accessing prior knowledge, expanding the types and kinds of questions formulated, and developing superordinate and subordinate keywords for generating search strings. Summarisation skills were developed by creating written summaries for a 'friend' of the information generated for the inquiry using the 321 strategy (FOR-PD previously described).

In Internet workshops 3 and 4, the children conducted independent work based on the topic theme of 'animal adaptations to their environment' focussing on the biome that were investigating. This allowed the children to apply the knowledge they had gained in generating search terms from previous workshops in the context of an authentic online inquiry. The interchangeable roles of Questioner, Navigator and Summariser, (emulating the Reciprocal roles of Palinscar & Brown, 1984), with

prompt cards as temporary scaffolds, were introduced in workshop 3, to aid planning, discussion and collaboration. The role of the questioner was to discuss the focus questions of the inquiry with the group; plan and revise the search terms generated; and monitor the effectiveness of the search strings for the inquiry focus. The role of the navigator related to the deployment of end-user application knowledge, such as backtracking, the use of online organisational features and the activation of appropriate hyperlinks. Finally, the summariser role encompassed the summarisation of information; judging the relevance of the information generated for the search focus; and clarifying and monitoring difficult vocabulary.

Class Reflections

The children reflected on the process and product of the Internet Inquiry at three stages within these workshops. Firstly, they reflected in the form of an initial class share session at the start of the Internet workshop, where the class group focussed on what they had learned in previous workshops. Secondly, quick shares occurred at points within the Internet workshops where the group reflected on or shared their focus questions, the navigational skills they had developed, or the information retrieved, with the rest of the group. Finally, the class reflected both as triad groups (written) or as final reflection class share sessions (oral) on what they had learned within that particular Internet workshop.

Aspects of Themes Emerging From the Learning Ecology in Main Study Internet Workshops 1 to 4: Generating Search Terms

This section presents evidence, from inductive and deductive analysis of a large range of data sources, of the children's use of the Internet, and their learning within these Internet workshops. The aspects of themes emerging from Main Study

workshops 1 to 4 relate to (1) the use of self-regulated online reading strategies during the Internet workshops, related to generating, evaluating and critiquing search terms and formulating questions; (2) the role of the class teacher in Internet workshop as a co-learner and co-constructor of knowledge; (3) the role of peer collaboration and social learning during Internet inquiry.

The use of Self-Regulated Reading Strategies in Internet Workshop Related to Generating, Evaluating and Critiquing Search Terms and Formulating Questions

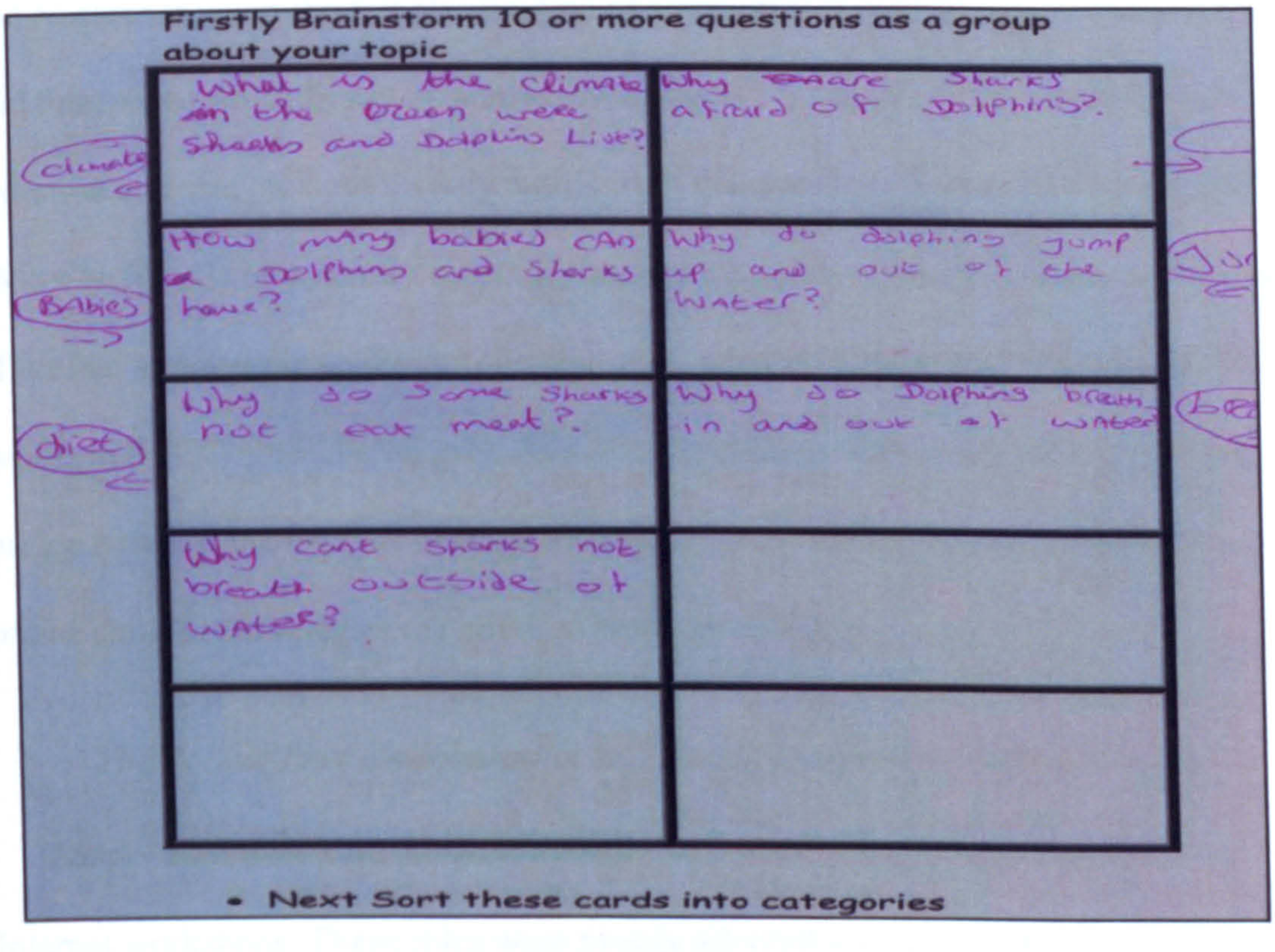
The initial class share at the start of Main Study workshop 2 suggested a growth in the ability of the groups to access prior knowledge in relation to generating search strings as the following extract from the conversation suggest:

> The more details that you put it the easier it is to find it...the plus sign is better... we have to think of something we already know... you ask a question...think what you know about it and think is it too broad a term (MS,FN,W1,p1-2).

There was some evidence of the use of self-regulated reading strategies relating to accessing prior knowledge, monitoring search results in relation to the origin of sites and monitoring the relevance of the information retrieved. The children had considerable difficulty in formulating self-generated questions for Internet inquiry and required extensive scaffolding to develop the types and kinds of questions they formulated. The focus in workshop 2 was on encouraging the children to ask more conceptually based questions and on formulating and categorising questions into 'thick' and 'thin' questions drawing again on the QARs model (Raphael & Au, 2005). Following explicit strategy instruction in formulating and categorising questions into superordinate categories the children independently formulated and categorised their own questions. Evidence from the conversations of the children and written questions on their worksheets (See Figure 7.2) suggest that there was some

growth in the types and kinds of questions formulated across all of the groups from literal type questions to more conceptually based questions.

Figure 7.2. Brainstorm and categorisation of questions: Work sample from group 1.



The Role of the Class Teacher as a Co-Learner and Co-Constructor of Knowledge, with the Children, in Internet Workshop

Explicit strategy instruction in the Internet workshops at this stage of the Main Study was provided by the researcher (at a later stage the class teacher undertook this role). The role adopted by the class teacher during the early workshops in the Main Study was that of co-learner and co-constructor with the children of the skills and strategies of searching for information during Internet inquiry. For example, in Main Study workshop 1 when the researcher was explaining the need to read and investigate search results rather than just choosing the first result randomly the class teacher commented, "I do that all the time and get frustrated, the plus sign and the

key words, I wouldn't have known that. I have learned something that I don't do very well so this is brilliant advice girls" (MS,FN,W1,p1). She also mediated the instructional content for the class during Internet workshop and provided advice for the researcher when she felt clarification of instructional content was necessary. She did this in two ways; firstly by summarising the skills taught ("You write the question and you pick out the key words from the question, did everyone get that?") (MS,FN,W2,p2) or secondly by clarifying and querying workshop content, ("Maybe if we had an example so if your question was 'what do Koalas eat' what are the key words in that?") (MS,FN,W2,p2). As such, the class teacher provided a mediating bridge between the explicit strategy instruction provided by the researcher and the online skills and strategies the children were developing.

The Role of Peer Collaboration and Social Learning in Internet Inquiry

Leadership roles were adopted by members of the focal groups during the Internet workshops. These roles were mostly adopted by the 'better' readers in each group and focussed on initiating planning, the construction of search strings, reading aloud on-screen content, and providing help with the spelling of search terms. Aspects emerging pertaining to the role of peer collaboration in these workshops included the ability of the focal groups to remain on task within the session; and the resolution of disputes within the groups.

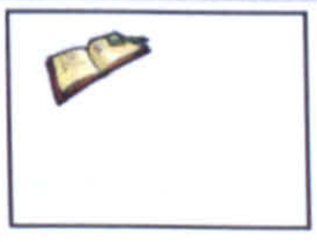
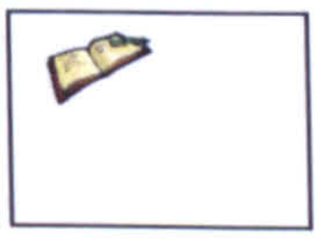
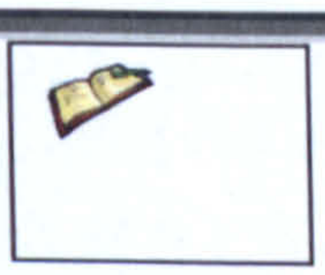
The onsite observational notes written by the researcher immediately following Internet workshop 2 noted that the children "were all focussed on the task at hand and remained motivated throughout the workshops. The noise level within the computer room remained low and there was a noticeable buzz of busy work within the groups"(MS,FN,W2, p16). However, when the conversations of the groups were

transcribed and analysed it became apparent that there were a small number of off-task incidents across the groups which were not related to the focus of the Internet inquiry. Nevertheless, the children had successfully completed the worksheets for the workshop and a review of the Camtasia recorded files indicated that while the children were conducting conversations, cursor activity was still occurring on-screen. This suggested that the children were working with divided attention and focussing both on the activities within the Internet workshop and conducting conversations unrelated to the focus activity.

Disputes arose within the focal groups related to planning the focus of Internet inquiry (for example, the types and kinds of questions formulated), and the roles undertaken by individuals within the groups. This was particularly the case in groups 1 and 2 where individual members of the group disputed whether they were the 'typers', 'writers' or 'clickers' on a particular day.

Following analysis of the Internet workshops at this stage of the Main Study, and in line with the iterative framework of F&DE (Reinking & Bradley, 2004), where barriers to the successful implementation of the goal of the study could be considered, adjustments were made to the intervention based on this analysis. Reciprocal roles were introduced building on the children's own interpretations of the roles of 'typer', 'clicker' and 'writer' within the focal groups. The interchangeable reciprocal roles of 'Questioner', 'Navigator' and 'Summariser' were introduced in Main Study Internet workshops 3 and 4. Examples of the prompt cards developed as temporary scaffolds for these roles are shown in Figure 7.3 and the Questioner, Navigator and Summariser bibs worn by the children in Internet workshop are shown in Figure 7.4.

Figure 7.3. Samples of the prompt cards provided for the children for the roles of Questioner, Navigator and Summariser.

Questioner	Navigator	Summariser
 What are we trying to find out today?	 Which link should we follow?	 What's the most important information here?
 How will we pick our key words? What are our key words?	 Will we read the blurb under each search result?	 Let's skim and scan to see if this website is useful for our question.
 Are there any other words we could choose for our search term?	 Will we scroll down the page?	 What would we tell our friend?

The children accessed their prior knowledge of reciprocal roles within the classroom (predicting, summarising, clarifying and questioning) (Oczkus, 2003) and the roles of 'Artful Artist', 'Passage Picker', 'Connector' and 'Questioner' from their literature circles (Daniels 2002) in constructing the activities related to each role. The navigator they deemed to be the "finder or clicker" who "scans the [results] page and decides what to click into [as the] first one [hyperlink] might be good but the last one might be better" (MS,FN,W4,p3). The questioner's role was "to make the

question that you want to find out...shorten the search terms so it won't be too broad ...use the plus sign it tells the computer that you want the two of them" (MS,FN,W4,p1). The summariser's role was to "pull the most important things, put it in your own words and size it down [and] say what it's about in one sentence...some of the words might be in like dark print so you know to use them... and see the words we don't understand"(MS,FN,W4,p3). The children wondered about the 'clarifier' and 'connector' role deciding that clarifying the meaning of vocabulary and connecting with prior knowledge would also be part of the summariser role.

Figure 7.4. Bibs worn by focal groups for the interchangeable roles of Questioner, Navigator and Summariser.

Following the introduction of the online reciprocal roles there was less evidence of off-task activity in workshops 3 and 4 across the focal groups. Evidence from the data suggested that the stepped structure afforded by the roles provided support and

guidance for the groups and encouraged a sense of shared responsibility, enabled them to critique online activity, and helped to engage and motivate the children. For example, group 2 commented that "this is the first week we didn't fight". Bridie in group 1 motivated and urged the others in the group to engage with the workshop activities "we need to put in a bit more effort than we have been doing" (MS,FN,W4,G1,p26).

In sum, explicit strategy instruction provided by the researcher in the Generating Search Terms workshops focussed on planning, evaluating and critiquing search terms for Internet inquiry. The children applied the skills and strategies in these workshops with scaffolded help from the class teacher and researcher. Evidence from analysis of the data suggest that the children were beginning to engage in self-regulatory reading processes relating to accessing and engaging with prior knowledge, formulating questions to guide Internet inquiry, evaluating search terms and monitoring search results. The class teacher adopted the role of co-learner and co-constructor of knowledge with the children acting as a mediating bridge between the instructional content provided by the researcher and the online skills the children were developing. Data analysis suggest that the introduction of the reciprocal roles of Questioner, Navigator and Summariser provided the children with roles to focus and structure their activities within Internet inquiry. Likewise, the class reflections at key stages seemed to enable the children to share insights of skills and strategies developed during Internet inquiry with the class group as a whole.

Following the four Internet workshops where the instructional emphasis was on generating search terms the focal groups were asked to independently complete an untimed Internet Inquiry Progress Task. Analysis of the multifaceted range of data

sources available for Internet Inquiry Progress Task 2 allowed the researcher to document and analyse possible developments within the focal groups in conducting Internet inquiry. Task 2 also allowed for comparisons to be made to earlier Internet Inquiry Progress Tasks. Analysis of the tasks also provided evidence of the effectiveness of the teaching and scaffolding provided in Internet workshops 1 to 4.

Internet Inquiry Progress Task 2

In Internet Inquiry Progress Task 2 the focal group children were asked to find information online relating to the adaptations animals made to where they live. The children generated information relating to a named, previously unexplored, animal, from the biome chosen by them for investigation in the class project. Therefore, the groups in turn looked for information on sharks (group 1; Oceans and Seas); gila monsters (group 2; Deserts) and brown bears (group 3; Forests).

The aspects of themes emerging from within the ecology of learning following analysis of the data included (i) the use of self-regulatory processes involved in the information-seeking cycle; (ii) the level of metacognitive awareness of the focal groups in relation to the levels of knowledge at a declarative, procedural, and conditional level, and the ability of the group to flexibly apply such knowledge in the ill-structured domain of the Internet (Spiro et al., 2004); and (iii) the ability of the focal group members to motivate each other, engage with the task, and engender self-efficacy within the group.

These aspects are discussed within the phases of online information seeking model which include (a) goal formation, understanding the task; (b) generating and revising search terms; (c) investigating search results; (d) locating and critically

evaluating the relevancy of the information to the task focus and (e) transforming, synthesising and communication of information. In the sections which follow attention is drawn where appropriate to possible developmental differences *across* the focal groups as they conducted this Internet task; and monitoring the progress in conducting Internet inquiry *within* each focal group from earlier Internet Inquiry Progress Tasks.

Goal Formation and Planning: Understanding of Internet Inquiry Progress Task 2

There was good understanding across the groups of the goal of Internet Inquiry Progress Task 2, which was to ascertain how a named animal adapted to where they lived. For example, the written response of group 2 noted that it was to find out *"where they live and how they survive and what do they eat"* Groups 1 and 3 activated to some extent their prior knowledge of the biome in which their animal lived. For example, in group 1 "to see where they live but I think some people know that already...so how they adapt in the ocean" (MS,T2,G1,p3). There was, however, no evidence of extensive planning prior to conducting the task in the discussions of the three groups.

The Ability of the Groups to Create and Revise Search Strings

Analysis of the data suggested that the groups were generating search terms by focussing on key words within Internet Inquiry Progress Task 2 and using the topic plus focus strategy to generate search terms (Eagleton et al., 2003; Eagleton & Dobler, 2007). Differences which emerged between the groups related to (i) the flexibility of the groups in recovering from unsuccessful search string generation and (ii) the ability of the groups to engage in self-regulatory processes in each information-seeking cycle.

Flexibility in Generating and Revising Search Terms

As illustrated in Table 7.4 group 1 initially used the *topic plus focus* strategy <sharks + adapt> for search term generation. This was followed by using *natural language* search strings, such as <where sharks lives>; and <how do sharks live> in later information-seeking cycles. While group 1 displayed procedural and declarative knowledge in generating search strings ("it's too broad, we'll have to narrow it down", MS,T2,G1,p5), they lacked the flexibility in generating search strings to do so, thus suggesting a lack of conditional knowledge of when to revise search terms when they proved ineffective. This resulted in frustration within the group typified in Bridie's comment, "do something better or something...I just don't know what to do" (MS,T2,G1,p13). Both group 2 and 3 initially used *broad single term* search strings <gila monster> and <brown bears> respectively and though each group were successful in generating some information for the task from this 'shopping mall' approach (Eagleton & Dobler, 2007) they quickly narrowed the search strings until as Nicky noted they were "just right" using the *topic plus focus* strategy flexibly thus suggesting a level of conditional knowledge. Groups 2 and 3 used superordinates, synonyms and subordinates to generate search strings drawing on prior knowledge of the domain and topic vocabulary to modify the search strings generated in each information-seeking cycle. Group 3 also activated a search strategy that had been successful for them during earlier Internet workshops, showing an adaptive flexibility in strategy use and an emerging confidence built on prior success. For example, Leona suggested to the group, "I wonder if you go into 'biomes', and I went in there yesterday and got loads of, millions of [information], what if you went into the forest and then you could see loads about the bears and all" (MS,T2,G3,p15).

The Use of Self-Regulatory Processes in Generating Search Strings

Clear differences emerged between the groups in relation to the ability of the focal groups to engage in self-regulatory processes in generating search strings in each information-seeking cycle. The level of success experienced by the groups in generating and revising search strings related to the ability of each focal group to engage in discussions and reflections of the possibilities, related to self-regulatory processes including planning, monitoring, questioning and evaluating each search string generated. There was limited evidence from the data that groups 1 and 2 engaged in self-regulatory processes. For example, in group 1 in relation to planning when Bridie noted "right I'm going to write sharks and adapt", Chrissie responded, "that's what I'm thinking sharks plus adapt" without further comment. Group 2 engaged in some limited amounts of planning ("should we go back into Google and type in gila monsters adaptions [sic] or habitat like where they live", MS,T2,G2,p3); and monitoring in relation to vocabulary, " does venomous mean they have no venom? ", MS,T2,G2,p6) using the search string <gila monster +and are they venomous> to ascertain the meaning. In group 3, however, there were examples of the group engaging in self-regulatory behaviour in each information-seeking cycle. For example, in relation to planning ("are there any other words we can use for this search term? We could use habitat", MS,T2,G3,p7); questioning ("what's another word for live?"(MS,T2,G3,p5); evaluating (Eileen "stop for a minute there, where are we? Researcher, what are you thinking now Eileen? That if we're trying to find out adapt there's no point in keeping in diet"); monitoring ("right, now search. She's after typing in brown bears plus diet and there's a lot of hits though, right what could we do to narrow it down?" MS,T2,G3,p8).

Table 7.4 *Search Terms Used by the Focal Groups in Internet Inquiry Progress Task 2 with Cross Group Comparison of Strategies*

Search String Generation Codes	**Group 1:Sharks**	**Group 2: Gila Monster**	**Group 3:Brown Bears**
S1. Single term S2. Multiple terms based on the task terms S3. Natural language phrase S4. Natural language phrase in question format S5. Topic plus focus S6. Topic plus focus multiple terms S7. Topic plus focus synonym(s)/subordinate S8. Topic plus focus superordinate(s) S9. Dot com S10. Other (Coding adapted from Guinee et al., 2003)	<sharks+ adapt> (S5) <sharks + live>(S5) (not activated) <sharks + adapt> (S5) <where sharks lives> (S3) <how do sharks live> (S4)	<gila monster> (S1) <gila monster + habitats> (S8) <gila monster + adaptations to habitats> (S6) <gila monster +and are they venomous> (S10)	<brown bears> (S1) <brown bears + adapt> (S5) <brown bears +adapt + home> (S6) <brown bears + adapt + habitat> (S8) <brown bears + diet> (S8) <brown bears + diet + live> (S10) <brown bears +live> (S7) <biomes> (S10) <biomes + forest> (S10)
Cross group comparison of search string generation: Researcher's overview of group activity	Limited evidence of planning and revision of search terms across each information–seeking cycle. (n=4)	Some evidence of planning and revision of search terms across each information–seeking cycle. (n=4)	Good evidence of planning and revision of search terms across each information–seeking cycle.(n=9)
	Fair level of monitoring of search terms with attempt made to narrow focus with each revision made.	Good level of monitoring of search terms with attempt made to narrow focus with each revision made.	Good level of monitoring of search terms with attempt made to narrow focus with each revision made.
	Using *topic plus focus* strategy followed by natural language phrases in revision of search terms.	Using *topic plus focus* superordinates, synonyms and subordinates in revision of search terms.	Using *topic plus focus* superordinates, synonyms and subordinates in revision of search terms.
	Limited flexibility in generating search terms suggesting procedural and declarative levels of knowledge.	Some flexibility in generating search terms suggesting emerging level of knowledge at procedural, declarative and conditional levels.	Some flexibility in generating search terms suggesting emerging level of knowledge at procedural, declarative and conditional levels.

Ability of Groups to Investigate Search Results with a Critical Eye

Evidence emerging from analysis of the data suggested that the focal groups were moving from the '*snatch and grab'* approach of Internet Inquiry Progress Task 1 where they randomly clicked on the first or second result to a more '*limited strategic scrolling'* approach with some initial evidence of '*skilful investigation'* of search results focussing primarily on matching keywords from the abstract blurb, and considering the relevance of the information presented to the goal of the assigned task. There was little evidence that the focal groups were investigating search results in relation to the information provided by the domain-name prefix or suffix of the website address from the URL to ascertain the origin or trustworthiness of the website at this stage of the study.

Combining evidence, from the Camtasia online screen activity record sheet with the transcript of the verbal protocols of the children in group 1 as they worked through the task suggested that although the children were activating the first or second search result in the task (see Table 7.5), they were monitoring reference to the adaptations made by sharks in the search result abstract blurbs "leopard sharks adapt to their environment by their skin and colour, they use their skin to hide in coral, the skin blends in with them"(MS,T2,G1,p6). Indeed evidence from the time stamps from the Camtasia online screen activity sheet showed that group 1 were spending more time investigating search results (four minutes 36 seconds) when compared to the time spent generating search terms (three minutes 12 seconds). This suggested that the children were moving away from the *snatch and grab* approach of earlier tasks to a more *limited strategic scrolling* approach. On the third cycle of information-seeking, Kylie also monitored the URL of the search result

(www.librarythinkquest.org) referring to the domain prefix "that's libraries, so that would be like a book" (MS,T2,G1,p11). However, in the same cycle the children were distracted from the task following the story of a diver half eaten by a shark (2nd result) and the story of a killer shark (6th result) with morbid fascination.

Group 2 engaged more with *limited strategic scrolling* in investigating search results, ("we went to the first one and see if it's any good and then we went to the other ones", MS,T2, CInt,G2,p2), and monitoring the relevance of the information contained in the abstract blurbs to the focus of the task, "we're looking through the links to see which one is the best... reading the piece underneath it then we clicked onto a link", MS,T2,G2,p3). It was evident that this group were monitoring the meaning of vocabulary contained in the abstract blurb as Nicky asked "what does that mean, that word venomous? (MS,T2,G2,p7). There was evidence in the data that the children in group 2 also engaged in more planning before activating a search result: "Do you want to go into that one 'cause that one says about its habitat and diet. Habitat is about, like, whereabouts they live like" (MS,T2,G2,p4). As a result the search results pages they activated were more relevant to the task focus. Group 2 spent more time than either of the other two groups reading content pages (12 minutes and 48 seconds).

Data evidence suggested that group 3 were the most efficient group in conducting Internet inquiry allocating their time in a ratio of 1:1:2 to generating search terms, investigating search results and reading content pages. They discussed the possibilities before activation of any search results by monitoring, evaluating and making inferences about the information contained in the blurbs, as the following illustrative extract suggests:

> Eileen: We're searching with brown bears plus adapt plus habitat.
>
> Jane: Look there, brown bears in Spain, that couldn't be right 'cause we found out on a different website that they are from the Kodiaks yokes [islands] so that mightn't be a true website.
>
> Eileen: But there could be brown bears all over the world.
>
> Jane: True
>
> Eileen: Right, we'll go down and see if there is
>
> Jane: ….any of our search terms. Bears, the return of the brown bear to Switzerland?
>
> Lara: That's a pdf file
>
> Eileen: Do you want to read the blurb under one of these? (MS,T2,G3,pp7-8).

Table 7.5 *Actions of the Groups in Activating Search Results in Each Cycle of Information-Seeking in Internet Inquiry Progress Task 2*

Cycle of Information Seeking	Group 1	Group 2	Group 3
1st cycle	2nd result (0 1st result (0)	1st result (0) 8th result (1) then (2) then (1)	Do not activate any results
2nd cycle	Do not activate any results	2nd result (1) then (2)	2nd result (1) then (2) then (1)
3rd cycle	1st result (1) then (2) 2nd result (not relevant to task) 6th result (not relevant to task)	4th result (1) 8th result (1)	Do not activate any results
4th cycle	2nd result (0) 1st result (1) **STOP**	2nd result (0) **STOP**	2nd result (1) then (2)
5th cycle			1st result (1) then (2)
6th cycle			1st result (1)
7th cycle			6th result (1) then (2)
8th cycle			Do not activate any results
9th cycle			1st result(1) **STOP**

Note. Scrolling activity determined from Camtasia activity record sheet indicated in brackets. (0) refers to no scrolling; (1) scrolling down (2) scrolling up

Locating, Transforming and Communication of Information

Evidence from the data suggested that the ability of the focal groups to effectively and efficiently generate and revise search terms and investigate search results inter-facilitated the targeting and retrieval of relevant online information related to the task goal. Group 2 and 3 monitored the information retrieved for the task using self-regulatory reading behaviours, such as asking questions "what are we trying to find out?"(MS, T2,G3,p4); making inferences, "try habitat because it might have, if it says something about where they live, it might have something about how they adapt as well" (MS,T2,G3,p13), and connecting with prior knowledge "you should know in your head what you are trying to find out" (MS,T2,CInt,G2,p10). There was a move away from the "satisficing" behaviours (Agosto, 2002a) of earlier tasks where the children were essentially looking for an answer, acceptable to them, to a question rather than trying to gain conceptual knowledge of the topic. Groups 2 and 3 generated relevant information related to animal adaptations early in the task but continued to find more information related to the task goal ("right we found out that they have very thick fur and that helps them adapt to their environment. Will we try another search term?" MS,T2,G3,p5).

The use of online informational text structures helped the groups to reduce the problem of targeting information relevant to the task and reducing information overload. Groups 2 and 3 used the online 'edit-find' feature extensively although spelling difficulties in group 2 hampered this group in using this online help effectively.

Group 3 were the most effective group in using online informational text structures as the following extract illustrates:

Jane: That page is a good page isn't it?

Eileen: Yeah

Researcher: What makes that a good page?

Jane: Because it automatically tells you (overlapping speech separated for transcription)

Eileen: It tells you, it has them all separated into different parts
[Informational text structures]

Jane: Yeah, and it says adapt in one part and that's what we were looking for.

Researcher: Ok

Jane: We don't need to use the 'edit-find', don't we not?

Lara: No

Jane: We can just scan the page and we found it (MS,T2,G3,p6)

All of the groups experienced some success in generating information related to a range of adaptations made by a named animal in relation to their environment. Groups 2 and 3 were the most successful groups generating four written examples of adaptations made by their specified animal to their environment (group 1 generated two examples of adaptations). Difficulties with the use of the 'copy-delete' approach as a summarisation strategy persisted. There was, however, some limited evidence of development in the children's ability to synthesise information retrieved related to the task goal. For example, Bridie in group 1 read the following text onscreen <Leopard sharks are distinctly marked with dark brown spots on silvery grey background .The leopard shark is a very slim animal with a narrow head> and

commented to the group "it's all right 'cause he has spots to hide in places. He has a narrow head save there was all narrow rocks and stuff" (MS,T2,G1, p6).

There was some evidence in the data that the effective use of the roles of Questioner, Navigator and Summariser engendered motivation and engagement within the focal groups and helped the groups to engage in peer-to-peer collaboration. Each member of group 3 used their individual roles to great effect. For example, in the individual role of *Summariser* "scan the page and see would that be useful. The bear can swim so it can catch fish" (MS,T2,G3,p5); *Questioner*, "what could we do to narrow it down"MS,T2,G3,p3) and *Navigator*, "do you want to read the blurb under one of these"? (MS,T2,G3,p8). The ability of this group to collaborate through the use of the reciprocal roles enabled them to revise their online search strategy enabling successful completion of the task. Likewise, the use of the roles in group 2 enabled this group to experience early success in the task thereby assisting the group to remain focussed on the task goal. There was less evidence in the data that group were 1 using the reciprocal roles to any extent. This led to limited success in generating information ("we never find an answer to our question") which in turn diminished the sense of self-efficacy and motivation within the group ("we're not very good",) and increased the level of frustration in the group ("ah, this isn't helping us" (MS,T2,G1,p17).

In sum, success in Internet Inquiry Progress Task 2, across the groups, was related to the following areas. Firstly, the ability of the groups to flexibly orchestrate a repertoire of skills and strategies in generating and revising search terms related to the task. This success was related to their skill in using the 'topic plus focus' strategy and their ability to generate subordinates, synonyms and superordinates as search

terms. Secondly, success also depended on the ability of the groups to investigate search results with a critical eye. There was a move away from the *snatch and grab* strategy evidenced in earlier tasks to a more *limited strategic scrolling* approach where the groups discussed the possibilities in relation to the information contained in the blurbs. What the groups were not doing at this stage was evaluating the information provided by the URL, with regard to the origin of the site, or the trustworthiness of the information. Thirdly, difficulties persisted in relation to the summarisation of information. The more successful groups used informational text structures and online help features effectively. Finally, motivation and engagement was engendered by the effective use of the reciprocal roles of Questioner, Navigator and Summariser within the groups.

The emphasis in the next set of Internet workshops was on developing the children's ability to *skilfully investigate* search results with a critical eye.

Main Study Internet Workshops 5-8 with Focus on Investigating Search Results: Instructional Content, Skills Development and Class Reflections

This series of four Internet workshops, with a primary focus on investigating search results, built on and consolidated the skills and strategies for conducting Internet inquiry developed in the earlier Internet workshops. The instructional focus in these four 'investigating search results' workshops (see Table 7.6) was on developing skills in reading search results with a critical eye concerning (a) the number of 'hits' retrieved from the search engine; (b) critiquing the abstract blurb with regard its relevance to the task focus; (c) unpacking the elements of the website address URL in relation to the domain name-prefix and the domain-suffix; and (d) evaluating the reliability of the search result.

Table 7.6 *Instructional Content, Skills Development, Reflection by Class Cohort and Aspects of Themes Emerging the Learning Ecology from 'Investigating Search Results' Internet Workshops 5 to 8*

Investigating Search Results	**Instructional Content**	**Skills Developed**	**Reflection by Class**	**Aspects Emerging from the Learning Ecology**
Workshop 5	Develop knowledge of domain topic; and information-seeking cycle Investigate examples of search engine results with Inspector Clue-Search	Making connecting with prior knowledge domains. Understanding the elements of a website address.	*Initial class share* Whole class *Quick share* of strategies, skills and information	1) The role of adaptive scaffolding in facilitating the development of effective online skills and strategies 2) The development of online self-regulatory reading skills and strategies
Workshop 6	Activate prior knowledge of investigating search results Formulate questions Summarise information	Making connecting with prior knowledge domains. Asking thick and thin questions. Taking notes.		3) The relationship of social learning and peer collaboration to motivation and engagement
Workshop 7	Investigate and Evaluate search results Summarisation of information retrieved	Critiquing search results. Summarising skills.	*Final reflection* by class group (oral) and triad group (written)	4) The ability of the children to investigate search results with a critical eye
Workshop 8	Judge reliability of websites.	Evaluating, judging, investigating search results.		

Instructional Content and Skills Development

The child-friendly Inspector Clue-Search (as shown in Figure 7.5) was utilised in workshops 5 and 6 to introduce the idea of investigating search results by seeking clues in the abstract blurb or URL as to the origin or trustworthiness of the website. In workshop 7, 'Looking closely at URLs', the children were asked to evaluate and critique a simulated online Internet inquiry with regard to penguin babies and how their parents look after them. Workshop 8 developed the children's ability to ascertain the origin and authorship of a website, and evaluate the reliability or trustworthiness of a website from the search result.

Figure 7.5. Investigating search results: Skilful investigation with Inspector Clue-Search.

Main Study Internet workshops 5 to 8 also extended the ability of the children to activate prior knowledge sources, formulate questions, take notes based on the information read and summarise information.

Class Reflections

The 'share board' was introduced where the children posted their focus questions and summaries of information retrieved on a chart under conceptual categories (for example, 'reproduction'). A quick share session was also introduced where the children shared the information generated that day with the whole class group. The questions asked by other class members, in these quick share sessions, regarding the

information generated, required the triad groups to clarify and expand their own thinking with regard to this information. Final reflections involved both written reflections by the triad group on the process and product of Internet searching and their use of the reciprocal roles, and whole class discussions reflecting on their developing knowledge of Internet skills and strategies.

Aspects of Themes Emerging from the Learning Ecology Pertaining to Main Study Investigating Search Results Internet Workshops 5 to 8

Analysis of a range of data sources suggested that the aspects of themes emerging from analysis of the data from these series of workshops related to (i) the scaffolding (Azevedo et al., 2003) provided by the researcher and teacher; (ii) the development of self-regulatory reading strategies; (iii) the ability of the children to conduct Internet inquiry especially with regard to investigating search results with a critical eye; and (iv) the role of social learning and peer-support in engendering motivation and engagement. These aspects are discussed in the sections which follow.

The Role of Scaffolding in Internet Inquiry

The researcher and the class teacher provided scaffolded support to the groups, as they applied the skills and strategies learned in the Internet workshops during independent searching for information related to the Internet inquiry project. This scaffolding was dynamic and adapted to the particular needs of the triad groups. It involved a delicate balancing act where support and assistance was provided, but the children's own ability to independently engage in self-regulatory, metacognitive reading behaviours, such as planning, monitoring, evaluating and questioning was also developed. Analysis of the data suggested that the type of scaffolding provided

related to explaining, consolidating and extending both reading and online strategies and procedures. For example, in Main Study Internet workshop 5, group 2 were exploring the question 'how do tortoise's shells protect them' using the search strings <tortoise + their shells> with little success resulting in Nicky exclaiming "it has nothing about their shells, it's stupid" (MS, FN,W5, G2, p10). The researcher asked, "So what exactly are you trying to find out?" (MS, FN,W5, p11) and teased out the possibilities with the group extending their question to reveal that they wanted to determine how the shell protected the desert tortoises from predators. The group then used a *topic plus natural language search string* <Tortoises + their protection from preditors> and experienced success with this strategy generating the written information, *"their shells are like skeletons. they suck in their legs into their shells to hide from predators"* In workshop 6, when Lara wanted to explore the question, "where do desert tortoises have their babies and how long do they live?" Aileen deepened the question and asked, "and do you want to look at how they care for their babies as well?"(MS, FN,W6, G2, p9), suggesting that the children were engaging in self-regulatory processes following earlier scaffolding.

Scaffolding was also used to reinforce and extend the explanations and knowledge provided in explicit instruction in earlier mini lessons. For example, the clues provided in the URL as in the following extract from group 3:

Researcher: Now look at this URL here what does that tell us?

[www.SeaWorld.org]

Eileen: it's an organisation

Researcher: And what kind of an organisation. Look at the first part of it what does that tell you.

Jane: SeaWorld.

Researcher: SeaWorld, and do we know anything about SeaWorld? (pause) SeaWorld is a place in

Eileen: (interrupts) America, there's all whales and dolphins and all such animals.

Researcher: So would you think that might be a good place to go into to find information about penguins? (MS,FN,W6,G3,p6).

Data analysis also revealed that the amount of scaffolding provided by the researcher and teacher diminished and faded as the Internet workshops progressed suggesting that the children required less teacher and researcher assistance in successfully searching for information during Internet inquiry. The children were developing their own self-regulatory reading strategies in an online environment as described in the section which follows.

The Development of Self-Regulatory Reading Strategies During Internet Inquiry

Analysis of the data emerging from this series of workshops suggested that the children were engaging in more self-regulatory reading processes in relation to planning, monitoring, evaluating and questioning. The children engaged in *planning,* in relation to activating and connecting with the level of prior knowledge they had, related to online information-seeking and domain and topic knowledge. For example, the following extract distilled from the class discussion of the steps involved in searching for information, showed good procedural and declarative knowledge of the steps involved in Internet inquiry:

> If you know what your question is pick out the key words...if it's too broad you have to pick out the key words to make it just right. Then put them into the search engine... a load of different ones 'hits' comes up and you don't always pick the first one you have to go through them first...read the blurb

> and see what it says and what you know already to see what you're looking for in the blurb...read and go back and check up on it...animals and their adaptations, how they change to live in their world that they live in (MS,FN,W5,pp1-3).

The focal groups engaged in *monitoring* in relation to the search terms generated, the search results investigated, difficulties encountered with spellings, the types and kinds of questions formulated, and the summarisation of information retrieved. In planning and monitoring search term generation, for example, Eileen asked Jane in group 2 "em what's the question again? Jane noted that they were trying to ascertain "what animals live in the forest". Eileen replied, "how about forests plus animals plus what, would that make sense?" to which Jane retorted "plus what, that doesn't make sense though" and the group used the search string <forest +animals +live>. The groups *monitored* difficulties in relation to spelling by using the Google online spell check <did you mean>adopting a "so what, it will always come up" strategy approach (MS,FN,W6,G2,p10) which effectively helped them to generate search strings speedily without worrying about incorrect spelling, "that doesn't look like deciduous...just type it for us and we'll see" (MS,FN,W5,G3,p18).

The availability of the 'share board', where the children placed their post-it focus questions, involved the children in cognitive decision-making and self-regulatory practices in three ways. Firstly, they had to choose which of their focus questions to post on the share board. Secondly, they had to physically locate the questions under the correct conceptual category. Finally, they had to reflect and monitor the kinds of questions they asked to focus their Internet inquiry, whether they were '*thick or thin*' questions as Aileen in group 2 explained:

> Now the thin question is, 'does an owl have wings' and the thick question is 'why do, how does an owl fly', 'how does his wings help him fly?' A thin

> question is something that you might know, that is in front of you, a thin question is an easy question that you probably know about the answer, and a thick question you have to think about it (MS,FN,W7,G2,p3).

The use of the share session at the end of the Internet workshop also encouraged the children to monitor their understanding of the information generated so that they could convey it to the class group.

Following scaffolding by the researcher and class teacher, the children's approach to summarisation progressed from an exclusive use of the copy-delete strategy (or copy and paste into a Microsoft Word document) to an emerging approach which entailed elements of determining importance, making notes, monitoring and clarifying vocabulary, evaluating reliability of information retrieved and synthesising information through rephrasing. An illustrative example is Aileen's attempt to summarise the passage in Figure 7.6 while thinking aloud:

> Wait, we could edit this. Hold on, have to see what this means 'elliptical'. Only a few of the 100 survive, I'm putting it in small, to adulthood. The mating season is Spring to Autumn. The eggs are incubated in a funnel shaped nest. That their babies die. I'm wondering, how do desert tortoises have babies. Right so, write under that desert tortoise and reproduction (MS,FN,W7,G2,p12).

Figure 7.6. Text of onscreen information for desert tortoises.

> <The mating season for the desert tortoise is lengthy. It occurs from spring to fall, with a peak in late summer/early fall (September). They typically lay 4-8 eggs per clutch, with 1-2 clutches per year. The eggs are hard, chalky and elliptical or spherical and buried in a funnel-shaped nest. They are incubated for 90-120 days. Hatchlings from only a few eggs out of every hundred actually survive the 7-15 years it takes to reach full adulthood.>
>
> Note web source http://en.wikipedia.org/wiki/Desert_Tortoise

Investigating Search Results with a Critical Eye

As this series of workshops progressed, the children developed their abilities to monitor and investigate the search results returned. They monitored the number of hits returned although now realising that a large quantity of search results did not necessarily indicate that all of the results were irrelevant to the task ("you don't always pick the first one you have to go through them first, you need to look at them in anyway"(MS,W5,FN,p2). They began to comment in their independent work on the domain-name prefix (National Geographic or Enchanted Learning, for example), or the domain-suffix, "like dot org you know because it's a dot org site and you can rely on them"(MS,W6,FN,p2) or "look at the web address. It's about cruises and it's a dot com site and it has lots of pictures and we're not looking for pictures" (MS,FN,W7,p5). There were also early indications that the groups were monitoring the authorship of websites ("wait that's from a college, I can't understand that one" (MS,FN,W8,G3,p24) or "That's not reliable this is the kid's one remember? They have loads of wrong spellings" (MS,FN,W8,G3,p18) and the reliability of information ("go to another website and see if it's the same thing", (MS,FN,W6,p2) or as Chrissie, drawing on prior knowledge, explained:

> If you've heard it before like save you heard that the shark, one third of his brain is dedicated to his senses and you went on another one and it said the shark's whole brain is used to his senses then that's not true (MS,FN,W8,G3,p3).

Data analysis indicated that the confidence of the children in their ability to successfully search for information on the Internet was growing. This growing confidence engendered both motivation and self-efficacy as discussed in the section which follows.

The Role of Social Learning and Peer-Support in Engendering Motivation and Engagement: "That was the best one ever"

Analysis of the data revealed that the amount of input in relation to scaffolding and assistance provided to the triad groups by both the researcher and class teacher decreased as this series of Internet workshops progressed. Evidence suggested that the use of the share board, for post-its of focus questions and summaries of information generated, helped to focus the children. Likewise, the class discussions and reflections at the beginning and end of the Internet workshop where the groups shared and accessed their prior knowledge of information-seeking during Internet inquiry helped to engage the groups and engender motivation. The effective use of the interchangeable roles of Questioner, Navigator and Summariser helped members of the triad groups to scaffold each other to collaborate more effectively. The amount of off-task behaviour decreased dramatically. The growing level of engagement of the children with Internet inquiry is reflected in the confidence with which Aileen discussed the group's plan for seeking online information with the researcher:

> We're doing reproduction and our question is 'how do desert tortoises have babies' and our key words are *desert tortoises* plus *reproduction*. So our Google search term was desert tortoises + reproduction. How do you research the search results [reading from worksheet] Right so, which one will we go into? That's the one we go into remember and it had all the stuff about it (MS,FN,W8,G2,P4).

It was clear that the groups were becoming more successful in generating information for their project theme of animal adaptations to the environment. The level of success in retrieving information also helped to engender self-efficacy and motivation as the following quote from Jane suggests, "look there's how they eat, how they care, this is brilliant, how they breathe. Ah! How they move! That's just what we're looking for" (MS,FN,W5,G3,p19). When Kylie was asked by the

researcher to explain why she thought the group's work on Internet workshop 5 "was the best one ever" she reflected that it was "better than any other week, better than usual. We tried not to fight and looked for stuff, we had a little bit of rows, but we knew what to do and even what to do with the information (MS,FN,W5,G3,p25).

Independent Searching for Information Internet Workshops 9-12

In the final four workshops conducted after the Easter school holidays the project theme of *animals and their adaptations* to the environment was extended to include *endangered animals* living within the biome under investigation by the triad groups and in particular why these animals were endangered. The researcher gave a brief demonstration of the Reale books (www.realebooks.com) software package which the children then used to create multimodal online books in this series of Internet workshops.

Instructional Input, Skills Development and Class Reflections for Internet Workshops 9-12

The class teacher gradually began to lead this series of Internet workshops. These workshops followed a similar pattern to the earlier Internet workshops and developed and consolidated the children's abilities in both developing online reading comprehension and online information-seeking skills and strategies (summarised in Table 7.7). The children engaged in longer periods of independent work where they either searched for information related to the individual project biomes or created the Reale books on lap tops, purchased by fundraising activities conducted by the parents on the school committee. The children also began to use these laptops independently within their own classrooms to develop the Reale books.

Class Reflections

The workshops commenced with a class discussion where the groups shared either their prior knowledge of information-seeking processes online, or prior knowledge of the domain topic of animal adaptations or endangered animals in a particular biome. The class cohort also engaged in quick share sessions during Internet workshops where class members shared insights gained from a particular website; an effective online strategy; or a technique for the Reale books, such as designing a collage of photographs. Finally, the triad groups reflected on their ability to engage with the reciprocal roles and the class group reflected on the process of online searching and the topic knowledge gained during Internet workshop.

Table 7.7 *Main Study Internet Inquiry Project: Instructional Content, Skills Development, Reflection by Class Group and Aspects of Themes Emerging from 'Independent Searching for Information' Workshops 9-12*

Independent Searching for Information	Instructional Content	Skills Developed	Reflection by Class	Aspects Emerging from the Learning Ecology
Internet workshops 9-12	Activate prior knowledge of topic domain and online-information seeking skills during Internet inquiry. Demonstration of Reale book software. Develop strategies for summarisation of information. Generate questions.	Engaging with prior knowledge of topic domain. Generating search terms. Investigating search results. Developing domain vocabulary knowledge. Summarising: concept maps. Formulating levels of questions.	*Initial class share* at beginning of workshop *Quick share* in middle of workshop *Reflection by triad group and class* group on the process and product of Internet inquiry at the end of the Internet workshop	1) Peer collaboration in the development of online information seeking skills during Internet inquiry and the construction of Reale books. 2) Development of reading strategies: *Formulating questions;* *Generating information*

Aspects of Themes Emerging from the Learning Ecology in Main Study Internet Workshops 9-12: Investigating Search Results

Analysis of the data suggested that two aspects of themes emerged from the learning ecology in Internet workshops 9 to 12 related to (i) the role of peer collaboration in the development of online information-seeking skills during Internet inquiry and (ii) to the development of reading strategies in an online environment.

The Role of Peer Collaboration in the Development of Online Information-Seeking Skills and in the Construction of Multimodal Compositions

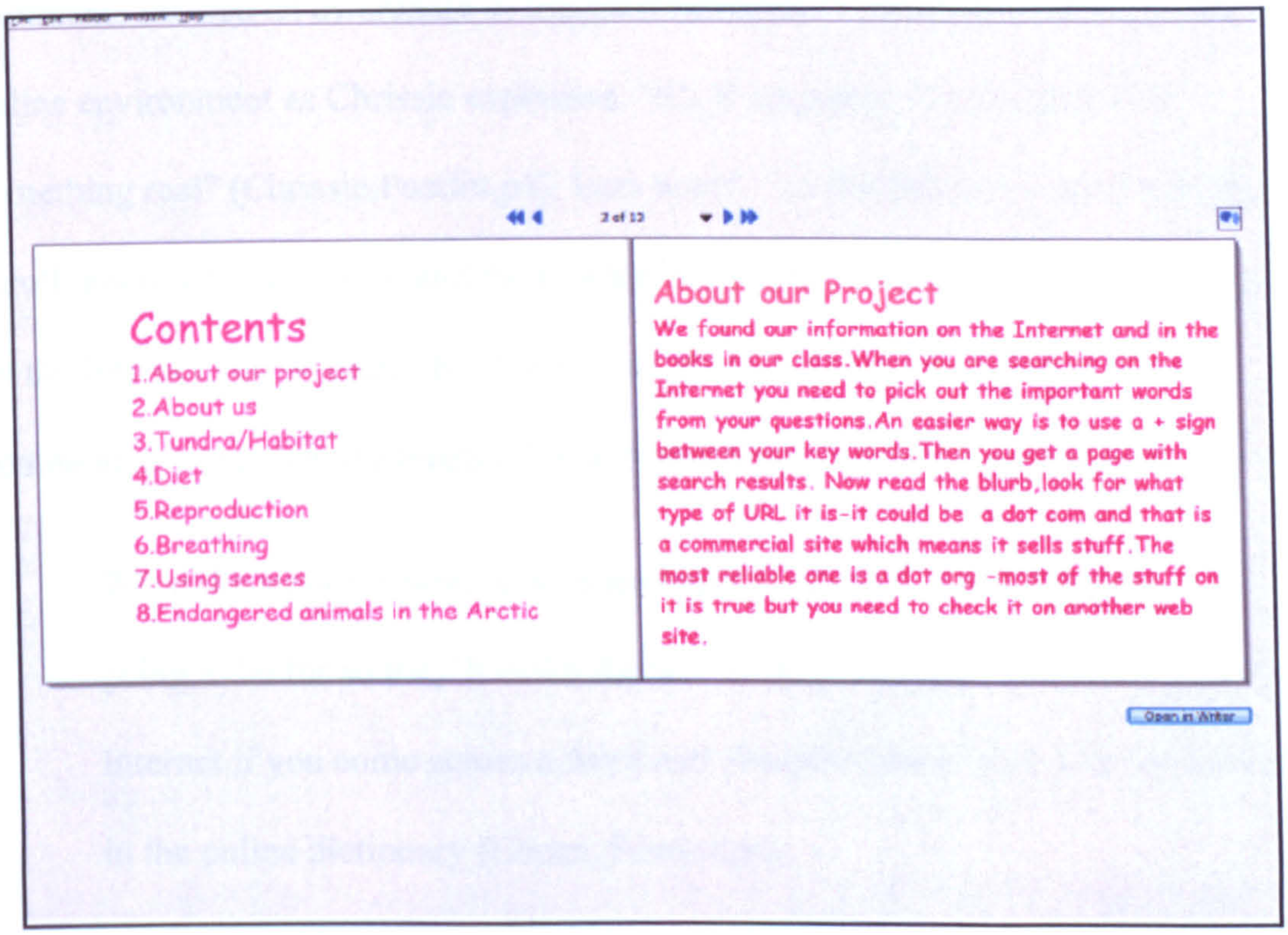
The children shared their developing knowledge of online information- seeking strategies gained during Internet workshop with other triad groups and with the class in class share sessions. For example, "*We learned that you don't always have to go a to a dot org site because we went on to a dot net site and we got a lot of information*" (MS,W11,Work sample, G3) or "*We found out that the BBC is a trustable website*"(MS,W11,Work sample,G2). Chrissie in group 1 noted:

> We don't always look at the URL, we also look at the blurb, to see if our words we put in our search term are in the blurb, and we look at the site and if it doesn't work we look at another one (MS,FN,W11,G1,p5).

The children developed, adapted and shared their expertise, across the class group, in crafting their multimodal compositions in the form of the Reale books. The children extended the use of the software as demonstrated by the researcher to include the use of image collages, the use of background colours, the appearance of font in terms of size, colour and style, and the inclusion of informational text structures, such as author information, table of contents, and instructions for readers on how to search for information in an online Internet environment. Figure 7.7 presents a screen shot of a Reale book page, from group 3, showing a table of

contents and information for the reader on seeking information in an online environment. Sample screen shots from the Reale books constructed by each focal group are available in Appendix L. For ethical reasons, and to protect the anonymity of the school and the children any identifying names have been removed from the Reale books.

Figure 7.7. Screen shot of a page from Reale book for group 3.



Analysis of the post interviews data transcripts with the individual focal group children suggested that the children had a real sense of audience and authorship in constructing the Reale books. For example, an audience beyond the four walls of the classroom, as Jane explained, "you can send it over to your sister, your sister can see it, if she is all the way over in England" (Jane, PostInt, p8). A number of the children commented on authorship and on the need to provide reliable information in the Reale book.

For example, Lara observed:

> You have to make sure the information is reliable 'cause otherwise other people will, I don't know, put it like, 'do you think this information is true' or it could be an author reading it and they could put it in a book and then the information is not reliable (Lara,PostInt,p8).

In the Post interviews the focal group children were asked to comment on possible differences between reading a book and reading on the Internet. Their comments showed an awareness of the predominance of informational text in an online environment as Chrissie explained, "the information on the Internet is something real" (Chrissie,PostInt,p4). Lara noted, "on the Internet you have to like scroll down with the mouse and then on the book all you have to do is flick a page... on the Internet you wouldn't be able to read about other people's lives". Eileen commented on readability levels of print-based text compared to online text:

> When the author is writing it [print-based text], they know what age it's going to be for so they'll make the words easier for you, 'cause like on the Internet if you come across a word and you don't know you've to try search in the online dictionary (Eileen, PostInt,p4).

Although Lara noted the ease of access to specific information: "like if I'm looking up lizards plus diet and it gives you what they eat and all, but then when you're reading it [in a book] you have to just sit there like that, sometimes you don't even know what you're reading" (Lara,PostInt, p5). However, Jane cautioned, "it all depends on what question you are looking for... sometimes it does be real hard to look up information. Sometimes, I only enjoy it when it is easy. When it is hard it does be getting [gets] on my nerves" (Jane,PostInt,p5)

The Development of Online Reading Comprehension Strategies

There was a suggested growth in the ability of the class cohort to formulate deeper levels of questions across the timeline of the study. This is charted in Table 7.8 for three stages of the Main Study at the initial, mid, and late stages. Analysis of these questions suggest the inclusion of more conceptually challenging questions, such as 'why' questions (Why are desert tortoises endangered) or 'how' questions (How do penguins understand each other) or questions which suggest the inclusion of domain specific and topic knowledge vocabulary, such as superordinate categories (How do sharks communicate).

Table 7.8 *The Types and Kinds of Questions Formulated Across the Timeline of the Study*

Formulating Questions to Focus Internet Inquiry. Workshops 1-12 Main Study	**Group 1**	**Group 2**	**Group 3**
Initial (Workshop 4)	Why do some sharks not eat meat?	What to bobcats eat?	How do koalas mate?
Mid (Workshop 6)	How do sharks communicate? How deep do they go?	Where do desert tortoises have their babies?	How do penguins understand each other?
Late (Workshop 12)	Dose [Does]their behaviour [crocodiles] cause them to be isticed [extinct]?	Why are desert tortoises endangered?	What are the threats to penguins? How are they endangered?

The higher levels of questions formulated can lead not only to an increase in conceptual knowledge of a domain but also are "conducive to deeper text processing and better comprehension" (Taboada & Guthrie, 2004, p. 295). A qualitative review

of the Reale books using the Guthrie and Taboada (2004) framework suggested growth in the ability of the children to provide more conceptually-based information in these online books. There was considerable growth in the depth of information provided in these books when compared to the depth of information provided in the PowerPoint presentations in Year 1 of the study. There was a move from the inclusion of simple facts (level 1) and simple description statements (level 2) to providing more complex explanations of the interactions of organisms in a biome (level 3) (see Figure 7.8) and to the inclusion of information on patterns of interrelationships between organisms within a biome (level 4)(see Figure 7.9).

Figure 7.8. Complex explanation of the interactions of organisms in a biome: Reale book.

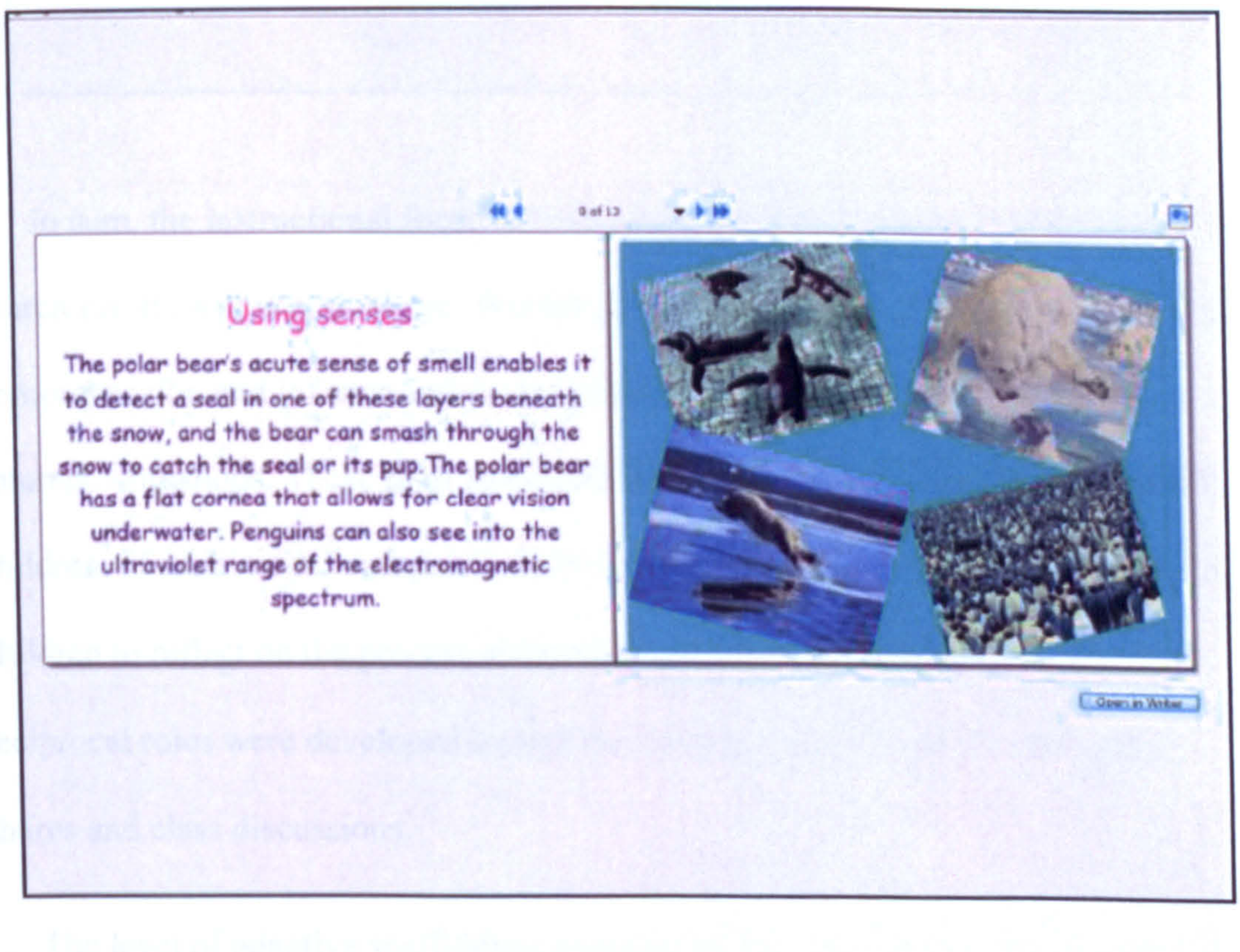
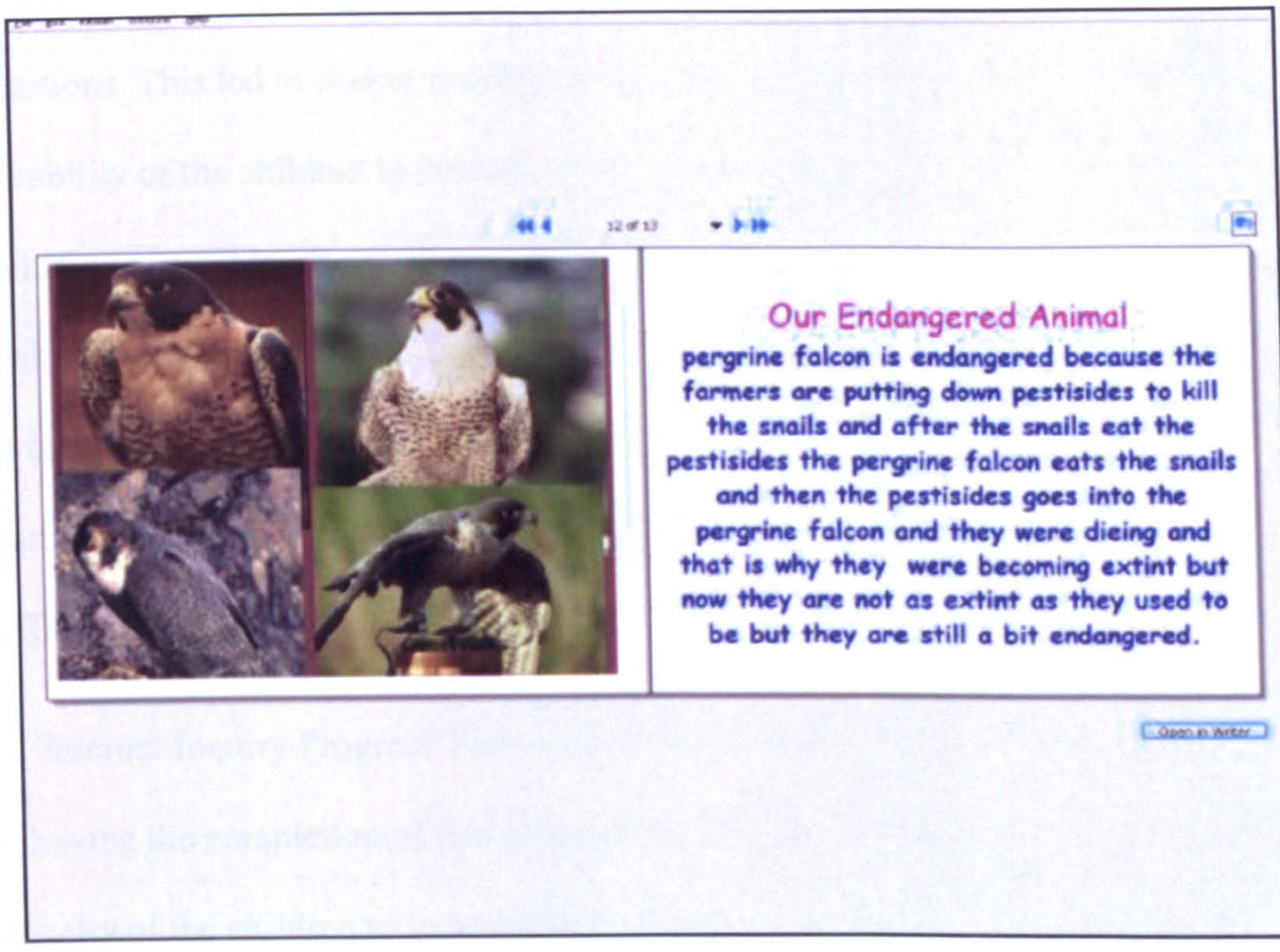


Figure 7.9. Patterns of interrelationships between organisms within a biome: Reale book.



In sum, the instructional focus in Internet workshops 5 to 8 was on investigating search results with a critical eye. Workshops 9 to 12 consolidated the online reading comprehension and information-seeking skills and strategies developed in previous Internet workshops. These final workshops also included the construction, by the children, of multimodal compositions in the form of Reale books. The ability of the children to reflect on the process and product of Internet workshops and the reciprocal roles were developed though the introduction of share boards, quick shares and class discussions.

The level of adaptive scaffolding provided by the class teacher and researcher diminished across this series of workshops as the children developed and shared online skills and strategies through peer-to-peer collaboration. Peer collaboration engendered motivation, engagement and self-efficacy within the groups. The

integrated nature of the curriculum may have enabled the children, to access and connect with a range of prior knowledge sources, and formulate deeper levels of questions. This led to deeper processing of text with a concomitant development in the ability of the children to construct more conceptually based knowledge. The children engaged in more self-regulatory processes, such as planning, monitoring evaluating and questioning. Finally, the workshops developed the children's skills in investigating search results with a critical eye, both with regard to matching the search result blurb to the task focus and unpacking clues within the URL domain suffix and prefix.

Internet Inquiry Progress Task 3 conducted with the focal group children, following the completion of this series of workshops in the Main Study, explored the capacity of the children to independently conduct the information-seeking cycle.

Internet Inquiry Progress Task 3

Internet Inquiry Progress Task 3a and Task 3b asked the three focal groups to find the answers to two closed questions and two open questions. Task 3c asked the focal groups to critique a simulated online Internet inquiry. These tasks were detailed in Table 4.1 in chapter 4. The protocols used in this task were similar to those of earlier Internet Inquiry Progress Tasks as previously outlined.

The aspects of themes emerging from within the ecology of learning from this task, following careful analysis, relate to (i) the capability of the focal groups to orchestrate a range of strategies in relation to Internet inquiry; (ii) their abilities to flexibly adapt strategies developed during the Internet workshops, concerning their capacity to generate search terms and investigate search results with a critical eye;

and (iii) the role of peer collaboration in both engendering motivation and self-efficacy (related to using the roles of Questioner, Navigator and Summariser), and enabling the groups to engage in self-regulatory, metacognitive reading behaviours. These aspects are discussed in the sections which follow under the information-seeking processes of Internet inquiry including (a) goal formation, understanding the task; (b) generating and revising search terms; (c) investigating search results; (d) locating and critically evaluating the relevancy of the information retrieved to the task focus and (e) transforming, synthesising and communication of information. Attention is drawn to possible developmental differences between the focal groups where appropriate.

Goal Formation and Planning: Evidence from Internet Inquiry Progress Task 3

Evidence from the data suggest that there was a growth in the ability of the focal groups to engage in discussions concerning planning before commencement of the Internet inquiry task. Across the groups there was a good understanding of all of the sections within Internet Inquiry Progress Task 3. For example, Chrissie explained Internet Inquiry Tasks 3a and 3b related to the wallaroo as, "how does he live, and what does he eat and how do they manage to live in their environment" (MS,T3,G1,p1). The groups adopted the roles of Questioner, Navigator and Summariser, providing clear explanations of the roles they would adopt during these series of closed and open Internet tasks. Group 3 planned the task in stages "we have to find out where they live first, so wallaroo plus habitat because it's another word for live" (MS,T3,G3,p3). Bridie in group 1 wanted to "click into pictures [Google images] and find a picture of the yokes [wallaroo]. I don't know what it looks like ...Is the walaroo endangered as well?" Chrissie, however, commented, "no, if you go

into the information, it will tell us what it is" (MS,T3,G1,p2). In group 3, Nicky also wanted to view an image of a wallaroo before commencing the task. "We should type in Google, walaroo, and then go into images and see a picture of it first see what it looks like 'cause it's a new animal that we've never seen" "(MS,T3,G2,p1). In Nicky's case the group agreed with this plan it and after viewing an image of a wallaroo they activated their prior knowledge of kangaroos living in Australia. Nicky also led the planning of Internet Inquiry Progress Task 3b in this group, "endangered plus corncrake we have to find out why he's endangered first, and if it hasn't got that write extinction" (MS,T3,G2,p4).

Generating Search Terms: The use of Flexible Strategies in Relation to Generating and Revising Search Terms

Analysis of the data revealed that there was considerable growth in relation to the types and kinds of terms generated as search strings across the focal groups, when compared to earlier Internet Inquiry Progress Tasks. This growth was demonstrated in the levels of knowledge and self-regulatory processes the groups employed in the strategic generation of search strings.

Group 1 experienced early success in generating search strings for the closed questions in Internet Inquiry Progress Task 3a relating to the habitat and diet of the walaroo. The group utilised the *topic plus superordinate* search string strategy in finding the answers to these questions as shown in Table 7.9. They reverted to using a *natural language phrase in question format* using the search strings <how do wallaroos adapt to their environment> or <are corncrakes badly threatened with extinction> when they started to experience difficulties in finding relevant information related to the task focus. Chrissie explained this strategy, "we'll try an

actual question. We'll have to write a question for this, we can't just write wallaroo". This suggested that the group were aware of the ineffectiveness of the use of broad search terms. However, they persisted with the use of natural language formats despite the inefficiency of using such a strategy. The ability of group 1 to generate search strings developed over the course of the study from a random use of *single terms* in Internet Inquiry Progress Task 1 to the use of the topic plus superordinate search strings in Internet Inquiry Progress Task 3. However, although the group had both procedural and declarative knowledge in relation to search string generation they lacked the flexibility to recover from unsuccessful search string generation later in the task suggesting a lack of knowledge of search string generation at a conditional level.

Group 2 initially used the broad search term <wallaroo> in Google images to ascertain the nature of the animal they were investigating. They followed this approach by using a topic plus focus strategy using subordinates, superordinates and multiple terms. They also used the focus plus topic approach. This had previously been described as an effective strategy by Bridie during a class share in Internet workshop.

Group 3 again used the topic plus superordinate strategy approach. They planned the search terms they used, "type in the key words of the question, like wallaroo plus habitat, it's another word for where they live" (MS,T3,G3,p2) using the search string <wallaroo +habitat>. They monitored unknown vocabulary using an online dictionary to ascertain meanings. In Internet Inquiry Progress Task 3b, related to the endangered corncrake, Jane asked the group, "will we ask the question instead of doing the plus sign? Last week we done [did] it and it came up" (MS,T3,G3,p8). The

group used the natural language phrase in question format search string <why is the corncrake endangered > without success ("it's not good writing the question", MS,T3,G3,p9), but recovered from this unsuccessful strategy by reverting to a topic plus focus and focus plus topic approach.

The strategies used by both groups 2 and 3 in generating and revising search strings suggest they had good awareness of search string generation at procedural, declarative and conditional levels of knowledge by this stage of the study.

In Task 3c, an online Internet inquiry simulation, the groups critiqued a range of search strings generated by 'Mary' concerning a scenario in which Mary wondered how Burmese pythons can swallow large animals and not choke (See Appendix E for Task 3c). In the examples which follow the groups are critiquing these search strings by drawing on their prior knowledge of search string generation and acknowledging the need to narrow a search inquiry by focussing on key words. For the search string <Burmese python> group 1 considered that, "it will just tell you about it and not tell you how it swallows it whole". Group 2 monitored the search string vocabulary and deemed <Burmese python + swallow> as, "not good because it could come up about birds instead of snakes". Finally, using a question format, such as < How does a Burmese python swallow an animal whole?> was judged ineffective by group 3 as, "questions don't always work on Google". Aileen provided her own helpful search string for 'Mary'<Burmese pythons+ adaptations +diet> explaining, "adaptations like what they eat. I'd pick diet, see what they eat, and it would probably tell you what they eat and how they eat it" (MS,T3c,G2,p3).

Table 7.9 *Internet Inquiry Progress Task 3a, 3b Search Term Generation Across the Groups*

Code	Questions	Group 1	Group 2	Group 3
S1. Single term S2. Multiple terms based on the task S3. Natural language phrase	*Can you find out where does a wallaroo live?*	<wallaroo + environment>(S8) < wallaroo +live>(S5)(not activated) <where does a wallaroo live>(S4)	<wallaroo> (S1) (Google images) < wallaroo +live>(S5)	<wallaroo + habitat> (S8) <dictionary> (S10)
S4. Natural language phrase in question format	*What kind of food do they eat?*	<wallaroo + diet> (S8) <dictionary > (S10)	<wallaroo + diet> (S8)	<wallaroo + diet> (S8)
S5. Topic plus focus S6. Topic plus focus multiple terms S7. Topic plus focus (synonym(s)/ subordinates)	*What adaptations do they make to live in their environment?*	<wallaroo + adaptations >(S8) <wallaroo +change>(S5) <How do wallaroos adapt to their environment> (S4) <How do wallaroos adapt> (S4)	<wallaroo +adaptions to habatat>(S6) (sic)	<wallaroo + adaptions >(sic) (S8) <dictionary > (S10)
S8. Topic plus focus (superordinate(s), S9. Dot com S10. Other (Adapted from Guinee et al., 2003)	*Why is the corncrake endangered and what can be done to save the corncrake*	<corncrake + endangered>(S5) <are corncrakes badly threatened with extinction> (S4)	<endangered + corncrake> (S10) <extint + corncrake> (S10) (sic)	<corncrakes> (S1) not activated <Why is the corncrake endangered > (S4) <corncrake + endangered> (S5) <endangered + corncrake> (S10)
Cross group comparison of search string generation: Researcher's overview of group activity		Good evidence of planning and revising search terms across each information-seeking cycle. (n=11)	Good evidence of planning and revising search terms across each information-seeking cycle. (n=6)	Good evidence of planning and revising search terms across each information-seeking cycle. (n=9)

Cross group comparison of search string generation: Researcher's overview of group activity	Good level of monitoring and awareness of ineffective search strings. Some monitoring of vocabulary through online dictionary.	Good level of monitoring and revision of ineffective search string generation.	Good level of monitoring and revision of search string generation. Good monitoring of vocabulary through online dictionary..
	Using topic plus focus superordinate and natural language phrase in question format.	Using single term with planned rationale followed by topic plus focus superordinate search string.	Using topic plus focus superordinate.
	Limited flexibility in search string revision suggesting levels of knowledge at procedural and declarative levels.	Good flexibility in search string revision suggesting levels of knowledge at procedural and declarative and conditional levels.	Good flexibility in search string revision suggesting levels of knowledge at procedural and declarative and conditional levels.
Overall development across Internet Inquiry Progress Task 1, 2, 3.	Developed from random use of broad, single term search string generation to use of topic plus superordinate search string generation based on understanding of task goal.	Developed from use of natural language phrases generation to flexible use of topic plus superordinate search string generation based on understanding of task goal.	Developed from single, multiple and natural language phrases generation to flexible use of topic plus superordinate search string generation based on understanding of task goal.

Investigating Search Results: The Ability of the Focal Groups to Critically Evaluate and Skilfully Investigate Search Results

Evidence emerging from analysis of the Camtasia activity record sheets relating to investigating search results suggested that all of the groups had moved from the random *snatch and grab* strategy of the baseline Sick Rabbit Task and that of earlier Internet Inquiry Progress Tasks to more skilful use of a *limited strategic scrolling* approach or *skilful investigation* approach when investigating search results. Analysis of the data suggest that differences in the patterns of behaviours across the groups related to the abilities of the groups to investigate search results *effectively*, *efficiently* and *speedily* with a critical eye giving due regard to monitoring the key words and information contained in the abstract blurb with respect to the task goal; observing the number of search results 'hits' returned; and scrutinizing the URL with regard to the domain name-prefix and suffix.

The Camtasia activity record sheet for group 2 indicated that the group were moving from a *limited strategic scrolling* approach to an emerging use of a *skilful investigation* approach by scrolling down through the search results before activating any results and monitoring and recalling search results already visited as indicated in Table 7.10. Cursor activity indicated that the group were reading the abstract blurb and matching and monitoring the key words in relation to the task, "to see like has it got, does it have the information that we're looking for. 'Cause sometimes it just has something else you're not looking for" (MS,T3,G2,p4).

Analysis of the data in relation to groups 1 and 3 as shown in Table 7.10 suggested that these groups were beginning to use a *skilful investigation* strategy of search results at an emerging level (group 1) and a developing level (group 3). The

children in group 1 matched the abstract blurb to the task, monitored the *URL in* relation to the domain name suffix and prefix ("it says there it's an organisation and it has the two words in the blurb", MS, T3,G1,p4), made some predictive inferences based on the hyperlink heading, and monitored the number of hits returned as search results. The search terms they developed were less effective than those generated by group 3 so the search results returned were also less effective suggesting the interfacilitation of strategies between generating effective search terms and the skilful investigation of search results was necessary for conducting successful Internet inquiry.

Group 3 engaged in more planning discussions before activating any search results than either of the other two groups. For example,

> Jane: Will we try the top one?
>
> Eileen: It's a dot com site it's a commercial site. Doesn't that mean its selling stuff to ye? Wait.
>
> Jane: This one? Pick this one because the blurb sounds a bit interesting about where they live (MS,T3,G3,p3).

They engaged more in predictive inferencing of hyperlink headings or abstract blurbs, "see the corncrake project for details of the corncrake grant scheme. Well, it's probably about the government giving them a grant to help them save it" (MS,T3,G3,p11). Also, they monitored the reliability of information in the search results blurb recalling sites already visited, "it's a pdf file. That's true, 'cause that's the second time I saw that. I saw that on the website results on habitat" (MS,T3,G3,p5). They also monitored the domain name suffix and prefix to a greater degree than either of the other groups, "we'll try this one 'Corncrake Fact Sheet' it's

a dot ie and it's Bird Watch Ireland" (MS,T3,G3,p10). The actions of group 3 in investigating search results suggested that this group were investigating search results with a critical eye, by orchestrating a repertoire of strategies. Their capacity to skilfully investigate search results at a *developing* level suggested knowledge at a declarative, procedural and conditional level.

Table 7.10 *Cross Group Comparison of Investigating Search Results Task 3a and 3b*

Internet Inquiry Progress Task 3a 3b	**Group 1**	**Group 2**	**Group 3**
Can you find out where does a wallaroo live?	Click on 0 results (cycle 1) Click on 2nd result (0) (cycle 2)	Click on 1st result (0) (cycle 1) Click on 1st result (0) (cycle 2)	Click on 1st result (1 then 2) Click on 3rd result (1 then 2) (cycle 1) Click on 1st result (1 then 2) (cycle 2)
What kind of food do they eat	Click on 2nd result(0) Click on 1st result (0) (cycle 1) Click on 4th result (1) (cycle 2)	Click on 2nd result (0)	Click on 2nd result (1)
What adaptations do they make to live in their environment	Click on 2nd result (1) (cycle 1) Click on 0 results scroll (down page of results) (cycle 2) Click on 0 results scroll (down page of results) (cycle 3) Click on 4th result (1) (cycle 4)	Click on 2nd result (1 then 2) Click on 3rd result (1 then 2) Click on 4th result (1 then 2 then 1)	Click on 2nd result (1 then 2 then 1) Click on 4th result (1 then 2 then 1) (cycle 1) Click on 1st result (1) (cycle 2)
Why is the corncrake endangered and what can be done to save the corncrake	Click on 2nd result (1) (cycle 1) Click on (4th results)(1) (cycle 2) **STOP**	Click on 4th result (1) Click on 1st result (1 then 2) (cycle 1) Click on 2nd result (1 then 2 then 1) Click on 5th result (1 then 2 then 1) (cycle 2) **STOP**	Click on 1st result (1 then 2) (cycle 1) Click on 0 results (cycle 2) Click on 4th result (1 then 2) (cycle 3) Click on 0 results (cycle 4) **STOP**

Summary of actions of group in activating search results: Researcher overview of group activity		Use Google images to activate image of wallaroo.	
	Some scrolling through search results.	Some scrolling through search results.	Some scrolling through search results.
	Skimming information provided in search result abstracts.	Skimming information provided in search result abstracts.	Skimming information provided in search result abstracts.
	Making references to domain name suffix and prefix in conversations.	No references to domain name suffix and prefix in conversations.	Making references to domain name suffix and prefix in conversations.
	Revisiting results page.	Revisiting results page.	Revisiting results page.
	Cross checking information in other search results.	Cross checking information in other search results	Cross checking information in other search results.
		Recall of websites previously visited.	Recall of websites previously visited.
	Making predictive inferences based on hyperlink.		Making predictive inferences based on hyperlink.

Note. Scrolling activity determined from Camtasia activity record indicated in brackets. (0) refers to no scrolling; (1) scrolling down (2) scrolling up

Locating, Transforming and Communication of Information for Internet Inquiry Progress Task 3

The aspects of themes emerging from the data from Internet Inquiry Progress Task 3 regarding the generation of information relate to (i) the differences between the approaches adopted by the groups to open and closed questions during Internet inquiry; (ii) the use of end-user application knowledge in relation to the use of online navigational functions; and (iii) the ability of the groups to summarise and communicate information related to the task goal.

Approaching Open and Closed Questions

The focal groups seemed to approach the open and closed questions of Task 3a and 3b in a different manner. For the closed questions they successfully "found the answer, right next question" (MS,T3,G2,p2) displaying a 'satisficing'(Agosto, 2002a) behaviour. They approached the open questions related to adaptations by looking for additional information, "we can probably find out more" (MS,T3,G1,p8) suggesting that they were aware of the complexity of answers involved in more open questions. They also cross checked the information for open questions, "to look for another site just to see if that's reliable information...that's the second one that we've been on so we know it's true 'cause it said it on both of them, exact same answer" (MS,T3,G2,p4).

The Application of End-User Application Knowledge: Use of Online Features

All of the groups navigated between websites with ease. Group 1 used the back button at a novice level, for example activating the back button several times to return to the search results page. Groups 2 and 3 displayed a more strategic use of back button activation, using the drop-down cache memory of previous websites visited for example. The disorientation experienced by the groups in earlier Internet tasks was not in evidence. Groups 2 and 3 made extensive use of the 'edit-find' feature, online dictionaries and the online spell check feature in Google <did you mean>.

Summarising and Communicating Information

Overall the three focal groups were partially successful (group 1) or successful (groups 2 and 3) in generating a range of adaptations and summarising information

concerning the open question in relation to the adaptations made by a walaroo to where they live.

Group1 were partially successful in generating information in relation to the open question of why a corncrake is endangered. They reverted to their own world knowledge often referred to as 'common sense' in generating information for the second part of the task regarding what could be done to save the corncrake as the following extract from a conversation between Chrissie and Kylie in group 1 suggests:

> Chrissie: The farmers are going around the things [corncrakes] but they just won't go away. They must be deaf or something.
>
> Kylie: When the farmer's mowing the grass they could easily run over them if they're in the grass.
>
> Chrissie: If I was a farmer I'd get a brush and shoo them away.
>
> (MS,T3,G1,p14).

Both groups 2 and 3 successfully generated information showing some development in the groups' abilities to synthesise information in their own words regarding both why the corncrake is endangered and what steps could be taken to save this bird as shown in the written work sample examples which follow:

> *"Other animals are eating them .And not many of them are being born. If they get more fields for them they would have more food to eat. And they should cut the grass a different way so they can hide from predators"* (group 2)

And

> *"The farmers are cutting the grass too soon. They need the grass to hatch the eggs. They need to grow more hay. Don't cut the hay until the 1st of August. This gives the bird a chance to escape and their eggs to hatch"* (group 3)

There was evidence in the data that the focal groups were beginning to monitor their understanding of information presented. Group 3 used the online dictionary and their own prior knowledge when they encountered unknown words. For example, for the word *decline*, Eileen wondered:

> Eileen: Is it like, start to die? Right, try that in there 'corncrakes start to die [decline] when traditional farming systems began to be replaced by modern agricultural methods'. Does that make sense?
>
> Jane: Yeah, they're cutting the grass too soon.
>
> Lara: So why does the birds need grass?
>
> Eileen: They need the grass so that they can hatch the eggs. (MS,T3,G3,p12)

In sum, Internet Inquiry Progress Task 3 provided evidence that all of the focal groups were engaging in more self-regulatory reading processes in relation to planning, monitoring, questioning, and evaluating reading processes in generating search terms, investigating search results and locating information.

There was growth across all of the groups in generating search terms. All of the groups had moved from the random use of broad, single terms to a more strategic use of the topic plus focus strategy. Groups 2 and 3 showed most flexibility and creativity in generating and revising search terms suggesting developing awareness of search string generation at a declarative, procedural and conditional level.

In investigating search results, the groups had moved from the *snatch and grab* approach of earlier Internet Inquiry Progress Tasks to a more *limited strategic scrolling* approach (group 2) and an emerging (group 1) and developing (group 3) *skilful investigation* approach. The children's ability to question the reliability of information by cross-checking information was also developing.

The groups' abilities to use online informational text structures and online help features helped them to access information more easily. There was also evidence that the children were developing an ability to summarise information by determining importance and rephrasing and editing text. However, difficulties with summarising information persisted especially in relation to the use of the copy-delete strategy.

Overall, group 3 were the most successful group in conducting Internet inquiry during the Internet Inquiry Progress Tasks. They engaged at a metacognitive level with more self-regulatory reading processes. The group successfully and flexibly orchestrated a repertoire of skills and strategies showing the interfacilitation of strategies in relation to generating search terms, investigating search results and locating information. Finally, group 3 used the interchangeable roles of Questioner, Navigator and Summariser effectively to facilitate peer collaboration and enable social learning in an online environment.

CHAPTER EIGHT

ANALYSIS OFTHE STUDY CONDUCTED WITH THE 3RD/4TH CLASS COHORT

Introduction

This chapter relates to the study conducted with the 3rd/4th class cohort which was conducted in parallel with the 5th/6th class study. This account is necessarily constrained and is not presented in as much detail as that presented for the 5th/6th class cohort in chapters 6 and 7. This is because the central focus of the dissertation is the 5th/6th class cohort. Nevertheless, the 3rd/4th class study was important, and revealed some interesting insights which I want to share in this chapter. Part one of the chapter will discuss analysis of the data in relation to the 3rd/4th class cohort across the three phases of the study. This will be followed by a constrained analysis of the three Internet Inquiry Progress Tasks conducted with the 3rd/4th class cohort. The second part of the chapter will discuss developmental patterns in relation to similarities and differences between the 3rd/4th class cohort and the 5th/6th class cohort.

Part 1: RDCWL Phase 1a and 1b with the 3rd/4th Class Cohort

Reading Development and Critical Web Literacy (RDCWL) Phase 1a: 3rd/ 4th Class Cohort

The thematic unit of instruction, developed in consultation with the class teacher, for the third class cohort in year 1 was 'Our Pets'. The theme was developed from

the strand unit 'Plant and Animal Life' and the strand 'Living Things' from the 3rd class science curriculum (DES/NCCA, 1999b). The Internet workshops developed in RDCWL Phase 1a in year 1 of the study linked science, literacy and the Internet. The instructional content and skills developed in this series of eight Internet workshops were the same as those described for the 5th class cohort and previously summarised in Table 6.1. The next section presents an analysis of aspects emerging from the overarching themes of (i) the level of scaffolding required; (ii) the development of online reading comprehension skills and strategies and (iii) the capacity of the children to conduct the online information-seeking cycle.

Aspects of Themes Emerging from the Learning Ecology in Internet Workshops 1 to 8 in RDCWL Phase 1a in the 3rd/4th Class Cohorts

The aspects emerging from analysis of a range of data sources (previously described in chapter 4) in the 3rd/4th class cohort relate to (i) the level of scaffolded support required by the 3rd/4th class groups to enable them to conduct activities during Internet workshops; (ii) the ability of the groups to engage with self-regulatory online reading comprehension processes including formulating questions and summarising information; (iii) the ability of the groups to select, evaluate and revise the search terms generated to focus their online search; and (iv) the ability of the groups to evaluate the reliability of online information. These aspects are developed in the sections which follow.

The Level of Scaffolded Support Required by the 3rd/4th Class Group in Internet Workshops

The 3rd/4th class cohort required a high level of scaffolded support from both the class teacher and the researcher in the earlier stages of the study. The children had

difficulties collaborating, problem-solving, and working independently without recourse to immediate help from the class teacher or researcher. For example, in group 6 Colleen commented, "We're waiting ages. I don't know what to do. Tell her we don't know what key phrases are" (RDa,FN,W3,G6,p2).

The groups also experienced problems with decoding and vocabulary. This was not surprising given the overall low levels of literacy achievement in the class. Eighty-four per cent of the class cohort were at or below the 25th percentile as determined by the Drumcondra Sentence Reading Test (Eivers et al., 2004) at the baseline phase (see Table 5.3). The better readers in each triad group, of their own volition, read the onscreen information aloud for other members of the group or helped with spelling issues.

Identifying the architecture of online information text structures was problematic for the children and the researcher provided explicit instruction in a series of mini-lessons in workshops 1 and 2 on both recognising and utilising such online information text structures. Predictive inferencing, of the content of hyperlinks, was also challenging, as the children were drawing on a somewhat limited prior domain, world or vocabulary knowledge. For example, in the scavenger hunt in the Starchild website in workshop 2 the children were asked to predict the contents of the hyperlink labelled 'Columbia accident' (related to the Columbia space shuttle disaster in 2003). Group 5 predicted that "it might be an accident, like at the Columbia jackets factory", (RDa,FN,W2,G5,p4).

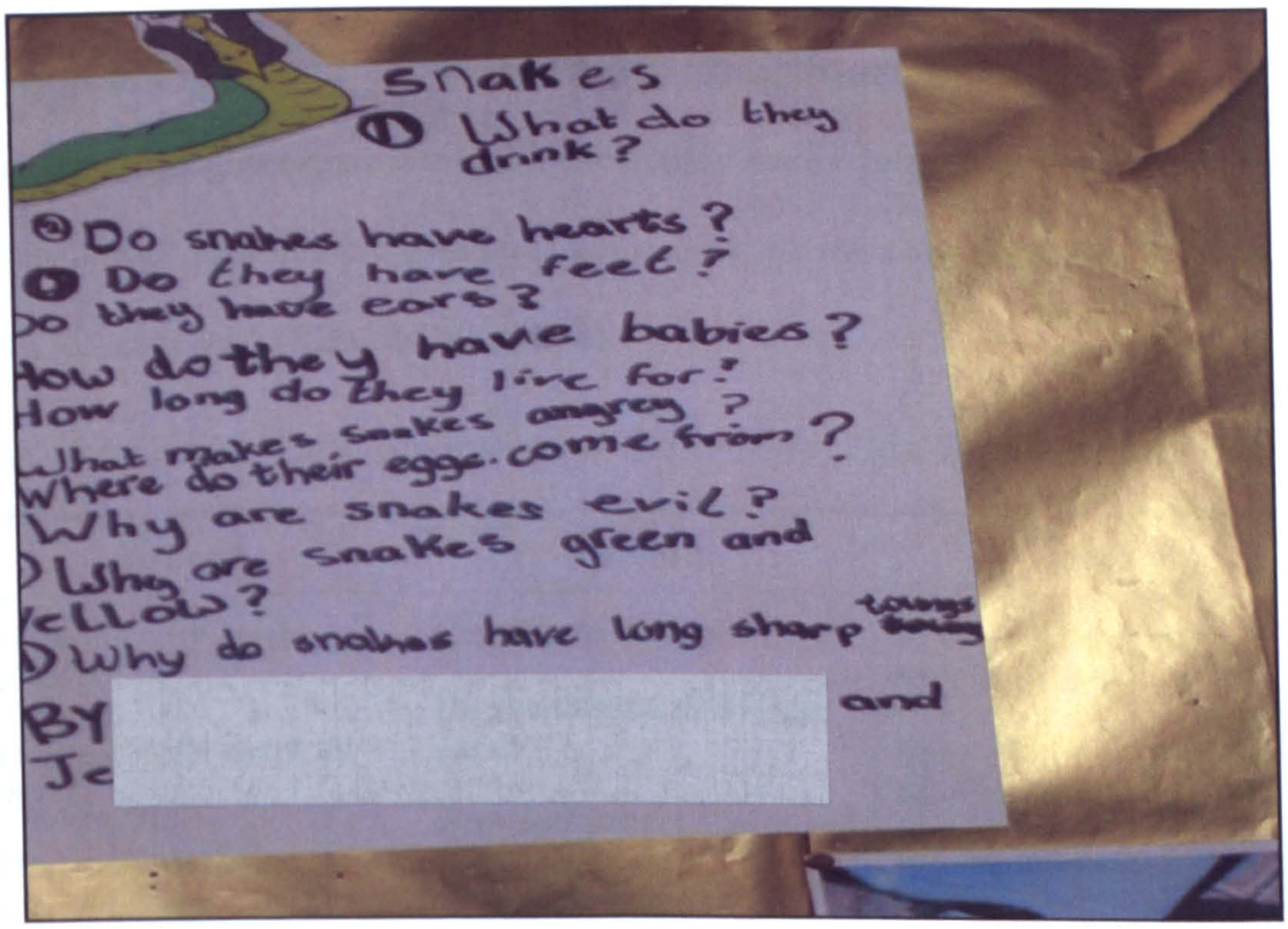
The class teacher and researcher provided scaffolding related to the developing needs of the children. These reactive scaffolds included *procedural scaffolds,* for example how to carry out a task, or how to ask questions; or *prompt scaffolds,* such

as the importance of activating prior knowledge or clarifying ideas expressed; or *instructional scaffolds,* such as the use of a strategy glove for decoding words. The scaffolds provide 'just-in-time' help for the children as they conducted Internet inquiry and may have helped to develop self-efficacy within the focal groups. The assistance provided helped the children to persist with tasks which were beyond their current capabilities. Such assistance prompted Nelly in group 4 to comment to other group members "We're doing brilliant toady aren't we, writing today?" (Rda,FN,W5,G4,p6) or Mary in group 6 to note "I was doing me [my] hardest" (RDa,FN,W5,G6,p11).

The Ability of the Groups to Engage with Self-Regulatory Online Reading Comprehension Processes

Formulating questions. There was little evidence at this stage of the study that the children were engaging in self-regulatory reading processes, such as monitoring, planning, evaluating, or questioning of information. The written questions the children formulated to guide their web quest in RDCWL Phase 1a workshops 3 and 4, as shown in a sample chart in Figure 8.1, were text explicit, factual, level 1 type questions (Guthrie & Taboada, 2004, p. 301), such as "do snakes have hearts?"; or "what colour eyes do they [horses] have?"; or level 2 simple description questions (p. 302), such as "how do you get babies out of a horse?"

Figure 8.1. Sample chart of the questions formulated to guide the web quest in RDCWL Phase 1a, workshop 3.



The 3rd class groups persisted in generating text explicit literal questions in later workshops. For example, the self-generated questions formulated in Internet workshop 6 for paragraphs of information about 'cool things about great white sharks' were green, right there, literal type questions (see Table 8.1). This was in spite of explicit instruction on formulating different types and kinds of questions, drawing on the QARs model, adapted to include a multisensory colour coding and kinaesthetic dimension (discussed previously in relation to the 5th/6th class cohort in Chapter 6, p.193. There are a number of possible reasons for the children's persistence in formulating literal type questions in this phase of the study. First, it may be related to the developmental stage of the children. Second, it may be due to the fact that the children had no previous experience in self-generating questions. Previously, the class teacher had provided questions for the class. Third, the children

were experiencing difficulty in relation to the level of vocabulary on websites. For example, when the children were asked to highlight words on the screen which could cause their 'friend' difficulty, the number of highlighted words provided a window onto the difficulties experienced with vocabulary across the groups. Katie observed, "there's loads of words my friend wouldn't know, we were thinking they would be hard for ourselves" (RDa,FN,W6,G4,p8).

Table 8.1 *Formulation of Questions in Workshop 6 for 'Cool Things About Sharks'*

Group 4	Group 5	Group 6
Do sharks have tooth fairies?	**Can sharks be super stars?**	**Do you know what scientists think?**
Is a great white shark all white?	**Do you think a shark has ears?**	**Do you know where sharks can swim in 40 days?**
What does [do] sharks eat on occasions?	**How do they get sharks out of the sea?**	**Do you know what sharks can do?**
How many babies can the great white hold?		

Note. Font colour green relates to *right there* 'go' questions (Adapted from Hollas, 2004).

Summarising information. Analysis of the data suggested that the groups were attending to the surface code of the text only and were not focussing on the meaning of the text or indeed understanding what they were reading. The summaries produced across the groups tended to be haphazard, with the children restating information verbatim, typically the initial topic sentence. Little attempt was made across the groups to restate the information in their own words. This suggested that the children in the 3rd/4th class focal groups were using the "strategic deficiency" approach (Garner, 1987, p. 303).

Evaluating, Generating, and Revising Search Terms

The emphasis in RDCWL Phase 1a, workshop 5, was on planning, accessing prior knowledge and evaluating search terms. This knowledge was then independently applied in finding answers in a scavenger hunt. The 3rd /4th class cohort showed good understanding in evaluating the differences between 'good' and 'bad' search terms. For example, the search term 'animals' was considered to be a bad search term by group 4 as Katie explained, "You wouldn't get the answer right away. Like you'd have to go through all the birds and dogs and all" (RDa,FN,W5,G4,p5). While the groups utilised the 'topic plus focus' search strategy (Eagleton et al., 2003) in finding the answers to the scavenger hunt in RDCWL Phase 1a workshop 5 they experienced a number of difficulties. The question '*Name two films Colin Farrell acted in'* (as shown in Table 8.2) demonstrated some of these difficulties. These included (i) difficulties with spellings and spacing within the search strings (for example, <ColinFarrelandfilms>; (ii) limited revision of search strings including persistence with unsuccessful search string patterns (indicative, perhaps, of a limited vocabulary range); and finally, (iii) inefficiency in finding the answer to questions. For example, the time taken to find the answer to the 'Colin Farrell' question ranged from 8 minutes 34 seconds to 12 minutes 28 seconds.

Table 8.2 *Search Strings Generated and Search Engines Used for the Scavenger Hunt Questions Across the Focal Groups in the 3rd/4th Class Cohort*

Scavenger Hunt question: Name two films Colin Farrell acted in					
Group 4		**Group 5**		**Group 6**	
Search string generated	Search engine used	Search string generated	Search engine used	Search string generated	Search engine used
Choose movies from categories on Yahooligans <Colin Farrell> <Colin Farrell>	Yahooligans (www.yahooligans.com) Google	<ColinFarrelandfilms> Error message <your search did not match any documents> <Colin Farrell and Films>	Google	<Colin Farrell and films> <Colin Farrell and filns> Choose <did you mean> <Colin Farrell and films>	Yahooligans Google
Total time in minutes spent on finding an answer to question	**10:13**	**Total time in minutes** spent on finding an answer to question	**12:28**	**Total time in minutes** spent on finding an answer to question	**8:34**

Note. The total time in minutes in finding answers to questions was determined by triangulating the time stamps from the Camtasia activity record of online activity with the transcript of the focal groups' conversations.

Evaluating the Reliability of Online Information

In RDCWL, Phase 1a, workshop 8, groups 5 and 6 judged the information on the 'dog island' spoof website as *very reliable.* Sally in group 6 noted "it would help them to be sociable and to have a family" (RDa,FN,W8,G6,p2). Diana commented "it helps the dogs and it would not be on the computer if it was fake" (RDa,FN,W8,G5,p3). Group 4, and in particular Katie in group 4, questioned the reliability of the information presented on the dog island website, drawing on world knowledge often referred to as 'common sense'. She judged the information as

somewhat reliable referring to practical issues, such as availability of food and water for the dogs in the comments which follow:

> There'd be loads of dogs there, and they'd have done loads of stuff, and like, save [say if] they were really stuck on an island like, and they had nothing, what would they eat? How would they get a wash? Well, I know how they'd get a wash, but if they got a wash like that's salt water, and something might happen to their skin or something. Where would the water be? They can't drink sea water so... (RDa,FN,W8,G4,p1).

The 3rd /4th class focal groups did not use any of the signals on the website, such as author information, product information or the availability of email contact to judge reliability. As such, the 3rd/4th class children drew on their prior knowledge of the domain topic and the desirability on their part that the information was true. Also, it appears that world knowledge plays an important part in questioning the reliability of information in an online environment.

Summary of Macro-Analysis Pertaining to RDCWL Phase 1a

A macro-analysis of the issues, from aspects emerging from the ecology of learning pertaining to the study, was conducted at the end of RDCWL Phase 1a. In line with the iterative framework of F&DE, the barriers to the successful implementation of the study in 3rd/4th class cohort were identified as (i) the ability of the groups to problem solve and work independently in an online environment; (ii) the reading ability of the children in terms of decoding and vocabulary, including the impact this had on reading for understanding; (iii) the ability of the children to self-regulate when reading, particularly in relation to activating prior knowledge, formulating questions and summarising information; and finally, (iv) the level of end-user application knowledge. The intervention was then formatively modified and a number of instructional moves and adaptations were made, in close consultation

with the class teacher, to the curriculum, both within the classroom, and within the Internet workshops. These changes were similar, to some extent, to the changes made to the curriculum in the study with the 5th/6th class cohort. Similarities included the development of reading fluency; domain topic knowledge and vocabulary; end-user application knowledge; and knowledge of online and print informational text structures. A number of further changes were made to the curriculum in the 3rd/4th class study. These included a strong focus on the development of self-regulatory reading processes, such as activating and connecting with prior knowledge and formulating questions to guide online searching. The children in the 3rd/4th class cohort were given shorter passages of online text to read and summarise. This provided a more stepped, structured approach to the Internet workshop worksheets. Finally, more attention was given to the readability level of text on the assigned websites.

The next section opens with a brief overview of the changes made in the classroom curriculum. This is followed by a succinct consideration of the five Internet workshops conducted in RDCWL Phase 1b, conducted in year 2 prior to commencement of the Main Study. The section closes with an analysis of data sources and aspects of themes emerging from the ecology of learning pertaining to these Internet workshops.

Reading Development and Critical Web Literacy Phase 1b

The thematic unit of instruction for the 3rd/4th class cohort in year 2 of the study was "Birds and their Environments", again developed in close consultation with the class teacher. The theme was developed from the strand unit 'Plant and Animal Life' and the strand 'Living Things' from the 4th class Science curriculum (DES/NCCA,

1999b). The hands-on activities conducted during RDCWL Phase 1b included a focus day with a professional bird guide, online observations (via a webcam) of the development of blue tit nestlings, and observations of the habits of native birds at feeding stations in the school wildlife garden. Changes were made to the development of reading which were similar in fashion to those made in the 5th/6th class cohort. These included the introduction of literature circles and literature circle roles (see Figure 6.9 for an example of the prompt cards for these roles); the use of authentic literature as class readers which linked to the project theme (for example, *Adam's Starling* (Perdue, 2001); and an increase in the number of *levelled* informational texts related to the theme in the class library.

The instructional content and skills development of the series of Internet workshops developed in Phase 1b is presented in a condensed format in Table 8.3.

Table 8.3 *Summary of Instructional Content, Skills Development and Aspects of Themes Emerging From the Learning Ecology in RDCWL Phase 1b*

Phase 1(b) RDCWL Internet Workshop	**Instructional Content**	**Skills Development**	**Aspects Emerging from the Learning Ecology**
Workshop 1 ***Online informational text structures***	Online informational text structures. End-user application knowledge.	Developing navigational skills. Using online help features. Reflecting on process and product of online inquiry.	• Scaffolded help by class teacher and researcher • Ability of the children to locate, transform and summarise information • Types and kinds of questions asked • Reading as the active construction of meaning
Workshop 2 ***All about birds***	Development of prior knowledge sources. Summarisation. Formulating questions. Domain vocabulary. End-user application knowledge.	Connecting with prior knowledge. Summarising: 321 strategy. Formulating types and kinds of questions. Developing vocabulary skills.	

Workshop 3 ***What makes a bird a bird?***	Development of prior knowledge of domain topic. Formulating questions. Summarisation. Vocabulary development.	Locating information. Generating 'thick' and 'thin' questions. Summarising: Concept map. Using online dictionary for finding meaning of vocabulary.
Workshop 4 ***Birds of prey***	Development of prior knowledge sources. Formulating questions. Summarisation. Strategies for vocabulary development. End–user application knowledge.	Connecting with prior knowledge. Generating text explicit and text implicit questions. Summarising: Use of 321 strategy. Locating words which would cause difficulty for 'friend'. Activating hyperlinks. Navigating between websites. Reflecting on process and product of online inquiry.
Workshop 5 ***Flightless birds***	Development of prior knowledge sources. Formulating questions. Summarisation. Strategies for vocabulary development. End–user application knowledge.	Making connections with prior knowledge. Formulating questions for a 'friend'. Summarising: Determining importance. Developing strategies to predict meaning. Skimming and scanning: Online informational text structures.

Aspects of Themes Emerging From the Learning Ecology in RDCWL Phase 1b

The aspects of themes emerging from the learning ecology in this series of Internet workshops relate to (i) the level of scaffolding provided by the class teacher and researcher to the children in conducting these Internet workshops and (ii) the

development of self-regulatory online reading comprehension processes, particularly in relation to formulating questions, activating prior topic knowledge and locating and transforming information. These aspects are developed in the sections which follow.

The Level of Scaffolding Provided by the Class Teacher and Researcher

There was a gradual release of responsibility for the activities in these Internet workshops from the class teacher and researcher to the children. The guided assistance provided to the individual triads was adapted to the needs of the groups. This assistance was focussed more on building self-confidence in the groups and providing them with the tools to independently direct their own online activities and engage in self-initiated problem solving. There was evidence in the data that the need to provide immediate assistance to the triad groups diminished as the Internet workshops progressed suggesting that the triad groups were engaging in a level of self-initiated problem solving while completing workshop activities. Scaffolded assistance was provided in the development of end-user application knowledge. For example, directing the children to skim and scan for online features, such as hyperlinks and home icons and using online features, such as the 'edit-find' feature. Scaffolded assistance was also provided in developing self-regulatory reading processes, such as developing strategies to clarify the meaning of vocabulary, connecting with prior knowledge, and formulating questions. For example, the children were scaffolded to ask more conceptually based questions. When group 4 asked the question "Why does a bird need feathers?" the researcher commented:

> Researcher: Why does a bird need feathers? That's a very good question. You could have asked a question like "does a bird have feathers", what sort of a question would that be?

Katie: (interrupts) A very thin question.

Researcher: Yes, it wouldn't be that interesting to try and find that out, but "why does he need feathers?" that's a good question, isn't it? That's a thick question, it's got some more things that you need to find out. (RDb,FN,W4,G4,p4).

The next section discusses the growth in the children's use of self-regulatory processes while reading, such as activating prior knowledge, asking questions and locating and summarising information.

The Development of Self-Regulatory Processes While Reading

Activating prior knowledge sources during group activities. The children were asked to activate their prior knowledge of the domain topic at the start of each of the five Internet workshops in the RDCWL Phase 1b. This encouraged the children to make connections with their prior knowledge. As the Internet workshops progressed there was evidence from the data that the children discussed issues, and were beginning to independently draw on prior knowledge from books, films and world knowledge to clarify vocabulary. For example, in discussing the meaning of the word *regurgitate* the children in group 5 drew on their life experiences: "my cousin always does that, it means you eat your food and bring it back up" (RDb,FN,W5,G5,p5). Sally in group 6 explained the processes the children were using in determining the meaning of vocabulary: "you think in your brain, you think what flight is first, and then less, and then go flightless, something that doesn't fly. You can read the sentence that the word is in and see what does it mean...looking at the picture and reading a little bit of it to find out what it is on the page" (RDb,FN,W5,G6 p6). In RDCWL Phase 1b, workshop 4, the children accessed their prior knowledge from images in books in discussing why a bald eagle was a

carnivore. In the example which follows, Katie is questioning the text and wondering how a bald eagle can swallow a mouse without choking. This example suggests evidence of how group members negotiate and construct meaning together by initiating, responding, explaining and drawing on one another's experiences in monitoring text (Daiute & Dalton, 1993; Goatley et al., 1995).

> Miriam: He eats meat 'cause every time I see a picture of a bald eagle he has a mouse in his mouth.
>
> Katie: Do you know when they're eating a mouse do they choke?
>
> Nelly: No, well, if they did they'd all be dead.
>
> Miriam: His head is the same shape as a mouse, he has a big throat. (RDb,FN,W4,G4,p1)

Formulating different levels of questions. The ability of the children to formulate questions, to guide their Internet activity, developed across this series of workshops in Phase 1b. The children were encouraged to change the section headings of online text into questions to focus their reading activity. There was evidence from the work samples that the children began to apply this strategy independently as the workshops progressed (for example, for the section heading 'Feathers' group 6 asked, "why do birds need feathers?"). In RDCWL Phase 1b, workshop 2, there was written work sample evidence, which suggested some growth in the levels of questions formulated. For example, the questions formulated included, *"why can an ostrist [ostrich] not fly?"* (group 4); *"why do feathers fall off birds?"* (group 5); and *"Is a bird very hot?"* (in reference to the fact that birds are warm blooded) (group 6). Asking *why* questions suggest the possibility of more thought provoking, conceptually based answers, than literal yes/no or factually based questions.

Similarly, the question, *"Is a bird very hot"*, may seek to understand the homeothermic nature of birds and their ability to regulate body temperature from a child's perspective.

Determining importance in text. Evidence suggested that the children were creating summaries by copying online information verbatim, and focussing on interesting details, rather than determining importance in text. However, there were more discussions focussing on responding to text while reading. Part of the response to reading is to generate anecdotes which clearly relate to the topic, to draw on relevant prior knowledge and to connect life experiences to the text, in a way that makes it more meaningful for the other children in the group. The following example from group 4 illustrates this point. The group were drawing real life comparisons in discussing the information that an ostrich can kill with a single kick:

Katie: What's eight feet? Come on tell me!

Miriam: Well, I'm three feet.

Katie: That's bigger than my uncle Geoffrey. He wouldn't be able to walk through that door, he'd have to bend down.

Nelly: And he's 330 lbs [ostrich] one ostrich kick, one kick imagine!

Katie: My uncle Geoffrey got a kick from an ostrich but he didn't die. He has a big huge bruise around his body...and he's still alive and he has to breathe like this, look watch [gives example to group]...

Miriam: A kick off an ostrich would be very sore.

Katie: Tell me about it. My uncle was roaring crying and he was only 18 then. It doesn't have Australia 'cause that's where it happened. There's some mean birds out there! (RDb,FN,W5,G4,p2).

In sum, the series of five workshops in RDCWL Phase 1b, focussed on developing end-user application knowledge, navigational skills and domain topic knowledge. Analysis of this series of workshops suggested some growth in the ability of the children to work independently and problem-solve as triad groups; some growth in the ability of the groups to generate questions moving from literal type questions to more conceptually challenging questions; some growth in the ability of the children to activate and connect with prior topic, domain or world knowledge as they responded to text; and finally, limited growth in their ability to locate information and transform that information into coherent summaries of the text read.

Aspects of Themes Emerging from the Learning Ecology in Main Study Internet Workshops 1-4 with a Focus on Generating Search Terms

The instructional content and skills development in the Main Study Generating Search Terms workshops in the 3rd/4th class cohort were similar to those for the 5th/6th class cohort. The reader's attention is directed towards Table 7.3 where the content of the Generating Search Terms workshops was presented in a condensed format. Similarly, the share boards, class reflections, and class discussions paralled those of the 5th/6th class group (again see Table 7.3). The skills and strategies necessary to generate search strings were developed in authentic learning situations within an Internet inquiry project. The aspects of themes emerging from analysis of a range of data sources, previously described, in the Generating Search Terms workshops relate to (i) the level of scaffolding provided to the triad groups as they conducted Internet inquiry and the function of the roles of Questioner, Navigator,

Summariser in enabling the groups to collaborate in self-initiated problem solving; and (ii) the development of self-regulated strategies in generating search terms.

The Function of the Reciprocal Roles in Developing the Groups' Abilities to Problem-Solve During Internet Inquiry

The level of scaffolding provided by the class teacher and researcher continued to diminish across this series of workshops. This was possibly helped by the introduction of the roles of Questioner, Navigator and Summariser in Internet workshops 3 and 4 (for a fuller description of these roles see chapter 7 p. 235; similarly the prompt cards used for the roles were presented in Figure 7.3). These roles helped the triad groups to collaborate and to structure their online activity. The class discussions and reflections at the beginning, mid-point, and end of the Internet workshops also facilitated the children in structuring, sharing and co-ordinating the strategies they had learned. The following quotes are distilled from the *class discussions* at the start of the Main Study workshop 4, and illustrate the children's understanding of the reciprocal roles of Questioner, Navigator and Summariser.

The Questioner: children's understanding

> They make up questions and the best things to start your questions with, the six that you should use, is who, what, when, where, why, how... Say I wanted to find out about parrots and you didn't know anything about them she'd type it down and then look up the Internet... You put parrots plus diet if you're trying to find out what they eat.

The Navigator: children's understanding

> You decide what you're going to look up on as a group and what you typed in and all and sometimes the navigator they scan down the page...You pick which one to go into [and] read the little blurb under it.

The Summariser: children's understanding

> When you're reading it, you find out information and you write it down...You read out loud first. She picks out all the interesting bits...You figure out the words. You can highlight it with the mouse or sound it out or write it on the page and if you don't really know what it means you can look it up on the dictionary [or] break it up into pieces... [or]read the rest of the paragraph you might be able to figure it out (MS,FN,W4,p1-2).

The children's understanding of the questioner role, as shown in the above quotation, included an awareness of the language needed for asking questions; the difference between browsing when you have limited prior knowledge using broad search terms, and focussed searching, using the topic plus superordinate search string formulation, when you are looking for particular information. The discussion around the navigator role suggested an awareness of the active nature of navigation in an online environment where the navigator consciously determines which result to activate by scanning the page, reading the blurb and choosing which result to activate. Finally, the quotation in reference to the summariser role suggested an understanding of the need to condense information and utilise a range of strategies for clarifying vocabulary, such as using contextual clues.

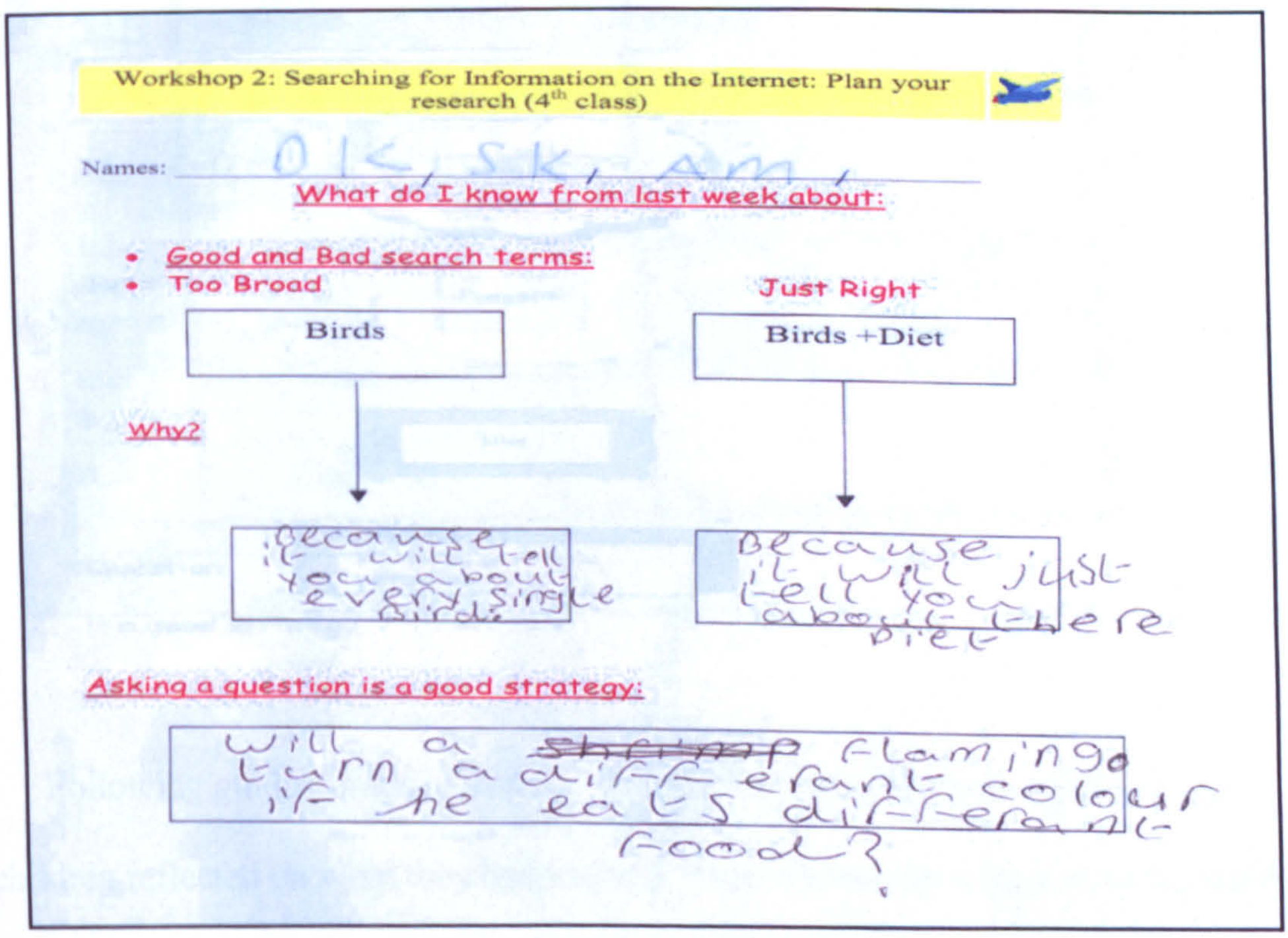
The Development of Self-Regulatory Reading Processes in Generating Search Terms

There was some evidence from the data that the children were engaging in self-regulated strategies, such as planning, questioning, monitoring, and evaluating with regard to generating search terms. The focus in Main Study Workshops 1 and 2 was on narrowing the search focus and evaluating search terms. Figure 8.2 presents a work sample from group 5 in Main Study workshop 2 where the group evaluated search strings as *too broad* or *just right* and gave reasons for their assertions.

Diana commented, "Birds is too broad it [will] tell you every single thing about birds. If you narrow it down, to birds plus diet, it would just tell you about diet"

(MS,FN,W2,G5,p1). The questions formulated across the groups suggested growth in the types of questions generated. These questions included "would the woodpecker when he's chopping the wood does he eat the wood?" or "save [say if] the flamingo didn't eat the shrimp and he ate a different colour food would he be a different colour?" or "do all birds eat insects?" (MS,FN,W2,p2). The children also showed good awareness of the types and kinds of questions to ask. "A thick question is a question that you have to look up for, a thin question is a question that's right there. Thick questions [are questions about] something that you're really interested in instead of stuff that you already know" (MS,FN,W2,p2).

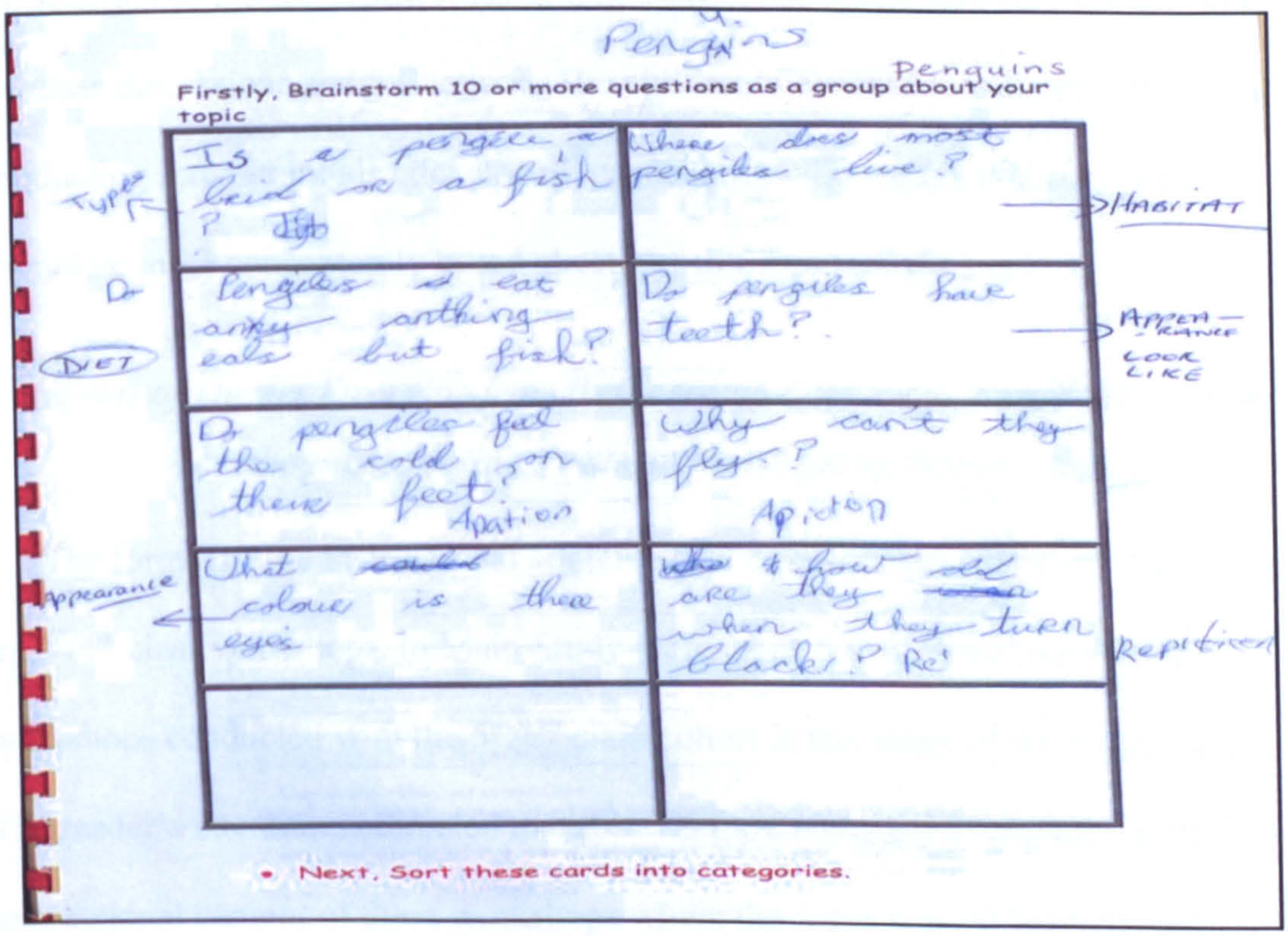
Figure 8.2. Evaluating 'good' and 'bad' search terms, work sample from group 5.



Following explicit strategy instruction of the '*theme topic focus question*' strategy (Eagleton & Dobler, 2007), the children engaged in planning an Internet search using the keywords from their questions as search strings. The children

brainstormed a series of questions and then categorised these questions into superordinate categories. A work sample of this strategy is shown in Figure 8.3. Evidence suggested that the ability of the groups to formulate questions and categorise them into superordinate categories to focus their Internet inquiry developed across this series of workshops.

Figure 8.3. Main study Internet workshop 2 work sample group 4: Brainstorming and categorising questions into superordinate categories.



Following guided practice of these strategies in Main Study workshop 2 the children reflected on what they had learned. Their comments reflected on the need to narrow an Internet search by planning and monitoring the use of the 'topic plus focus' strategy to deal with the amount of information on the Internet, showing a good level of declarative and procedural knowledge. Group 4's comments were typical of the class reflections: "you have to narrow it down to get less information

on the Internet. If you want to find out about birds and diet you click in birds and diet; if you want to find out who birds eat you click birds and prey. We learned that it's better and quicker to put key words, birds plus diet" (MS,FN,W2,G4,p3).

To summarise, the ability of the triad groups to problem solve and conduct Internet inquiry developed during Main Study workshops 1-4, helped, it is suggested, by the scaffolding provided by the class teacher and researcher, the introduction of the reciprocal roles of Questioner, Navigator and Summariser, and the class discussions and reflections. The children's abilities to self-regulate when conducting Internet inquiry developed, particularly with regard to their ability to formulate more conceptually based questions to focus Internet inquiry.

Aspects of Themes Emerging from the Learning Ecology in Main Study Internet Workshops 5-12 with a Focus on Investigating Search Results

The format of the instructional content, skill development, and class discussions in 3rd/4th class workshops, in Main Study workshops 5 to 8, were similar to the workshops conducted with the 5th/6th class cohort at this stage of the Main Study. The reader's attention is directed to Table 7.6 for a condensed summary of the instructional content of these workshops where the focus was on Investigating Search Results with a critical eye.

The independent work in Main Study workshops 9 to 12 focussed on a mini-project in relation to native garden birds. The instructional format for these workshops was again similar in pattern to the workshops in 5th/6th class (see Table 7.7). The Internet workshops focussed on developing reading comprehension strategies to activate prior topic knowledge, plan questions to guide Internet inquiry, and develop vocabulary strategies and summarisation skills. These strategies were

developed in tandem with the development of online information-seeking skills and strategies, such as generating search terms and investigating search results.

The aspects emerging from the ecology of learning in Main Study Internet workshops 5-12 relate to (i) the role of social collaboration in engendering motivation and engagement; (ii) the ability of the groups to investigate search results with a critical eye; and (iii) the development of self-regulatory reading processes.

The Role of Social Collaboration in Engendering Motivation and Engagement

There was a growing confidence within the groups in their own abilities to independently apply their developing end-user application knowledge and the skills and strategies developed during Internet workshops. The reciprocal roles, class discussions, availability of share boards to post questions and summaries, and class and group reflections seemed to enable the children to communicate successful strategies, discuss solutions to problems encountered and share knowledge of Internet inquiry processes. For example, in the following vignette, distilled from a *class discussion* in Main Study Internet workshop 5, the children are sharing their knowledge of the information-seeking processes in online inquiry:

> You think what questions you have, like what you're going to look at, habitat, reproduction, what you want to learn...say what you already know, think what you know...say you want to learn about owls and their diet, you put in the focus words keywords [of] owls plus diet and if that doesn't work you have to maybe go into owls...if it's too broad it gives you all the information and what you're looking for is just right...[search results] you scroll down the page and look at what's the best one, read the blurb and see does it fit, if it's the right one (MS,FN,W5,p1-2).

This class discussion vignette shows a growing awareness within the groups of the need to initiate Internet inquiry with a question and connect with prior

knowledge. It also demonstrates their understanding of search string generation and the necessity to investigate search results with a critical eye.

Investigating Search Results with a Critical Eye

There was considerable evidence, emerging from the data, that the children were engaging with the character of *Inspector Clue-Search* in this series of Internet workshops and were becoming more aware of advertisements of URLs and websites in the general media. They were also investigating search results with a critical eye in a number of ways. Firstly, they showed a growing awareness of the need to scan the search results returned: "The clues right. We looked at the URL to see what kind of website it was and we scanned all 10 results and read the blurbs" (MS,FN,W9,G4,p2). Secondly, they accessed prior knowledge of the URL in unpacking evidence contained in the domain prefix ("the Wikipedia will always help you. You just scramble down there while I write in the category heading", FN,MS,W9,G5,p1); the domain suffix ("We're going into a website and it's an organisation. It's called House Wren and it's from an encyclopaedia and me and Miriam think it's going to be a good website", MS,FN,W11,G4,p2).Thirdly, their ability to critique the returned search results developed over this series of workshops and this was particularly evident in Main Study workshop 7, when they critiqued the returned search results for a simulated inquiry as *most useful* and *least useful*, again citing evidence in relation to the blurbs and the elements within the URL. For example, the written work sample in group 4 commented on the *most useful* search result: *"It's a library website* [www.librarythinkquest.com] *and they could have got it from a book in the library and it's an organisation ,it could be reliable and you could check another website*", (MS,FN,W7,G4,work sample). Similarly, group 5

observed about the *least useful* search result: *"It's a commercial site and it doesn't tell us anything about penguins and it tries to sell things and we don't understand the writing of the heading at the top of the blurb. That site wouldn't tell us nothing"* (MS,FN,W7,G5,work sample).

There was some evidence that the children were aware of reliability issues regarding information on the Internet, and the need to cross-check information and connect with their own prior knowledge from books, other websites or the television."If you think it's not true read another website and see if it's the same. If it all says the same thing then it's definitely true...if you're reading it see if it's what you already know, you could like have read it in a book, or you could have saw [seen] it on another website or the television" (MS,FN,W8). Although the children appeared to have, both procedural and declarative knowledge, in relation to cross checking the reliability of information on other websites, they seldom did so. This may suggest that they lacked conditional knowledge of why it was necessary to cross-check information. The next section explores the abilities of the children to self-regulate during Internet inquiry.

The Development of Self-Regulatory Strategies During Internet Inquiry

Data evidence suggested that there was some growth in the abilities of the children to self-regulate in relation to planning, monitoring, evaluating and questioning. This related to both generating search terms and investigating search results where the children monitored and recalled previous websites visited, planned and revised the keywords used for search strings, and developed in their ability to ask questions to focus online inquiry. Table 8.4 provides samples of the questions

formulated by the focal groups in Main Study workshops 4, 6 and 12. The types of questions generated suggest some growth in the ability of the groups to ask more conceptually challenging questions, such as 'How do feathers help penguins to swim at sea?'This contrasts with the self-generated questions posed in the earlier Internet workshops, conducted in year 1 of the study, such as 'Is a great white shark all white?' The questions posed in Table 8.4 also suggest a growth in the use of domain and topic vocabulary and prior knowledge. This may have been related to the emphasis placed on developing this prior domain knowledge in the RDCWL Phase 1b Internet workshops and the hands-on activities conducted with the 3rd/4th class cohort prior to the commencement of the Main Study workshops. This suggests that the development of a range of prior domain knowledge sources is crucially important to plan questions to focus Internet inquiry.

Table 8.4 *Formulating Questions to Guide Internet Inquiry: Sample Questions from the 3rd/4th Class Focal Groups in Main Study Internet Workshops*

Main Study workshops	Group 4	Group 5	Group 6
Initial (MS Workshop 4)	How do penguins look after their babies?	How tall is the peacock?	Why do owls have their beaks like that?
Mid (MS Workshop 6)	How do their feathers help penguins to swim at sea?	Why does the male have so many colours and the female doesn't?	How do their wings help them catch their prey?
Late (MS Workshop 12)	Why does the male wren lose their feathers in the breathing [breeding] season?	What colours are their eggs how do they communicate and what do they make their nests with?	How do yellowhammers communicate?

The developing ability of the children to generate search terms and investigate search results facilitated the location of relevant information related to their inquiry focus. The children persisted in reading aloud the information on websites although the reading was more fluent and was now undertaken by both the better and middle readers in each group. Although difficulties with vocabulary persisted ("well-harder words, does be a lot harder the words, and me [my] mam doesn't even know them. Sometimes I don't get the sentences" MS,FN,W12,G4), there was more focus on questioning, monitoring and evaluating the information retrieved. There was awareness, also, of the need to summarise information: "read it and put it in your own words" (MS,FN,W9,G4,p2), but work sample evidence suggested a persistence among the groups of directly copying the information retrieved.

In sum, analysis suggested that the triad groups were developing confidence in their abilities to conduct online inquiry. This confidence was developed, it is suggested, by the spiral nature of the curriculum, by the explicit instruction of online strategies, by the scaffolded help provided by the class teacher and researcher, and especially by peer collaboration, share sessions and reflections both within and across the triad groups. The children's capacity to self-regulate continued to develop, particularly in relation to their ability to formulate questions to focus their online activity.

A series of Internet Inquiry Progress Tasks were also conducted with the 3rd/4th class cohort as key points of the study. These tasks provided evidence of the growing ability of the focal groups to independently conduct Internet inquiry. The Internet Inquiry Progress Tasks were similar, in structure, to those conducted with the 5th/6th class cohort (for a description of the Internet Inquiry Progress Tasks in 3rd/4th class

see Table 4.1. See Appendix D for researcher protocol in conducting these tasks). Internet Inquiry Progress Task 1 was conducted prior to commencement of the Main Study workshops. Internet Inquiry Progress Task 2 was conducted after the Generating Search Terms, Main Study workshops. Internet Inquiry Progress Task 3 was conducted after the Main Study was completed. The analysis of these tasks is presented in the sections which follow.

Analysis of Internet Inquiry Progress Tasks 1, 2 and 3 in 3rd/4th class

The next sections draw on both inductive and deductive analysis of the data sources, including the online activity and verbal protocols of the focal group children in conducting Internet Inquiry Progress Tasks 1, 2 and 3. Analysis will be presented across the three Internet inquiry tasks. Attention to developmental differences, both within and across the focal groups, will be discussed where appropriate in relation to the five phases of the Internet information-seeking model, as defined in the present study. These phases were (a) goal formation, understanding the task; (b) generating and revising search terms; (c) investigating search results; (d) locating and critically evaluating the relevancy of the information generated to the task focus; and (e) transforming, synthesising and communication of information. The themes emerging from the data included (i) the use of self-regulatory processes in the development of online reading comprehension and information-seeking skills and strategies; (ii) the levels of knowledge at a declarative, procedural, and conditional level in both generating search terms and investigating search results; (iii) the interfacilitation between the bottleneck skills of generating search strings, investigating search results and locating online information; and (iv) the role of peer collaboration and

social learning in engendering engagement, motivation and persistence with online tasks. Aspects of these themes are presented within the information-seeking cycle.

Goal Formation and Planning: Internet Inquiry Progress Tasks 1, 2, and 3

Analysis of the series of Internet progress tasks conducted with the 3rd/4th class focal groups suggested growth, from a low base, in the ability of the groups to plan and formulate goals for their Internet activity. In Internet Inquiry Progress Task 1 the children were asked to ascertain how penguins adapt to life in the Antarctic. They demonstrated a clear understanding of the task question, epitomised in Aine's comments: "we want to know how, like, penguins live in the sea, like, what they do when they live in the Antarctic, and what they eat and all, and how they stick the coldness, about penguins, how they adapt, how they stick the Antarctica"(MS,T1,G5,p1). However, there was little evidence of extensive planning across all of the 3rd/4th class focal groups prior to commencement of the task.

Similarly, in Internet Inquiry Progress Task 2 the groups engaged in little overt planning. The focus of task 2 related to the diet of a penguin. Group 5 neither engaged in discussions nor in overt planning in relation to the task goal. Diana simply announced that "we're going into Google" using <peacocks plus diet> as their search string because "it will direct me into what they eat and it'll tell us what we're trying to find out" (MS,T2,G5,p1). Mary in group 6 used her role as Questioner to focus the group, using the reciprocal role prompt cards to enquire "what are we trying to find out today?" followed by asking "what's the word or phrase you are going to put into a search engine?" Coleen decided on using the natural language phrase in question format, <what do owls eat> which the group used without any further discussion. Group 4 engaged in some discussion of the

search terms they utilised in planning the task by activating prior knowledge of superordinate categories. Miriam wondered, "what penguins eat or something?" Nelly asked "would that be adaptation?" to which Miriam replied "no that would be diet". Group 4 engaged in some monitoring during the task, focussing on what penguins eat, where they locate food and the adaptations they make in eating food. There was a move away from simply finding a simple answer to a question, in this group, the 'satisficing' behaviour displayed in Internet Inquiry Progress Task 1, to developing a more conceptual understanding of the information they were reading, as Katie commented, "we found our answer. We can go down and see if there's something else or go into something else or something" (MS,T2,G4,p4).

There was good understanding, across the three groups, of all the sub tasks in Internet Inquiry Progress Task 3 and evidence that the groups were growing in their abilities to discuss and control the Internet Inquiry Progress Tasks presented. For example, for task 3a, related to where macaws live, what macaws eat, and how they adapt to where they live, group 5 encapsulated the task using superordinates, such as "we have to find out their habitat, their diet and their adaptations". There was more evidence of planning and discussions among the groups. For example, the children tried to connect with prior knowledge of the domain topic in planning the task. Nelly discussed the possibilities with the other group members "I was going to say macaw bird but we don't know that it's a bird. Just write in macaw first, and see if anything comes up about birds, and if it does we'll just write macaw birds" (FN,T3,G4,p2)

Generating and Revising Search Terms

The ability of the groups to generate search strings developed from *single term* search strings with no revision (SRT task) to generating *natural language phrases*

(Task 1), to the use of the *topic plus focus* strategy with varying levels of knowledge and flexibility(Tasks 2 and 3) as shown in Table 8.5.

Table 8.5 *Search Strings Generated by Focal Groups Across Internet Inquiry Progress Tasks 1, 2 and 3*

Search String Code	Internet Inquiry Progress Tasks	Group 4	Group 5	Group 6
S1. Single term S2. Multiple terms based on the task S3. Natural language phrase S4. Natural language phrase in question format	**Task 1**	<penguins in the Antarctic>(S3) <penguins>(S1) <Antarcita>(sp) (S1) <Antarctica animals> (S2)	<penguins in antartaca> (sp)(S3) <penguins in antarctica> (S3) <How penguins adapt in antarctica>(S3) <How do penguins adapt in antartica>(sp)(S4)	<penguins in the antarctic>(S3) <penguins in antarctic> (S3)(Yahooligans) <where penguins live> (S3)
S5. Topic plus focus S6. Topic plus focus multiple terms	**Task 2**	<diet + what penguins eat>(S10)	<peacocks + diet> (S8)	<what do owls eat>(S4) <owl + diet> (S8)
S7. Topic plus focus (synonym(s)/ subordinates)	**Task 3a**	<macaw> (S1) <macaw bird+habitat> (S8)	<macaw+habitat> (S8) <macaw+diet> (S8)	<macaw+habitat> (S8) <macaw +diet>(S8)
S8. Topic plus focus (superordinate) S9. Dot com S10. Other (Coding adapted from Guinee et al., 2003)	**Task 3b**	<macaw +adaptations> (S8)	<macaw+adaptation > (S8)	<macaw+adaptations >(S8) <macaw+behaviour> (S7) <adaptations>(S1) <macaw +environment> (S7) <macaw+adaptations > (S8)
	Task 3c	<macaw+pet>(S5)	<macaw +diet>(S8)	<macaw+care>(S5)

In Internet Inquiry Progress Task 1 the 3rd/4th class focal groups used mainly *natural language phrases* based on their understanding of the task focus. Despite an awareness in both group 5 and group 6 of the need to revise search strings as "that's not helping us"(MS,T1,G6,p4) and "that doesn't give us anything does it?"(MS,T1,G5,p2), both of these groups persisted with the same search string format. Group 5 were also hampered by spelling difficulties in the search terms used. The evidence suggested that group 4 displayed greater flexibility in generating and revising search terms than either of the other groups in this task. Group 4 were successful with the first search term generated < penguins in the Antarctic> displaying a confidence within the group epitomised by Nelly "she's typing in what we're going to go on to, Da-Da! Google search go!" (MS,T1,G4,p2). Despite finding some initial information related to the task focus with the initial search string, group 4 revised their search strategy, following some discussion, to a broad search focus adopting the 'shopping mall' approach. They used the search string <penguins> as "first of all you could click penguins and you could say where they live" (MS,T1,G4,p7). Later they revised this search string to <Antarctica> because "we're not gaining on very much there anywhere, maybe if you just go into Antarctica maybe that will tell us about the penguins" (MS,T1,G4,p10) and finally, they used <antarctic animals>, "I think we should have wrote down, Antarctic animals, that might give us some [information]" (MS,T1,G4,p11).

There was considerable evidence, in Internet Inquiry Progress Task 2, that the groups had progressed from their persistence in using what were often unsuccessful, natural language phrasings, apparent in Task 1. In general, the groups used the topic plus focus strategy in Task 2. The number of search terms they generated across the

groups was small (n=1 or n=2) as shown in Table 8.5. This may have been related to the nature of the task or the fact that the children were more successful in locating information with the initial search string that they had generated. Group 5 used the topic plus focus superordinate term of <peacocks plus diet> to direct their online search without any revision. In the Camtasia exit interview they made no comment about possible revisions to the search string generation beyond a comment, "that we got loads of things done, we found out what we were looking for" (MS,T2,CInt,p5). One possible interpretation is that group 5 had learned strategic knowledge of search string generation, at both procedural and declarative levels, during explicit strategy instruction in the Internet workshop. Further evidence was needed to see whether this knowledge could be applied flexibly at a conditional level. The flexibility in search term generation in both groups 4 and 6 suggested that the groups were moving towards a level of conditional knowledge of search term generation. Group 6 used the natural language phrase of <what do owls eat> followed by the topic plus focus superordinate <owls + diet> search string. The revised search term they suggested "was to try and shorten it a bit". Group 4 used a search string <diet+what penguins eat> which showed a flexibility, on their part, in generating a search string which combined a superordinate category and a natural language phrase. They displayed good knowledge of the rationale behind this strategy in the Camtasia exit interview "that it wouldn't be too broad and it wouldn't be too small. We tried to narrow it down, just a slight bit, by adding diet in" (MS,T2,CInt,G4,p1)

Analysis of Internet Inquiry Progress Task 3 suggested a more strategic use of the topic plus superordinate strategy (see Table 8.5). The focal groups displayed some flexibility in generating search terms, drawing on strategies and skills

developed in Internet workshops. There was some evidence that the groups were engaging with self-regulatory reading processes, such as planning, evaluating and monitoring. There was some evidence that the ability of the groups to generate search terms had developed at varying levels of procedural, declarative and conditional knowledge. For example, group 4 used the single term <macaw> to ascertain from the search result abstracts that a macaw was a bird. They then included bird in the search term <macaw bird + habitat>drawing on knowledge gained, from earlier Internet workshops, of the need to include *bird* in the search string in order to exclude irrelevant search results (for example, Penguin books). By monitoring the information returned, they spotted the information related to diet for the second part of the task, and so did not revise the search string. They engaged in planning the search string <macaw + adaptations> by discussing other possibilities such as <macaw + environment>. Group 5 did not display the flexibility of strategy use in generating and revising search terms displayed by either group 4 or 6. This may suggest that the levels of knowledge for search string generation in group 5 were more developed at procedural and declarative levels of knowledge than at a conditional level. Evidence from the Internet workshops would also suggest this. However, despite a lack of flexibility and creativity in generating search strings, group 5 were successful in locating information for the task focus. They reflected that "our search terms worked for us. Every single search term we typed in found out something" (FN,T3,G5,p16).

Further evidence of the focal groups' abilities to critique search strings emerged from a simulated inquiry task in Internet Inquiry Progress Task 3c. This task related to a simulated inquiry conducted by 'Mary' who wondered how barn owls can hunt

for small animals at night without bumping into trees. For example, the consensus across the focal groups was that the search string <barn owls> was *too broad* because, "Everything on barn owls [would come up] and you'd be ages looking for what you're trying to find out" (group 5). Similarly, <How can barn owls hunt for small animals at night?> was *too long* "I think that's too long. I think they should put it into key words" (group 4). Finally, <barn owls + adaptations + hunt> was "*Just right* 'cause the thing adaptation, could be anything about their adaptations, so you'd have to put in hunt as well, if you're looking for hunt" (group 6).

Investigating Search Results

The 3rd/4th class focal group adopted two basic strategies in investigating search results, a *snatch and grab* approach and a *limited strategic scrolling* approach (see Table 8.6). This analysis is based on combining the transcription of the think aloud protocols of the focal groups as they conducted the online tasks, with the Camtasia online activity record transcripts, to provide a fuller account of online reading activity. The *snatch and grab* approach is indicated when the group activated a search result randomly with no scrolling (for example, click on 1st result (0)).

Group 5 moved from a *snatch and grab* approach early in Internet Inquiry Progress Task 1 to a more strategic approach to activating search results as the task progressed. For example, reading the search result heading "that one there, it's telling us how penguins live in the Antarctic ... 'cause it tells you, it says learn how penguins adapt to the Antarctica" (MS,T1,G5,p4). Groups 4 and 6 adopted a more *limited strategic scrolling* approach, as indicted in Table 8.6, focussing on information contained in the search result paragraph abstract, and the heading on each search result. Scrolling through results could indicate either that some careful

reading activity was occurring before a search result was activated (suggested by cursor movement along online text on the Camtasia output file), or could also suggest an inefficient strategy in terms of speed and efficiency. Group 6, for example, scrolled through results before activating, in cycle two, the 3rd and 7th results respectively, following scrolling. However, when Sally asked "which one will I go into?" Coleen responded "which one did we not go into yet?" (MS,T1,G6,p3), suggesting both inefficiency and limited strategic activation of results.

Table 8.6 *Actions of the 3rd/4th Class Groups in Activating Each Search Result in Internet Inquiry Progress Task 1*

Cycle of Information Seeking	Group 4	Group 5	Group 6
1st cycle	Click on 5th result (1)	Click on 2nd result(0) Click on 1st result (0) not relevant to task Click on 5th result (1) not relevant to task	Click on 1st result (0) Click on 4th result (1) Click on 7th result (1) Click on 3rd result (2)
2nd cycle	Click on 4th result (site categories in Yahooligans)(1)	Click on 1st result (0)	Click on 3rd result (1) Click on 7th result (1) then (2)
3rd cycle	Click on 0 results (Google)	Click on 1st result (0)	Click on 1st result (0) Click on 9th result (1) **STOP**
4th cycle	Click on 2nd result(1) **STOP**	Click on 1st result (1) **STOP**	

Note. Scrolling activity determined from Camtasia activity record indicated in brackets. (0) refers to no scrolling; (1) scrolling down (2) scrolling up.
Note. One cycle of information-seeking is completed when the search string is revised or the group finished searching for information.

In Internet Inquiry Progress Task 2 there was more evidence that the groups were moving towards a *limited strategic scrolling* approach in activating search results (see Table 8.7). Group 4's comments in the Camtasia exit interview were typical of the responses of the 3rd/4th class focal groups:

> We read under them, and we read the first one, and we thought that looks good…you could find out about, where you're going to learn in a bit of the paragraph, and then you can see what drafts you are going to learn… it said diet and feeding, we read all the questions, and then it said answers so we would have found the answers to the questions (MS,T2,CInt,G4,p1).

Data evidence suggested that the children monitored the search results, to some degree, for keywords which matched the task focus. Again, what the children were not doing was focussing on evidence provided by the URL of the origin of the website, or clues contained in the URL to establish the trustworthiness of the website.

Table 8.7 *Actions of the 3rd/4th Class Focal Groups in Activating Each Search Result in Internet Inquiry Progress Task 2*

Information-Seeking Cycle	Group 4	Group 5	Group 6
1st cycle	Click on 1st result (0) (cursor movement indicating reading activity of result) Click on 3rd result (1) **STOP**	Click on 1st result (1) then (2) Click on 3rd result (1)(2)(1) Click on 7th result (1) Click on 9th result (1) **STOP**	Click on 1st result (0)
2nd cycle			Click on 6th result (1) **STOP**

Analysis of Internet Inquiry Progress Task 3 (shown in Table 8.8) suggested that the children had moved considerably to a more developed *limited strategic scrolling* approach of investigating search results by focussing on (i) skimming the information contained in the search results paragraph and matching key words to the task focus and (ii) making some references to the domain name suffix and prefix. The groups were more strategic in activating search results. For example, group 4 did not activate any results of the first cycle of information-seeking. Instead they revised the search string and activated the 7th result on the second information-seeking cycle. This suggests that they were developing an awareness of key indicators of relevancy in the search results. They recalled sites previously visited, and used the cache memory of sites visited to backtrack, suggesting a growing sophistication with navigation on the Internet. The group also monitored the relevance of the search result to the task goal, noting in the comments which follow that the information retrieved was not relevant to the task. "The first Google yoke that we went into was just macaws and that didn't work out. It just came up with everything that *was offside* and wasn't very important" (FN,T3,G4,p6). In critiquing the most useful search result in Task 3c group 4 commented on the domain suffix and the reliability of information suggesting an emerging level of *skilful investigation* of search results and a developing awareness of the clues provided by the URL: "It's dot org, it might have, it's probably reliable because they got it from a book or something and put it on their web page" (FN,T3(c),G4,p6).

Group 6 monitored vocabulary ("the hard words, you couldn't read anything", FN,T3c,G6,p6), recalled search results previously visited, and focussed on key words in the abstract paragraph related to the task:" it has behaviour written after

adaptation. Well I'd go into that one" (FN,T3,G6,p8). There was also an emerging awareness of a *skilful investigation* of URLs in this group. "It's only a buying thing. Amazon, they're the ones you buy things on" (FN,T3,G6,p9).

Finally, group 5 scrolled down through the search results, taking their time before activating any of them, with little discussion, "we're thinking which one will we pick, there's loads of them, and that some of the results are really confusing" (FN,T3,G5,p7). Diana's comment in Task 3(c) "I'm thinking it [search results] looks very hard so we mightn't know most of the words on it" (FN,T3c,G5,p6) suggested that the group were experiencing difficulties with the decoding of words in search result abstracts.

Table 8.8 *Actions of the 3rd/4th Class Focal Groups in Activating Each Search Result in Internet Inquiry Progress Task 3*

Information-seeking processes Task 3a, 3b.	Group 4	Group 5	Group 6
Can you find out where does a macaw live?	Click on 0 results Click on 7th result (1)	Click on 1st result (1) Click on 1st result (1)	Click on 2nd result (1) then (2) Click on 5th result (1)
What kind of food do they eat?	Click on 7th result (0)	Click on 1st result (1) Click on 3rd result (1)	Click on 3rd result (1) Click on 5th result(not relevant to task) Click on 3rd result (1)
What adaptations do they make to live in their environment?	Click on 2nd result (1) Click on 3rd result (1)	Click on 4th result (1) Click on 2nd result (1) Click on 3rd result (1)	Click on 1st result Click on 8th result Click on 7th result (1) Click on 3rd result (1) Click on 0 results Click on 2nd result (1) Click on 3rd result (1)
Scenario presented to focal groups to find out how to take care of a macaw as a pet	Click on 4th result (1) Click on 2nd result (1) **STOP**	Click on 2nd result (1) Click on 4th result (1) **STOP**	Click on 6th result (1) Click on 1st result (1 then 2) **STOP**

Locating, Transforming and Communication of Information Related to Internet Inquiry Progress Tasks 1, 2 and 3

The aspects emerging from the ecology of learning across this series of Internet Inquiry Progress Tasks regarding locating, transforming and communicating

information relate to (i) the focal groups' abilities to generate relevant information for the task focus; (ii) a growth in the capacity to engage in self-regulatory reading processes as part of a collaborative group; and (iii) the interfacilitation between generating search terms, investigating search results and generating relevant information.

The focal groups' abilities to generate relevant information for the task focus.

The baseline task presented to the focal groups in the Sick Rabbit Task (SRT) was to find information to help a friend with a sick rabbit. This task has strong similarities to the task given to the 3rd/4th class groups in Task 3b, in relation to providing information about the care of the macaw as a pet. As such, growth in the ability of the children to generate information, across all the Internet Inquiry Progress Tasks, can be exemplified by comparing and contrasting data analysis from both of these tasks.

In the baseline SRT, as previously discussed in Chapter 5, the focal groups had great difficulty generating any information related to the task, displayed weak end-user application knowledge, became disoriented on the Internet, and had very limited capacities to generate search terms and investigate search results. This was especially the case in group 4 where the group never retrieved any information relevant to the task. This lead Katie to assert, "There's no rabbits on the Internet" (SRT,G4,p7). In Task 3b the focus was on the care of a macaw as a pet and the focal groups generated relevant pieces of advice for 'Mary' connected to behaviour, life-span, environment, diet, health and play (group 4, n=11; group 5, n=6; and group 6, n=3). This suggested considerable growth in the capacity of the groups to locate and generate relevant information during Internet inquiry. They were also less easily satisfied with

the information retrieved. When the researcher asked the children to reflect on their ability to retrieve information related to the task, Katie noted "we wanted to find out a little more, like can you learn them tricks?" (FN,T3b,G4,p6). It was also clear that the children were more focussed in their discussions on determining importance in the information they retrieved for the task focus, as the following examples from groups 4 and 5 in relation to life-span and environment suggest:

> Miriam: I think we should write down macaws can live up to 50 to 70 years 'cause then she'd know that she'd probably have a pet for life and 'cause she might be thinking, 'oh, I might only have this for like a year' or something (FN,T3b,G4,p2).

and

> Sienna: Macaws are sensitive to smoking. They're not allowed to smoke, and save [say if] her Mam and Dad were smoking, they'd had to smoke out the back [garden] and if she didn't know that, and they smoked while the macaw was there, the macaw would go mad in the kitchen (FN,T3b,G5,p14).

Growth in capacity to engage in self-regulatory reading processes as part of a collaborative group. The use of the reciprocal roles of Questioner, Navigator and Summariser within the groups helped the groups to collaborate and effectively structure their online activity. The roles appeared to engender self-regulation, motivation, engagement and self-efficacy within the groups. Evidence emerging from the data sources suggested growth and development, across the series of Internet Inquiry Progress Tasks, in the ability of the focal groups to engage in more self-regulatory reading processes, such as monitoring, evaluating, planning, asking questions of text, and connecting with prior knowledge when reading. This was particularly the case in group 4. The following illustrative vignette, from Internet Inquiry Progress Task 2, shows group 4 engaged in active construction of meaning,

through asking questions, activating prior knowledge of regurgitation, and monitoring the text.

Miriam: Penguins don't have teeth.

Katie: Do they not? Where does it say that? How do they feed then? Then how do they chew?

Miriam: They just swallow it, and some of them they keep in their belly like, and vomit it back up. I know that sounds disgusting.

Katie: So, they just go Unk!

Miriam: Yeah, but they keep some of it in their mouth and have it in their stomach.

Katie: How do they sleep?

Miriam: Do they hunt at night? (MS,T2,G4,p5)

Decoding difficulties persisted across the series of Internet Inquiry Progress Tasks, (particularly in focal groups 5 and 6), but evidence suggested that the children were overcoming some of these difficulties. The groups were more aware of the need to monitor their understanding of text, as Miriam explained: "That it's going to be kinda' hard 'cause I don't know what some of the words mean. *I know how to say them but I don't know what they mean*" (FN,T3,G4,p2). When the groups encountered unknown words they used the Google search engine, the online dictionary or thesaurus to determine meaning. Then, they reread the text thereby monitoring and developing their understanding of what they were reading. They also asked questions of the text to monitor understanding. For example, when reading information related to the diet of macaws, which included chicken thigh bones, Coleen, in group 6, accessed prior knowledge to ask, "can they eat bones? Have

birds got teeth?" to which Sally responded, "no, they've only got a beak. They champ down see that pointy thing" (FN,T3,G6,p6).

The Interfacilitation Between Generating Search Terms, Investigating Search Results and Generating Relevant Information

The growth in the development of the 'bottleneck skills' of effectively generating and revising search strings and investigating search results with a critical eye across the Internet Inquiry Progress Tasks facilitated the children in locating information relevant to the task focus. Analysis of the Camtasia activity record sheets, for both the SRT task and Internet Inquiry Progress Tasks 3a and 3b, indicated considerable growth, in the percentage amount of time, relative to the task length, spent on reading online content pages (see Table 8.9). This suggests that the children were developing competence, in both generating search terms and investigating search results, and this growing competence facilitated the children in locating and reading content pages which were relevant to the task focus. There was also considerable growth in the children's end-user application knowledge. For example, their abilities to navigate between and within websites; their growing confidence in using Internet language to communicate with one another; and the use of online informational text structures, such as headings and online help features.

Table 8.9 *Proportion of Time Spent on Content Pages Relative to the Task Length in the SRT Task and Internet Inquiry Progress Task 3 a and b*

Internet Inquiry Task	**Group 4**	**Group 5**	**Group 6**
SRT Task	0%	15%	28%
Internet Inquiry Progress Task 3a, 3b	65%	55%	66%

In sum, the 3rd/4th class children's abilities to conduct Internet inquiry developed considerably across the study. They developed skills and strategies to generate and revise search strings and investigate search results with a critical eye. The growth in both generating search strings and investigating search results interfacilitated the location of relevant content pages to read. Differences in the abilities of the groups to conduct online inquiry were related firstly, to their capacity to self-regulate in an online environment and secondly, to the levels of procedural, declarative and conditional knowledge of online reading and information-seeking skills and strategies. The development of effective online reading and information-seeking skills and strategies was enabled, it is suggested, by the spiral nature of the integrated curriculum, by peer and social collaboration, coupled with explicit strategy instruction and scaffolded assistance.

Communication of Information

A qualitative review of the PowerPoint presentations produced by the 3rd/4th class cohorts in year 1 of the study in RDCWL (Phase1a) revealed that the children organised the information under headings and matched the illustrations to the text content (see Appendix I for sample PowerPoint slides). The information presented on the PowerPoint slides consisted predominantly of factual statements, with some limited examples of simple descriptive statements (Guthrie & Taboada, 2004). For example, "A woodpecker can dig for insects in tree trunks with his sharp beak" (group 6). Some of these statements drew on the children's prior experience of owning pets ("When cats are sad you hear them crying and you feel sorry for them so you have to make them comfy and feed them"). Other statements were

copied verbatim from the original text source ("A young raptor adult soars on long parallel sided wings that are flexed").

The children constructed multimodal presentations in the form of Reale books during the Main Study. Reale books were previously described for the 5th/6th class cohort in chapter 7. The Reale books developed by the 3rd /4th class children in the Main Study showed development in the ability of the children to organise information under informational text structures. They also contained author information and had more of a sense of audience. For example, all of the Reale books contained information for the reader on how to search for information online. A qualitative review of the information contained in these books using the Guthrie and Taboada (2004) framework revealed that group 5 persisted in the presentation of factual type information in the format of a questions-and-answer presentation of information. For example, they formulated the question, "How do peacocks say hello to each other?" and wrote, "They say it with sound, smell and body language". The Reale books of groups 4 and 6, showed some growth in the ability of the children to include more complex explanations of the interactions of organisms within a biome. For example, "Penguins' legs are set far back on their body which makes them walk with a waddle" (group 4) and [owls] "Their hearing is excellent and they use their ears to find their prey" (see Appendix J for sample Reale pages from the 3rd/4th class cohort).

Part 2 Comparison of Aspects of Themes Emerging from the Learning Ecology in 3rd/4th Class with the 5th/6th Class Cohort

The sections which follow consider developmental patterns, in relation to similarities and differences between the 3rd/4th class and 5th /6th class cohorts across the present longitudinal study. Aspects of themes emerging from the data relate to (i) the development of online reading comprehension strategies and the ability of the groups to self-regulate when reading; (ii) the ability to engage in information-seeking cycles on the Internet; and finally, (iii) the role of peer collaboration in developing online skills and strategies.

The Development of Online Reading Comprehension Strategies and the Ability of the Groups to Self-Regulate When Reading

The sections which follow compare and contrast the development, across both cohorts, of the growth in reading fluency, decoding and prior domain vocabulary; the ability of the children to formulate questions; and the capacity of the children to summarise information.

Overall, the baseline reading achievement levels in the 3rd/4th class cohort were lower than the reading achievement levels in the 5th/6th class cohort. This impacted upon the ability of the 3rd/4th class children to read online information. The 3rd/4th class cohort expended considerable cognitive energy on decoding, attending to the surface code of the text. Initially, they engaged in neither constructing meaning as they read, nor indeed, deep processing of the text.

The introduction of literature circles increased the amount and breadth of the reading undertaken by the children in both class cohorts. The integrated nature of the curriculum, linking science, literacy and the Internet, allowed the children to forge

links across the curriculum and to develop domain topic vocabulary knowledge. Likewise, the hands-on activities helped to develop a more extensive vocabulary related to the domain topic of the class Internet project. The class teacher and researcher, spent considerable time supporting the 3rd/4th class cohort children in developing skills and strategies to deal with decoding and vocabulary difficulties. However, overall, the 5th/6th class cohort had less difficulty decoding text. They had a more extensive reading vocabulary range and more world knowledge to draw on. They engaged more in discussion of the possibilities in their triad groups and were also more capable of a deeper processing of the text than the 3rd/4th class cohort.

The ability of the children to formulate self-generated questions developed across the longitudinal study. In RDCWL, Phase 1a, workshop 6, the class cohorts were asked to formulate questions to ask a 'friend' to ascertain the 'friend's' understanding of a particular text. Table 8.10 shows a cross group comparison, between the 3rd/4th class (shown previously in Table 8.1) and the 5th/6th class (shown previously in Table 6.4) cohorts.

Table 8.10 *Cross Group Comparison of the Formulation of Questions for 'Cool Things About Sharks' in Workshop 6 (RDCWL, Phase 1a)*

Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
How long would a shark be at birth? **Do you think that females tend to be bigger than males?** **How long can a shark hear?** **Do you think that sea lions taste better than people?**	**What blends with the murky sea floor?** **Are all sharks man eaters?** **How long was a baby shark?** **Name some of the things that a great white shark can swallow?**	**How do you think they can fit so much babies in their belly?** **How long do you think it will take the shark to grow to its normal size?** **How does a shark loose all its teeth?** **How come they have back teeth there and humans don't?**	**Do sharks have tooth fairies?** **Is a great white shark all white?** **What does sharks eat on occasions?** **How many babies can the great white hold?**	**Can sharks be super stars?** **Do you think a shark has ears?** **How do they get sharks out of the sea?**	**Do you know what scientists think?** **Do you know where sharks can swim in 40 days?** **Do you know what sharks can do?**

Note. Font colour green relates to right there 'go' questions; orange to think and search 'slow down' questions; red relates to author and me 'stop' questions and black relates to on my own 'race-flag' questions (Adapted from Hollas, 2004).
Note. In this Table groups 1-3 refer to the 5th/6th class cohort. Groups 4-6 refer to the 3rd/4th class cohort.

The 3rd/4th class cohort (groups 4-6) formulated text explicit, literal questions, often using the sentence structure for question formulation. These questions required a simple classification, yes/no, or factual type answers. This level of questioning relates to level one on the Guthrie and Taboada (2004) and Taboada and Guthrie (2006) questioning rubric. The questions reflected the developmental level of the children. For example, do sharks have tooth fairies? Although the 5th/6th class cohort also formulated text explicit questions in the earlier workshops, by workshop 6 there was more movement in this cohort towards more text implicit, or scriptically

explicit, questions. These are level two type questions (Guthrie & Taboada 2004; Taboada & Guthrie, 2006) requiring more conceptual knowledge to formulate the question and focussing more on descriptions of the processes within the biome. Group 3 in 5th/6th class cohort, in particular, had moved considerably towards questions at level three requiring more complex explanations of the interrelationships within the biome. This group also engaged in more self-regulatory reading processes, such as planning, monitoring, evaluating, and connecting with prior knowledge. This suggests that self-regulatory reading processes may support a deeper processing of text and lead to the formulation of more conceptually based questions.

By the end of the Main Study both class cohorts had developed considerably in their abilities to formulate questions to focus their online activity. A cross group comparison is shown in Table 8.11 from three stages of the Main Study: initial, mid and late stages. (This table is drawn from Table 7.8 for 5th/6th class and Table 8.4 for 3rd/4th class). The questions are higher level questions requiring more conceptually based knowledge about the interaction and inter-relationships of organisms within a biome. The questions demonstrate an awareness of superordinate categorisations, such as communication and reproduction. The 5th/6th class questions draw on a more extensive domain-specific vocabulary range; the questions are more connected with prior domain knowledge and show a more extensive world knowledge than the 3rd/4th class cohort questions.

Table 8.11 *Formulating Questions to Guide Internet Inquiry: Sample Questions from the Focal Groups in 3rd/4th and 5th/6th Class Cohorts in Main Study Internet Workshops 4, 6 and 12*

	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6
Initial (w4)	Why do some sharks not eat meat?	What to bobcats eat?	How do koalas mate?	How do penguins look after their babies?	How tall is the peacock?	Why do owls have their beaks like that?
Mid (w6)	How do sharks communicate? How deep do they go?	Where do desert tortoises have their babies?	How do penguins understand each other?	How do their feathers help penguins to swim at sea?	Why does the male have so many colours and the female doesn't?	How do their wings help them catch their prey?
Late (w12)	Dose [Does] their behaviour [crocodiles] cause them to be isticed [extinct]?	Why are desert tortoises endangered?	What are the threats to penguins? How are they endangered?	Why does the male wren lose their feathers in the breathing [breeding] season?	What colours are their eggs, how do they communi-cate, and what do they make their nests with?	How do yellow hammers communi-cate?

Note. In this Table Groups 1-3 refer to the 5th/6th class cohort. Groups 4-6 refer to the 3rd/4th class cohort.

As described earlier in the chapter, the 3rd/4th class cohort initially attended to the surface code of the text, and therefore their summaries of online text tended to be haphazard. The children merely copied the information verbatim, often using the initial topic sentence as a summary. The groups, on occasions, were distracted by interesting details within the text and often referred to salacious details in their summaries. By the end of the Main Study group 5 had moved from the 'strategic deficiency' (Garner, 1987) strategy to the use of the 'copy-delete' strategy. Meanwhile, there was some evidence that groups 4 and 6 were engaging in more

self-regulatory reading processes and were discussing the possibilities with regard to summarisation to a greater extent. There was evidence of rephrasing of information and some evidence of the emergence of superordinates in the summaries generated in these groups.

While difficulties with summarisation also persisted in the 5th/6th class cohort, there was some evidence that the focal groups in 5th/6th class (in particular group 3) were developing skills, albeit at an emergent level, in determining importance, making notes, and monitoring and clarifying vocabulary. They evaluated the reliability of information retrieved and synthesised information through rephrasing as a summary.

The 3rd/4th class cohorts often approached the online reading task in a linear fashion reading from the top of the screen to the bottom. By comparison, the 5th/6th class cohort independently used a number of online features, such as the 'edit-find' feature, which helped them to deal with the amount of information presented online, and to speedily access relevant information. The groups also made more extensive use of navigational features, such as the drop-down cache menu of websites visited. They also accessed the glossary and online dictionary, explored menu headings and subheading, investigated hyperlinks, and utilised online spelling helps, and the Google image search engine to a far greater extent than the 3rd/4th class cohort. This suggests a higher level of end-user application knowledge in the 5th/ 6th class cohort.

The information contained in the Reale books constructed by both class cohorts suggested growth in the depth of information provided in the Reale books when compared to the earlier PowerPoint presentations. However, there was more growth in the ability of the 5th/6th class cohort to include more complex statements about the

interactions and patterns of inter-relationships among organisms in a biome (see Appendix L for Reale book sample pages). Overall this suggests developmental differences between the two cohorts in summarisation.

Standardised Reading Achievement Scores

Two standardised reading achievement tests, the DSRT and the MICRA-T, were administered at pre-, mid- and post-intervention phases. A one-way repeated measures ANOVA was conducted to compare standardised achievement scores on the Drumcondra Sentence Reading Test (DSRT) and the MICRA T test at the baseline, mid-intervention and post-intervention phases. The means and standard deviations are presented in Table 8.12. The DSRT data revealed a significant effect for time for both the $5^{th}/6^{th}$ class cohort (Wilks' Lambda =.53, F(2,11) =4.95, p<.029, partial eta squared =.474) and the $3^{rd}/4^{th}$ class cohort (Wilks' Lambda =.33, F(2,18) =17.81, p<.000, partial eta squared =.664).

In contrast, the MICRA-T results did not reveal a significant effect for either the $5^{th}/6^{th}$ class cohort (Wilks' Lambda =.99, F(2,13) =.00, p<.99, partial eta squared=.001) or the $3^{rd}/4^{th}$ class cohort (Wilks' Lambda =.89, F(2,18)=1.08, p<.35, partial eta squared =.108).

A post hoc paired-samples t-test was conducted to compare mean scores of reading achievement on pupil scores for the DSRT. There was a statistically significant increase in the DSRT for the $5^{th}/6^{th}$ class cohort from pre scores (M=83.46, SD =11.19) to post scores (M=88.62, SD=8.80), t(12)=-2.43, p<.032. The eta squared statistic (.33) indicated a large effect size. Similarly, there was a significant increase in the DSRT for the $3^{rd}/4^{th}$ class cohort from pre scores

(M=80.90, SD =11.83) to post scores (M=87.85, SD=12.37), t(19)= -4.11, p<.000. The eta squared statistic (.46) indicated a large effect size.

A possible explanation for the lack of convergence of significance between the DSRT and the MICRA-T may be that the DSRT is a better measure of pupil achievement at the extreme ends of the distribution, in this case at the lower end. For example, the mean standardised score at pre-test for the DSRT is 10 points lower than the MICRA-T standard scores in the 3rd/4th class cohort (Personal communication, G. Shiel, March, 31, 2009).

Table 8.12 *Mean Reading Achievement Scores of 5th/6th Class and 3rd/4th Class as Determined by the DSRT and MICRA-T at Pre, Mid and Post Stages of the Study*

Class grade	Standardised Reading Achievement Test	Time conducted	Mean Standardised Scores	SD
5th/6th class	DSRT	Pre	83.46	11.19
	n=13	Mid	86.15	9.82
		Post	88.62	8.80
	MICRA-T	Pre	90.40	10.44
	n=15	Mid	90.47	11.99
		Post	90.53	11.00
3rd/4th class	DSRT	Pre	80.90	11.83
	n=20	Mid	90.95	11.88
		Post	87.85	12.37
	MICRA-T	Pre	90.50	11.59
	n=20	Mid	90.30	10.78
		Post	88.75	9.56

Online information-Seeking Cycles: Generating Search Terms and Investigating Search Results

Analysis of the data, in reference to generating search terms, suggested that there was considerable growth within both class cohorts in their ability to generate effective search strings, across the phases of the present study. The focal groups moved from the random use of *broad* search terms and *natural language* phrasing in both the baseline SRT task and early in RDCWL Phase 1a to the use of the *topic plus focus superordinate* search string in the Main Study. The ability of the focal groups to generate search strings was helped by the development of domain and topic vocabulary knowledge in the RDCWL Phase 1b, and the hands-on activities conducted during the study. This enabled the children to use synonyms, subordinates and superordinates to revise their search strings. The $5^{th}/6^{th}$ class cohort could plan and revise search strings to a greater extent, had more flexibility in generating and revising search strings, and had more awareness of ineffective search strings than the $3^{rd}/4^{th}$ class cohort groups. This suggested that the $5^{th}/6^{th}$ class cohort had higher levels of knowledge of search string generation at procedural, declarative and conditional levels of knowledge than the $3^{rd}/4^{th}$ class cohort.

In investigating search results with a critical eye, the $3^{rd}/4^{th}$ class cohort groups moved considerably from the favoured *snatch and grab* approach in search result investigation early in the study to a more *limited strategic approach* with some evidence of a *skilful investigation* approach emerging in groups 4 and 6. Analysis suggested that the $5^{th}/6^{th}$ class cohort were more skilful in investigating search results focussing more on clues provided in the abstract paragraph, the URL domain-suffix and-prefix. They also revisited the search results page, cross-checked information,

questioned the reliability of information retrieved, and made more overt references to predictive inferencing based on hyperlinks than the 3rd/4th class children.

The 5th/6th class cohort also investigated search results more effectively, efficiently and speedily than the 3rd/4th class cohort. For example, Tables 6.3 and 8.2 documented the time taken by each of the focal groups to retrieve an answer to the question, '*Name two films Colin Farrell acted in*' from the scavenger hunt in Workshop 5 (RDCWL, Phase 1a). This time differential ranged from 1 minute 20 seconds (group 1), 8 minutes 30 seconds (group 2), and 7 minutes 34 seconds (group 3) in the 5th/6th class cohort to 10 minutes 13 seconds (group 4), 12 minutes 28 seconds (group 5), and 8 minutes and 34 seconds (group 6). Overall, the 3rd/4th class cohort took more time to generate an answer to this question. This suggested that the speed, efficiency and ability to navigate between and across websites were lower in the 3rd /4th class cohort than the 5th/6th class cohort.

Internet Inquiry Progress Tasks 3a and b conducted at the end of the Main Study provided further evidence of the speed and efficiency with which the focal groups retrieved information for a task focussed on the habitat, diet and adaptations to the environment made by a macaw (3rd/4th class) and a walaroo (5th/6th class). Groups 5 and 6 spent 37 minutes 24 seconds and 28 minutes 6 seconds respectively on retrieving relevant task information. Group 4 generated relevant information for the task in 20 minutes 4 seconds. Group 1 in the 5th/6th class cohort expended a similar amount of time to group 4 in retrieving information in 23 minutes 30 seconds. Groups 2 and 3 in 5th/6th class cohort spent 9 minutes 42 seconds and 15 minutes 39 seconds respectively on the task. It is important to note that the time taken in the 5th/6th class cohorts also included time spent cross-checking information on other

websites and using an online dictionary. This suggested that the quality of time expenditure was also more developed in the 5th/6th class cohort. Other authors (Leu et al., 2004, p. 1597) have indicated that speed and efficiency in information retrieval are crucial skills to develop on the Internet.

The Role of Scaffolding and Peer-Collaboration in an Online Environment

The researcher provided explicit strategy instruction at the outset of the Internet workshop in developing both online reading skills and end-user application knowledge. This was followed by guided and independent practice where the class teachers and researcher scaffolded the children to apply these skills and strategies in online inquiry activities. The scaffolding provided by the class teachers and researcher was dynamic and evolved across the course of the study. This just-in-time assistance helped the groups to persist with difficult tasks and developed self-efficacy within the groups.

Initially the 3rd/4th class cohort required a high level of immediate assistance to conduct online inquiry. Analysis suggested that the cohort were initially unable to work independently, or problem-solve, as a group without recourse to the assistance of the class teachers or researcher. The need for immediate assistance diminished in both class cohorts across the longitudinal study. This was particularly the case in the 5th/6th class cohort.

The introduction of the reciprocal roles of Questioner, Navigator and Summariser helped the groups in a number of important ways. Firstly, the prompts provided as scaffolds of the roles helped the children to apply the reading strategies of questioning, navigating and summarising to structure the online activities of the groups. Secondly, the roles helped the children to self-initiate problem-solving

within the groups. The 5th/6th class cohort engaged in more discussions of the possibilities and the peer-to-peer interactions within these groups consisted of initiating, explaining, clarifying, justifying, negotiating, challenging and disputing the activities within the group. Across both cohorts the ZPD was dynamic and changing (Daiute & Dalton, 1993) where the more 'knowledgeable other' changed as the children adopted leadership roles within the groups. The adoption of leadership roles within the groups was associated with the level of reading ability, problem-solving capabilities, or the capacity to activate a range of prior knowledge sources, including end-user application knowledge, domain and topic knowledge and world knowledge. Peer-to-peer scaffolding helped children to stay on task, to direct online activities and self-regulate their reading activities.

The introduction of the share-boards for posting focus questions and summaries, the class discussions and share sessions at various points within the Internet workshops, and the class, group and individual reflections on conducting the reciprocal roles of Questioner, Navigator and Summariser, helped the children to share their knowledge of online strategies, to consolidate their understanding and to self-monitor during online activity. This helped to develop persistence, self-efficacy, motivation and engagement within the groups.

Chapter 9 presents a consolidated review of the findings across this predominantly qualitative longitudinal study.

CHAPTER NINE

CONSOLIDATED REVIEW AND DISCUSSION OF FINDINGS ACROSS THE STUDY

Introduction

This longitudinal study was conducted in a designated disadvantaged school in Ireland over an 18 month period with two class cohorts as they moved from 3rd to 4th and 5th to 6th classes respectively. It employed a Formative and Design Experimental methodology (F&DE) in an authentic classroom based Internet inquiry project to iteratively refine the study intervention, as barriers to implementation of the pedagogical goal of the study were identified, and factors that enhanced effectiveness of the intervention were revealed. The pedagogical goal of the study was to develop effective online reading skills and strategies with struggling readers from disadvantaged communities during Internet inquiry. This classroom based project sought to develop an integrated curriculum which forged links between literacy, science and the Internet. The study was conducted in three interlinked phases: the Baseline Phase, Reading Development and Critical Web Literacy (RDCWL) Phases 1a and 1b, and the Main Study phase.

The study had three purposes. Firstly, the study explored the baseline skills and strategies of struggling readers as they conducted online Internet inquiry within the learning ecology of the classroom. Secondly, through an iterative process of refinements at both micro- and macro-levels of analysis it developed an integrated curriculum which sought to scaffold these children as they developed effective online reading comprehension skills and strategies. Thirdly, it explored the affective,

cognitive and social dimensions of learning in groups and the role of peer collaboration in developing online reading skills and strategies during Internet inquiry. This chapter will discuss the findings from this predominantly qualitative study set against relevant studies conducted in the field.

Research Questions (RQ) Underpinning the Study

1. RQ1 What are the skills and strategies struggling readers use as they search for, locate, summarise, critically evaluate, transform, and communicate information gleaned from the Internet?

2. RQ2 Could explicit strategy instruction scaffold these children to develop effective reading skills and strategies online in an authentic classroom based Internet inquiry project?

3. RQ3 What are the cognitive, affective and social dimensions of peer collaboration during online reading activity and what are the social aspects of learning in groups during Internet inquiry?

Skills and Strategies of Struggling Readers from Disadvantaged Communities in Conducting Online Inquiry

RQ1 What are the skills and strategies struggling readers from disadvantaged communities use to search for, locate, summarise, critically evaluate and communicate information gleaned from the Internet?

Reflection on Findings from the Baseline Analysis Stage

In seeking to answer RQ1 the researcher was mindful of the advice of Alexander, Kulikowich and Jetton (1994) to "assess what individuals know and care about prior

to any intervention and [use] that information to design effective learning environments" (p. 220). The interplay between the learner and the learning ecology in the classrooms was charted through a range of data sources to provide a thick description of the site. The following sections summarise the findings from analysis of data sources with regard to (i) the instructional environment prior to the implementation of the intervention; and (ii) the baseline Internet inquiry skills and strategies of the children ascertained from the Sick Rabbit Task (SRT).

Findings from Analysis of the Instructional Environment in the 3rd and 5th Class Classrooms Prior to the Intervention

Analysis of a range of data sources, which included transcripts of the interviews conducted with the class teachers, transcripts of the individual interviews with the focal group children, standardised reading test scores, the Pupil Attitude Questionnaire (Eivers et al., 2004) and the ImpaCT2 (Harrison et al.,2002) questionnaire provided a thick description of the instructional environment prior to the intervention. Data analysis suggested both barriers to implementation and factors likely to enhance implementation of the pedagogical goal. Both were considered previously in chapter 5, Analysis of the Baseline Phase, and are summarised in turn in the sections which follow.

Identification of Possible Barriers to Implementation of the Pedagogical Goal of the Study

Literacy Achievement Levels of the Pupils

The reading achievement levels of the children as determined by standardised reading test results for both the Drumcondra Sentence Reading Test (DSRT) and the Micra-T indicated that overall both class cohorts had low levels of literacy

achievement. (see Table 5.3 and Appendix C for the percentages of pupils at or below key percentile markers in the DSRT and Micra-T in 3rd and 5th classes respectively). The intervention was designed to develop reading skills in both offline and online environments.

Instructional Practices in Reading in the Classroom

Analysis of the transcripts of the interviews with the class teachers indicated that the reading methodologies employed by them consisted of hearing reading in a 'round robin' fashion, rather than teaching reading and engaging in explicit strategy instruction within a balanced literacy framework. Changes in instructional practices in reading were necessary to develop a "mindful engagement" with literacy (Pearson, Cervetti & Tilson, 2008, p. 74) and to develop and orchestrate the motivational, cognitive and social aspects of reading within a balanced literacy framework.

Access to Technology in the Home and at School

Analysis of data sources revealed that access to and usage of technologies was limited in both the school and home environment (see Table 5.2 for access to ICT at each class level). The use of ICT within the instructional environment in the classroom and in the computer room was limited to word processing and the use of educational software for drill and practice purposes.

Factors Likely to Enhance Implementation of the Pedagogical Goal

Attitudes of the Pupils Towards Reading

Despite the lack of access to books in the home the children had positive attitudes both towards reading (see Table 5.6) and of themselves as readers (see Tables 5.7). A number of studies have provided evidence linking motivation to read,

attitudes to reading, self-perceptions of reading ability and reading achievement (Cosgrove et al., 2000; Elley, 1992; ERC, 2004). Therefore, the children's positive attitudes towards reading and their self-perceptions of reading ability were considered to be factors likely to enhance the implementation of the intervention.

Aspirations and Expectations of Teachers and Pupils Towards School Attainment

The teachers had positive expectations of the ultimate educational attainment levels of their pupils expecting that they would complete the second level school system. The pupils also had positive aspirations and expectations of finishing the second level system and of going to a third level college (see Table 5.4). These expectations of educational attainment contrast sharply with the reality of the level of educational attainment reached by Travellers in Ireland discussed previously in chapter 5 (DES, 2005b; Nolan & Maitre, 2008).

Commitment and Enthusiasm of the School Principal, Class Teachers and Pupils for the Study

The school principal was very supportive of the study from its inception and through each phase of the study. The class teachers volunteered to take part in the study and were clearly committed to and enthusiastic about the study. For example, they undertook a number of professional readings in the area of reading development, focussing primarily on the development of reading comprehension. As a consequence, changes were made to the teaching of reading in the classroom. Likewise, the teachers were also eager to develop their own knowledge of online reading skills on the Internet and to integrate ICT more meaningfully within the class curriculum. The teachers explained the voluntary nature of participation in the study

to the children and their parents. All of the children agreed to participate and were enthusiastic about their participation.

Summary and Discussion of Findings from the SRT

The performance of the focal group children in conducting an Internet inquiry task, the Sick Rabbit Task (SRT), established the skills and strategies used by these children in conducting online inquiry at the baseline phase. Analysis of the transcripts of the verbal protocols and the Camtasia online activity record sheets of the focal groups in 3rd and 5th classes respectively, in conducting the SRT, (previously reported in chapter 5, Analysis of the Baseline Phase), revealed that the focal group children experienced difficulties in three aspects of conducting online inquiry. First, they had difficulties related to their level of end-user application knowledge. Second, they were limited by the level of online reading information-seeking skills they had to conduct Internet inquiry. Third, they had a limited repertoire of reading strategies to draw upon in an online environment. Findings from each of these areas are considered in turn.

End-User Application Knowledge

The findings from an analysis of the data sources revealed that the focal groups had limited knowledge of the Internet Explorer browser tools, the architecture of online informational text structures, search engine algorithms, navigational skills, and Internet language vocabulary. The limited level of end-user application knowledge resulted in disorientation and frustration with the technology within the focal groups and hampered the groups in retrieving information for the focus question of the Internet inquiry task.

The Use of Online Information-Seeking and Reading Comprehension Skills and Strategies in Conducting the SRT

The sections which follow consider in turn a summary of the findings from both the information-seeking skills and strategies and the online reading comprehension skills and strategies used by the focal group children during the online inquiry task.

Online Information-Seeking Skills and Strategies

The focal groups neither articulated the goal of their Internet inquiry nor engaged in any level of prior planning. The children generated single, multiple, or 'dot com formula' search strings with little revision in terms of broadening or narrowing the search focus, substitution of synonyms, superordinate terms or the use of Boolean logic. The focal groups investigated search results in a cursory fashion adopting a *snatch and grab* approach. The process of Internet searching involves the interfacilitation of both of the key Internet skills of generating effective search terms and investigating search results with a critical eye. The focal groups in both class cohorts (excluding group 4 who never progressed beyond the search results page) spent on average 27 % of the task time reading information on websites. The majority of the focal groups' time was spent on the process of Internet searching rather than on a product of such a search i.e. the information found.

Online Reading Comprehension Skills and Strategies

Analysis of the online reading strategies adopted by the focal groups in conducting the SRT revealed that the children had a limited repertoire of reading strategies to call upon when meaning broke down during reading. The children were hampered by difficulties with decoding and vocabulary and an inability to make overt connections to prior topic knowledge. Likewise, the focal groups did not

appear to engage in self-regulatory reading activities, such as planning, monitoring, predicting or questioning. They read the web pages in a linear fashion and did not appear to use any of the online informational text structure features. Analysis of running records conducted on the oral reading ability revealed that the children had difficulty assessing the readability level on the websites they were reading. The focal groups did not engage in any critical evaluation or questioning of the largely superficial information retrieved for the task topic.

Summary of Findings from the Baseline Phase

Challenges to the implementation of the pedagogical goal within the classroom learning ecology were identified at the baseline phase. These included the low levels of literacy achievement in both class cohorts; the instructional methods in reading; and the low level of access to, and use of, ICT in the home and at school. Factors likely to enhance implementation of the pedagogical goal included the children's positive attitude towards reading and school; the positive expectations of the teachers and pupils for their ultimate educational attainment; the clear commitment to the study from all of the participants; the willingness of the teachers to change instructional reading practices in the classroom and their eagerness to integrate Internet technology with literacy and content areas. Analysis of the SRT enabled the researcher to establish the capabilities of the children to conduct Internet inquiry at the Baseline Phase. The children were hampered by low levels of end-user application knowledge, online information-seeking and reading comprehension skills and strategies.

The difficulties which these struggling readers encountered are reflected in other studies previously reviewed in chapter 2 'Review of the Literature'. For example,

previous studies conducted with adults reported that adults expressed frustration with searching for information after a short time (Eagleton et al., 2003; Hill & Hannafin, 1997). Similarly, difficulties were reported with planning issues (Kafai &Bates, 1997), generating search terms, (Bilal, 2000); investigating search results (Wallace & Kupperman, 1997), and locating information (Agosto, 2002).

The researcher was cognisant of these factors in designing the intervention and in seeking to develop these baseline Internet skills. Changes to literacy practices in the class reading instruction programme were implemented in close consultation and collaboration with the class teachers. Each triad focal group was of mixed ability with at least one member with some self-reported access to ICT and the Internet in the home. Literacy skills and strategies were developed in both online and print based environments. Findings from analysis of the ability of the children to conduct Internet inquiry tasks established the current capabilities of the children. It was then possible to chart any possible progress made by them in developing online reading skills and strategies on the Internet across the timeline of the present study.

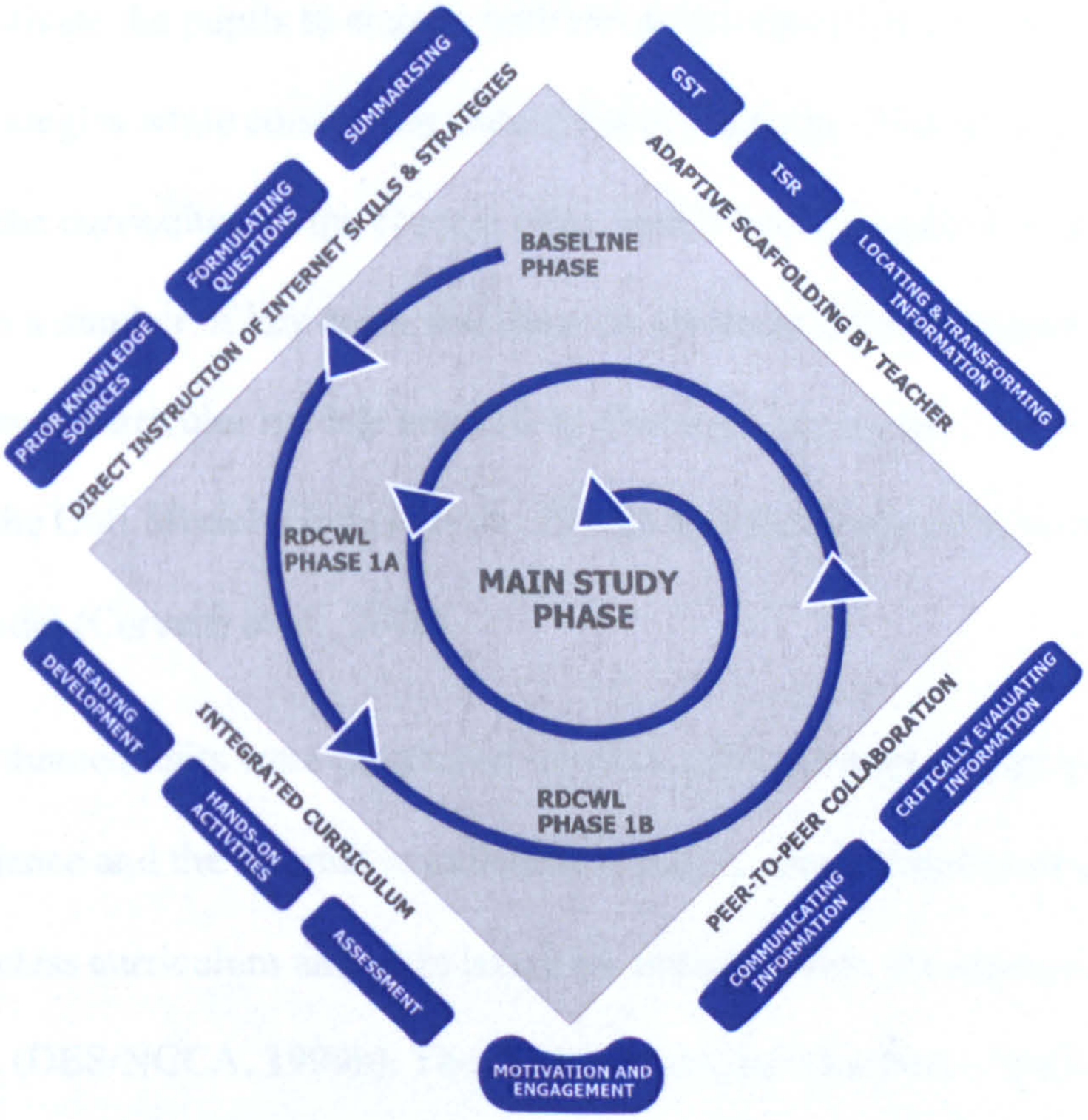
Scaffolding the Development of Online Reading Skills and Strategies for Struggling Readers During Internet Inquiry in an Authentic Classroom Based Project

RQ2 Can explicit strategy instruction scaffold struggling readers to develop effective online reading skills and strategies in an authentic classroom-based Internet inquiry project?

The next sections deconstruct RQ2 to discuss the findings for this question in three areas across the timeline of the three interlinked phases of the study: RDCWL Phase 1a, RDCWL phase 1b, and the Main Study. Figure 9.1 presents a schematic representation of the design of the study as it evolved formatively across the

longitudinal study. The centre of the figure depicts the spiral nature of the study design. The four sides of the square represent the classroom contexts which supported the development of online skills and strategies. They included direct instruction of skills and strategies, adaptive scaffolding, peer-to-peer collaboration and the development of an integrated curriculum. The outer rectangular shapes relate to the components of the integrated curriculum as it evolved; including online skills and strategies in reading comprehension (prior knowledge sources, formulating questions, summarising); the information-seeking cycle (generating search terms, investigating search results, locating, transforming, critically evaluating, and communicating information), reading development, hands-on science activities, underpinned by assessment and the development of motivation and engagement.

Figure 9.1. Schematic representation of the design of the study as it evolved across the timeline of the study.



Note. GST: Generating Search Terms; ISR: Investigating Search Results.

Reflection on Findings from the Development of an Integrated Curriculum

A focus of the present study area was the development of an integrated curriculum, which forged links between literacy, science and the Internet, in the context of an authentic classroom-based inquiry project. The curriculum and instructional methodologies were refined over an eighteen month period, in close consultation with the class teachers, through a process which involved both micro- and macro-analysis in line with the F&DE methodology underpinning the study. Findings from the present study may offer insights into ways in which online skills and strategies could be developed within an integrated curriculum within the ecology of learning in classrooms.

The Integrated Nature of the Curriculum Helped to Motivate and Engage the Pupils

A finding from the present study was that the integrated nature of the curriculum helped to motivate the pupils to engage with the development of effective online skills and strategies while conducting online inquiry activity. The strategy to attempt to integrate the curriculum in the context of an authentic pedagogical context was developed in a number of key areas and drew on elements of two important offline integrated cross curricular models previously discussed in chapter 2, Review of the Literature; the Cori Model (Guthrie et al., 2004a) and the Seeds of Science/ Roots of Reading model (Cervetti et al., 2006).

Firstly, themed units were developed which sought to create a synergy between literacy, science and the Internet in authentic contexts. The themes were embedded within the class curriculum and were based on strands within the science and literacy curriculum (DES/NCCA, 1999b). The themes included 'Our Pets'; 'Birds and their Environments'; 'Life in the Undergrowth' and 'Animals and Adaptations to their

Environments' for 3rd, 4th, 5th and 6th classes respectively. Within these themes the children were provided with a bounded choice of activities (Guthrie, 2004) which challenged them to work, with scaffolded support provided by the researcher and class teachers, at the edge of their zone of proximal development (Vygotsky,1978).

Secondly, situational interest (Hidi & Renninger, 2006) in the themed units was developed in a number of ways. The use of literature circles (Daniels, 2002) developed both interest and reading fluency. The inclusion of relevant informational texts in the class library, DVDs and narrative texts which linked to the theme, and the use of hands-on activities and science experiments supported the development of situational interest. Developing situational interest in this way helped to motivate and engage the children and enabled them to draw on multiple sources of prior knowledge and facilitated them in making intertextual links (Hartman, 1995) across narrative, informational print based and online domains. The children's ability to make intertextual links required explicit instruction and developed gradually across the timeline of the study. In the Main Study there was evidence in the transcripts of the conversations of the children that they were developing in their ability to engage in the discourse of science, and were drawing on multiple sources of prior knowledge and making connections between these prior knowledge sources. For example, in the Main Study, in group planning discussions to generate search strings, the children drew on their knowledge of science vocabulary to substitute a range of superordinate categories for where animals live (habitat), the food they eat (diet) and how they produce offspring (reproduction). Group 3, for example, in workshop 7 of the Main Study drew on prior knowledge sources in their conversations, such as DVDs they had viewed, print informational texts they had read, and websites

previously visited, to cross check information relating to how penguins adapt to life in the Antarctic.

Thirdly, online reading comprehension skills and strategies were developed in authentic activities rather than teaching these online skills in de-contextualised activities prior to commencement of the study. Developing skills-in use in authentic activities helped the children to transfer these skills to independent usage and to cultivate a culture of self-efficacy and self-belief within the children that they could conduct online inquiry. The development of skills-in-use also helped the children to develop effective online reading comprehension skills while building conceptual knowledge around the project theme.

Finally, the Internet workshops in the three interlinked phases of the study were designed in a spiral fashion to build on and expand the knowledge base developed in earlier phases and deepen prior experiences, skills and strategies in the areas of end-user application knowledge, online reading skills and strategies and online reading information-seeking skills across the timeline of the study.

The integrated nature of the curriculum created a classroom culture and context which fostered a positive disposition towards learning among the pupils. The integrated nature of the curriculum encouraged active participation and collaboration where the children were supported by the class teachers and researcher to undertake challenging, authentic and interesting activities. The spiral nature of the curriculum allowed the children to deepen and connect with a range of prior knowledge sources across the timeline of the study. Therefore, the integrated nature of the curriculum helped to motivate and engage the pupils, to build confidence and self-efficacy in

their ability to conduct online activities both as members of the triad groups and also as a class group (Guthrie & Wigfield, 2000; Guthrie et al., 2004a; Turner, 1995).

Reflection and the Development of Online Skills: Peer, Self and Teacher Assessment.

A finding from the present study suggests that the development of effective online skills and strategies was underpinned by the ability of the children to reflect on their developing knowledge of online reading and information-seeking skills and strategies. The children were encouraged to engage in reflection and self-assessment on the *process* and *product* of Internet searching. These class reflections included share sessions of effective online skills and strategies discovered by the groups or class reflections discussing the relevance and quality of information retrieved by the groups for their focus question. For example, in workshop 5 in the Main Study the $5^{th}/6^{th}$ class cohort reflected on what they had learned about the recursive phases involved in the process on conducting Internet inquiry, such as determining important questions to investigate, generating and revising search terms, investigating search results with a critical eye, transforming, evaluating and synthesising information retrieved (MS,W5,FN,pp1-3; see pp. 260-261). These reflections provided evidence of the knowledge developed, at procedural and declarative levels, while conducting Internet inquiry. The following exchange in workshop 4 of the Main Study provides an example of the ability of the class cohort to tease out issues related to accessing prior knowledge and cross checking information from other websites to evaluate online information:

Child A: How do you know whether it's lies or not?

Child B: Well, save [say if] Jane knew a lot about tigers, like, if we went into a website with tigers, and then it said, like, that when tigers have babies they lay eggs. Well, Jane knows that's not true.

Child C: [interrupts] What if Jane didn't know that?

Child A: Exactly!

Child B: You could go to another one [website] and see if the information is the same (FN,MS,W4,p3).

They also engaged in reflections and in self-assessment on how they conducted the *reciprocal roles* of Questioner, Navigator or Summariser. The reciprocal roles provided a structured framework to encourage a sense of shared responsibility in conducting Internet inquiry. The children engaged in both self- and peer- assessment of how successful they had been in conducting their own roles in each Internet session. The scores they assigned to each other were less relevant than the critique and discussions they engaged in assigning these scores. For example, in the Camtasia exit interview following Internet Inquiry Progress Task 3a other members of group 3 assigned a score of five to Eileen as Navigator because "she done very well...she listened to us, then she read them [search results] and then she came up with a new suggestion and she picked the one she thought was best" (MS,T3a,G3,CInt,p14).

The Internet Inquiry Progress Tasks conducted across the timeline of the study provided information about the children's progress in conducting online inquiry and the level of reading and Internet skills which the children could independently apply without recourse to the class teacher or researcher for assistance. The analysis of the online activity of the children captured by the Camtasia software programme was triangulated with analysis of the transcripts of the think aloud protocols of the focal

triad groups as they conducted each Internet Inquiry Progress Task. This provided evidence of the ability of the focal groups to conduct Internet inquiry and an inventory of the strengths and needs of the children in key areas of the information-seeking cycle, such as generating search terms, evaluating search results, or their ability to self-regulate in the use of online comprehension strategies. The researcher then reflected on these informal inventories to prioritise specific skills and strategies requiring further development. The insights gained from the results of the Internet Inquiry Progress Tasks informed the development of the curriculum in subsequent Internet workshops.

Thus, the opportunities afforded to the children to actively engage in self-and peer-assessment and reflection empowered the children to take responsibility for the development of online reading skills and strategies, and to monitor and to self-regulate their own learning (Afflerbach, 2007). Likewise the "learner centred assessment" (Tierney, 2000) conducted by the researcher sensitised her to the needs of the children in relation to the development of online reading skills and strategies. This information was used in planning subsequent Internet workshops.

The Support Provided by Explicit Instruction, Adaptive Scaffolding and Peer-to-Peer Collaboration to Develop Online Skills Within the Gradual Release of Responsibility Model

A finding from the study indicated that within the gradual release of responsibility model (Pearson & Gallagher, 1983; updated by Duke & Pearson, 2002) three elements supported the children to develop and embed strategies for conducting online Internet inquiry i.e. explicit strategy instruction, adaptive scaffolding and peer-to-peer collaboration.

Explicit strategy instruction of online Internet reading skills and strategies in the form of brief mini-lessons (See Appendix F) was provided by the researcher (and later by the class teachers) using think aloud techniques (Davey, 1983) to provide explicit examples of: (i) what the particular strategy was (declarative knowledge); (ii) how to use it (procedural knowledge) and (iii) why and when the strategy is used (conditional knowledge). The children were scaffolded by the researcher and class teacher with just-in-time assistance to apply these skills and strategies (Wood et al., 1976). In the present study the level of scaffolding was dynamic and adjusted to the needs of the triad groups. Analysis of the data as discussed previously in chapters 7 and 8 revealed that three main types of scaffolds evolved (procedural, prompt, and instructional) and were utilised by the researcher and class teacher to explain, consolidate and extend the application of online strategies. This type of adaptive scaffolding (Azevedo et al., 2003) involved a delicate balancing act between providing multiple opportunities to practice these skills with supportive guidance and developing the children's ability to independently apply these skills, and crucially develop self-regulated learning. This level of support motivated the pupils and developed self-efficacy within the groups so that they engaged and persisted with tasks as Mary explained: "I was doing me [my] hardest" (FN,RDa,W5,G6,p11). Although explicit instruction and adaptive scaffolding were important to the development of online skills and strategies evidence that learning was taking place became apparent in peer-to-peer collaborative interactions as the children provided assistance to one another on an as-needed basis to share, refine and hone their emerging Internet skills. For example, Aileen in group 2 drew on knowledge gained from Internet mini-lessons as she explained the differences between 'thick and thin questions' with examples for other members of the class cohort (MS,W7,G2,p3, see

pp. 261-2) or again later in the same workshop as reported earlier (see p. 262) she provided examples for other group members of her summarising techniques, such as editing ("we could edit this"), synthesising ("I'm putting it small") vocabulary meaning ("hold on, have to see what elliptical means") and creating categories for information ("write that under desert tortoises and reproduction"). The reciprocal roles of Questioner, Navigator and Summariser also provided evidence of the level of knowledge that the children had of Internet inquiry skills and strategies, how they were scaffolding each other and embedding the skills taught explicitly by the researcher during Internet inquiry.

Castek (2009) in her study of contexts supporting the development of the new literacies in a one-to-one lap top classroom found that the move from direct teacher scaffolding to peer-to-peer scaffolding was swift and pupils appeared to learn and develop skills from each other. A finding from the present study is that the level of scaffolding provided by the researcher and class teachers diminished across the timeline of the study, suggesting that pupils were developing self-regulatory strategies to activate and connect with relevant schemata, organise and retrieve knowledge and monitor and reflect on their own learning.

In the Pearson and Gallagher gradual release of responsibility model (Pearson & Gallagher, 1983; updated by Duke & Pearson, 2002) the high degree of teacher support diminishes as students assume responsibility for a learning activity. In the present study the trajectory of release of responsibility did not occur in a direct fashion from teacher to pupil. In the zone of "guided practice" peer-to-peer scaffolding assumed a greater significance as the study progressed for the

development of online skills, than the adaptive scaffolding provided by the researcher or class teacher.

Findings from the present study imply a somewhat more complex release of responsibility than is described by Pearson. In the present study there was strategy instruction followed by adaptive scaffolding in tandem with peer-to-peer collaboration which in turn developed effective online skills and strategies.

Summary of Finding for RQ2 Concerning the Development of an Integrated Curriculum

Three findings emerged from analysis of the data set regarding the development of curriculum. First, the integrated nature of the curriculum, which forged links across literacy, content areas and the Internet, the development of multiple prior knowledge sources, and the spiral nature of the development of online reading skills and strategies during Internet workshops across the timeline of the study, helped to motivate and engage the pupils and contributed to the development of online skills. Second, assessment and reflective practices, such as peer- and self-assessment empowered the pupils to take responsibility for their own learning. The strengths and needs of the children in relation to the development of online reading comprehension and information-seeking skills and strategies were assessed through observing the pupils' use of online skills and strategies, and reflecting on pupil commentary during Internet workshop, and especially through a series of Internet Inquiry Progress Tasks conducted across the timeline of the study. Analysis of these observations and reflections informed subsequent curriculum design. Third, the trajectory of the gradual release of responsibility model was not in a direct fashion from teacher to student. Rather, it involved explicit strategy instruction coupled with a diminishing

level of adaptive scaffolding by the researcher and class teachers in tandem with peer-to-peer scaffolding to develop and share online skills and strategies. Peer-to-peer collaboration assumed more importance as the study progressed as the children shared their developing online skills and strategies.

Reflection on Findings from Developing Online Reading Comprehension Skills and Strategies

The Internet workshops conducted across the timeline of the study from RDCWL Phase 1a and 1b and the Main Study sought to develop both online reading comprehension and online reading information-seeking skills and strategies. The development of online reading comprehension included formulating questions, activating and connecting with prior knowledge sources and summarisation of information. Each of these reading comprehension skills and strategies are considered in turn in the sections which follow. This is followed by a consideration of findings from the development of online reading information-seeking skills and strategies.

Formulating Questions to Guide Internet Inquiry

The literature supports the positive effect of instruction in generating questions and the development of active reading comprehension (Brown & Palinscar, 1985; Raphael & Pearson, 1985; NRP, 2000; Rosenshine, Meister & Chapman, 1996; Scardamalia & Bereiter, 1992; Singer & Donlon, 1982). The ability of students to formulate questions to guide online inquiry is of crucial importance (Leu et al., 2004). The questions formulated provide a direction for the quest for information to answer those questions; an active sense of purpose in targeting and recognising specific information (Eagleton & Dobler, 2007); make the search for information

more meaningful (Kuiper & Volman, 2008); and help students to articulate the goal of their inquiry (Burke, 2000). The types and kinds of questions formulated are important as they develop personal interest and engagement in the task (Singer & Donlon, 1982), promote a deeper processing of texts (Taboada & Guthrie, 2006), and are drawn from the current topic knowledge and inquisitiveness of the children.

The findings as they emerged from analysis of the data sources in relation to formulating questions were threefold. Firstly, the nature of the task question, whether formulated by the researcher or children, influenced the searching behaviour of the children and the depth of conceptual knowledge that they constructed. Secondly, the pupils needed explicit instruction and scaffolded support in formulating *self-generated* questions to focus online inquiry and this was developed across the timeline of the study. Finally, prior domain knowledge influenced the types and kinds of questions formulated.

The Nature of the Task Question Influenced the Searching Behaviour of the Pupils in Constructing Knowledge

The questions formulated across the timeline of the study were either researcher/teacher determined or self-generated by the pupils. Researcher/teacher determined questions included closed questions designed to develop navigational and online reading information-seeking skills during scavenger hunts in the Internet workshops. Open questions requiring higher order thinking skills or predictive inferencing were also used. Open and closed questions were used to guide the series of Internet Inquiry Progress Tasks conducted across the timeline of the present study to assess the progress of the focal groups in conducting Internet inquiry.

Over the course of the present study, the children engaged in progressively less "satisficing" behaviour (Agosto, 2002a, 2002b) when they were searching for information on open questions, such as those assigned by the researcher during Internet workshops and the Internet Inquiry Progress Tasks. Evidence suggested that the children were looking for answers to closed questions and seeking more conceptual knowledge when seeking the answers to open assigned questions. For example, for the question in Internet Inquiry Progress Task 3a, *What does a walaroo eat?* group 3 wrote: "grasses and shrubs" as the answer and commented, "grasses and shrubs, they don't eat much. Right what's the next one?" (MS,T3a,G3,p6). For the more open question of, *What adaptations does a walaroo make to live in their environment?* group 3 wrote: "They have furry pads under their feet for climbing. It is adapted to dig water from the ground that's how he gets his water. They're best adapted to heat and dryness. They are active". Jane commented: "let's see if there's more information" (MS,T3a , G3,p7). The pattern of behaviour in looking for more information for open task questions was similar in both class cohorts. For example, in Internet Inquiry Progress Task 3a the children spent more time on the open rather than the closed questions at a time ratio of 3:1 in the $5^{th}/6^{th}$ class cohort and 2:1 in the $3^{rd}/4^{th}$ class cohorts, as determined by stamp stamps on the Camtasia Activity record sheets for both class cohorts.

The *quantity* of time spent on open questions may be one issue to consider, however, the *quality* of the time spent is of much more significance. Analysis of the transcripts of the conversations of the groups and the Camtasia activity record sheets indicated that the groups engaged in more discussions, clarified unknown vocabulary through the use of an online dictionary, generated more information, revised search

strings to a greater extent, engaged in more information-seeking cycles, and engaged in more cross-checking of information on other websites for the open rather than the closed task questions. This concurs with the results of the Schacter et al. (1998) study which found that children were more successful on open rather than closed tasks. However, it contrasts with the conclusion reached by Bilal in a series of studies (1998, 2000, 2001, 2002) that children had most difficulty with open tasks. The "consumerist" nature of students' online behaviour (Kuiper & Volman, 2008) in seeking answers to questions in the shortest time span (Wallace & Kupperman, 1997) rather than gaining conceptual understanding may be influenced by the nature of the task question, whether open or closed.

The level of questions *self-generated* by the pupils also influenced the nature of knowledge construction and learning across the timeline of the study. In the RDCWL phases of the study the children formulated questions at level 1 or level 2 of the Guthrie and Taboada (2004) and Taboada and Guthrie (2006) questioning hierarchy framework. These questions were factually based requiring a simple answer (level 1) or simple description (level 2). For example, the self-generated questions formulated by the pupils in the web quest in RDCWL phase 1a of the study were either level 1questions *do beetles have wings*? or level 2 questions *how do earwigs breathe* ? The information generated by the groups in their PowerPoint presentations on the project theme of 'Our Pets' (3rd class) or 'Life in the Undergrowth' (5th class) focussed more on factual rather than conceptual knowledge. There was evidence of growth in the ability of the children to develop more conceptually challenging questions as the study progressed. For example, *how do their [owl's] wings help them catch prey?* (MS,W6,Group 6) (see Table 8.11 for

more examples). The ability of the children to develop level 3 type questions requiring elaborate information about the interactions of organisms within a biome in both classes developed across the timeline of the study. The Reale books produced by the children at the end of that study showed a higher level of conceptual knowledge and complexity in the information produced by the pupils when compared to the earlier PowerPoint presentations. There was more of a sense of audience with biographical details included, notes for readers on how to conduct Internet inquiry, and organisational structures, such as a table of contents. There were more explanations of the inter-relationships between organisms, drawing on and making connections between multiple sources of information. See Appendix J and L for sample pages of Reale books.

Scaffolded Support was Necessary to Develop the Student's Abilities to Self-Generate Questions

The ability of the children to self-generate conceptually challenging questions did not occur spontaneously and required explicit instruction and scaffolded support across the timeline of the study. The QARs model (Raphael & Au, 2005; Raphael & Pearson, 1985; Raphael & Wonnacott, 1985) was adapted to provide the children with both multisensory and kinaesthetic tools to discuss the relationship between the level of questions formulated and the information required to generate an answer. For example, the four levels of questions in the QARs model were supplemented by a multisensory colour code dimension. Colour codes of green (right there) orange (stop and search), red (author and me) and black (on my own) indicated where and how to search for answers to questions. Hand signals related to these types of questions also added a kinaesthetic aspect. Both of these tools introduced a metalanguage for the children to describe and discuss the different types of

information elicited by different levels of questions, and how, and where, to find that information.

The Role of Prior Domain Knowledge in Formulating Questions

The macro analysis conducted at the end of RDCWL Phase 1a indicated that one of the barriers to successful implementation of the pedagogical goal of the study (F&DE) was the limited level of prior knowledge of the domain topic. One of the purposes of the series of five workshops conducted in RDCWL Phase 1b was to develop prior knowledge of the domain topic of 'Birds and their Environments' (4th class) and 'Animals and Adaptations to their Environments' (6th class) prior to commencement of the Main Study. Analysis of the data suggested that the children formulated more conceptually challenging questions in the Main Study. For example, asking more conceptually challenging 'why' questions, such as "Why does the male wren lose their feathers in the breathing [breeding] season?" (MS,G4,W12). The vocabulary used by the children in formulating these questions suggested that the children were becoming more socialised in the discourse of science and in a sense they were more engaged with "talking science" (Chi, DeLeeuw, Chiu, & LaVancher, 1994; Hawkins & Pea, 1987). This suggested that the children were accessing and connecting with their prior vocabulary knowledge developed in earlier Internet workshops in formulating questions. Prior domain knowledge influenced the type of questions formulated.

The Role of Prior Knowledge in Constructing Meaning from Text

As discussed in the Review of the Literature in chapter 2, readers draw on world knowledge (Anderson & Pearson, 1984), domain and topic knowledge (Alexander, 1992; Alexander Jetton & Kulikowich, 1995), informational text structure

knowledge (Armbruster, 1986; Goldman & Rakestraw, 2000) and linguistic knowledge (Anderson et al., 1978) in print based environments to construct meaning from text. This is supplemented in an online environment by prior end-user application knowledge, such as familiarity with the architecture of informational online text structures and navigational skills (Coiro & Dobler, 2007). The literature is divided about the role of prior knowledge in an online environment. Hill and Hannafin (1997) noted that system knowledge in the form of end-user application knowledge affected application of strategies online. Moos and Azevedo (2008) argued that prior domain knowledge was significantly related to the development of self-regulation online in terms of monitoring and planning. McDonald and Stevenson (1998) found that prior domain knowledge contributed significantly to knowledge of the significance of text structures. Lawless et al. (2003) contended that lack of prior domain knowledge contributed to the disorientation experienced by online readers. In counterpoint, Bilal's (2001) study with elementary school pupils noted that children with high levels of prior topic knowledge did not experience success in locating relevant information for the task. Likewise Calisir and Gurel (2003) in a study with adults found that content-specific prior knowledge had little impact on searching tasks. Coiro (2007) argued that prior topic knowledge did not appear to affect readers with average or above average online reading skills as those readers could accrue knowledge as they navigated through a hypertextual environment.

Two findings emerged in relation to the role of prior knowledge in an online environment with this population of struggling readers. Firstly, findings from the present study suggest that the online reader may need to activate, connect and integrate a wider range of prior knowledge sources in the online environment of the

Internet than in the more constrained environment of print based reading texts.

Secondly, these struggling readers required an extended period of scaffolded support to activate and connect with a range of multiple sources of prior knowledge.

Activation of and Connection with a Range of Prior Knowledge in an Online Environment

Field note evidence revealed that the children encountered difficulties in RDCWL Phase 1a which were directly related to the level of prior topic knowledge they had of the topic domain. This caused them difficulties with vocabulary usage, search string generation, evaluation of search results and judgement of the relevance of the information retrieved. Following macro analysis of RDCWL Phase 1a, the next phase, RDCWL Phase 1b, developed domain knowledge of the topic before the Main Study commenced. This enabled the children to draw on prior domain and topic knowledge as they conducted online Internet inquiry. In the present study field note evidence suggested that children need to orchestrate a wider range of prior knowledge in an online environment. For example, activation of prior domain knowledge influenced the creation and revision of search strings; the ability to investigate search results; and the ability of the children to make predictive inferences. Prior domain knowledge also assisted the children in determining importance in text and to browse for information under category headings. Prior knowledge of the architecture of online text structures facilitated the speed and ease with which the children could locate information. Likewise, a well developed knowledge of end-user application knowledge redirected cognitive energy from navigating in an online space to constructing meaning when reading. Prior knowledge was developed as previously described from multiples sources including

print base sources and hands-on activities. Drawing on the Seeds/Roots model for vocabulary development (Cervetti et al., 2007), the integrated approach to the development of prior knowledge in the present study can be summed up as 'develop it, do it, read it, connect with it, talk about it, write about it, integrate it'.

Explicit Instruction is Required to Enable Children to Connect with Prior Knowledge Sources

Each Internet workshop in the Main Study commenced with a KWL (Ogle, 1986) to activate and connect with prior knowledge of skills and strategies developed in previous Internet workshops. The class teachers and researcher provided scaffolded assistance to the children to ensure that they activated and connected with prior domain, text structure and end-user application knowledge. The researcher drew explicit attention to the role of prior knowledge. For instance, in workshop 2 of the Main Study the researcher drew attention to the importance of activating prior knowledge as a strategy that good readers use (FN,MS,W2). The following exchange later in Internet workshop 2 demonstrates this strategy in use as the children activate and connect with prior topic and vocabulary knowledge.

> Nelly: First, we have to find out what do we know about penguins. We know that they are warm blooded 'cause they have an extra layer of skin, a layer of blubber. They have a big layer of fat under their skin.
>
> Miriam: They can disguise themselves into a ball.
>
> Katie: They can camouflage themselves into a ball like a rock.
>
> Nelly: Here, what do we want to find out today? What do you want to learn?
>
> Katie: How do they learn to swim? Adaptation? (MS,FN,W2,G4,p1)

Summarisation and Determining Importance in Text

Two findings emerged with regard to summarisation from the present study. Firstly, the children had difficulty determining importance in text. Secondly, differences between the class cohorts with regard to summarisation appeared to be developmental in nature.

Determining Importance in Text

A finding from the study was that these struggling readers had difficulty distinguishing between author determined and reader determined importance in text. The children had difficulties in distinguishing important from interesting information in text and were often distracted by salacious details (Garner et al., 1989). The following exchange illustrates this difficulty:

> Chrissie: Some scientists think that dolphins can kill small organisms with a click.
>
> Kylie: We don't need to know that... we're on the other one [Important things I found out].
>
> Chrissie: Could you kill someone with a scream. They kill small fish with a click. Oh J imagine that.
>
> Kelly ah! [lets out small scream] you're dead hah! (MS,FN,W9,G1,p20)

A number of strategies were used to develop and heighten the children's awareness of the difference between important and interesting information in text. For example, 'what would you tell a friend about what you had read' (RDCWL Phase 1a workshop 6); the 321 strategy (FOR-PD) RDCWL Phase 1b; and concept mapping (see Figure 6.5). Class discussions focusing on determining importance revealed that the children had developed some sensitivity to determining importance

in text as the study progressed (Winograd, 1984). Aileen explained the difference as: "something is interesting you like it but something that's important it matters like" (FN,RDb,W2,p9).

Differences in the Ability to Summarise Information

Differences in the ability to summarise information appeared to be developmental in nature (Dole et al., 1991; Pearson et al., 1996; Winograd, 1984). The children had an awareness of what a summary was, as Katie in the 3rd/4th class cohort explained, "A summary is like a little blurb and you have to put it in your own words ...if I knew what to do 'cause we're only learning"(MS,FN, W4 G4, p3). Initially, both class cohorts used a haphazard approach to summarisation with little attempt made to restate information in their own words or minimal integration of information. This was particularly the case in the 3rd/4th class cohort. This cohort initially attended only to the surface code of the text and this added to their difficulties in summarisation. As the study progressed there was evidence that the 3rd/4th class cohort moved to a copy-delete strategy (Brown et al., 1983) with some emergence of the use of superordinates and restating of information retrieved as a summary. However, the 5th/6th class cohort, and in particular group 3, were developing skills, albeit also at an emergent but more developed level, in determining importance, making notes, monitoring and clarifying vocabulary, synthesising information through rephrasing as a summary of the information retrieved. This appears to suggest developmental differences between the two cohorts in summarisation.

Summary of Finding for RQ2 Concerning the Development of Online Reading Comprehension Strategies

The nature of the task, as to whether it was open or closed, influenced the subsequent searching behaviour of the children. The children engaged more with open questions whether self-generated or assigned. They also engaged in less 'satisficing' behaviour in seeking more conceptual understanding and searching across more websites when seeking information for the open task questions. The researcher and class teachers provided scaffolded support to help the children to develop more conceptually challenging questions. The children's ability to formulate higher-level questions developed across the timeline of the study. Prior knowledge influenced the type and kinds of questions formulated. The orchestration of prior knowledge is more complex in an online environment where the reader must activate and connect with a range of prior knowledge sources. These include prior domain and vocabulary knowledge, prior end-user application knowledge and prior knowledge of the architecture of online informational text structures. The children had difficulty determining the difference between *reader* versus *author* importance in text. There was some growth from a low base in the ability of the children to summarise text. Differences between the two cohorts in summarisation appeared to be developmental in nature.

Reflection on the Findings from the Development of Online Reading Information-Seeking Skills

The present study, as discussed in the review of the literature in chapter 2, drew on literature pertaining to information-seeking models from both a *user perspective* in closed hypertext systems (Bates, 1989; Kuhlthau, 1991; Marchionini, 1992; Yang,

1997) and a *reader perspective* in open information networks, such as the Internet (Eagleton & Dobler, 2007; Harrison, 2006; Harrison et al., 2006; Leu et al., 2004) to encapsulate a model of the online information-seeking process as (a) goal formation, understanding the task; (b) generating and revising search terms; (c) investigating search results; (d) locating and critically evaluating the relevancy of the information retrieved to the task focus and (e) transforming, synthesising and communication of information. The next sections discuss the findings from the present study in relation to these areas.

Goal Formation, Understanding the Task

Previous studies have found that children have neither a clear strategy for executing a task nor rarely do they engage in any level of planning before commencement of such tasks (Fidel at al., 1997; Kafai & Bates, 1997). Indeed, this was the case, in the present study with the focal groups in both class cohorts, in the SRT, where the groups launched into the task with no clear plan or strategy. A finding from the present study suggests there was growth across the timeline of the study in the ability of the groups to self-regulate in terms of planning, developing focus questions, activating prior knowledge of the task domain and the formation and revision of goals as the task or activity proceeded. In the Main Study the children discussed strategies for developing and revising search strings by categorising key terms into subordinates, superordinates and synonyms. They discussed and planned which search results to investigate and which information to read. This took longer to develop in the 3rd/4th class cohort. This growth in strategy development and planning in goal formation was helped by explicit instruction in goal formation and planning in the Internet workshops, connecting with prior

knowledge through discussion before the workshops commenced and the use of the reciprocal roles of Questioner, Navigator and Summariser.

The Process of Locating Information during Internet Inquiry: Generating Search Terms and Investigating Search Results

Locating information (Leu et al., 2004) in an online environment involves the ability to (a) strategically generate and revise search terms and (b) investigate search results with a critical eye. These skills are central to the Internet inquiry process. The present study looked closely at the development of these 'bottleneck skills' and a number of general findings are presented here before looking at the development of these skills within the study in the sections which follow. What the following sections will argue is related to the following four points. Firstly, results from the study suggest that both of these skills are amenable to instruction. Secondly, interfacilitation occurs between these skills and one's ability to locate online information. For example, one's ability to generate effective search terms facilitates the effectiveness of the search results returned. Investigation of search results with a critical eye may result in revision of ineffective search strings. Both skills in turn facilitate the location of information relevant to the task focus. Thirdly, the ability to self-regulate in an online environment, in terms of questioning, planning, monitoring and evaluation, is critical to the development of both skills. Fourthly developmental differences, which appeared between the focal groups within each class cohort, and across the class cohorts, appeared to depend on the metacognitive activation of knowledge at procedural, declarative and conditional levels.

Generating Search Terms

A primary instructional focus of Internet workshops 1 to 4 in the Main Study phase was on generating search terms. These workshops focussed on the effective generation of search terms in terms of narrowing the focus of an Internet search, brainstorming vocabulary categories at synonym, subordinate and superordinate level, and critiquing, revising and evaluating the effectiveness of key terms. These skills in generating and revising search strings were developed and applied within the context of an authentic online inquiry in a classroom based project.

A finding from the present study suggests that there was considerable growth across the timeline of the study in the ability of the pupils in both class cohorts to construct, generate and revise search terms. Analysis of the online activity of the groups captured by Camtasia software and transcribed on Camtasia activity record sheets, from both the Internet workshops and the series of Internet Inquiry Progress Tasks, suggested an emerging taxonomy of search string generation which was utilised to code the search strings generated by the focal groups across the timeline of the study. This taxonomy built on earlier work from Guinee et al. (2003). This enabled the researcher to monitor growth in the construction of a range of search strings both from within the Internet workshops with the class cohorts and from the Baseline SRT through the series of Internet Inquiry Progress Tasks conducted with the focal groups. This growth in the range of search strings can be charted from the use of *broad, multiple, single* or *'dot com formula'* search strings with no revision in the SRT, to *single, multiple* or *natural language phrasing* in Internet Inquiry Progress Task 1 with emerging levels of self-regulation (see Table 7.1; Table 8.5, for coding scheme); to the independent use of *topic plus focus* strategy (Guinee et al.,

2003) in Internet Inquiry Progress Task 2 (see Table 7.4; Table 8.5, for coding scheme); and finally, to the use of the *topic plus focus superordinate, subordinate and synonym* with a greater level of awareness and self-regulation in Internet Inquiry Progress Task 3 (see Table 7.9; Table 8.5 for coding scheme) in $5^{th}/6^{th}$ and $3^{rd}/4^{th}$ classes respectively. The $5^{th}/6^{th}$ class cohort used a greater range of search strings with fewer spelling errors than the $3^{rd}/4^{th}$ class cohort. Difficulties with linguistic and vocabulary skills impacted more on the $3^{rd}/4^{th}$ class cohort in generating search strings than the $5^{th}/6^{th}$ class cohort.

Growth in the ability of the focal groups in both class cohorts to generate and revise a range of search strings was also related to the degree of flexibility, self-regulation and levels of knowledge exercised within the groups. Data analysis of the transcripts of the conversations of the focal group children during the Internet workshops and verbal protocols of the focal groups in conducting the Internet Inquiry Progress Tasks revealed developmental differences between the focal groups. These differences were previously discussed in chapter 8. The differences related to the ability of the groups to draw on a developing prior knowledge and experience of generating search terms to self-regulate in terms of devising focal questions, planning of key terms, monitoring the effectiveness of these terms, and evaluating and critiquing the usefulness of the search strings generated. A second key difference between the groups related to the flexibility and creativity with which they generated search strings and the levels of knowledge with which they did so. This related to procedural, declarative and conditional levels of knowledge. The level of conditional knowledge and self-regulation within the focal groups in constructing and revising search strings distinguished the most successful groups

(groups 2 and 3) from least successful group (group 1) in the 5th/6th class cohort. Cross cohort comparison between the 3rd/4th class and 5th/6th class cohorts revealed that overall the 5th/6th class cohort had higher levels of knowledge of search string generation at procedural, declarative and conditional levels of knowledge than the 3rd/4th class cohort. They were also to draw on a more extensive vocabulary range to flexibly plan a greater range of search strings. The 5th/6th class cohort were more aware of ineffective search strings and had greater ability, flexibility and creativity to recover from unsuccessful search string generation and revise these search strings accordingly.

Investigating Search Results

The instructional focus in Internet workshops 5 to 8, in the Main Study, was on investigating search results with a critical eye. The child friendly 'Inspector Clue Search' was introduced to the children to help them to apply skills, following instruction, with regard to looking for clues in the search results and giving consideration to the number of 'hits' retrieved from the search engine; critiquing the abstract blurb to assess its relevance to the task focus; unpacking the elements of the website address URL in relation to the domain name-prefix and the domain-suffix; and evaluating the reliability of search results from clues provided in the search result blurbs and URLs.

A finding from the present study indicates that there was considerable growth in the ability of the focal groups to investigate search results with a critical eye. Analysis of the Camtasia online activity record sheets indicated preliminary evidence, from the small population sample, for the emergence of a taxonomy of skills with regard to investigating search results. This taxonomy of skills ranged

from adopting a *snatch and grab* approach to a *limited strategic scrolling* approach and finally, to a *skilful investigation* approach.

In the SRT the children in the 5th/6th class focal groups investigated search results in a cursory fashion adopting a *snatch and grab* approach. By contrast, in the Main Study, the approach was much more developed. For example, in Internet Inquiry Progress Task 1 the focal groups in 5th/6th class adopted a *snatch and grab approach* with evidence of the emergence of a *limited strategic scrolling* approach at two levels referring to (a) clicking on each result in turn or (b) choosing a result with limited self-regulated monitoring of the hyperlink heading or the descriptive paragraph abstract (see Table 7.2). The *limited strategic scrolling* approach was more developed in Internet Inquiry Progress Task 2 (see Table 7.5). The groups were involved in some level of strategic consideration of clues presented in the search results with regard to matching the relevance of key words from the task to the descriptive abstract blurb. Camtasia activity record evidence also indicated that the groups were scrolling through search results to a greater extent and spending more time reading search results. There was also some initial evidence that group 3 were orchestrating a number of strategies with regard to investigating search results at a more *skilful investigation* level. In Internet Inquiry Progress Task 3 (see Table 7.10) all groups had moved to a *skilful investigation* approach at a *novice* level (group 2) *emerging* level (group 1) or *developing* level (group 3). Skilful investigation refers to the abilities of the groups to investigate results *effectively*, *efficiently* and *speedily* with a critical eye giving due regard to monitoring the key words and information contained in the abstract blurb with respect to the task goal; observing the number of search results 'hits' returned; and scrutinizing the URL with regard to the domain

name-prefix and suffix. The 5th/6th class focal groups developed in their abilities to speedily activate relevant search results and locate information more efficiently across the timeline of the study. This finding lends some support to one of the central principles of the new literacies perspective that "speed counts in important ways on the Internet" (Leu et al., 2004, p. 1589).

The 3rd/4th class groups (as shown on Table 8.6; Table 8.7 and Table 8.8 for Internet Inquiry Progress Tasks 1, 2 and 3 respectively) also moved from the *snatch and grab* approach evident in the SRT to a *limited strategic scrolling* approach with some evidence that groups 4 and 6 were using an emerging *skilful investigation* approach in Internet Inquiry Progress Task 3. There was also evidence that the 3rd/4th class focal groups were hampered by the level of vocabulary in search results as Diana explained: "I'm thinking it [search results] looks very hard so we mightn't know most of the words on it" (FN,T3c,G5,p6).

A second finding with regard to activation of search results refers to the level of metacognition and self-regulation in activating search results. The Camtasia activity record sheets provided evidence of what a 'click' signified on the Internet. First, the 'click' of a hyperlink transition denoted self-regulation where cursor activity indicated that the focal groups skimmed and read the information provided in the search results abstracts and monitored for key indicators of relevancy to the task focus. Scrolling through search results suggested that the groups were monitoring for clues provided in the search results. Second, a 'click' on a hyperlink followed predictive inferencing, where the groups were involved in discussions of what lay beneath a search result before planned activation. Third, a 'click' to a previously visited search result or previous search results pages indicated that the groups were

recalling, crosschecking and evaluating the search results in their discussions. The groups developed procedural and declarative knowledge of investigating search results following explicit strategy instruction. This was demonstrated in the class share sessions where the children, for example, discussed the information provided by a URL in Internet workshop 7. Conditional knowledge was shown as the groups discussed and applied this knowledge during Internet inquiry.

Locating, Transforming, and Evaluating Online Information

Locating Information

Difficulties experienced by readers in locating information on the Internet (as previously discussed in the Review of the Literature in chapter 2) include managing information overload (Foltz, 1996; Hill & Hannafin, 1997; Nachmias & Gilad, 2002; Rouet & Levonen, 1996; Sutherland-Smith, 2002; Treymayne & Dunwoody, 2001; Yang, 1997), equating quantity of information with quality (Agosto, 2002) and a belief that the information needed for an often poorly formed question is a mere 'mouse click' away (Kuiper & Volman, 2008; Nachmias & Gilad, 2002).

Data analysis of the SRT indicated that the focal groups spent a limited amount of time actually reading content information. Instead, they spent most of the time of the SRT on the process on Internet searching. Part of the instructional emphasis in the series of Internet workshops conducted in the Main Study was on developing the skills and strategies of generating and revising search terms and investigating search results. These skills are important to the process of Internet searching. A finding from the present study suggests that an understanding of these skills and an ability and facility to apply them effectively interfacilitated the location of relevant online information. The percentage of time spent by the groups on the product of Internet

searching, i.e. reading content pages, developed exponentially across the timeline of the study. For example, in the 3rd/4th class cohort the percentage time spent on reading content rose from an average of 14% in the SRT to an average of 62% in Internet Inquiry Progress Task 3a (see Table 8.9).

Readability issues were prominent in the SRT. As the children developed reading fluency, readability became less of an issue. The children were working in triad groups and, as such, had "multiple resources at the reading construction site" (Kucan & Beck, 1997) to share the construction of meaning when reading. They often judged readability by considering the density of the text presented, ("the writing can be very small", Eileen, PostInt, p. 3) and clicking off the website immediately. They monitored their understanding of the vocabulary on a website, clicking off websites with 'difficult' vocabulary. For example, the 3rd/4th class cohort used the '5 finger' strategy where each finger raised by a child indicated a word they were unable to read or understand and five fingers raised indicated a web page that was too difficult for them to read at present.

A finding from the study suggests that familiarity with the architecture of online information structures helped with the management of information overload and facilitated the ease of access to online information. The patterns of reading behaviour of online information differed between the focal groups in the 3rd/4th class cohort and the 5th/6th class cohort focal groups. The 3rd/4th focal groups class approached the reading of online information in a linear fashion from the top to the bottom of the page largely drawing on print based reading strategies. The 5th/6th focal groups were more adept with using the architecture of online informational text structures (e.g. glossary, menu, headings, sub heading and hyperlinks) and online helps (e.g. 'edit-

find' feature, Google image search, online dictionary, and online spelling helps) to skim and scan web pages and this enabled the 5th/6th class groups to both speedily access information and deal with the amount of online information presented on the content pages.

A finding from the study also suggests that self-regulation was important to judge the relevance of the information retrieved to the focus question. Peer collaboration enabled the children to discuss and reflect on the information presented on websites. Such discussions allowed the triad groups to filter information, to monitor the relevance of that information to the focus of inquiry, to plan relevant choices following discussion and to determine their path through the information.

Evaluation of Online Information

The literature reviewed in chapter 2 suggests a number of issues relating to the ability of children to evaluate online information. These issues relate to the children's lack of questioning and evaluation of online information. Children rarely ask questions, such as; Is the information trustworthy? Can I depend on it? How can I judge reliability? (Hirsh, 1999; Lorenzon, 2002; Shenton & Dixon, 2004a; Wallace & Kupperman 1997); Is the information accurate? Is it believable? How can I tell? Do I understand it? (Burke, 2002; Fidel et al., 1999); Does the information satisfy my information needs? (Agosto, 2002); and What is the author agenda? (Comber & Simpson, 2001; Fabos, 2008; Leu, 2002; Muspratt et al., 1996; Sutherland-Smith, 2002).

The development of children's ability to evaluate online information was encouraged in a number of ways across the timeline of the present study. Firstly, the children were explicitly taught how to evaluate the information provided in the URL

domain-suffix and-prefix concerning the reliability, origin and purpose of the site. Secondly, the children were encouraged to corroborate and cross-check information across a number of websites and connect with their prior domain and world knowledge to verify information. Finally, in class discussions and in their triad groups the children were asked to reflect on the evaluation of online information. Evidence from class discussions in the Main Study indicated that the children were aware of the need to evaluate the veracity and reliability of information presented online by cross-checking on other websites or accessing their own prior knowledge. However, they rarely corroborated online information across multiple websites and never questioned author motive or agenda. Two explanations are possible. Firstly, more scaffolding and explicit instructional emphasis and focus, across a wider range of critical evaluation skills and over a longer time period, was required to develop the children's skills and abilities to critically evaluate online information. Secondly, highly developed critical evaluation skills may be developmental in nature and may therefore be difficult to develop with children. The application of critical evaluation skills requires a maturity of reflection and a world knowledge that children do not possess. The most we can hope to achieve, therefore, is that children become aware of the need to have their antennae raised around issues of reliability, veracity, authority and author bias in evaluating online information.

Summary of Findings in Relation to the Development of Online Information-Seeking Skills

The online information-seeking process in the present study was defined as goal formation, and understanding the task; (b) generating and revising search terms; (c) investigating search results; (d) locating and critically evaluating the relevancy of the

content page to the task focus and (e) transforming, synthesising and communication of information. There was growth across the timeline of the study in the ability of the focal groups to formulate and discuss strategies to focus online inquiry. This was developed by explicit instruction and the introduction of the reciprocal roles of Questioner, Navigator and Summariser. Interfacilitation occurred between the ability of the groups to generate and revise effective search terms, investigate search results with a critical eye and their ability to locate relevant information for the task focus. Differences which appeared between the focal groups and across the class cohorts appeared to be developmental in nature and depended both on the focal groups' ability to self-regulate in an online environment and on the levels of metacognitive knowledge at declarative, procedural and conditional levels exercised by the groups. Critical Internet literacy involved the development of evaluation skills mapped onto information-seeking skills. These skills included evaluating clues provided in the URL and assessing individual websites from the point of view of author stance and agenda, reliability and veracity of content. Although the children developed procedural and declarative knowledge of these evaluation skills they proved to be difficult to develop beyond a mere mantra to become embedded into the psyche of the children as part of reading and investigating online information.

Reflections on the Findings From the Nature of Learning in Groups: Peer Collaboration During Online Inquiry

RQ3 What are the cognitive, affective and social dimensions of peer collaboration during online reading activity and what are the social aspects of learning in groups during Internet inquiry?

Daiute and Dalton (1993, p. 330) note that "children need experts as intellectual mentors, but engagement with peers provides a type of intellectual workout that is

also essential to the mastery of subject matter and skills". In the present study the children worked in mixed ability triad groups when conducting Internet inquiry in the computer room. There were a number of reasons for grouping the children in this way. Firstly, from a logistical level there were a limited number of working and reliable computers available in the computer room which meant the children had to share access to computers. Secondly, analysis of data from the baseline phase indicated that individual members in the triad groups had low levels of achievement in literacy and limited levels of online skills. Therefore, they could possibly not have accomplished alone what the triad group members in collaboration could accomplish together. This was especially the case in the initial phases of implementation of the project. Thirdly, from a methodological viewpoint, working in triad groups provided opportunities for collecting data on the moment-to-moment conversations and decisions made in the groups during Internet workshop and think aloud protocols during Internet Inquiry Progress Tasks. Subsequent analysis provided insight into the development of thinking processes in the groups in relation to the development of online skills. Transcripts of the conversations and think aloud protocols were combined and analysed with the Camtasia screen activity records and the artefacts of the groups' work to provide fuller account of the groups' online activity. Such close inspection of peer collaboration in the triad groups provided a window onto the distribution of decision making processes by which the groups conducted online Internet inquiry, how they developed and applied online reading skills and strategies, how the learning of skills and strategies was accomplished and how the groups constructed meaning together. The transcripts provided access to the richness of interactions in group situations in the ecology of learning in classrooms. The literature, as reviewed in chapter 2, also provides robust and clear evidence of the

benefits for learning accrued by students when working collaboratively in groups (Barron & Darling-Hammond, 2008; Cohen et al., 1982; Ginsburg-Block et al., 2006; Johnson & Johnson, 1981, 1989, 1999; Slavin, 1996).

Three key findings emerged from analysis of the data sources in relation to RQ3, which explored the cognitive, affective and social dimensions of peer collaboration during online inquiry and the nature of social aspects of learning in groups. The first finding relates to the need to provide a structural framework to encourage peer collaboration in an online environment given that it did not occur or develop naturally. A second finding relates to the active social construction and development of online skills and strategies during peer collaboration. A third finding suggests that peer collaboration facilitates a deeper processing of texts. Each of these finding are developed in turn in the sections which follow.

Gradual Release of Responsibility: Zone of Peer-to-Peer Collaboration

A finding from the present study suggests that peer-to-peer collaboration did not occur spontaneously but could be developed as a result of pedagogic intervention. In the gradual release of responsibility model, a framework needed to be developed to support online learning within groups in the zone of student responsibility. At the outset of each Internet workshop the researcher (and later the class teachers) provided explicit strategy instruction or modelling of a particular skill or strategy related to the development of end-user application knowledge, online reading comprehension skills or strategies and information-seeking skills. This was followed by guided and independent practice of the particular skill or strategy within the context of that day's Internet workshop. The gradual release of responsibility model (Pearson & Gallagher, 1983; updated by Duke & Pearson, 2002) provides for

different levels of scaffolding within an instructional environment where the teacher scaffolds the development of autonomy within the student and where eventually the student takes responsibility for both activating and monitoring the independent use of a particular skill or strategy. The gradual release of responsibility model refers to the expert-to-novice scaffolding process and is not as explicit as to what occurs within the zone of student responsibility when students could possibly scaffold each other in developing the autonomous use of strategies. This is particularly the case in an online environment. In the present study the level of support and scaffolding provided by the researcher and class teacher was higher in the early stages of the study. A greater level of scaffolding was needed by the 3rd/4th class cohort initially because the children were more passive in their approach to learning and had more difficulties in working or problem solving independently of the class teacher.

Analysis of data in RDCWL Phase 1a and 1b suggested that peer-to-peer collaboration did not occur spontaneously. Initially there were instances of off-task behaviour which when analysed suggested that the children were actively engaged with the activity or task but were working with divided attention. In RDCWL Phase 1a, Internet workshop 5, prompt scaffolds were introduced at key discussion point moments on the Internet worksheets to encourage the children to '*Stop Think and Talk'*. These prompts were designed to initiate dialogue and problem-solving activities within the groups. It was clear that the role of the 'more knowledgeable other' in the zone of proximal development fluctuated depending on the nature of the online activity. For example, the 'better' reader in the triad group of their own volition read onscreen content aloud for other group members drawing on better developed levels of reading fluency, decoding and vocabulary knowledge. At other

times group members drew on their developing end-user application knowledge, prior domain or world knowledge to direct online activities. Leadership roles also emerged within the groups where often the same individual member kept the other members of the group on task and monitored and directed activities within the group. There were also occasions where individual members engaged in what Kerr and Bruun (1983) have referred to "free-rider effects". This suggested that some of the members of the triad groups were less actively engaged in group activities and could possibly have been adopting more passive roles during online activities. Other studies (Barron, 2003; Johnson & Johnson, 1999; Slavin, 1991) have commented on the importance of designing activities which encourage productive collaboration in groups and develop the quality of interactions between group members.

A number of structures were developed across the time line of the study to support peer-to-peer collaboration. The interchangeable reciprocal roles of Questioner, Navigator and Summariser (emulating the reciprocal roles of the Palinscar and Brown (1984) model) were introduced in the Main Study phase. Prompt cards were designed for each of the roles, with suggested activities and questions as temporary scaffolds, to provide support to each of the group members. As such, the roles encouraged ownership of the activities and a sense of agency and responsibility for members of the triad groups and helped to develop strategy use and application of online skills.

The introduction in the Main Study in workshop 6 of *share boards* where group members could post group questions and summaries of information located during online activities also facilitated sharing and collaboration across groups within the class cohorts. The online strategies and skills developed during the Main Study

Internet workshops were also discussed at the outset of the Internet workshop with *initial class share sessions* where pupils discussed and shared prior knowledge of online skills and strategies from previous Internet workshops. *Quick share* sessions occurred incidentally during these Internet workshops when groups shared successful strategies with the class; insights from conducting online activities; or websites containing particularly useful information for the project theme. Finally, collaboration was encouraged through reflection on the process and product of online information-seeking inquiry. The children as a class group shared insights on the process of Internet searching, for example strategies for generating and revising search terms and investigating search results with a skilful and critical eye. They also shared insights and strategies on the product of Internet searching; the summaries of information located; determining importance in text; and the communication of information to others in the form of multimodal compositions (PowerPoint presentations and Reale books, for example). Analysis of the data suggested that the $5^{th}/6^{th}$ class cohort were more successful in collaborating during online inquiry. Of the $5^{th}/6^{th}$ class cohort group 3 was the most successful group. This group engaged more with the roles of Questioner, Navigator and Summariser and used the roles at a conditional level with more independent use of the roles as the study progressed. This suggested that the reciprocal roles encouraged and supported peer-to-peer collaboration.

Peer Collaboration Supports Active Construction of Meaning

The framework for collaboration as developed formatively across the time line of the study provided structures and encouraged the children to engage in "huddling" (Barron, 2003) to conduct online inquiry. Data evidence suggested that the children

were engaged and motivated to complete Internet workshop inquiry activities. Evidence suggested that peer collaboration included both generative and reflective processes (Collins et al., 1989; Daiute & Dalton, 1993) and expanded an individual's ability to develop their own personal knowledge and understanding as a member of a group. Working in a group expanded the individual member's ability to generate, expand, contest, examine and evaluate their own ideas with those of others in the group. It extended the contributions of group members and encouraged active construction of knowledge and understanding within the group. This concurs with findings from the literature that collaboration encourages students to explain processes and solutions to problems encountered (Barron, 2000; Daiute & Dalton, 1993; Goatley et al., 1995, Johnson & Johnson, 1999). Collaboration also allowed members of the triad groups to apply the skills modelled by the researcher or class teacher and may have enabled them to develop these skills in the company of others where confusions of how to apply skills could be resolved within the group. This occurred more frequently without teacher or researcher help as the study progressed.

As the study progressed there was more even distribution of activities within the group. Although the children read online content aloud there were more instances of silent reading and exchanges and discussions following such reading. There was more turn-taking within the groups with read alouds with the 'better' and 'middle' readers undertaking these roles. There were different levels of expertise within the group with regard to online reading skills and strategies, end-user application knowledge, and the ability of group members to access and connect with prior knowledge of the domain topic, navigational skills, online informational text structures and world knowledge. It was often the 'weaker' print readers who

accessed and connected with a wider level of world knowledge often referred to as common sense. Collaboration within the groups allowed time for the development and application of skills and strategies.

Peer Collaboration Facilitates a Deeper Processing of Texts

Peer collaboration developed engagement and self-efficacy within the triad groups. Data analysis suggested that collaboration encouraged the group members to engage in self-regulatory reading processes, such as planning, monitoring, formulating questions and making inferences drawing on knowledge within the group. Peer collaboration also developed a sense of agency and self-efficacy within the groups.

Brown and Campione (1986, p1064) noted that "learning involves the internalisation of activities originally witnessed and practiced in co-operative settings". This refers to the Vygotskian notion of the inter-and intra-psychological plane. Nicky in group 2 in the $5^{th}/6^{th}$ class cohort reflected the opinion of most of the children in explaining that working in groups helped as "three heads are better than one...and if you were searching for something and you are on your own, you don't know how to do it if you're working in a group someone else might know how to do it so they can help you". Field note evidence suggested that the children with Internet access at home were independently using their online reading skills and strategies to search for information for the project and were sharing these online skills and strategies with parents, grandparents and siblings. Likewise, the children had a good level of understanding of the online information-seeking process and could articulate the process well in response to the researcher question "Can you describe how you

search for information on the Internet?" in the individual post Interviews conducted with the children. For example Aileen explained the process as:

> You look at your question and look at the key words and you type the key words into Google and then you see, you read the URLs and the blurb and see what it tells you... if it's .com it's usually a selling site ...tells you what country it's from, or tell you whether it's a government or whether it's educational and is it good information. If you find a piece of information you go to a different website and see if it's on the stuff that it says the same and see is it true. (Aileen, PostInt, p.5)

The literature provides evidence that individuals who work in groups do better on later individual assessment (Barron & Darling-Hammond, 2008). Indeed, Yeager, Johnson, Johnson and Snider (1990) noted positive effects on student achievement to high, medium and low performing students. However, a question which remains from this study is the degree of transition of self-regulation from the social plane to the intrapersonal plane and the extent to which individual members within the group could independently and competently conduct Internet inquiry and apply the skills and strategies developed within the group as individual explorers on the Internet. This was not explored in the present study and warrants further investigation.

Summary of findings from the Nature of Learning in Groups: Peer Collaboration During Online Inquiry

The level of scaffolding provided by the class teachers and researcher diminished across the timeline of the study as the children developed online skills and strategies through peer-to-peer interactions. Peer-to-peer collaboration did not occur spontaneously and required the introduction of structures, such as reciprocal roles, share boards, class and group discussions on the process and product of Internet inquiry to develop the quality of interactions in groups. Peer collaboration supported the active construction of meaning and facilitated a deeper processing of texts as

group members expanded their own individual understanding of skills and strategies through examining, contesting, evaluating and negotiating with other group members during Internet inquiry. Peer-to-peer collaboration also developed self-efficacy and a sense of agency within the groups.

Coda

Chapter 9 attempted to reflect across all of the phases of the present study on the extent to which the study was successful in both answering the research questions underpinning the study and in improving pupils' online reading comprehension and online reading information-seeking skills and strategies (and incidentally the knowledge of the teachers working with these children). There is cumulative evidence that the children's use of skills and strategies at the individual and group level changed significantly and that their learning deepened a great deal more than would have been expected from natural maturation. Chapter 10 discusses the educational implication for these findings from the point of view of classroom pedagogy and curriculum, development of theory and implications for future research. It also considers the limitations of the present study.

CHAPTER TEN

CONCLUSION: DISCUSSION OF IMPLICATIONS AND LIMITATIONS OF THE STUDY

Introduction

The F&DE methodological framework "serves the central goal of putting theory to work in a way that simultaneously informs practice and refines or generates useful theory grounded in practice" (Reinking & Bradley, 2008, p. 43). In conducting an F&DE the researcher recognised the multiple realities (Labbo & Reinking, 1999) within the learning ecology of a classroom and in seeking to achieve a valued pedagogical goal identified both factors likely to enhance implementation of an intervention and possible barriers to success. In the present study, the intervention was modified formatively in a principled manner at a micro- and macro-level, in response to careful analysis of a range of data sources, both at the outset and throughout each phase of the study to engineer a finely tuned intervention developed at the coal face of a classroom learning ecology.

In the present study, the pedagogical goal was to scaffold struggling readers in a disadvantaged school community to develop effective online reading comprehension and information-seeking skills and strategies. Firstly, the study explored the baseline skills and strategies of these readers as they conducted online Internet inquiry. Secondly, through an iterative process of refinements at both micro- and macro-level, the study developed an integrated curriculum which linked literacy, science and the Internet and sought to scaffold these children as they developed effective online reading comprehension and information-seeking skills and strategies. Thirdly,

it explored the affective, cognitive and social dimensions of learning in groups and the role of peer collaboration in developing online reading skills and strategies during Internet inquiry.

Reflecting the multiple realities present within the learning ecology of classrooms three theoretical lenses were brought to bear on the study; (a) a new literacies perspective (Coiro et al., 2008; Eagleton & Dobler, 2007; Leu et al., 2004); (b) a motivation and engagement framework (Guthrie & Wigfield, 2000; Gambrell, 1996); and (c) scaffolding theories (Wood et al., 1976).

This chapter will discuss the implications of the findings from the study for the development of classroom pedagogy, the development of literacy theory and possible areas for future research for curriculum design; the development of online reading comprehension; the development of online information-seeking skills and strategies; and the role of scaffolding and peer-to peer collaboration for the acquisition of the new literacies. This will be followed by a consideration of the limitations of the study and concluding remarks.

Implications of Findings Concerning the Development of an *Integrated Curriculum* for Classroom Pedagogy, Literacy Theory, and Future Research

Findings concerning the development of an integrated curriculum were threefold. First, the integrated and spiral nature of the curriculum, as it developed across the timeline of the present longitudinal study, created a synergy between literacy, science and the Internet, and helped to motivate and engage the pupils and contributed to the development of effective online reading comprehension skills. Second, the ability of the children to engage in reflective practices, such as peer- and self-assessment, helped them not only to develop online reading skills but also to

reflect on the nature of their own learning and thus empowered them to take responsibility for that learning. Third, three elements within the gradual release of responsibility model (Pearson & Gallagher, 1983; updated by Duke & Pearson, 2002) supported the children to develop and embed strategies for conducting online Internet inquiry i.e. explicit strategy instruction, adaptive scaffolding and peer-to-peer collaboration.

Integrated Curriculum: Implications for Policy Formulation

An audit of ICT infrastructure in the study school at the baseline phase revealed the presence of old and often unreliable computer technologies which created barriers to the meaningful integration of technology into the school curriculum. A number of recent reports (DES, 2008a; DES, 2008b; Information Society Commission, 2002; Shiel & O'Flaherty 2005) in Ireland have highlighted the need to provide sustained long term investment in ICT infrastructure, technical support and nationwide broadband connectivity. Sustained investment in technological infrastructure is an important factor to consider for access to ICT and the adoption and integration of ICT in the curriculum. The DES report (2008b) noted that the integration of ICT into the school curriculum in Ireland was largely superficial and the frequency with which Irish teachers incorporate ICT into their pedagogies lags well behind the European average. The manner in which technology is accommodated (Reinking, Labbo & McKenna, 2000) within class room pedagogies and educational practices ultimately affect learning with ICT (Zhao & Frank, 2003).

Integrated Curriculum: Implications for Classroom Pedagogies

Findings from the study revealed possible implications for both the development of an integrated curriculum and the development of classroom pedagogies within the

new literacies framework. The integrated nature of the curriculum as it evolved across the time line of the study helped to develop self-efficacy and to motivate and engage the children. In seeking to create a synergy between literacy, science and the Internet the curriculum drew on a suite of approaches in other print-based models, such as the Cori Model (Guthrie et al., 2004a) and the Seeds of Science/Roots of Reading model (Cervetti et al., 2006). Specific suggestions and exemplars of Internet workshops and classroom based activities could be drawn on in other classroom contexts by class teachers to develop thematic units which could forge links between the content areas, literacy and the Internet. These suggestions and exemplars included hands-on activities and the development of intertextual links (Hartman, 1995) across narrative, informational print-based and online domains. The spiral nature of the curriculum as it evolved, allowed the children to draw on multiple prior knowledge sources, and to build on, and deepen, their knowledge base and prior experiences of the skills and strategies developed in terms of end-user application knowledge, online reading comprehension and online information-seeking skills and strategies. Allowing children the time and opportunity to develop, hone and deepen their level of knowledge of online skills and strategies across the timeline of the study was important to develop self-efficacy and to motivate and engage the children.

Reflective practices, such as peer- and self-assessment, helped the children not only to develop online reading skills, but also to reflect on the nature of their own learning, and thus empowered them to take responsibility for that learning. Dialogue was important to develop 'mindful engagement' (Pearson et al., 2008) where the children could draw on the understanding of 'more knowledgeable' others within the

group to discuss, develop and internalise their own developing understanding of online skills and strategies. Practices, such as class shares and quick shares helped the children to share their developing knowledge of online skills and strategies. Likewise, the reciprocal nature of the roles of Questioner, Navigator and Summariser provided the children with a framework to encourage consensus and a sense of shared responsibility in conducting online inquiry.

Three elements within the gradual release of responsibility model are important to consider for the development of online skills and strategies. Explicit strategy instruction in the form of a think aloud mini-lesson developed specific online skills and strategies. This was followed by adaptive scaffolding which provided just-in-time guided assistance for the pupils in applying online skills. Peer-to-peer scaffolding assumed greater importance as the study progressed as the children shared their developing knowledge of online reading skills. The trajectory of the gradual release of responsibility model was not in a linear fashion. It involved explicit strategy instruction coupled with a diminishing level of adaptive scaffolding by the researcher and class teachers in tandem with peer-to-peer scaffolding. It is important that the class teacher is aware of the changing nature of responsibilities within the gradual release of responsibility model within the new literacies framework.

The children were engaged with authentic online reading and writing inquiry activities where they were challenged to work at the edge of their zone of proximal development with scaffolded support. The scaffolded support was adapted and sensitive to the developing needs of the children and provided the children with the metacognitive tools to develop effective online skills and strategies. The children

developed online skills in the context of real activities. This emphasis on the development of skills-in-use rather than the development of de-contextualised skills is important for teachers to consider when developing online skills and strategies with struggling readers.

Integrated Curriculum: Implications for the Development of Literacy Theory

"The content of new technologies can replicate the past or transform the future. Ultimately, it will take a conscientious effort to change ways of thinking, ways of doing, and ways of believing" (Young, 2008, p. 352). The instructional environment within the learning ecology of the classroom changed considerably across the timeline of the study in a number of key aspects. The role of the teacher changed from a *transmitter* of knowledge to a role which initially encompassed a *co-learner* and *co-constructor* role of online skills and strategies within Internet inquiry *with* the children to a *facilitator* role at the end of the study as knowledge of ICT and Internet skills and strategies developed. The children's role within the learning ecology changed from passive recipients of knowledge to more active and metacognitive constructors of knowledge as they developed their own literacy skills and online reading comprehension skills and strategies through collaboration among peers and between groups. In sum, the learning ecology changed as "interdependence promote[d] an atmosphere of joint responsibility, mutual respect, and a sense of personal and group identity"(Brown, 1994). The classroom environment promoted dialogue, ownership, collaboration, a sharing of responsibility and reciprocity.

Drawing on socio-cultural Vygotskian perspectives, Luckin (2008) argues for the inseparability of teaching and learning and the "relationship between a learner's context and the learning that occurs as a result of interactions within that context" (p.

450). The development of such an ecological learning community in classrooms (Brown, 1994; Zhao & Frank, 2003) may be important to consider in supporting the acquisition on the new literacies within classroom contexts.

Integrated Curriculum: Implications for the Development of Future Research

The spotlight in this study was on the children, and specifically on listening to the children's voices, observing their online activities, and viewing the artefacts they produced, as they developed online skills and strategies within an integrated curriculum model. Future research could focus on the role of the classroom teacher in developing online literacies with children within the learning ecology of the classroom and how best to support the changing role of classroom teachers to take account of the changes in the shift of the balance of power within a new literacies classroom.

In the present study the researcher worked collaboratively, and *in situ*, with the class teachers and supported them as they developed their own Internet skills and ICT knowledge. As the study progressed, the school principal and other class teachers visited the computer room on a regular informal basis to observe both the children working and to view instructional practices. The class teachers presented progress reports concerning the development of classroom pedagogies, the integrated nature of the curriculum, and the new literacies of the Internet to the staff at whole school meetings. Future research could focus on a professional development model where class teachers could collaborate and support each other, with for example researcher help, in developing new literacies skills and strategies within a school-wide learning ecology (Zhao & Frank, 2003).

The F&DE methodology is an emerging methodological framework underpinned by a pragmatic epistemological stance which seeks to develop a bi-directional and reciprocal relationship between research and practice where firm connections between both are developed. The present study drew on the F&DE framework to explore the development of online skills and strategies with struggling readers in terms of what works and in what circumstances. F&DE is an emerging methodology and methodologies developed in the present study could be developed further in future studies. The role played by a researcher as an 'insider' in an F&DE intervention is important to consider. In the present study the researcher both designed and implemented the intervention in close consultation and collaboration with the class teachers. It was important, therefore, to build a trusting relationship with the class teachers which would allow the researcher to become a part of the learning ecology of the classroom. The researcher had extensive teaching experience at all levels of the primary school system in disadvantaged and non-disadvantaged schools and this helped to establish the 'insider knowledge' of the researcher. Also the researcher was willing to take a 'risk' to become actively involved in delivering instruction to the children in Internet workshops. This not only built trust but also enabled the class teachers to 'risk take' themselves and take over delivery of instruction in later Internet workshops. At the same time the researcher needed to be mindful as a researcher of issues of validity, credibility and trustworthiness in conducting the intervention. The role of the researcher in conducting F&DE may warrant further attention in future studies.

The findings from the present study could also provide a workable model to inform best practice in the acquisition of the new literacies. Alternatively specific

findings from the present study could inform future conventional experiments to further explore specific contexts and classroom pedagogies that foster the acquisition of new literacies (Castek, 2008; McCandliss, Kalchman & Bryant, 2003; Reinking, Malloy, Rogers & Robbins, 2007; Pressley & El-Dinary, 1997).

Implications of Findings Concerning the Development of *Online Reading Comprehension* Skills and Strategies for Classroom Pedagogy, Literacy Theory and Future Research

Findings related to the development of online reading comprehension skills and strategies concerned areas, such as formulating questioning; activating and connecting with prior knowledge; and summarisation of information. The children's ability to formulate conceptually challenging questions developed with support across the timeline of the study. The children sought more conceptual understanding and searched across more websites when seeking information for the open task questions. The online reader may need to orchestrate a wider range of prior knowledge sources in an online environment than in the more constrained environment of print-based text. The children had difficulty in determining importance in text which was related to difficulties they experienced in distinguishing the difference between author determined and reader determined importance in text. The differences in the ability to summarise text between the class cohorts appeared to be developmental in nature. Summarisation skills and strategies were however, amenable to instruction, and were developed across the timeline of the study from a low base.

Online Reading Comprehension: Implications for Classroom Pedagogies

The Internet represents an online space which appears to be a boundless frontier of information. The quest for information on the Internet is influenced by the nature of the question formulated (Eagleton & Dobler, 2007). At times one looks to the Internet for specific information to answer literal type questions. However, in order to move beyond the acquisition of facts and push for deeper conceptual learning online, class teachers need to be aware of the need to push for deeper levels of questions to focus the online search for information. The ability of the children to formulate self-generated questions developed with scaffolded help across the timeline of the study by using two approaches. Firstly, the questions formulated were aided by developing prior domain and topic knowledge. Secondly, the QARs model (Raphael & Au, 2005; Raphael & Pearson, 1985; Raphael & Wonnacott, 1985) was adapted to provide the children with multisensory tools (such as colour codes and hand signals) to create a metalanguage which helped them to discuss the types and kinds of questions formulated. Such approaches could be replicated in other classrooms. The range of prior knowledge sources is more complex in an online environment and class teachers need to provide support to children to ensure that children not only activate but also connect with and integrate this range of prior knowledge sources in their quest for information. Children's awareness of the differences between author determined and reader determined importance in text needs to be heighted in class discussions to distinguish between interesting and important details in text. In line with literature (Dole at al., 1991; Winograd, 1984) summarisation appears to be developmental in nature and is amenable to instruction.

Online Reading Comprehension: Implications for the Development of Literacy Theory

Previous work points to additional complexities in constructing meaning in an online environment (Afflerbach & Cho, 2009; Coiro & Dobler, 2007; RAND Reading Study Group, 2002; Spires & Estes, 2002). The development of online reading comprehension shares a number of commonalities with foundational print based skills, such as activation of prior knowledge, formulating questions, drawing inferences, determining importance in text and monitoring understanding (Dole et al., 1991; Pressley & Afflerbach, 1995). However, additional complexities may include, for example self-regulation in constructing somewhat unique pathways though online text and predictive inferencing of hypertextual links (Coiro & Dobler, 2007). Additionally the questions formulated drive the quest for information and may assume additional importance in an online environment (Eagleton & Dobler, 2007). Summarisation may involve more synthesis of information and more intertextual links across multiple modalities and websites (Alexander et al., 1994). A more contested area within the literature is the importance of prior knowledge sources in an online environment. A finding from the present study suggests that the online reader may need to activate, connect and integrate a wider range of prior knowledge sources in the online environment of the Internet than in the more constrained environment of print-based reading texts. For example, struggling readers need to locate information by drawing on prior knowledge of generating search terms and evaluating search results to locate information. Then, they have to assess the relevance of the information encountered by drawing on prior domain knowledge and relating the information found to the goal of the task. At the same time, they need to navigate through an online environment and draw on their

knowledge of the architecture of informational online text structures to access information speedily. This suggests that for struggling readers prior knowledge sources attain more not less significance in an online hypertextual environment.

Online Reading Comprehension: Implications for Future Research

The range of prior knowledge sources that the reader must orchestrate in an online environment may involve additional complexity for the online reader and warrants additional research in future studies. For example what level of prior end-user application knowledge does one need to effectively and efficiently retrieve online information? What level of prior domain knowledge does one need to generate search strings, investigate search results, and berrypick (Bates, 1989) and summarise information in an online environment? How does the nature of the task, whether open or closed, self-generated or assigned, influence the need to orchestrate prior knowledge sources? How does the nature of the task question influence the quality and quantity of time needed to search for information?

Implications of Findings Concerning the Development of *Online Information-Seeking* Skills and Strategies for Classroom Pedagogy, Literacy Theory and Future Research

The model of the online information-seeking process in the present study was defined as (a) goal formation, understanding the task; (b) generating and revising search terms; (c) investigating search results; (d) locating and critically evaluating the relevancy of the information retrieved to the task focus and (e) transforming, synthesising and communication of information. Findings from the study suggested growth in the ability of the children to plan and discuss the task focus across the timeline of the study. This was aided by the introduction of the reciprocal roles of

Questioner, Navigator and Summariser. Interfacilitation occurred between the critical online location skills of generating search terms and investigating search results. Developmental differences between the focal groups within and across the class cohorts related to the capability of the groups to orchestrate prior knowledge sources, the ability to self-regulate, the level of metacognitive knowledge utilised, and the flexibility and creativity with which they conducted online activity. Critical evaluation skills, such as the ability to evaluate author stance and agenda, veracity and reliability of information, proved to be difficult to develop beyond procedural and declarative levels of knowledge and may be developmental in nature.

Online Information-Seeking Skills and Strategies: Implications for Classroom Pedagogies

The strengths and needs of the children in relation to the development of online reading comprehension and information-seeking skills and strategies were assessed through observing the pupils' use of online skills and strategies and reflecting on pupil commentary during Internet workshop and especially through a series of Internet Inquiry Progress Tasks conducted across the timeline of the study. Methodologies employed in the present study, such as capturing the online activity of the children through the use of Camtasia software, and reflecting with them on their online activity in a Camtasia exit interview, could be utilised by class teachers to observe, with their students, and reflect on the skills and strategies employed by them in the online information-seeking cycle. Such data could be used both formatively to create a profile for the children of their strengths and needs during various stages of the online information-seeking cycle. Likewise, such data could be used summatively to assess the children's progress in developing online skills and

strategies and to develop curriculum and design mini-lessons based on observed needs.

Online Information-Seeking Skills and Strategies: Implications for Literacy Theory

Findings from the present study suggest a reciprocal interfacilitation between the ability to generate and revise search strings, investigate search results with a critical eye, and the subsequent location of relevant online information. This suggests that these overlapping skills need to be developed in tandem and in the context of skills-in-use rather than in de-contextualised situations. In the present study there was preliminary evidence from the small population sample of the developmental nature of both generating and revising search strings and investing search results both within each class cohort and across the class cohorts.

Online Information-Seeking Skills and Strategies: Implications for Future Research

The present study revealed preliminary evidence of a taxonomy of skills in relation to both generating search strings and investigating search results. Such a taxonomy could be developed further along with other emerging studies (Leu, Zawlinski et al., 2007) in future studies to provide insights for the development of more formal online assessment tools of the development of the new literacies within the online information-seeking cycle.

Although the children developed a somewhat "healthy scepticism" (Leu, 1997) towards investigating both search result URLs and checking the veracity of the information retrieved, questions remain regarding the development of online critical evaluation skills which future studies could investigate. In this study critical Internet literacy, including the ability to evaluate author agenda, veracity, reliability, and

authenticity of online information proved elusive to develop with the pupils beyond the level of procedural and declarative knowledge. Future research could focus on the development of critical literacy strategies and whether explicit instruction could embed these strategies into the ways in which children read and study online information.

Implications of Findings Concerning the Role of *Peer-to-Peer Collaboration* for Classroom Pedagogy, Literacy Theory and Future Research

Findings from the study indicated that peer-to-peer collaboration within the triad groups did not occur spontaneously and required the development of structural frameworks. Peer collaboration enabled the children to share insights of their developing knowledge of conducting online reading activities. Peer collaboration facilitated both active construction and the development of online skills and strategies and a deeper processing of texts.

Peer-to-Peer Collaboration: Implications for the Development of Classroom Pedagogies

Findings from the present study suggest that pupils appeared to learn and apply online skills best from sharing with other pupils within the context of challenging online activities. Nevertheless, peer collaboration did not occur spontaneously and procedures to encourage peer-to-peer collaboration required organisation. The structural framework to encourage peer-to-peer collaboration included the use of the reciprocal roles of Questioner, Navigator and Summariser, with prompt cards as temporary scaffolds. These reciprocal roles developed a sense of agency within members of the triad groups and also distributed responsibility for online activity among group members. The use of class discussions at the outset and conclusion of

each Internet workshop allowed the children to engage with both generative and reflective practices on the process and product of their online activity. Likewise, the use of share boards allowed the children to share insights into their developing knowledge of online reading comprehension and information-seeking skills and strategies. This structural framework may be important for class teachers to consider to ensure the development of agency and self-efficacy within groups, an even distribution among group members of online activities, and a sharing of online skills and strategies so that group members may learn from each other. In the classroom the teacher need to be cognisant of the need to monitor collaboration within groups, to encourage student independence and sharing in the zone of student responsibility.

Peer-to-Peer Collaboration: Implications for Literacy Theory

Peer-to-peer collaboration enabled the group to apply and hone the skills and strategies developed during explicit strategy instruction and guided practice. The role of the 'more knowledgeable other' in the group was dynamic and changed as pupils' levels of expertise in reading, applying end-user application knowledge, online reading skills and strategies and accessing and connecting with a range of prior knowledge sources shifted during online inquiry. Social learning seemed to assume greater significance in applying and developing online reading skills and strategies.

Peer-to-Peer Collaboration: Implication for Future Research

Scaffolding of online activity in terms of adaptive scaffolding and peer-to-peer scaffolding and collaboration appeared to facilitate the development of online reading comprehension and information-seeking skills and strategies. Future research could focus on the nature and optimal type of scaffolding required in an online environment. For example, at what point in the gradual release of

responsibility model does adaptive scaffolding give way to peer-to-peer scaffolding and collaboration? What signals should a teacher look for to ascertain when students are ready to scaffold each other? How does one monitor the nature of peer-to-peer scaffolding? Does the nature of teacher scaffolding influence the way students scaffold each other or in what ways do they differ? Further research is needed on developing self-assessment within groups as they develop, hone and reflect on the development of online skills. Research is needed into how the class teacher can monitor the inner workings of groups in developing online skills to maximise productive collaboration.

Finally, future research could focus on the degree of transition from the social plane to the intrapersonal plane and the extent to which individual members of groups could subsequently independently apply online skills and strategies learned in groups during Internet inquiry as individual explorers on the Internet.

Limitations of the Study

This exploratory study, conducted with struggling readers from a disadvantaged school community in an online environment during Internet inquiry, has the potential to offer some insights into the development of online skills and strategies with this population. It affords us a view of an integrated curriculum, which forged links between literacy, science and the Internet; the role of the researcher and teacher in undertaking explicit strategy instruction and adaptive scaffolding to develop these online skills; and the role of peer-to-peer collaboration in developing the new literacies in an online environment. Additionally, the iterative nature of the F&DE design framework where carefully controlled modifications emanated in response to the particular needs of these struggling readers enables us to view research-to-

practice connections *in situ* within the ecology of learning in classrooms.

Nevertheless, some limitations to the study must be acknowledged. These limitations are presented in the sections which follow.

The Role of the Researcher as Participant in the Study

The role of the researcher as a driving force of the intervention may have shaped the particular learning outcomes of the study. Procedures were implemented, as described in detail in chapter 3 (Methodology: Conceptual and Methodological Framework), to ensure reliability, validity, objectivity, credibility and trustworthiness. These measures included respondent validation, where although the researcher transcribed and analysed the data sources and designed modifications, advice and commentary was sought from the class teachers on a weekly basis before any modifications were made. Similarly, the researcher presented the study at various stages of design and analysis at International conferences such as the United Kingdom Literacy Association (UKLA) conference (2006); the National Reading Conference (2006, 2007, 2009); National Centre for Literacy Research, Nottingham, U.K., (2008) and the International Reading Association Conference (2009) where feedback and response from other researchers and practitioners was sought and acted upon. Multiple data sources were triangulated to increase confidence in the findings of the study and ensure validity.

Generalisability of the Study

The school chosen by the researcher was a designated disadvantaged school from Band 1 of the DEIS initiative (DES, 2005c). Band 1 refers to the highest level of social disadvantage. The school was an all girls' school reflecting an historic norm in the catchment area of the school. The findings may have been different in a mixed

population of boys and girls or all boys' school. The sample size was small. Therefore, the study findings may be specifically related to this particular population. However, the close interaction between theory, practice and research in an F&DE methodological framework suggests that transferability to other contexts may be possible.

Peer-to-Peer Collaboration

The children worked in mixed ability assigned triad groups. Working in this way, in groups of three, at a computer may have encouraged more collaboration among the children to support the development of content knowledge and the sharing of online skills and strategies than would have occurred if the children had been working on their own in a one-to-one computer situation. The role of peer collaboration may have emerged as a theme due to the nature of the particular arrangement of working in triad groups and warrants further investigation.

Concluding Remarks

In his Presidential address in 2005 to the NRC conference in Florida, Professor Don Leu, called for support for developing the new literacies for those on the margins of society. He argued that "students who need to be prepared the most are precisely those who are being prepared the least". As the Internet becomes more ubiquitous in society it is important that we support all children, but especially those with low levels of print literacy, in the complex and challenging world of the Internet. We must ensure equality of access for all but also we must ensure that the skills and strategies necessary to conduct Internet inquiry effectively and efficiently are developed. The present study offers some insights, for researchers and

practitioners alike, into how we can support struggling readers from disadvantaged communities to develop these skills and strategies through explicit strategy instruction, adaptive scaffolding and peer-to-peer collaboration in challenging authentic activities, embedded in an integrated curriculum, within the ecology of learning in classrooms. We have still clearly much to learn about the new literacies of the Internet.

REFERENCES

Afflerbach, P. (2000). Verbal reports and protocol analysis. In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of reading research, Volume III* (pp. 311-336). New York: Erlbaum.

Afflerbach, P. (2007). Understanding and using reading assessment, K-12. Newark, DE: International Reading Association.

Afflerbach, P., & Cho, B. Y. (2009). Identifying and describing constructively responsive comprehension strategies in new and traditional forms of reading. In S. E. Israel & G. G. Duffy (Eds.), *Handbook of research on reading comprehension* (pp. 69-90). New York: Routledge.

Afflerbach, P., Pearson, P. D., & Paris, S. G. (2008). Clarifying differences between reading skills and reading strategies. *The Reading Teacher, 61(5),* 364-373.

Agosto, D. E. (2002a). Bounded rationality and satisficing in young people's Web-based decision-making. *Journal of the American Society for Information Science and Technology,* 53, 16–27.

Agosto, D. E. (2002b). A model of young people's decision making in using the Web. *Library and Information Science Research, 24,* 311-341.

Alexander, P. A. (1992). Domain knowledge: Evolving themes and emerging concerns. *Educational Psychologist, 27,* 33-51.

Alexander, P. A. (1997). *The path to competence: A lifespan developmental perspective on Reading.* Paper commissioned by the National Reading conference Retrieved June 26, 2007 from http://www.nrconline.org/publications/ThePathToCompetence.pdf

Alexander, P. A. (2003). The development of expertise: The journey from acclimation to proficiency. *Educational Researcher, 32(8),* 10-14.

Alexander, P. A. (2006). The path to competence: A lifespan developmental perspective on reading. *Journal of Literacy Research, 37,* 413-436.

Alexander, P. A., & Jetton, T. L. (2000). Learning from text: A multidimensional and developmental perspective. In M. L. Kamil, P. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of reading research, Volume III* (pp. 285-310). Mahwah, NJ: Erlbaum.

Alexander, P. A., Jetton, T. L., & Kulikowich, J. M. (1995). Interrelationship of knowledge, interest and recall: Assessing a model of domain learning. *Journal of Educational Psychology, 87(4),* 559-575.

Alexander, P. A., & Kulikowich, J. M. (1994). How subject-matter knowledge affects recall and interest. *American Educational Research Journal, 31(2),* 313-337.

Alexander, P. A., Kulikowich, J. M., & Jetton, T. L. (1994). The role of subject matter knowledge in the processing of linear and non linear texts. *Review of Educational Research, 64(2),* 201-252.

Allington, R. L. (1983). The reading instruction provided readers of differing reading abilities. *The Elementary School Journal, 83(5),* 548-559.

Allington, R. L. (1994). The schools we have. The schools we need. *The Reading Teacher, 48(1),* 14-29.

Allington, R. L. (1998). Introduction. In R. L. Allington (Ed.), *Teaching struggling readers. Articles from the reading teacher* (pp. 1-8). Newark, DE: International Reading Association.

Allington, R. L., & McGill-Franzen, A. (2009). Comprehension difficulties among struggling readers. In S. E. Israel & G. G. Duffy (Eds.), *Handbook of research on reading comprehension* (pp. 551-568). New York: Routledge.

Anderson, R. C. (2004). Role of reader's schema in comprehension, learning, and memory. In R. B. Ruddell, N. J. Unrau, (Eds.), *Theoretical models and processes of reading* (5th ed., pp. 594-606). Newark, DE: International Reading Association.

Anderson, R. C., & Pearson, P. D. (1984). A schematic-theoretic view of the basic processing in reading comprehension. In P. D. Pearson (Ed.), *Handbook of reading research* (pp. 255-291). New York: Longman.

Anderson, R. C., Spiro, R. J., & Anderson, M. C. (1978). Schemata as scaffolding for the representation of information in discourse. *American Educational Research Journal, 15,* 433-440.

Anderson-Inman, L., & Horney, M. A. (1998). Transforming text for at-risk readers. In D. Reinking, M. C. McKenna, L. D. Labbo, & R. D. Kieffer (Eds.), *Handbook of literacy and technology : Transformations in a post-typographic world* (pp. 15-44). Mahwah, NJ: Lawrence Erlbaum Associates.

Armbruster, B. B. (1986). Schema theory and the design of content-area textbooks. *Educational Psychologist, 21(4),* 253-267.

Armstrong, T. (2000). *Information transformation: Teaching strategies for authentic research, projects, and activities.* Portland, ME: Pembroke Publishers.

Au, K. A. (2006). Diversity, technology and the literacy achievement gap. In D. Reinking, M. C. McKenna, L. D. Labbo, & R. D. Kieffer (Eds.), *Handbook of literacy and technology : Transformations in a post-typographic world* (pp. 363-368). Mahwah, NJ: Lawrence Erlbaum Associates.

Azevedo, R., Cromley, J. G., & Seibert, D. (2003). Does adaptive scaffolding facilitate students' ability to regulate their learning with hypermedia? *Contemporary Educational Psychology, 29,* 344-370.

Azmitia, M. (1988). Peer interaction and problem solving: When are two heads better than one? *Child Development, 59(1),* 87-96.

Baker, L. (1991). Metacognition, reading, and science education. In C. M. Santa & D. E. Alvermann (Eds.), *Science learning: Processes and applications* (pp. 2-13). Newark, DE: International Reading Association.

Baker, L., & Beall, L.C. (2009). Metacognitive processes and reading comprehension. In S. E. Israel & G. G. Duffy (Eds.), *Handbook of research on reading comprehension* (pp. 373-388). New York: Routledge.

Baker, L., & Brown, A. L. (1984). Metacognitive development in reading. In P. D. Pearson, R. Barr, M. Kamil, & P. Mosenthal (Eds.), *Handbook of research in reading* (pp. 353-395). New York, Longman.

Balcytiene, A. (1999). Exploring individual processes of knowledge construction with hypertext. *Instructional Science, 27,* 303-329.

Bandura, A. (1977). Self-efficacy: Towards a unifying theory of behavioral change. *Psychological Review, 82 (2),* 191-215.

Bandura, A., & Schunk, D. H. (1981). Cultivating competence, self-efficacy and intrinsic interest through proximal self-motivation. *Journal of Personality and Social Psychology, 41,* 586-598.

Bannan-Ritland, B. (2003). The role of design in research: The integrative learning design framework. *Educational Researcher, 32(1),* 21-24.

Barber, J., Catz, K. N., & Arya, D. (2006, April). *Improving science content acquisition through a combined science/literacy approach: A quasi-experimental study.* Paper presented at the American Educational Research Association Conference, San Francisco, CA.

Barbosa, P., & Alexander, L. (2004). Science inquiry in the CORI framework. In J. T. Guthrie, A. Wigfield, & K. C. Perencevich (Eds.), *Motivating reading comprehension. Concept-oriented reading instruction.* (pp. 113-142). Mahwah, NJ: Lawrence Erlbaum Associates.

Barron, B. (2000). Achieving coordination in collaborative problem-solving groups. *Journal of the Learning Sciences, 9(4),* 403-426.

Barron, B. (2003). When smart groups fail. *Journal of the Learning Sciences, 12(3),* 307-359.

Barron, B., & Darling-Hammond, L. (2008). How we can teach for powerful meaning? In L. Darling-Hammond, B. Barron, P. D. Pearson, A. L. Schoenfeld, E. K. Stage, T. D., Zimmerman, G. N. Cervetti, & T. L. Tilson (Eds.), *Powerful learning. What we know about teaching for understanding* (pp. 11-70). San Francisco, CA: John Wiley & Sons Inc.

Bates, M. J. (1989). *The design of browsing and berrypicking techniques for the online search interface.* Retrieved November 18, 2008 from http://www.gseis.ucla.edu/faculty/bates/berrypicking.html

Baumann, J. F. (1984). The effectiveness of a direct instruction paradigm for teaching main idea comprehension. *Reading Research Quarterly, 20(1),* 93-115.

Baumann, J. F., Ware, D., & Edwards, E. C. (2007). "Bumping Into Spicy, Tasty Words That Catch Your Tongue": A Formative Experiment on Vocabulary Instruction. *The Reading Teacher, 61(2)* 108-122.

Becker, H. J. (2000). Who's wired and who's not: Children's access to and use of computer technology. *The Future of Children, 10(2),* 44-75.

Bennett, S., Matton, K., & Kervin, L. (2008). The 'digital natives' debate: A critical review of the evidence. *British Journal of Educational Technology, 39(5),* 775-786.

Bereiter, C., & Bird, M. (1985). Use of think aloud in identification and teaching of reading comprehension strategies. *Cognition and Instruction, 2(2),* 131-156.

Bereiter, C., & Scardamalia, M. (2006). Education for the knowledge age: Design-centered models of teaching and learning. In P. A. Alexander & P. H. Winne (Eds.), *Handbook of educational psychology* (2nd ed., pp. 695-713). Mahwah, NJ: Erlbaum.

Biancarosa, G., & Snow, C. E. (2006). *Reading next-A vision for action and research in middle and high school literacy: A report to Carnegie Corporation of New York.* (2nd ed.) Washington, DC: Alliance for Excellent Education.

Bilal, D. (1998, October). Children's search processes in using world wide web search engines: An exploratory study. In Proceedings of the Sixty-First ASIA Annual Meeting, Pittsburgh, PA (pp. 45-53). Medford, NJ: Information Today, Inc.

Bilal, D. (2000). Children's use of the Yahooligans! web search engine:1. Cognitive, physical and affective behaviors on fact-based search tasks. *Journal* of *the American Society for Information Science, 51(7),* 646-665.

Bilal, D. (2001). Children's use of the Yahooligans! web search engine:11.Cognitive, physical and affective behaviors on research tasks. *Journal* of *the American Society for Information Science, 52(2),* 118-136.

Bilal, D. (2002). Children's use of the Yahooligans! web search engine:111. Cognitive, physical and affective behaviors on fully self-generated search tasks. *Journal* of *the American Society for Information Science, 53(13),* 1170-1183.

Birkerts, S. (1994). *The Gutenberg elegies: The fate of reading in an electronic age.* Boston: Faber & Faber.

Block, C. C. & M. Pressley, M. (Eds.) (2002). *Comprehension instruction: Research-based best practices.* New York: The Guilford Press.

Bloom, B. S., Engelhart, M. D., Furst, E. J., Hill, W. H., & Krathworhl, D. R. (1956). Taxonomy of educational objectives: The classification of educational goals. New York: Longmans.

Bogdan, R., & Biklen, S. (1992). *Qualitative research for education: An introduction to theories and methods* (2nd ed.). Boston: Allyn and Bacon.

Bolter, J. D. (1998). Hypertext and the question of visual literacy. In D. Reinking, M. C. McKenna, L. D. Labbo, & R. D. Kieffer (Eds.), *Handbook of literacy and technology: Transformations in a post-typographic world* (pp. 3-14). Mahwah, NJ: Lawrence Erlbaum Associates.

Borgman, C. L., Hirsh, S. G., Walter, V. A., & Gallagher, A. L. (1995). Children's searching behavior on browsing and keyword online catalogs: The science library catalog project. *Journal of the American Society for Information Science, 46(9),* 663-684.

British Educational Research Association (BERA) (2004). Revised Ethical Guidelines for Educational Research. Nottingham: British Educational Research Association. Retrieved November, 23, 2006 from http://www.bera.ac.uk/publications/pdfs/ETHICA1.PDF?PHPSESSID=1703538bec5cd46797030b3185273ad1

Britt, M. A., & Gabrys, G.L. (2001). Teaching advanced literacy skills for the World Wide Web. In C. R. Wolfe (Ed.), *Learning and teaching on the World Wide Web* (pp. 74-91). San Diego, CA: Academic Press.

Brown, A. L. (1992). Design experiments: Theoretical and methodological challenges in creating complex interventions in classroom settings. *Journal of Learning Sciences, 2(2),* 141-178.

Brown, A. L., & Campione, J. C. (1986). Psychological theory and the study of learning disabilities. *American Psychologist, 14(10),* 1059-1068.

Brown, A. L., & Campione, J. (1996). Psychological theory and the design of innovative learning environments: On procedures, principles and systems. In L. Schauble & R. Glaser (Eds.), *Innovations in learning environments: New environments for education* (pp. 289-325). Mahwah, NJ: Lawrence Erlbaum Associates, Inc.

Brown, A. L., & Day, J. D. (1983). Macrorules for summarizing texts: The development of expertise. *Journal of Verbal Learning and Verbal Behavior, 22,* 1-14.

Brown A. L., Day, J. D., & Jones, R. S. (1983). The development of plans for summarizing texts. *Child Development, 54(4),* 968-979.

Brown, A. L., & Palinscar, A. S. (1985). Reciprocal teaching of comprehension strategies: A natural history of one program for enhancing learning. (Technical Report No.CS-334) Urbana, University of Illinois: Center for the Study of Reading. (ERIC Document Reproduction Service No. ED 257046)

Brown, J. S. (1999, March). Learning, working and playing in the digital age. Conference presentation at the American Association for Higher Education (AAHE), Washington, D.C. Retrieved April, 9, 2009 from http://www.ntlf.com/html/sf/jsbrown.pdf

Brozo, W. G., Shiel, G., & Topping, K. (2007/2008). Engagement in reading: Lessons learned from three PISA countries. *Journal of Adolescent & Adult Literacy, 51(4),* 304-315.

Bruce, B. C. (1997). Literacy technologies: What stance should we take? *Journal of Literacy Research, 29,* 289-309.

Bruner, J. (1986). *Actual minds, possible worlds.* Cambridge, MA: Harvard University Press.

Bulger, M. (2006). *Beyond search: A preliminary skill set for online literacy* retrieved May, 29, 2009 from http://transliteracies.english.ucsb.edu/research-papers/translit-bulger-onlinelit.pdf.

Burke, J. (2002). The Internet reader. *Educational Leadership, 60(3),* 38-42.

Cambourne, B. (1995). Towards an educationally relevant theory of literacy learning: Twenty years of inquiry. *The Reading Teacher, 49,* 182-192.

Calisir, F., & Gurel, Z. (2003). Influence of text structure and prior knowledge of the learner on reading comprehension, browsing and perceived control. *Computers in Human Behavior, 19,* 135-145.

Castek, J. (2006, April). Adapting reciprocal teaching to the Internet using telecollaborative projects. In D. J. Leu & D. P. Reinking (Chairs), *Developing Internet reading comprehension strategies among Adolescents at risk to become dropouts.* Symposium conducted at the meeting of the American Educational Research Association, San Francisco, CA.

Castek, J. (2008). *How do 4th and 5th grade students acquire the new literacies of online reading comprehension? Exploring the contexts that facilitate learning.* Unpublished doctoral dissertation. University of Connecticut.

Castek, J. (2009, May). *How are the new literacies of online reading comprehension acquired by 4th and 5th graders?* Poster session presented at the 54th annual conference of the International Reading Association, Minneapolis, MN.

Central Statistics Office (CSO). (2006, 2007). *Census of population 2006, Volume 1-11.* Dublin: The Stationery Office.

Cervetti, G. N., Pearson, P. D., Barber, J., Hiebert, E. H., & Bravo, M. A. (2007). Integrating literacy and Science. The research we have the research we need. In M. Pressley, A. K. Billman, K. Perry, K. Reffitt, & J. M. Reynolds (Eds.), *Shaping literacy achievement. Research we have research we need* (pp. 157-174).New York: Guildford Press.

Cervetti, G. N., Pearson, P. D., Bravo, M. A., & Barber, J. (2006). Reading and writing in the service of inquiry-based science. In R. Douglas, M. P. Klentschy, & K. Worth (Eds.), *Linking science and literacy in the K-8 classroom* (pp. 221-244). Arlington, VA: National Science Teachers Association.

Cherryholmes, C. H. (1992). Notes on pragmatism and scientific realism. *Educational Researcher, 21(6),* 13-17.

Chi, M.T. H., de Leeuw, W., Chiu, M.-H. , & La Vanche, C. (1994). Eliciting self-explanations improves understanding. *Cognitive Science, 18,* 439-477.

Clarke, H. (1996). *Using language.* New York: Cambridge University Press.

Clay, M. M. (2002). *An observation survey of early literacy development* (2nd ed.). Portsmouth, NH: Heinemann.

Cobb, P., Confrey, J., diSessa, A., Lehrer, R., & Schauble, L. (2003). Design experiments in educational research. *Educational Researcher, 32(1),* 9-13.

Cohen, P. A., Kulik, J. A., & Kulik, C. C. (1982). Educational outcomes of tutoring: A meta-analysis of findings. *American Educational Research Journal, 19,* 237-248.

Cohen, L., Manion, L., & Morrison, K. (2003). *Research methods in education* (5th ed.). London: Routledge Falmer.

Coiro, J. (2003). Reading comprehension on the Internet: expanding our understanding of reading comprehension to encompass new literacies. *The Reading Teacher, 56(5),* 458-464.

Coiro, J. (2007). *Exploring changes to reading comprehension on the Internet: Paradoxes and possibilities for diverse adolescent readers.* Unpublished doctoral dissertation, University of Connecticut, Storrs.

Coiro, J., & Dobler, E. (2007). Exploring the comprehension strategies used by sixth-grade skilled readers as they search for and locate information on the Internet. *Reading Research Quarterly, 42,* 214-257.

Coiro, J., Knobel, M., Lankshear, C., & Leu, D. J. (2008). Central issues in new literacies and new literacies research. In J. Coiro, M. Knobel, C. Lankshear, & D. J. Leu (Eds.), *Handbook of research on new literacies* (pp. 1-21). Mahwah, NJ: Lawrence Erlbaum Associates.

Coiro, J., & Putman, M. (2008, December). *Promoting online reading success: Understanding students' attitudes towards reading on the Internet.* Paper presented at the 58th annual meeting of the National Reading Conference, Orlando, FL.

Collins, A. (1992). Towards a design science of education. In E. Scanlon & T. O'Shea (Eds.), *New directions in educational technology*, (pp. 15-22). New York: Springer-Verlag.

Collins, A. (1999). The changing infrastructure of educational research. In E. C. Lagemann & L. B. Shulman (Eds.), *Issues in Educational research: Problems and possibilities* (pp. 289-298). San Francisco: Jossey Bass.

Collins, A., Brown, J. S., & Larkin, K. M. (1980). Inference in text understanding. In R. J. Spiro, B. C. Bruce, & W. F. Brewer (Eds.), *Theoretical issues in reading comprehension: Perspectives from cognitive psychology, linguistics, artificial intelligence, and education* (pp. 385-407). Hillsdale, NJ: Erlbaum.

Collins, A., Brown, J. S., & Newman, S. (1989). Cognitive apprenticeship: Teaching the crafts of reading, writing, and mathematics. In L.B. Resnick (Ed.), *Knowing, learning and instruction: Essays in honor of Robert Glaser* (pp. 453-494). Hillsdale, NJ: Lawrence Erlbaum Associates Inc.

Collins, A., Joseph, D., & Bielaczyc, K. (2004). Design research: Theoretical and methodological issues, *The Journal of the Learning Sciences, 13(1),* 15-42.

Comber, B., & Simpson, A. (2001). *Negotiating critical literacy skills in the classroom.* Mahwah, NJ: Erlbaum.

Condon, M. W. F., & Harrison, C. (2009, May). Conversations around digital picture books by children. In D. Grisham, D. Johnson, & J. Coiro (Chairs). *Technology tools and strategies to promote reading, writing, and conversations,* Paper presented at the Pre-Conference Institute at the 54th annual meeting of the International Reading Association conference, Minneapolis, MN.

Conway, P. (2000). Schools Information Technology (IT) 2000: Technological innovation and educational change. *Irish Educational Studies, 19,* 227-244.

Cope, B., & Kalantzis, M. (2000). *Multiliteracies.* London, UK: Routledge.

Cosgrove, J., Kellaghan, T., Forde, P., & Morgan, M. (2000). *The 1998 Assessment of English Reading.* Dublin: Educational Research Centre.

Coté, N., & Goldman, S. R. (2004). Building representations of informational text: Evidence from children's think-aloud protocols. In R. B. Ruddell & N. J. Unrau (Eds.), *Theoretical models and processes of reading (*5th ed., pp. 660-683). Newark, DE: International Reading Association.

Coyne, P. (2009, May). Book builder: Digital scaffolded reading instruction for elementary and middle school students. In D. Grisham, D. Johnson, & J. Coiro (Chairs). *Technology tools and strategies to promote reading, writing, and conversations,* Paper presented at the Pre-Conference Institute at the 54th annual meeting of the International Reading Association conference, Minneapolis, MN.

Csikszentmihalyi, M. (1990). Literacy and intrinsic motivation. *Daedalus, 119 (2),* 115-140.

Daiute, C., & Dalton, B. (1993). Collaboration between children learning to write: Can novices be masters? *Cognition and Instruction, 10(4),* 281-333.

Dalton, B., & Proctor, C. P. (2008). The changing landscape of text and comprehension in the age of the new literacies. In J. Coiro, M. Knobel, C. Lankshear, & D. J. Leu (Eds.), *Handbook of research on new literacies* (pp. 297-324). Mahwah, NJ: Lawrence Erlbaum Associates.

Dalton, B., & Rose, D. (2008). Scaffolding digital comprehension. In C. C. Block & S. R. Parris (Eds.), *Comprehension instruction: Research-based best practices* (2nd ed., pp. 347-361). New York: The Guildford Press.

Dalton, B., & Strangman, N. (2006). Improving struggling readers' comprehension through scaffolded hypertexts and other computer-based literacy programs. In M. C. McKenna, L. D. Labbo, R. D. Kieffer, & D. Reinking, (Eds.), *International handbook of literacy and technology: Volume 11* (pp. 75-92). Mahwah, NJ: Lawrence Erlbaum Associates.

Daniels, H. (2002). *Literature circles: Voice and choice in book clubs and reading groups*. Portland, Maine: Stenhouse.

Davey, B. (1983). Think aloud: Modeling the cognitive process of reading comprehension. *Journal of Reading, 27(1),* 44-47.

Dede, C. (2004). Commentaries: If design-based research is the answer, what is the question? A commentary on Collins, Joseph, and Bielaczyc; diSessa and Cobb; and Fishman, Marx, Blumenthal, Krajcik, and Soloway in the JLS special issue on design-based research, *The Journal of the Learning Sciences, 13(1),* 105-114.

Denzin, N. K. (1970). *The research act in sociology: A theoretical introduction to sociological methods*. London: Butterworth.

Department of Education and Science/National Council for Curriculum and Assessment (DES/NCCA (1999a). *Primary school curriculum.* Dublin: The Stationery Office.

Department of Education and Science/National Council for Curriculum and Assessment (DES/NCCA). (1999b). *Primary school science curriculum: Teacher guidelines.* Dublin: The Stationery Office.

Department of Education and Science (DES) (2005a). *Literacy and numeracy in disadvantaged schools: Challenges for teachers and learners*. Dublin: The Stationery Office.

Department of Education and Science (DES) (2005b). *Survey of traveller education provision: Inspectorate of the Department of Education and Science*. Dublin: Government Publications.

Department of Education and Science (DES) (2005c). DEIS (*Delivering equality of opportunity in schools) An action plan for educational inclusion.* Dublin: The Stationery Office.

Department of Education and Science (DES) (2008a). *Investing in Information and Communications technology in schools 2008-2013: The report of the minister's strategy group*. Dublin: Department of Education and Science.

Department of Education and Science (DES) (2008b). *ICT in schools: Inspectorate Evaluation studies.* Dublin: Department of Education and Science.

Design-Based Research Collective, The. (2003). Design-based research: A context-specific paradigm for educational inquiry. *Educational Researcher, 32(1),* 5-8.

Diener, E., & Crandall, R. (1978). *Ethics in social and behavioral research.* Chicago: University of Chicago Press.

Dole, J. A., Duffy, G. G., Roehler, L. R., & Pearson, P. D. (1991). Moving from the old to the new: Research on reading comprehension instruction. *Review of Educational Research, 61(2),* 239-264.

Dole, J. A., Nokes, J. D., & Drits, D. (2009). Cognitive strategy instruction. In S. E. Israel & G. G. Duffy (Eds.), *Handbook of research on reading comprehension* (pp. 347-372). New York: Routledge.

Dreher, M. J., & Guthrie, J. T. (1990). Cognitive processes in textbook chapter search tasks. *Reading Research Quarterly, 25(4),* 323-339.

Dressman, M., & McCarthy, S. J. (2004).Towards a pragmatics of epistemology, methodology, and other people's theories in literacy research. In N. K. Duke & M. H. Mallette (Eds.), *Literacy research methodologies* (pp. 322-346). New York: Guilford.

Duffy, A. M. (2001). Balanced, literacy acceleration, and responsive teaching in a summer school literacy program for elementary school struggling readers. *Reading Research and Instruction, 40(2),* 67-100.

Duffy, G. G., & Roehler, L. R. (1987). Teaching reading skills as strategies. *The Reading Teacher, 40(4),* 414-418.

Duffy, G. G., Roehler, L. R., Sivan, E., Rackliffe, G., Book, C., Meloth, M. S., et al. (1987). Efforts of explaining the reasoning associated with using reading strategies. *Reading Research Quarterly, 22(3),* 347-368.

Duffy-Hester, A. M. (1999). Teaching struggling readers in elementary school classrooms: A review of classroom reading programs and principles for instruction. *The Reading Teacher, 52(5),* 480-495.

Duke, N. K. (2000). 3.6 minutes per day: The scarcity of informational text in first grade. *Reading Research Quarterly, 35(2),* 202-224.

Duke, N. K., & Pearson, P. D. (2002). Effective practices for developing reading comprehension. In A. E. Farstrup & S. J. Samuels (Eds.), *What research has to say about reading instruction* (3rd ed., pp. 205-264). Newark, DE: International Reading Association.

Duke, N. K., Schmar-Dobler, E., & Zhang S. (2006). Comprehension and technology. In M. C. McKenna, L. D. Labbo, R. D. Kieffer, & D. Reinking (Eds.), *International handbook of literacy and technology. Volume II* (pp. 317-326). Mahwah, NJ: Erlbaum.

Durkin, D. (1993). *Teaching them to read.* (6th ed.), Boston, MA: Allyn & Bacon.

Eagleton, M. B., & Dobler, E. (2007). *Reading the web: Strategies for Internet inquiry*. New York: Guildford.

Eagleton, M. B., & Guinee, K. (2002). Strategies for supporting student Internet inquiry. *New England Reading Association Journal*, 38, 2, 39-47.

Eagleton, M., Guinee, K., & Langlais, K. (2003).Teaching Internet literacy strategies: The hero inquiry project. *Voices from the middle, 10(3),* 28-35.

Edwards, D. M., & Hardman, L. (1999). 'Lost in hyperspace': Cognitive mapping and navigation in a hypertext environment. In R. McAleese (Ed.), *Hypertext: Theory into practice* (2nd Rev. ed., pp. 90-105). Oxford, UK: Intellect Books.

Eivers, E., Shiel, G., & Cunningham, R. (2008). *Ready for tomorrow's world? The competencies of Irish-15-year olds in Pisa 2006. Main report*. Dublin: Educational Research Centre.

Eivers, E., Shiel, G., & Shortt, F. (2004). *Reading Literacy in Disadvantaged Primary Schools*. Dublin: Educational Research Centre.

Elley, W. B. (1992). *How in the world do students read? IEA study of reading literacy.* The Hague: International Association for the Evaluation of Educational Achievement.

Engestrom, Y. (2001). Expansive learning at work: Toward an activity theoretical reconceptualisation. *Journal of Education and Work, 14(1),* 133-157.

Ericsson, K. A., & Simon, H. A. (1993). *Protocol Analysis. Verbal reports as data.* Cambridge, MA: The MIT Press.

Eveland, W. P, Jr., & Dunwoody (2000). Examining information processing on the World Wide Web using think aloud protocols. *Mediapsychology, 2,* 219-244.

Fabos, B. (2008). The price of information: Critical literacy, education, and today's Internet. In J. Coiro, M. Knobel, D. Leu, & C. Lankshear (Eds.), *Handbook of research on new literacies* (pp. 839-870). Mahwah, NJ: Erlbaum.

Fidel, R., Davies, R. K., Douglass, M. H., Holder, J. K., Hopkins, E. J., Miyagishima, B. K., et al. (1999). A visit to the information mall: Searching behavior of high school students. *Journal of the American Society for Information Science, 50(1),* 24-37.

Fielding, N. G., & Fielding, J. L. (1986). *Linking data.* London: Sage.

Fielding, L. G., & Pearson, P. D. (1994). Reading comprehension: What works. *Educational Leadership*, 62-68.

Fitzgerald, M. A. (1999) Evaluating information: An information literacy challenge. *School Library Media Research*. Retrieved September, 4, 2008 from http://www.ala.org/ala/mgrps/divs/aasl/aaslpubsandjournals/slmrb/slmrcontents/volume21999/vol2fitzgerald.cfm.

Flood, J., & Lapp, D. (1995). Broadening the lens: Towards an expanded conceptualization of literacy. In K. A. Hinchman, D. J. Leu, & C. K. Kinzer (Eds.), *Perspectives on literacy research and practice: The 44th Year Book of the National Reading Conference* (pp. 1-16). Chicago: National Reading

Conference.

Foltz, P. W. (1996). Comprehension, coherence and strategies in hypertext and linear text. In J.-F. Rouet, J. J. Levonen, A. Dillon, & R. Spiro (Eds.), *Hypertext and cognition.* (pp. 109-136). Hillsdale, NJ: Lawrence Erlbaum Associates.

Foreman, E. A., & Cazden, C. B. (1994). Exploring Vygotskian perspectives in Education: The cognitive value of peer interaction. In R. B. Ruddell, M. R. Ruddell, & H. Singer (Eds.), *Theoretical models and processes of reading* (4th ed., pp. 155-178). Newark, DE: International Reading Association.

Friedman, T. L. (2005). *The world is flat: The globalised world in the twenty-first century.* London, UK: Penguin.

Galvin, C. (2002). *Sharing innovative practice: The NCTE's schools integration project 1998-2000.* Dublin: NCTE.

Gambrell, L. B. (1996). Creating classroom cultures that foster reading motivation. *The Reading Teacher, 50,* 14-25.

Gambrell, L. B. (2006). Technology and the engaged learner. In M.C. McKenna, L. D. Labbo, R. D. Kieffer, & D. Reinking (Eds.), *International handbook of literacy and technology. Volume II* (pp. 289-294). Mahwah, NJ: Erlbaum.

Gambrell, L. B., Palmer, B. M., Codling, R. M., & Mazzoni, S. A. (1996). Assessing motivation to read. *The Reading Teacher, 49(7),* 518-533.

Garner, R. (1987). Strategies for reading and studying expository text. *Educational Psychologist, 22(3 & 4),* 299-312.

Garner, R., Gillingham, M. G., & White, C. S. (1989). Effects of "seductive details" on macroprocessing and microprocessing in adults and children. *Cognition and Instruction, 6(1),* 41-57.

Gee, J. P. (2003). *What video games have to teach us about learning and literacy.* New York: Palgrave MacMillan.

Ginsburg-Block, M. D., Rohrbeck, C. A., & Fantuzzo, J. W. (2006). A meta-analytic review of peer-assisted learning. *Journal of Educational Psychology, 98(4),* 732-749.

Glaser, B. G., & Strauss, A. L. (1967). *Discovery of grounded theory: Strategies for qualitative research.* Chicago: Aldine.

Goatley, V. J., Brock, C. H., & Raphael, T. E. (1995). Diverse learners participating in regular education "book clubs". *Reading Research Quarterly, 30(3),* 352-380.

Goldman, S. R., & Rakestraw, J. A. Jr. (2000). Structural aspects of constructing meaning from text. In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of reading research. Volume III* (pp. 311-336). New York: Erlbaum.

Gravemeijer, K., & Cobb, P. (2006). Design Research from a learning perspective. In J.van den Akker, K. Gravemeijer, S. S., McKenney, & N. Nieveen (Eds.), *Educational design research* (pp. 17-51). New York: Routledge.

Greig, A. D., & Taylor, J. (1999). *Doing research with children.* London: Sage Publications.

Grisham, D. L., & Wolsey, T. D. (2009, May). Podcasts: How, when, and why? In D. Grisham, D. Johnson, & J. Coiro (Chairs). *Technology tools and strategies to promote reading, writing, and conversations,* Paper presented at the Pre-Conference Institute at the 54th annual meeting of the International Reading Association conference, Minneapolis, MN.

Guba, E. G. (1978). *Towards a methodology in naturalistic inquiry in educational evaluation. CSE monograph series in evaluation no. 8.* Los Angeles: Center for the study of evaluation, University of California, Los Angeles,

Guinee, K. (2004). *Internet searching by K-12 students. A research based process model.* Association for Educational Communications and Technology, 27th, Chicago, IL. (ERIC Document Reproduction Service ED485138). Retrieved October 18, 2008 from http://eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/1b/a8/26.pdf.

Guinee, K., & Eagleton, M. B. (2006). Spinning straw into gold: Transforming information into knowledge during web-based research. *English Journal, 95(4),* 46-52.

Guinee, K., Eagleton, M. B., & Hall, T. E. (2003). Adolescents' Internet search strategies: Drawing upon familiar paradigms when sourcing electronic information sources. *Journal of Educational Computing Research, 29(3),* 363-374.

Guthrie, J. T. (1973). Models of reading and reading disability. *Journal of Educational Psychology, 65,* 9-18.

Guthrie, J. T. (2004). Classroom contexts for engaged reading: An overview. In J. T. Guthrie, A. Wigfield, & K. C. Perencevich (Eds.), *Motivating reading comprehension. Concept-oriented reading instruction* (pp. 87-112). Mahwah, NJ: Lawrence Erlbaum Associates.

Guthrie, J. T., Hoa, A. L. W., Wigfield, A., Tonks, S. M., Humenick, N. M., & Littles, E. (2006). Reading motivation and reading comprehension growth in the later elementary years. *Contemporary Educational Psychology, 32,* 282-313.

Guthrie, J. T., & Taboada, A. (2004). Fostering the cognitive strategies of reading comprehension. In J. T. Guthrie, A. Wigfield, & K. C. Perencevich (Eds.), *Motivating reading comprehension. Concept-oriented reading instruction* (pp. 87-112). Mahwah, NJ: Lawrence Erlbaum Associates.

Guthrie, J. T., Van Meter, P., Hancock, G. R., Alao, S., Anderson, E., & McCann, A. (1998). Does concept-oriented reading instruction increase strategy use and conceptual learning from text? *Journal of Educational Psychology, 90,* 261-278.

Guthrie, J. T., Van Meter, P., McCann, A. D., Wigfield, A., Bennett, L., Poundstone, C. C., et al. (1996). Growth of literacy engagement: Changes in motivations and strategies during concept-oriented reading instruction. *Reading Research Quarterly, 31(3),* 306-332.

Guthrie, J. T., & Wigfield, A. (2000). Engagement and motivation in reading. In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of reading research. Volume III* (pp. 403-422). New York: Erlbaum.

Guthrie, J. T., Wigfield, A., & Perencevich, K. C. (2004a). *Motivating reading comprehension: Concept-oriented reading instruction* .Mahwah, NJ: Erlbaum.

Guthrie, J. T., Wigfield, A., & Perencevich, K. C. (2004b). Scaffolding for motivation and engagement in reading. In J. T. Guthrie, A. Wigfield, K. C. Perencevich (Eds.), *Motivating reading comprehension: Concept-oriented reading instruction* (pp. 55-86). Mahwah, NJ: Erlbaum.

Guthrie, J. T., Wigfield, A., Barbosa, P., Perencevich, K. C., Taboada, A., Davis, M. H., et al. (2004). Increasing reading comprehension and engagement through concept-oriented reading instruction. *Journal of Educational Psychology, 96(3),* 403-423.

Gutierrez, K., & Stone, L. D. (2000). Synchronic and diachronic dimensions of social practice: An emerging methodology for cultural-historical perspectives on literacy learning. In C. D. Lee & P. Smagorinsky (Eds.), *Vygotskian perspectives on literacy research: Constructing meaning through collaborative inquiry* (pp. 150-164). New York: Cambridge University Press.

Hacker, D. (1998). Self-regulated comprehension during normal reading. In D. Hacker, J. Dunlosky, & A. Graesser (Eds.), *Metacognition in educational theory and practice* (pp. 165-191). Mahwah, NJ: Erlbaum.

Hammersley, M. (1990). *Reading ethnographic research: A critical guide.* London: Longmans.

Hargittai, E. (2002). Second-level digital divide: Differences in people's online skills. *First Monday 7(4),* Retrieved August 12, 2009 from http://firstmonday.org/issues/issue7_4/hargittai/index.html

Hargittai, E. (2004). Classifying and coding online actions. *Social Science Computer Review, 22(2),* 210-227.

Hargittai, E., & Hinnant, A. (2008). Digital inequality: Differences in young adults' use of the Internet. *Communication Research, 35(5),* 602-621.

Harris, K. (2007). *Evaluating Internet research sources.* Retrieved September, 4, 2008 from http://www.virtualsalt.com/evalu8it.htm

Harrison, C. (2004). *Understanding reading development.* London: Sage Publications.

Harrison, C. (2006). Postmodern research and elearning: Anatomy and representation. *European Educational Research Journal, 5(2),* 80-93.

Harrison, C. (2008). Researching technology and literacy. Thirteen ways of looking at a blackboard. In J. Coiro, M. Knobel, C. Lankshear, & D. J. Leu (Eds.), *Handbook of research on new literacies* (pp. 1283-1293). Mahwah, NJ: Lawrence Erlbaum Associates.

Harrison, C., Fisher, T., Haw, K., Lewin, C., Lunzer, E., Mavers, D., et al. (2002). ImpaCT2: Evaluation of the impact of Information and communication technologies on pupil attainment. Report presented to Becta/DfES.

Harrison, C., Omar, N., & Higgins, C. (2006). Postmodern principles for responsive reading assessment: A case study of a complex online reading task. In M. Sainsbury, C. Harrison, & A. Watts (Eds.), *Assessing reading from theories to classrooms* (pp. 140-157). UK: NFER.

Hartman, D. K. (1995). Eight readers reading: The intertextual links of proficient readers reading multiple passages. *Reading Research Quarterly, 30(3),* 520-561.

Hartman, D. K. (2000). What will be the influences of media on literacy in the next millennium? *Reading Research Quarterly, 35(2),* 280-282.

Hatch, T. (2009). The scholarship of teaching and web-based representations of teaching in the United States: Definitions, histories and new directions. *Educational Action Research, 17(1),* 63-78.

Hawkins, J., & Pea, R. D. (1987). Tools for bridging the cultures of everyday and scientific thinking. *Journal of Research in Science Teaching, 24(4),* 291-307.

Hayes, N., & Kernan, M. (2001). *Seven years old school experiences in Ireland. National report of the IEA pre-primary project.* Dublin: Centre for Social and Educational Research, Dublin Institute of Technology.

Henk, W. A., & Melnick, S. A. (1995). The reader self perception scale (RSPS): A new tool for measuring how children feel about themselves as readers. *The Reading Teacher, 48(6),* 470-482.

Henry, L. A. (2006). SEARCHing for an answer: The critical role of new literacies while reading on the Internet. *The Reading Teacher, 59(7),* 614-627.

Hidi, S. (1990). Interest and its contribution as a mental resource for learning. *Review of Educational Research, 60(4),* 549-571.

Hidi, S., & Anderson, V. (1986). Producing written summaries: Task demands, cognitive operations, and implications for instruction. *Review of Educational Research, 56,* 473-493.

Hidi, S., & Baird, W. (1988). Strategies for increasing text-based interest and students' recall of expository texts. *Reading Research Quarterly, 23(4),* 465-483.

Hidi, S., Baird, W., & Hildyard, A. (1982). That's important but is it interesting? Two factors in text processing. In A. Flammer & W. Kintsch (Eds.), *Discourse Processing* (pp. 63-75). North Holland Publishing Company.

Hidi, S., & Renninger, K. A. (2006). The four-phase model of interest development. *Educational Psychologist, 41(2),* 111-127.

Hiebert, E. H., & Taylor, B. M. (2000). Beginning reading instruction: Research on early interventions. In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of reading research. Volume III* (pp. 455-482). New York: Erlbaum.

Hill, J. R., & Hannafin, M. J. (1997). Cognitive strategies and learning on the World Wide Web. *Educational Technology Research and Development, 45(4),* 37-64.

Hirsh, S. G. (1999). Children's relevance criteria and information seeking on electronic resources. *Journal of the American Society for Information Science, 50(14),* 1265-1283.

Hmelo-Silver, C. E., Duncan, R. G., & Chinn, C. A. (2007). Scaffolding and achievement in problem-based inquiry learning: A response to Kirschner, Sweller, and Clarke (2006). *Educational Psychologist, 42(2),* 99-107.

Hoadley, C. M. (2004). Methodological alignment in design-based research. *Educational Psychologist, 39(4),* 203-212.

Hock, M. F., Brasseur, I. F., & Deshler, D. D. (2008). Comprehension instruction in action: the at-risk student. In C .Collins Block & S.R. Parris (Eds.), *Comprehension instruction: Research-based best practices* (2nd ed., pp. 271-293). NY: The Guildford Press.

Holland, S. (1979). *Rutland Street*. Oxford: Pergamon.

Hollas, B. (2004, May). *Strategies for differentiating textbooks for struggling readers.* Paper presented at the annual meeting of the International Reading Association, Reno, Nevada.

Information Society Commission (2002). *Building the knowledge society: Report to the government 2002.* Dublin: Information Science Commission.

International Reading Association (IRA) (2009). *New Literacies and 21st century technologies: A position statement of the International Reading Association.* Newark, DE: International Reading Association.

Internet World Statistics (2009). Internet usage statistics- The big picture: World Internet users and population stats. Retrieved, August, 21, 2009 from http://www.internetworldstats.com/stats.htm

Ivey, G., & Broaddus, K. (2007). A formative experiment investigating literacy engagement among adolescent Latina/o students beginning to read, write, and speak English. *Reading Research Quarterly, 42,* 512-545.

Jacob, E. (1992). Culture, context, and cognition. In M.D. Le Compte, W. L. Millroy, & J. Preissle (Eds.), *The handbook of qualitative research in education* (pp. 293–335). San Diego, CA: Academic Press.

Jimènez, R. T. (1997). The strategic reading abilities and potential of five low-literacy Latina/o readers in middle school. *Reading Research Quarterly, 32*, 224-243.

Johnson, D. (2009, May). Deepening literature response through engagement in online activities. In D. Grisham, D. Johnson, & J. Coiro (Chairs). *Technology tools and strategies to promote reading, writing, and conversations,* Paper presented at the Pre-Conference Institute at the 54th annual meeting of the International Reading Association conference, Minneapolis, MN.

Johnson, D. W., & Johnson, R. T. (1981). Effects of cooperative learning and individualistic learning experiences on interethnic interaction. *Journal of Educational Psychology, 73,* 444-449.

Johnson, D. W., & Johnson, R. T. (1989). *Cooperation and competition: Theory and research.* Edina, MN: Interaction Book Company.

Johnson, D. W., & Johnson, R. T. (1999). Making cooperative learning work. *Theory into Practice, 38(2),* 67-73.

Johnson, P., & Pearson, P. D. (1982). *Prior knowledge, connectivity, and the assessment of reading comprehension.* Technical Report No.CS-245).Urbana, University of Illinois: Center for the Study of Reading. (ERIC Document Reproduction Service No. ED217204)

Johnson, R. B., & Onwuegbuzie, A. J. (2004). Mixed methods research: A research paradigm whose time has come. *Educational Researcher*, 33, 7, 14-26.

Jones, D. (1996). *Critical thinking in an online world.* Retrieved May, 31, 2009 from http://www.library.ucsb.edu/untangle/jones.html

Kafai, Y., & Bates, M. J. (1997). Internet web-searching instruction in the elementary classroom : Building a foundation for information literacy. *School Library Media Quarterly, 25(2),* 103-111.

Kamil, M., & Lane, D. (1998). Researching the relation between technology and literacy: An agenda for the 21st century. In D. Reinking, M. C. McKenna, L. D. Labbo, & R. D. Kieffer (Eds.), *Handbook of literacy and technology : Transformations in a post-typographic world* (pp. 323-342). Mahwah, NJ: Lawrence Erlbaum Associates.

Karchmer, K. A. (2001). The journey ahead: Thirteen teachers report how the Internet influences literacy and literacy instruction in their K-12 classrooms. *Reading Research Quarterly, 36,* 442-467.

Kellaghan, T. (1977). *The evaluation of an intervention programme for disadvantaged children.* Windsor, BERKS: NFER Publishing Company.

Kerr, N. L., & Bruun, S. E. (1983). Dispensability of member effort and group motivation losses: Free rider effects. *Journal of Personality and Social Psychology, 44(1),* 78-94.

Kintsch, W. (1998). *Comprehension: A paradigm for cognition.* Cambridge, UK: Cambridge University Press.

Kintsch, W., & van Dijk, T. A. (1978). Towards a model of text comprehension and production. *Psychological Review, 85(5),* 363-394.

Kletzien, S. B., & Dreher, M. J. (2004). *Informational text in K-3 classrooms.* Newark, DE: International Reading Association.

Kress, G. (2003). *Literacy in the new media age.* London: Routledge.

Kucan, L., & Beck, I. L. (1997). Thinking aloud and reading comprehension research: Inquiry, instruction and social interaction. *Review of Educational Research, 67(3),* 271-279.

Kuhlthau, C.C. (1991). Inside the search process: Information seeking from the user's perspective. *Journal of the American Society for Information Science, 42(5),* 361-371.

Kuiper, E., & Volman, M. (2008).The web as a source of information for K-12 education. In J. Coiro, M. Knobel, C. Lankshear, & D. J. Leu, (Eds.). *Handbook of Research on New Literacies* (pp. 267-296) Mahwah, NJ: Erlbaum.

Kvale, S. (1996). *Interviews. An introduction to qualitative research interviewing.* Thousand Oaks, CA: Sage.

Labbo, L. D. (1996). A semiotic analysis of young children's symbol making in a classroom computer center. *Reading Research Quarterly, 31(4),* 356-383.

Labbo, L. D., & Reinking, D. (1999). Negotiating the multiple realities of technology in literacy research and instruction. *Reading Research Quarterly, 34(4),* 478-492.

LaBerge, D., & Samuels, S. J. (1974). Toward a theory of automatic information processing in reading. *Cognitive Psychology,* 6, 293-323.

Lacina, J. (2008). Technologically based teacher resources for designing comprehension lessons. In C .Collins Block & S.R. Parris (Eds.), *Comprehension instruction: Research-based best practices* (2nd ed., pp. 362-377). NY: The Guildford Press.

Large, A., & Beheshti, J. (2000).The web as a classroom resource: Reactions from the users. *Journal of the American Society for Information Science, 51(12),* 1069-1080.

Large, A., Beheshti, J., & Moukdad, H. (1999). *Information seeking on the Web: Navigational skills of grade-six primary school students.* Proceedings of the Annual Meeting of the American Society for Information Science (ASIS), 36, 84-97.

Larson, E. L. C. (2007). *A case study exploring the new literacies during a 5th grade electronic reading workshop*. Unpublished doctoral dissertation. University of Kansas State.

Larson, J., & Marsh, J. (2005). *Making literacy real.* London: Sage Publications.

Larson, L. C. (2009). Reader response meets new literacies: Empowering readers in online reading communities. *The Reading Teacher, 62(8),* 638-648.

Lave, J., & Wenger, E. (1991). *Situated learning: Legitimate peripheral participation.* Cambridge, England: Cambridge University Press.

Lawless, K. A., & Kulikowich, J. M. (1998). Domain knowledge, interest, and hypertext navigation: A study of individual differences. *Journal of Educational Multimedia and Hypermedia, 7(1),* 51-69.

Lawless, K. A., Mills, R., & Brown, S. W. (2003). Children's hypertext navigation strategies. *Journal of Research on Technology in Education, 34(3),* 274-284.

Lemke, J. (2006). Towards critical multimedia literacy: Technology, research and politics. In M.C. McKenna, L. D., Labbo, R. D. Kieffer, & D. Reinking (Eds.), *International handbook of literacy and technology. Volume II* (pp. 3-14). Mahwah, NJ: Erlbaum.

Leu, D. J. (1996). Sarah's secret: Social aspects of literacy and learning in a digital information age. *The Reading Teacher, 50(2),* 162-165.

Leu, D. J. Jr. (1997). Caity's question: Literacy as deixis on the Internet. *The Reading Teacher, 51,* 62-67.

Leu, D. J. (2000). Literacy and technology: Deictic consequences for literacy education in an information age. In M. L. Kamil, P. B. Mosenthal, P. D. Pearson, & R. Barr (Eds.), *Handbook of reading research. Volume III* (pp. 743-770). New York: Erlbaum.

Leu, D. J. (2002). The new literacies: Research on reading instruction with the Internet and other digital technologies. In J. Samuels & A.E. Farstrup (Eds.), *What research has to say about reading instruction* (pp. 310-336). Newark, DE: International Reading Association.

Leu, D. J. (2006). New literacies, reading research, and the challenges of change: A deictic perspective. In J. V. Hoffman, D. L. Schallert, C. M. Fairbanks, J. Worthy, & B. Maloch (Eds.), *The 55th Yearbook of the National Reading Conference*. (pp. 1-20). Milwaukee, WI: National Reading Conference

Leu, D. J., Castek, J., Hartman, D. K., Coiro, J., Henry, L. A., Kulikowich, J. M., & Lyver, S. (2005). *Evaluating the development of scientific knowledge and new forms of reading comprehension during online learning* (Final report submitted to the North Central Regional Educational Laboratory/Learning Point Associates). Retrieved January, 22, 2009 from http://www.newliteracies.uconn.edu/ncrel_files/FinalNCRELReport.pdf

Leu, D. J., Coiro, J., Castek, J., Hartman, D. K. Henry, L. A., & Reinking, D. (2008). Research on instruction and assessment in the new literacies of online reading comprehension. In C. C. Block & S. R. Parris (Eds.), *Comprehension instruction: Research-based best practices* (2nd ed., pp. 321-346). New York: The Guildford Press.

Leu, D. J., & Kinzer, C. K. (2000).The convergence of literacy instruction with networked technologies for information and communication. *Reading Research Quarterly, 35(1),* 108-127.

Leu, D. J., Kinzer, C. K., Coiro, J., & Cammack, D. (2004). Towards a theory of new literacies emerging from the Internet and other Information and Communication Technologies. In R. B. Ruddell & N. Unrau (Eds.), *Theoretical models and processes of reading* (5th ed., pp. 1570-1613). DE: International Reading Association.

Leu, D. J., Leu, D. D., & Coiro, J. (2004). *Teaching with the Internet-12: New literacies for new times.* Norwood, MA: Christopher-Gordon Publishers, Inc.

Leu, D. J., O'Byrne, W. I., Zawilinski, L., McVerry, J. G., & Everett-Cocapardo, H. (2009). Expanding the new literacies conversation. *Educational Researcher, 38, 264-269.*

Leu, D. J., & Reinking, D. (2005). *Developing Internet comprehension strategies among poor, adolescent students at risk to become dropouts.* U. S. Department of Education, Institute of Educational Sciences Research Grant. Retrieved January, 16, 2007 from http://www.newliteracies.uconn.edu/ies.html

Leu, D.J., Reinking, D., Carter, A., Castek, J., Coiro, J., Henry, L. A., et al. (2007). *Defining online reading comprehension: Using think aloud verbal protocols to refine a preliminary model of Internet reading comprehension processes.* Paper presentation at the Annual Meeting of the American Educational Research Conference, Chicago, IL. Retrieved May, 18, 2009 from http://docs.google.com/Doc?id=dcbjhrtq_10djqrhz

Leu, D. J., Zawlinski, L., Castek, J., Banerjee, M., Housand, B. C., & Liu, Y. (2007). What is new about the new literacies of online reading comprehension? In L. S. Rush, A. J. Eakle, & A. Berger (Eds.), *Secondary school literacy: What research reveals for classroom practice* (pp. 37-68). Urbana, IL: National Council of Teachers of English.

Lewis, A. (1992). Group child interviews as a research tool. *British Educational Research Journal, 18(4),* 413-421.

Lewis, R. T., & Fabos, B. (2005). Instant messaging, literacies, and social identities. *Reading Research Quarterly, 40 (4),* 470-501.

Lincoln, Y. S., & Guba, E. G. (1985). Natu*ralistic inquiry.* Beverly Hills, CA: Sage Publications.

Lipson, M. Y., & Wixson, K. K. (1986). Reading disability research: An interactionist perspective. *Review of Educational Research, 56(1),* 111-136.

Livingstone, S. (2003). Children's use of the Internet: Reflections on the emerging research agenda. *New Media and Society, 15(2),* 147-166.

Livingstone, S., & Bober M. (2004). Taking up opportunities? Children's uses of the Internet for education, communication and participation. *E-Learning, 1(3),* 395-419.

Livingstone, S., Bober, M., & Helsper, E. (2004). *Inequalities and the digital divide in children and young people's Internet use. Findings from the UK Children Go Online Project.* London: LSE. Retrieved August, 12, 2009 from www.children-go-online.net

Livingstone, S., & Helsper, E. (2007). Gradations in digital inclusion: Children, young people and the digital divide. *New Media and Society, 9(4),* 671-696.

Lorenzon, M. (2002). The land of confusion? High school students and their use of the World Wide Web for research. *Research Strategies, 18(12),* 151-163.

Luckin, R. (2008). The learner centric ecology of resources: A framework for using technology to scaffold learning. *Computers and Education, 50,* 449-462.

MacGregor, S. K. (1999). Hypermedia navigation profiles: Cognitive characteristics and information processing strategies. *Journal of Educational Computing Research, 20(2),* 189-206.

Madden, A., Ford, N., Miller, D., & Levy, P. (2005). Using the Internet in teaching: The views of practitioners (A survey of the views of secondary school teachers in Sheffield, UK), *British Journal of Educational Technology, 36(2),* 255-280.

Malloy, J. A., & Gambrell, L. B. (2008). New insights on motivation in the literacy classroom. In C. C. Block & S. R. Parris (Eds.), *Comprehension instruction: Research-based best practices* (2nd ed., pp. 226-240). New York: The Guildford Press.

Marchionini, G. (1992). Interfaces for end-user information seeking. *Journal of the American Society for information Science, 43(2),* 156-163.

Marsh, J. (2007). Digital childhoods, digital classrooms: The teaching and learning of literacy in a new media age. In B. Dwyer & G Shiel (Eds.), *Literacy at the crossroads: Moving forward, looking back* (pp. 36-50). Dublin: Reading Association of Ireland.

Marsh, J., & Bearne, E. (2008). *Moving literacy on: Evaluation of the BFI training project for lead practitioner scheme for moving image media literacy.* Royston: UKLA.

Maxwell, J. A. (2005). *Qualitative research design. An interactive approach.* (2nd ed. Thousand Oaks, CA: Sage Publications.

Maykut, P., & Morehouse, R. (1994). *Beginning qualitative research. A philosophic and practical guide*. London: The Falmer Press.

McCandliss, B. M., Kalchman, M., & Bryant, P. (2003). Design experiments and laboratory approaches to learning: Steps towards collaborative exchange. *Educational Researcher, 32(1),* 14-16.

McCombs, B. (1996). Alternative perspectives for motivation. In L. Baker, P. Afflerbach, & D. Reinking (Eds.), *Developing engaged readers in school and home communities* (pp. 67-89). Mahwah, NJ: Erlbaum.

McCormick, R., & James, M. (1988). *Curriculum evaluation in schools* (2nd ed.). London: Croom Helm.

McDonald, E. (1998). Reading achievement and educational disadvantage. *Irish Educational Studies, 17,* 208-221.

McDonald, S., & Stevenson, R. J. (1998). Effects of text structure and prior knowledge of the learner on navigation in hypertext. *Human Factors, 40(1),* 18-27.

McEneaney, J. E. (2006). Agent-based literacy theory. *Reading Research Quarterly, 41(3),* 352-371.

McGarr, O. (2008, December). The development of ICT across the curriculum in Irish schools: A historical perspective. *British Journal of Educational Technology,* 1-15. doi:10.1111/j.1467-8535.2008.00903.x

McGill-Franzen, A. (2005). In the press to scale up, what is at risk? *Reading Research Quarterly, 40(3),* 366-370.

McKenna, M. C., Kear, D. J., & Ellsworth, R. A. (1995). Children's attitudes towards reading: A national survey. *Reading Research Quarterly, 30(4),* 934-956.

McLaughlin, M. (2003). *Guided comprehension in the primary grades*. Newark, DE: International Reading Association.

McVerry, J. G. (2007). Forms and functions of threaded discussions. *New England Reading Association Journal, 43(1),* 79-85.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Thousand Oaks, CA: Sage.

Miller, S. D., & Faircloth, B. S. (2009). Motivation and reading comprehension. In S. Israel & G. G. Duffy (Eds.), *Handbook of research on reading comprehension* (pp. 307-322). New York: Routledge.

Moos, D. C., & Azevedo, R. (2008). Self-regulated learning with hypermedia: The role of prior domain knowledge. *Contemporary Educational Psychology, 33,* 270-298.

Morrow, V. (1996). *The ethics of social research with children and young people an overview.* Retrieved Oct 24th from http://www.ciimu.org/webs/wellchi/reports/workshop_1/w1_morrow.pdf

Morrow, V., & Richards, M. (1996). The Ethics of Social Research with Children: An Overview. *Children & Society, 10(2),* 90-105.

Mulkeen, A. (2001). The place of ICT in Irish schools: Early indicators of the changes since IT 2000. *Irish Educational Studies, 20,* 45-58.

Mulkeen, A. (2003). What can policy makers do to encourage integration of information and communications technology? Evidence from the Irish school system. *Technology, Pedagogy, and Education, 12(2),* 277-293.

Muspratt, A., Freebody, P., & Luke, A. (1996). *Constructing critical literacies: Teaching and learning textual practice.* Hampton, NJ: Hampton Press.

Myers, J., Hammett, R., & McKillop, A. M. (1998). Opportunities for critical literacy and pedagogy in student-authored hypermedia. In D. Reinking, M. C. McKenna, L. D. Labbo, & R. D. Kieffer (Eds.), *Handbook of literacy and technology : Transformations in a post-typographic world* (pp. 63-78). Mahwah, NJ: Lawrence Erlbaum Associates.

Nachmias, R., & Gilad, A. (2002). Needle in a hyperstack: Searching for information on the world wide web. *Journal of Research on Technology, 34(4),* 475-486.

Nahl, D., & Harada, V. H. (1996). Composing Boolean logic statements: Self-confidence, concept analysis, search logic, and errors. *School Library Media Quarterly, 24(4),* 199-207.

National Council for Curriculum and Assessment (NCCA) (2007). *ICT framework: A structured approach to ICT in curriculum and assessment.* Dublin: NCCA.

National Reading Panel (NRP) (2000). *Report of the national reading panel: Report of the subgroups.* Washington, DC: National Development Clearinghouse. Retrieved May, 15, 2007, from http://www.nationalreadingpanel.org/Publications/publications.htm

Neuman, S. B. (1999). Books make a difference: A study of access to literacy. *Reading Research Quarterly, 34,* 286-311.

Newell, A., & Simon, H. A. (1972). *Human problem solving.* Englewood Cliffs, NJ: Prentice-Hall.

Newman, D. (1990). Opportunities for research on the organizational impact of school computers. *Educational Researcher, 19,* 8-13.

Newman, D. (1992). Formative experiments on the co-evolution of technology and the educational environment. In E. Scanlon & T. O'Shea (Eds.), *New directions in educational technology* (pp. 61-70). New York: Springer-Verlag.

Nicholls, J. G. (1979). Development of perception of own attainment and causal attributions for success and failure in reading. *Journal of Educational Psychology, 71,* 94-99.

Nolan, B., & Maitre, B. (2008). *A social portrait of communities in Ireland.* Dublin: ESRI.

Oczkus, L. D. (2006). *Reciprocal teaching at work: Strategies for improving reading comprehension.* Newark, DE: International Reading Association.

OECD (Organisation for Economic Co-Operation and Development). (2007). *PISA 2006: Science competencies for tomorrow's world (Vol.1).* Paris: Author.

Ogle, D. M. (1986). K-W-L: A teaching model that develops active reading of expository text. *The Reading Teacher, 39(6),* 564-570.

Ogle, D., & Blachowicz, C. L. Z. (2002). Beyond literature circles. Helping students comprehend informational texts. In C.C. Block & M. Pressley (Eds.), *Comprehension instruction: Research based best practices* (pp. 259-274). New York: Guildford Press.

Oldfather, P., & Wigfield, A. (1996). Children's motivations for literacy learning. In L. Baker, P. Afflerbach, D. Reinking (Eds.), *Developing engaged readers in school and home communities* (pp. 89-114). Mahwah, NJ: Erlbaum.

Olshavsky, J. E. (1976-1977). Reading as problem solving: An investigation of strategies. *Reading Research Quarterly, 12(4),* 654-674.

Omar, N., Higgins, C., & Harrison, C. (2005). *Investigating an approach for online reading assessment.* Paper presented at the 5th IEEE International conference on advanced learning technologies in Kaohsuing, Taiwan.

Owens, R. F., Hester, J. L., & Teale, W. H. (2002).Where do you want to go today? Inquiry-based learning and technology integration. *The Reading Teacher, 55(7),* 616-625.

Padilla, M. J., Muth, K. D., & Lund Padilla, R. K. (1991). Science and reading: Many processing skills in common? In C. M. Santa & D. E. Alvermann (Eds.), *Science learning: Processes and applications* (pp. 14-19). Newark, DE: International Reading Association.

Pahl, K., & Rowsell, J. (2005). *Literacy and education: Understanding the new literacies studies in the classroom.* London: Paul Chapman Publishing.

Palinscar, A. S., & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. *Cognition and Instruction, 1(2),* 117-175.

Palinscar, A. S., & Magnusson, S. J., (2001). The interplay of firsthand and text-based investigations to model and support the development of scientific knowledge and learning. In S. M. Carver & D. Klahr (Eds.), *Cognition and instruction: Twenty five years of progress* (pp. 151-194). Mahwah, NJ: Erlbaum.

Palinscar, A. S., & Rupert-Herrenkohl, L. (1999). Designing collaborative learning contexts. In A. O'Donnell & A. King (Eds.), *Cognitive perspectives on peer learning* (pp. 151-178). Mahwah, NJ: Lawrence Erlbaum.

Paris, S. G., Lipson, M. Y., & Wixson, K. K. (1983). Becoming a strategic reader. *Contemporary Educational Psychology, 8,* 293-316.

Patton, M. Q. (2002). *Qualitative research and evaluation methods* (3rd ed.). Thousand Oaks, CA: Sage Publications.

Pearson, P. D. (2006, April). *Effective comprehension assessment in grades 2-5.* Paper presented at the annual meeting of the American Education Research Association, Los Angeles, CA.

Pearson, P. D. (2009). The roots of reading comprehension instruction. In S. E. Israel & G. G. Duffy (Eds.), *Handbook of research on reading comprehension* (pp. 3-31). New York: Routledge.

Pearson, P. D., Cervetti, G. N., Tilson, J. L. (2008). Reading for understanding. In L. Darling-Hammond, B. Barron, P. D. Pearson, A. L. Schoenfeld, E. K. Stage, T. D. Zimmerman, G. N. Cervetti, & T. L. Tilson (Eds.), *Powerful learning. What we know about teaching for understanding* (pp. 71-112). San Francisco, CA: John Wiley & Sons Inc.

Pearson, P. D., & Gallagher, M. C. (1983). The instruction of reading comprehension. *Contemporary Educational Psychology,* 8, 317-344.

Pearson, P. D., & Hamm, D. N. (2005). The assessment of reading comprehension: A review of practices. Past present and future. In S. G. Paris & S. A Stahl (Eds.), *Children's reading: Comprehension and assessment* (pp. 13-70). Mahwah, NJ: Erlbaum.

Pearson, P. D., Roehler, L. R., Dole, J. A., & Duffy, G. G. (1990). *Developing expertise in reading comprehension: What should be taught? How should it be taught? Technical report 512.* ERIC Document Reproduction Service No. ED324648 Retrieved September, 5th, 2008 from http://eric.ed.gov/ERICDocs/data/ericdocs2sql/content_storage_01/0000019b/80/22/72/89.pdf

Piaget, J., & Inhelder, B. (1969). *The psychology of the child.* London: Routledge & K. Paul.

Pikulski, J. J. (1994). Preventing reading failure: A review of five effective programs. In R.L. Allington (Ed.), *Teaching struggling readers. Articles from the reading teacher* (pp. 35-45). Newark, DE: International Reading Association.

Pintrich, P. R., Marx, R. W., & Boyle, R. A. (1993). Beyond cold conceptual change: The role of motivational beliefs and classroom contextual factors in the process of conceptual change. *Review of Educational Research, 63(2),* 167-199.

Prensky, M. (2001). Digital natives, digital immigrants. *On the Horizon, 9(5)* 1-6. Retrieved August, 14, 2009 from http://www.marcprensky.com/writing/Prensky%20-%20Digital%20Natives,%20Digital%20Immigrants%20-%20Part1.pdf.

Pressley, M. (2000). What should comprehension instruction be the instruction of? In M. L. Kamil, P. Mosenthal, P. D. Pearson, & Barr, R. (Eds.), *Handbook of reading research. Volume III* (pp. 545-562). Mahwah, NJ: Erlbaum.

Pressley, M., & Afflerbach, P. (1995). *Verbal protocols for reading: The nature of constructively responsive reading.* Hillsdale, NJ: Erlbaum.

Pressley, M., & El-Dinary, P. B. (1997). What we know about translating comprehension strategies instruction research into practice. *Journal of Learning Disabilities, 30(5),* 486-488.

Pressley, M., El-Dinary, P. B., Gaskins, I., Schuder, T., Bergman, J., Almasi, L., et al. (1992). Beyond direct explanation: Transactional instruction of reading comprehension strategies. *Elementary School Journal, 92,* 511-554.

Pressley, M., & Harris, K. H. (2006). Cognitive strategy instruction: From basic research to classroom instruction. In P. A. Alexander & P. H. Winne (Eds.), *Handbook of educational psychology* (2nd ed., pp. 265-286). Mahwah, NJ: Erlbaum.

Pressley, M., & Hilden, K. (2004). Verbal protocols of reading. In N. K. Duke & M. H. Mallette (Eds.), *Literacy research methodologies* (pp. 308-321). New York: Guilford.

Pressley, M., Johnson, C. J., Symons, S., McGoldrick, J. A., & Kurita, J. A. (1989). Strategies that improve children's memory and comprehension of text. *Elementary School Journal, 90,* 3-32.

Puma, M. J., Karweit, N., Cristofer, P., Ricciuti, A., Thompson, W., & Vaden-Kiernan, M. (1997). Prospects: Student outcomes. Final report. Washington, DC: Department of Education. (ERIC Document Reproduction Service No. ED. 413411). Retrieved September 22, 2009 from http://www.eric.ed.gov/ERICWebPortal/custom/portlets/recordDetails/detailmini.jsp?_nfpb=true&_&ERICExtSearch_SearchValue_0=ED413411&ERICExtSearch_SearchType_0=no&accno=ED413411.

Purves, A. (1998). Flies in the web of hypertext. In D. Reinking, M. C. McKenna, L. D. Labbo, & R. D. Kieffer (Eds.), *Handbook of literacy and technology : Transformations in a post-typographic world* (pp. 235-252). Mahwah, NJ: Lawrence Erlbaum Associates.

Putney, L. A. G., Green, J., Dixon, C., Durán, C., & Yeager, B. (2000). Consequential progressions: Exploring collective-individual development in a bilingual classroom. In C. D. Lee & P Smagorinsky (Eds.), *Vygotskian perspectives on literacy research: Constructing meaning through collaborative inquiry* (pp. 86-126). New York: Cambridge University Press.

Quintana, C., Reiser, B. J., Davis, E. A., Krajcik, J., Fretz, E., Duncan, R. G., et al. (2004). A scaffolding design framework for software to support science inquiry. *The Journal of the Learning Sciences, 13(3),* 337-386.

RAND Reading Study Group (2002). *Reading for understanding: Toward an R&D program in reading comprehension.* Santa Monica, CA: RAND.

Raphael, T. E., & Au, K. H. (2005). QAR: Enhancing comprehension and test taking across grades and content areas. *The Reading Teacher, 59(3),* 206-221.

Raphael, T. E., & Pearson, P. D. (1985). Increasing students' awareness of source information for answering questions. *American Educational Research Journal, 22,* 217-235.

Raphael, T. E., & Wonnacott, C. A. (1985). Heightening fourth-grade students' sensitivity to sources of information for answering comprehension questions. *Reading Research Quarterly, 20(3),* 282-296.

Reinking, D. (1997). Me and my hypertext:) A multiple digression analysis of technology and literacy (sic). *The Reading Teacher, 50,* 626-643.

Reinking, D. (1998). Synthesising technological transformations of literacy in a post-typographic world. In D. Reinking, M. McKenna, L. Labbo, & R. Kieffer (Eds.), *Handbook of literacy and technology: Transformations in a post-typographic world* (pp. xi-xxx). Mahwah, NJ: Erlbaum.

Reinking, D., & Bradley, B. A. (2004). Connecting research and practice using formative and design experiments. In N. K. Duke & M. H. Mallette (Eds.), *Literacy research methodologies* (pp. 149-169). New York: Guilford.

Reinking, D., & Bradley, B. A. (2008). *On formative and design experiments.* New York: Teachers College Press.

Reinking, D., Labbo, L. D., & McKenna, M. C. (2000). From assimilation to accommodation: A developmental framework for integrating digital technologies into literacy research and instruction. *Journal of Research in Reading, 23(2),* 110-122.

Reinking, D., Malloy, J., Rogers, A., & Robbins, K. (2007, December). *What a formative experiment reveals about Internet reciprocal teaching.* Paper presented at the 57th annual meeting of the National Reading Conference, Austin, TX.

Reinking, D., & Pickle, M. (1993). Using a formative experiment to study how computers affect reading and writing in classrooms. In D.J. Leu & C. K. Kinzer (Eds.), *Examining central issues in literacy research, theory, and practice. 42nd yearbook of the National Reading Conference,* (pp. 263-270). Chicago: National Reading Conference.

Reinking, D., & Watkins, J. (2000). A formative experiment investigating the use of multimedia book reviews to increase elementary students' independent reading. *Reading Research Quarterly, 35(3),* 384-419.

Richardson, L. (2000). Writing a method of inquiry. In N. Denzin & Y. Lincoln (Eds.), Handbook of qualitative research (2nd ed., pp. 923-949). Thousand Oaks, CA: Sage.

Robinson, V. (1998). Methodology and the research-practice gap. *Educational Researcher, 27(1),* 17–26.

Robson, C. (2002). *Real world research (*2nd ed.). Malden, MA: Blackwell Publishing.

Rose, D. H., & Meyer, A. (2002). *Teaching every student in the digital age: Universal design for learning.* Alexandria, VA: Association for Supervision and Curriculum Development.

Rosenblatt, L. M. (1978). *The reader, the text, the poem: The transactional theory of literary work.* Carbondale: Southern Illinois University Press.

Rosenshine, B., & Meister, C. (1994). Reciprocal teaching: A review of the research. *Review of Educational Research, 64(4),* 479-530.

Rosenshine, B., Meister, C., & Chapman, S. (1996). Teaching students to generate questions: A review of the intervention studies. *Review of Educational Research, 66,* 181-221.

Rouet, J.-F. & Levonen J. J. (1996). Studying and learning with hypertext: Empirical studies and their implications. In J.-F. Rouet (Ed.), *Hypertext and cognition* (pp. 9-23). Mahwah, NJ: Lawrence Erlbaum Associates.

Ruddell, R. B., & Unrau, N. J. (1997). The role of responsive teaching in focussing reader intention and developing reader motivation. In J. T. Guthrie & A. Wigfield (Eds.), *Reading engagement: Motivating readers through integrated instruction.* (pp. 102-125). Newark, DE: International Reading Association.

Ryan, R. M., & Deci, E. L. (2000). Intrinsic and extrinsic motivation: Classic definitions and new directions. *Contemporary Educational Psychology, 25,* 54-67.

Salomon, G. (1991). Transcending the qualitative-quantitative debate: The analytic and systemic approaches to educational research. *Educational Researcher, 20(6),* 10-1 8.

Scardamalia, M., & Bereiter, C. (1992). Text-based and knowledge-based questioning by children. *Cognition and Instruction, 9(3),* 177-199.

Schacter, J., Chung, G. K., & Dorr, A. (1998). Children's Internet searching on complex problems: Performance and Process Analyses. *Journal of the American Society for Information Science, 49(9),* 840-849.

Schiefele, U. (1999). Interest and learning from text. *Scientific Studies of Reading, 3(3),* 257-279.

Schmar, E. S. (2002). *A collective case study of reading strategies used by skilled fifth grade readers reading on the Internet.* Unpublished doctoral dissertation. University of Kansas State.

Schoenfeld, A. H. (1999, October). Looking toward the 21st century: Challenges of educational theory and practice. *Educational Researcher, 28(7),* 4-14.

Schoenfeld, A. H. (2006). Design experiments. In J. L. Green, G. Camilli, P.B. Elmore, A. Skukauskaite, & E. Grace (Eds.), *Handbook of complementary methods in education research* (pp. 193-205). Mahwah, NJ: Lawrence Erlbaum.

Schunk, D. H., & Zimmerman, B. J., (1997). Developing self-efficacious readers and writers: The role of social and self-regulatory processes. In J. T. Guthrie & A. Wigfield (Eds.), *Reading engagement: Motivating readers through integrated instruction.* (pp.34-50). Newark, DE: International Reading Association.

Shenton, A. K., & Dixon, P. (2003). A comparison of youngsters' use of CD-Rom and the Internet as information resources. *Journal of the American Society for Information Science and Technology, 54(11),* 1029-1049.

Shenton, A. K., & Dixon, P. (2004a). Issues arising from youngsters' information-seeking behavior. *Library and Information Science Research, 26,* 177-200.

Shenton, A. K., & Dixon, P. (2004, b). The nature of information needs and strategies for their investigations in youngsters. *Library and Information Science Research,* 26, 296-310.

Shiel, G. (2001/2002). Reforming reading instruction in Ireland and England. *The Reading Teacher, 55,* 372-374.

Shiel, G. (2006). The PISA assessment of reading literacy. *The Irish Journal of Education, 37,* 79-100.

Shiel, G., & Murphy, R. (2000). *Drumcondra English profiles. A framework for assessing oral language, reading and writing in primary schools*. Dublin: Educational Research Centre.

Shiel, G., & O' Flaherty, A. (2005). *NCTE 2005 census on ICT infrastructure in Schools: Statistical report.* Dublin: NCTE.

Silverman, D. (2005). *Doing qualitative research (2nd ed.).* London: Sage Publications.

Simon, H. A. (1955). A behavioural model of rational choice. *Quarterly Journal of Economics, 69,* 99–118.

Simon, H. A. (1956). Rational choice and the structure of the environment. *Psychological Review*, 63, 129–138.

Simon, H. A. (1979). *Models of thought.* New Haven, CT: Yale University Press.

Simons, H. (1982). Conversation piece: The practice of interviewing in case study research. In R. Mc Cormick (Ed.), *Calling education to account* (pp. 239-246). London: Heinemann.

Singer, H., & Donlon, D. (1982). Active comprehension: Problem solving schema with question generation for comprehension of complex short stories. *Reading Research Quarterly, 17(2),* 166-186.

Slavin, R. E. (1996). Research for the future. Research on cooperative learning and achievement: What we know, what we need to know. *Contemporary Educational Psychology, 21,* (43-69).

Smagorinsky, P., & O'Donnell-Allen, C. (2000). Idiocultural diversity in small groups: The role of the relational framework in collaborative learning *Vygotskian perspectives on literacy research: Constructing meaning through collaborative inquiry* (pp. 165-190). New York: Cambridge University Press.

Smolin, L. I., & Lawless, K. A. (2003). Becoming literate in the technological age: New responsibilities and tools for teachers. *The Reading Teacher, 56(6),* 570-577.

Snow, C. E., & Biancarosa, (2003). Adolescent literacy and the achievement gap: What do we know and where do we go from here? Carnegie Corporation of New York.

Snyder, I., & Bulfin, S. (2008). Using new media in the secondary English classroom. In J. Coiro, M. Knobel, D. Leu, & C. Lankshear (Eds.), *Handbook of research on new literacies*. (pp. 805-837). Mahwah, NJ: Erlbaum.

Solomon, P. (1993). Children's information retrieval behavior: A case analysis of an OPAC. *Journal of the American Society for Information Science, 4(4),* 245-264.

Spires, H., & Estes, T. H. (2002). Reading in web-based learning environments. In C. C. Block & M. Pressley (Eds.), *Comprehension instruction: Research based best practices* (pp. 115-125). New York: Guilford Press.

Spiro, R. J., Coulson, R. L., Feltovich, P. J., & Anderson, D. K. (2004).Cognitive flexibility theory: Advanced knowledge acquisition in ill-structured domains. In R. B. Ruddell & N. J. Unrau (Eds.), *Theoretical models and processes of reading* (5th ed., pp. 640-654). Newark, DE: International Reading Association.

Stanovich, K. E. (1986). Matthew effects in reading: Some consequences of individual differences in the acquisition of literacy. *Reading Research Quarterly, 21(4)*, 360-407.

Street, B. (1998). New literacies in theory and practice: What are the implications for language in education? *Linguistics and Education, 10(1),* 1-24.

Strickland, D. S., Ganske, K., & Monroe, J. K. (2002). *Supporting struggling readers and writers. Strategies for classroom interventions 3-6.* Newark, DE: International Reading Association.

Sutherland-Smith, W. (2002). Weaving the literacy web: Changes in reading from page to screen. *The Reading Teacher, 55(7),* 662-669.

Swan, E. A. (2003). *Concept-oriented reading instruction. Engaging classrooms, lifelong learners.* New York: Guildford Press.

Synder, I., & Bulfin, S. (2008). Using media in the secondary English classroom. In J. Coiro, M. Knobel, C. Lankshear, & D. J. Leu (Eds.), *Handbook of research on new literacies* (pp. 805-838). Mahwah, NJ: Lawrence Erlbaum Associates.

Taboada, A., & Guthrie, J. T. (2004). Growth of cognitive strategies for reading comprehension. In J. T. Guthrie, A. Wigfield, & K. C. Perencevich (Eds.), *Motivating reading comprehension. Concept-oriented reading instruction.* (pp. 273-306). Mahwah, NJ: Lawrence Erlbaum Associates.

Taboada, A., & Guthrie, J. T. (2006). Contributions of student questioning and prior knowledge to construction of knowledge from reading information text. *Journal of Literacy Research, 38,* 1-35.

Tapscott, D. (1998). *Growing up digital: The rise of the net generation.* NY: McGraw-Hill.

Tashakkori, A., & Teddlie, C. (2003). *Handbook of mixed methods in social and behavioral research.* Thousand Oaks, CA: Sage Publications.

Tierney, R. J. (2000) Literacy assessment reform: Shifting beliefs, principled possibilities, and emerging practices In N. D. Padak et al. (Eds.), *Distinguished educators on reading: Contributions that have shaped effective literacy instruction* (pp. 517-541). Newark, DE: International Reading Association.

The New London Group (1996). A pedagogy of multiliteracies: Designing social futures. *Harvard Educational Review, 66(1),* 60-92.

The New London Group (2000). A pedagogy of multiliteracies designing social futures. In B. Cope & M. Kalantzis (Eds.), *Multiliteracies: literacy learning and the design of social futures* (pp. 9-37). London: Routledge.

Treymayne, M., & Dunwoody, S. (2001). Interactivity, information processing and learning on the World Wide Web. *Science Communication, 23(2),* 111-134.

Tsai, M.-J., Tsai, C.-C. (2003). Information searching strategies in web-based science learning: The role of Internet self-efficacy. *Innovations in Education and Teaching International, 40(1),* 43-50.

Turner, J. C. (1995). The influence of classroom contexts on young children's motivation for literacy. *Reading Research Quarterly, 30(3),* 410-441.

Turner, J., & Paris, S. G. (1995). How literacy tasks influence children's motivation for literacy. *The Reading Teacher, 48(8),* 662-675.

United Nations (1990). *Convention on the Rights of the Child.* Retrieved November 23, 2006, from http://www.unicef.org/crc/index_30227.html

University College London CIBER group (2008). *Information behaviour of the researcher of the future.* London: University College London. Retrieved September, 2, 2008 from http://www.bl.uk/news/pdf/googlegen.pdf

Volman, M., van Eck, E., Heemskerk, I., & Kuiper, E. (2005). New technologies, new differences: Gender and ethnic differences in pupils' use of ICT in primary and secondary education. *Computers and Education, 45,* 35-55.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes.* Cambridge, MA: Harvard University Press.

Wall, E., & Burke, K. (2004). *MICRA-T Mary Immaculate Reading Attainment Tests.* Dublin: C. J. Fallon Publishers.

Wallace, R., & Kupperman, J. (1997, March). *On-line search in the science classroom: Benefits and possibilities*. Paper presented at the Annual Meeting of the American Educational Research Association, Chicago. Retrieved October 18, 2008 from https://www.msu.edu/~mccrory/pubs/online_search.pdf.

Warschauer, M. (2003).*Technology and social inclusion: Rethinking the digital divide.* Cambridge MA: The MIT Press.

Weir, S. (2003). *The evaluation of Breaking the Cycle: A follow-up of the achievement of 6th class pupils in urban schools in 2003*. Report to the Department of Education and Science.

Weir, S., Milis, L., Ryan, C. (2002). *The Breaking the Cycle Scheme in urban schools: Final evaluation report.* Report to the Department of Education and Science. Dublin: Educational Research Centre.

Wigfield, A., Eccles, J.S., Yoon, K. S., Harold, R. D., Arbreton, A. J. A., Freedman-Doan, C., et al.(1997). Change in children's competence beliefs and subjective task values across the elementary school years: A 3-year study. *Journal of Educational Psychology, 89(3),* 451-469.

Wigfield, A., & Guthrie, J. T. (1997). Relations of children's motivation for reading to the amount and breadth of their reading. *Journal of Educational Psychology, 89(3),* 420-432.

Wigfield, A., Guthrie, J. T., Tonks, S., & Perencevich, K. C. (2004). Children's motivation for reading: Domain specificity and instructional influences. *The Journal of Educational Research, 97(6),* 299-308.

Williams, P., & Rowland, I. (2007). *Information behaviour of the researcher of the future. The literature on young people and their information behaviour Work Package 11*. A British library JISC study. Retrieved September, 2, 2008 from http://www.ucl.ac.uk/infostudies/research/ciber/downloads/GG%20Work%20Package%20II.pdf

Windschitl, M. (2000). Using the WWW for teaching and learning in K-12 classrooms: What are the interesting research questions? *CyberPsychology & Behavior, 3(1),* 89-96.

Winograd, P. N. (1984). Strategic difficulties in summarizing texts. *Reading Research Quarterly, 19(4),* 404-425.

Wolcott, H. F. (1994). *Transforming qualitative data. Description, analysis, and interpretation.* Thousand Oaks, CA: Sage Publications.

Wood, D., Bruner, J. G., & Ross, G. (1976). The role of tutoring in problem solving. *Journal of Child Psychology and Psychiatry, 17,* 89-100.

Wray, D., & Lewis, M. (1997). *Extending literacy: Children reading and writing non-fiction.* New York: Routledge.

Wyatt, D., Pressley, M., El Dinary, P. B., Stein, S., Evans, P., & Brown, R. (1993). Evaluations: Cold and hot cognition when experts read professional articles that are important to them. *Learning and Individual Differences, 5(1),* 49-72.

Xu, S. H., Perkins, R. S., & Zunich, L. O. (2005). *Trading cards to comic strips. Popular culture texts and literacy learning in grades K-8.* Newark, DE: International Reading Association.

Yager, S., Johnson, R. T., Johnson, D. W., & Snider, B. The impact of group processing on achievement in cooperative learning groups. *The Journal of Social Psychology, 126(3)* 389-397.

Yang, S. C. (1997). Information seeking as problem solving using a qualitative approach to uncover the novice learners' information-seeking processes in a Perseus hypertext system. *Library and Information Science Research, 19(1),* 71-92.

Young, P. A. (2008). Exploring culture in the design of new technologies of literacy. In J. Coiro, M. Knobel, C. Lankshear, & D. J. Leu (Eds.), *Handbook of research on new literacies* (pp. 325-358). Mahwah, NJ: Lawrence Erlbaum Associates.

Zammit, K., & Wilson, M. (2006). Multiliteracies. *School is for me: Pathways to student engagement. The Fair Go Project.* NSW: Department of Education and Training. (pp. 59-64). Retrieved May, 15, 2009, from http://www.psp.nsw.edu.au/resources/index.html

Zawilinski, L. (2009). HOT blogging: A framework for blogging to promote higher order thinking. *The Reading Teacher, 62(8),* 650-661.

Zhao, Y., & Frank, K. A. (2003). Factors affecting technology uses in schools: An ecological perspective. *American Educational Research Journal, 40(4),* 807-840.

Zhao, Y., Tan, S. H., & Mishra, P. (2000/2001). Teaching and learning: Whose computer is it? *Journal of Adolescent & Adult Literacy, 44(4),* 348-354.

APPENDICES

APPENDIX A Letters of Consent

Letter of Consent Parents and Care Givers

St. Patrick's College
Dublin 9
DATE
Dear Parents/Carers,

Your child's school has agreed to take part in a Literacy Research Project which aims to improve your child's confidence in reading and writing and also develop their ability to conduct research on the Internet as part of a school project. The first phase of this project will involve all of the teachers and children in the 3rd and 5th class in the school.

As part of this research work, I will be working within the classroom and computer room with both teachers and children. Your child may be selected to take part in an interview to find out her views on and attitudes towards reading and writing and the Internet. This will be digitally recorded. Some of the work will involve carrying out research tasks on the Internet. The use of the Internet will be carefully monitored at all times. Your child's work on the Internet will also be digitally recorded.

Your child's name or the name of the school will not appear on any documents. Information provided by your child will always be anonymous and will only be shared with other professionals working in the field for the purposes of the research study.

In order for your child to take part in this study I would be most grateful if you could discuss with your child the voluntary nature of participation in this project. Your child can withdraw from this project at any time. If they agree to participate in the project could you both sign and return the permission slip at the end of this note. If you have any questions about this project please do not hesitate to contact the principal or class teacher in the first instance. I will also be available to answer any questions you may have concerning the project.

I am very excited about this project and look forward to working with you, your child and the school. Many thanks for your support.

Yours Sincerely

_____

Bernadette Dwyer

I have discussed the project with my child and I consent to my child's participation in this project.
Signed by parent----------Print name----------

Signed by child----------Print name----------

Letter of Consent Teachers

St. Patrick's College
Dublin 9
Date
Dear Teacher,

Thank you for agreeing to participate in the Literacy Research Project which also forms part of the work for my PhD thesis.

This project seeks to investigate how best to support schools in developing best practice in integrating ICT with literacy instruction and in so doing to enable children to reach their full potential as readers and writers. I aim, through collaboration with you, to examine best practice internationally and to support the school in developing a literacy framework that suits its needs. In this phase of this project, I will work with teachers and children involved in 3rd and 5th class
As part of this research project you may be asked to participate in individual interviews to ascertain your views on the teaching reading and writing, integrating the Internet into the curriculum and also on how the research project is progressing. These will be digitally recorded.

In developing the framework, I anticipate working with you in a number of ways: providing professional reading material to inform practice; providing classroom resources to help you translate theory into practice; being on-site in the school to discuss your needs and questions and to debate issues; working alongside you in the computer room. All responses will be treated with the utmost confidentiality. Your anonymity will be preserved in all data collection and analysis. At no time will you or your school be identifiable through any documentation.

In the event that a difficulty arises, you would, of course be entitled to withdraw from the study, though my hope is that such a situation will not arise. I would be grateful if you would sign the attached permission slip to formally indicate your consent to participate in the research study.

I look forward to collaborating with you and am excited about the project.

Yours Sincerely,

.....

Bernadette Dwyer

.....

I agree to participate in the Literacy Initiative Project.

Signed_____Date_____

Print TEACHER NAME_____

APPENDIX B Sample Questions from Children's Post Interview Schedule May 2007

Internet Questions

1. How good do you think you are at reading on the Internet?
2. Is there any difference between reading a print text like a book or reading on the Internet?
3. Have you got the Internet at home? If So…
4. What do you use it for at home? Prompts what else?
   What do you use the Internet for? Prompts expand on these play games, e-mail search for information, MSN, help with homework, download, chat rooms, making cards and invitations.
5. Do you have an email/MSN address/Bebo site? Who do you write emails to/talk to on MSN/Bebo. Is there any difference do you think between writing a letter to someone and sending them an email? Do you use email, msn to chat with your friends? Do you use the Internet together? Tell me about that
6. When you are searching for information on the Internet can you describe how you do it?
7. How good do you think you are at searching for information on the Internet?
8. How do you learn to do new things on the Internet?
9. Do you enjoy using the Internet? What do you enjoy/not enjoy most?
10. Are there any difficulties using the Internet?
11. Does working as a group in the computer room help you on the Internet? How does it help or not help
12. Do you have a favourite web site? What makes a web site good?
13. Tell me about the most interesting information you have read on the Internet in the last couple of weeks? Take a few minutes to think about it. Now tell me about it.
14. What new skills have you learned during the Internet project? Prompts PowerPoint/ Reale books /word processing

APPENDIX C Percentile Scores from the Micra-T Test; Technical Data on the DSRT and MICRA-T Reading Achievement Tests

Class level		Percentile Score from the Micra-T				
		≤ 10th	≤ 25th	≤ 50th	≤ 75th	≤ 90th
3rd class	Class-Based	43%	48%	83%	100%	
	Age-Based	43%	57%	74%	96%	100%
5th class	Class based	19%	44%	88%	100%	
	Age-Based	19%	38%	81%	100%	

Technical Data on the DSRT and MICRA-T Standardised Reading Tests

DSRT Technical information

The sample was stratified according to school size, whether large, medium and small. Further stratification of schools occurred within each of these 'explicit' strata according to gender composition. A further sample of large, medium and small junior schools containing pupils at first and second level only was added to the sample stratum. The sample size was therefore 2,000 pupils drawn from 100 schools with a response rate of 93% the school level.

Issues of reliability relating to standardised tests relates to the degree of confidence a user can place in the test results. Similarly there must also be a consistency in measurement of test-retest scores for the same person on the same test. Two indices of reliability were obtained for the DSRT. Both the Kuder-Richardson (K-R20) reliability co-efficient and the composite reliability index scores as reported in *the table below* at a satisfactory level suggesting internal test consistency.

DSRT Standardisation Study. K-R20 Reliability Coefficient and Composite Reliability Indices. (Source Eivers et al., 2004, p. 21)

Level/Form	KR-20 Reliability Coefficient (Raw Scores)	Composite Reliability Index (IRT Scale Scores)
3A	0.922	0.906
6A	0.896	0.901

MICRA-T Technical information

The MICRA-T was standardised using a multi-stage sampling approach involving a combination of proportionate probability and random sampling. In all 105 schools were invited to participate; 55 schools for the summer standardisation and 50 for the autumn standardisation. The participation response rate was 94.5% for the summer standardisation sample and 92% for the autumn standardisation sample. Overall the standardisation sample across all four levels of the MICRA-T was a representative sample of 10,000students. Internal consistency reliability was again tested (like the DSRT) using the Kuder-Richardson Formula (KR20) as outlined in the table below.

MICRA-T Standardisation Study. K-R20 Reliability Coefficient and Test-Retest Co-efficient. (Source Wall & Burke, 2004)

Level	KR-20 Reliability Coefficient FORM A	Test-retest Co-efficient Form A
2	0.93	0.93
3	0.946	0.925
4	0.964	0.981

APPENDIX D Internet Inquiry Progress Tasks: Researcher Protocol

6th class Internet Inquiry Progress Task 3a, 3b

Pre-checks
Power on the laptop. Connect to Mains outlet.
Test digital voice recorders and battery strength.
Ensure connection to Internet is available. Launch Internet Explorer.
Reset Browser log of web sites visited by earlier groups. Clear History
Launch Camtasia (click F9). Ensure Camtasia is recording.
Have observation sheet and pen at the ready.

Provide overview of Task.
Your task today is to go onto the Internet and find out the following information about a **wallaroo**: Give worksheet to focal group

1) Can you find out where does a wallaroo live?
2) What kind of food do they eat?
3) What adaptations do they make to live in their environment?

Second part of task explained on completion of Task 3(a)

4) Can you find out on the Internet why the corncrake is endangered and what can be done to save corncrake?

Language used by researcher
I cannot help you with the task. I want to see how you can work together to complete this search. Take your time.
Establish children's understanding of the task
Can you tell me what the task is in your own words?
Think Aloud instruction
Tell me what you are doing and what you are thinking out loud as you complete the task. Later, after we finish the task, we will look at the Camtasia video file together. Remember to keep telling me what you are thinking and doing as you search for information.
Think aloud questions
Tell me what the task is in your own words.
Tell me what you are thinking while you type in the search terms and what you are doing as you search for this information on the Internet.
How will you begin the task?
Which role will you undertake today-Navigator, Questioner, Summariser?
What is a word or phrase you would type into the search engine Google to find information to answer your question?
Prompts Non directional

- How did you select the search terms?
- What were you thinking while you read the search results
- Why are you clicking there?
- Where do you think that link is going to lead you?
- What were you thinking as you read this page?
- What's happening now?
- What else can you try?

Post Task Camtasia
Reflection on task looking at Camtasia file with the focus group.
Semi structured Interview questions will be held with the children as they view the Camtasia file post Internet Inquiry Task focussing on navigational skills and reading strategies.

1) What were you thinking while you read the search results. What are you thinking now as you read the search results. What else could you have done/tried ? (possible)When you read the "blurb" of the search result what were you looking out for? When you read the URL what were you looking out for
2) What strategies worked best for you today as you used Google. Did you change your search terms? Why?
3) What strategies did not work for you today? What worked best for you today?
4) What have you learned about searching for information on the Internet today?
5) What do good readers do as they search for information on the Internet?
6) On a scale of 1-5 (5 being the highest and 1 being the lowest)
7) How much do you think you found out about <Topic> today?
8) How much did you enjoy searching for information on the Internet?
9) How well did you collaborate today?
10) How would you rate your role today as Navigator, Questioner, Summariser?

Thank children for their participation

Post-Checks
Stop Camtasia recording (click F10). Playback of Camtasia should start automatically.
Save Camtasia file.
Save digital recording files.
Collect pupil artefacts.
Date Observation sheet.

APPENDIX E Internet Inquiry Progress Task 3c Sample from Worksheet

My friend, Mary, was watching a T.V. programme about Burmese pythons. They can swallow small animals like mice, rats and rabbits whole. How do they do that and why don't they choke she wondered? Mary looked for information on the Internet to find out how a Burmese python swallows large animal.

Here are the search terms she was thinking of using:

Look at each search term and decide as a group:

What do you think of each search term?

Which search term you would use and why?

1) Burmese python
2) How does a Burmese python swallow an animal whole?
3) Burmese python + swallow
4) Burmese python + adaptations

Allow children time to discuss each one. Second Part of Internet Inquiry Progress Task

This is the search term that Mary used:

Burmese python + adaptations Put this search term into Google

As a group look at the search results and decide:

Which search result is **most useful** and why? Give some reasons.

Which search result is **least useful** and why? Give some reasons.

Can you find the answer to Mary's question?

How reliable is the information you found?

How can you know this information is reliable?

How did you work as a group today? What was your role? What did you learn today? What confused you?

Role	My score /5	Group score /5
Navigator		
Questioner		
Summariser		

What did you learn about searching for information today?

Well done. You worked very hard!!

APPENDIX F Internet Workshop Mini-lessons

Information-Seeking Cycle

There are lots of different search engines

- Exploring search engines Yahooligans, Google, Ask for kids, KidsClick
- Searching for images online

How do I generate effective search terms?

- Looking at the number of hits: narrowing search focus, too broad and just right
- Using the 'Theme, Topic, Focus, Question' strategy (adapted from Eagleton & Dobler, 2007)
- Evaluating 'good and bad' search terms
- Using synonyms for key words
- Evaluating search terms

How do I plan questions to focus online activity?

How can I investigate search results?

- Introducing Inspector Clue-Search
- Unpacking URLs: Understanding domain-name prefix and suffix
- Evaluating URLs

How can I evaluate online information?

- Recognising hoax web sites
- Critiquing web sites for content, presentation, ease of navigation, reliability, accuracy of information, author information

Communicating information

- Demonstrating PowerPoint features
- Demonstrating Reale book features

Online Reading Comprehension

- Recognising online informational text structures. Comparison to print based informational text structures
- Skimming and scanning to look for organisational features on web sites
- Formulating questions: adapting QARs using multisensory colour code dimension and kinaesthetic hand signals
- Checking readability levels introducing the 5 finger rule.
- Developing strategies for decoding vocabulary words; use of the strategy glove.
- Generating synonyms for key science concepts.
- Activating and connecting with prior knowledge.
- Summarisation: concept maps; determining importance what would you tell a friend about the information you had read? 321 strategy (adapted from FOR-PD online project)

Developing End-user Application Knowledge

- Recognising navigational features such as back button, hyperlinks, Click hold down back button; recognising audio and video links.
- Using 'edit find' feature to locate a specific word or phrase
- Using online dictionary

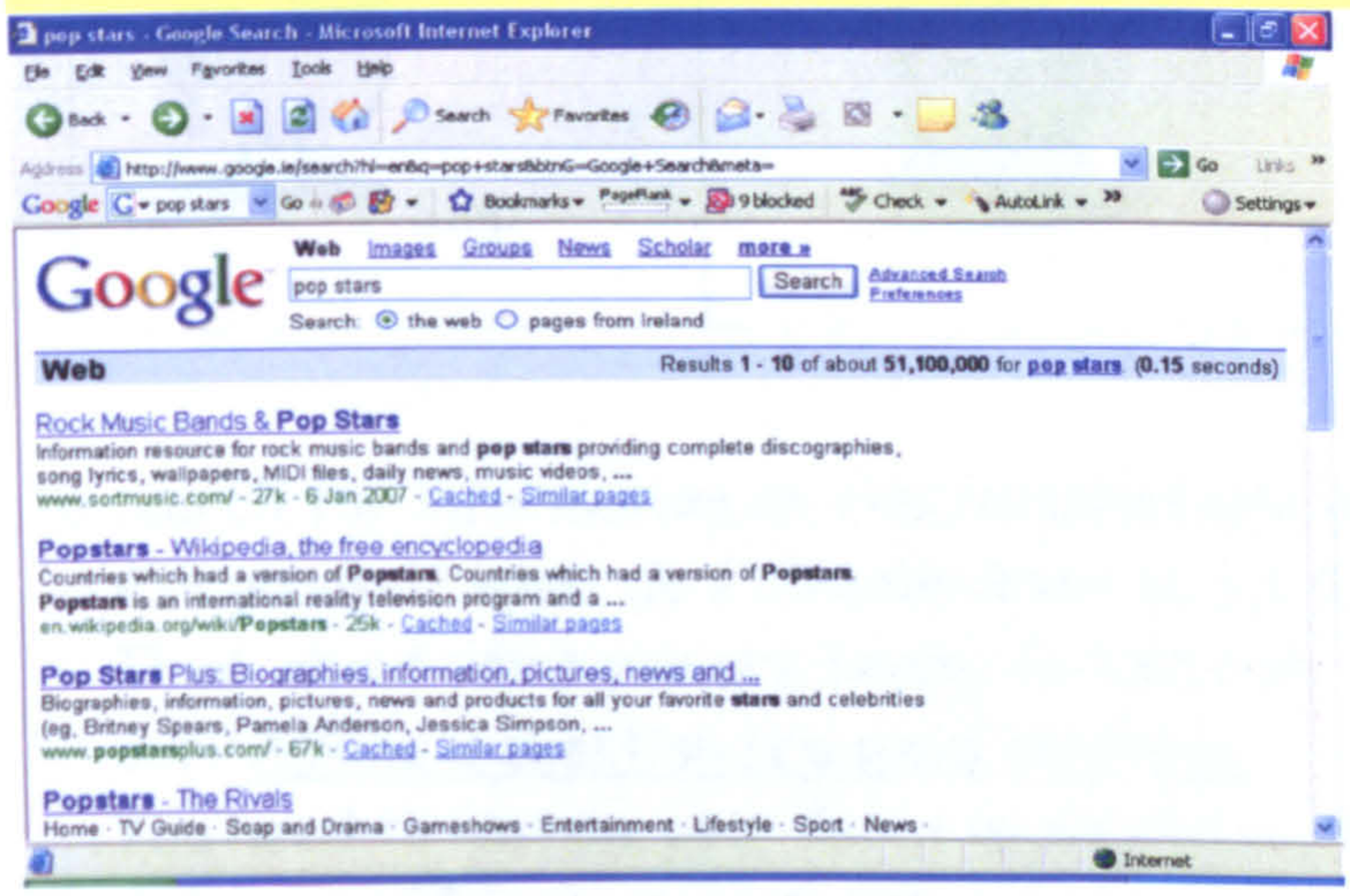
- Developing retrieval skills copy and paste into a word document; saving documents and images; printing documents and images
- Recognising browser features; finding URL by history link;
- Bookmarking favourite web sites setting bookmarks; organising bookmarks;
- Using spell check feature;

Peer to Peer Collaboration

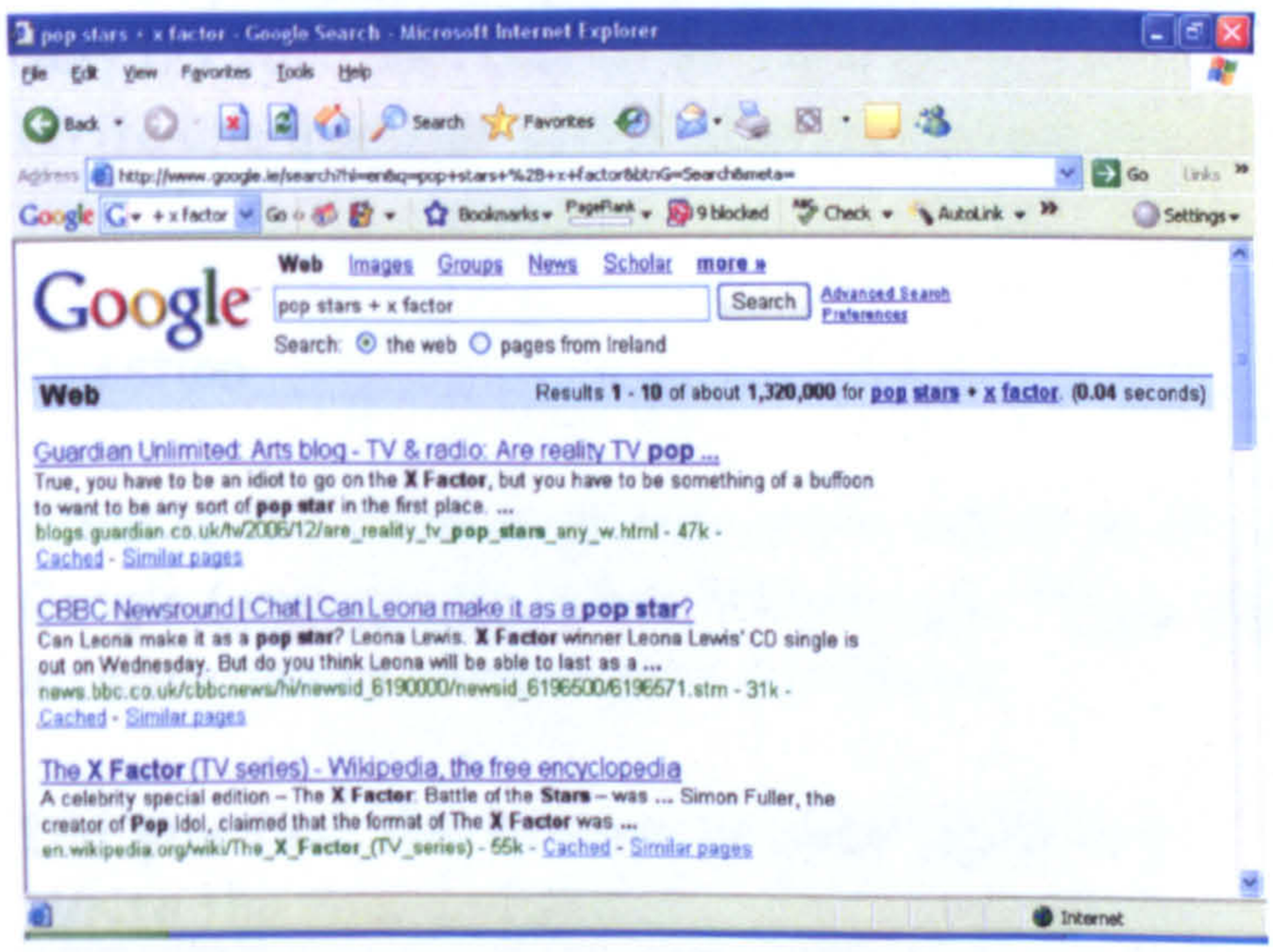
- Using Stop Think Talk as a strategy for planning.
- Using online reciprocal roles of Questioner Navigator Summariser with prompt cards.

APPENDIX G Internet Workshop Sample Worksheet

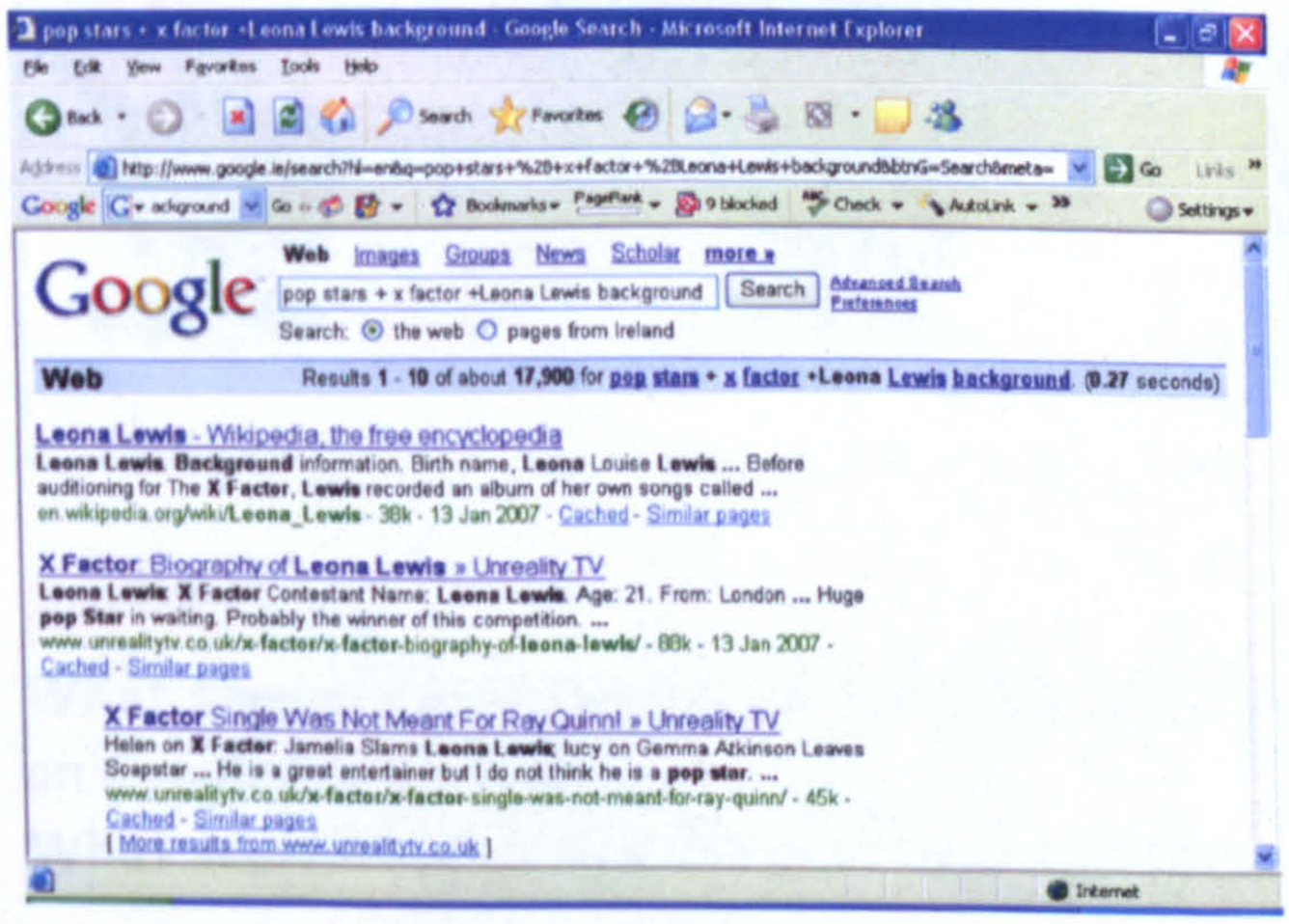
Main Study Workshop 1: Searching for Information on the Internet



How many Hits?



How many Hits?



How many Hits?

What was my question?

To search for information on the Internet you need to:

Ask yourself what do I already know about this subject.

Think about what you are trying to find out. *What do I want to find out?* Asking a question is a good strategy.

You need to narrow your focus as we did in the above example.

Ask yourself is my search term ***too broad*** or **just right**

Now try your own search as a group:

Write one question about what you would like to discover about

_____

Question_____

What is the word or phrase you would type into a search engine like Google (www.google.ie) or Yahooligans (http://kids.yahoo.com to find information to answer your question?

Did you find the answer to your question?

Write the answer here

Reflect:

What search term worked best for you as you searched for information on Google/Yahooligans?

What search term did not work for you? Why?

What did you learn? (*Too Broad*, *Just Right*)

Good and Bad Search Terms:

Narrow a topic

Practice narrowing a broad topic into a narrow topic. Begin with the first box and choose more specific topics as you go across the row. Finish with a question in the last box. The first one is done for you.

Theme	→	Topic	→	Focus	→	Question
Sports	→	Soccer	→	Manchester United	→	Who is their top scorer?
Books	→		→		→	
Pet Care	→		→		→	
History	→		→		→	
Your own topic	→		→		→	

Good and Bad Search Terms

Stop

Think

Talk

1) Question: Who was the first actor to play James Bond

Search Term: James Bond

Is this a Good or Bad search term? Why?

2) Question: Which of Michael Morpurgo's books have been made into films?

Search Term: Michael Morpurgo + films

Is this a Good or Bad search term? Why?

3) Question : Where does a meerkat live?

meerkat + habitat

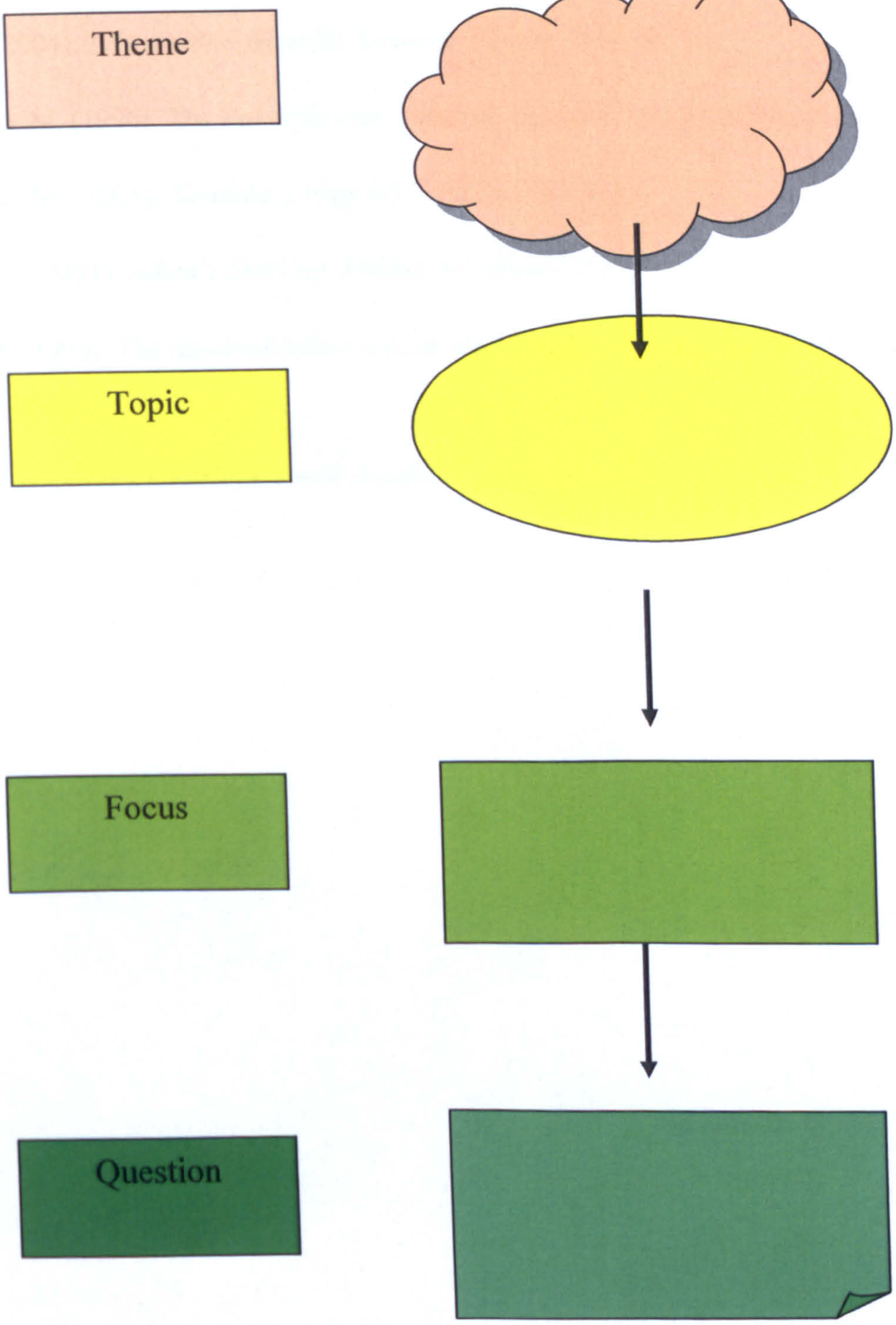
Is this a Good or Bad search term? Why?

4) Question: What birds stay in Ireland in the Winter?

Search Term

birds

Is this a Good or Bad search term? Why?



Reflect:

What did you learn about narrowing a search for information on the Internet today? What would you tell your friend? What did you learn about good and bad search terms? **Well done you worked really hard today!**

APPENDIX H Reference List of Children's Novels used as a Class Reader Linking to the Project Theme in each Class

May, P. (2004).*Billy and the seagulls*. London: Young Corgi Series.

Morpurgo, M. (1996). *The Butterfly lion*. London: Harper Collins Children's books.

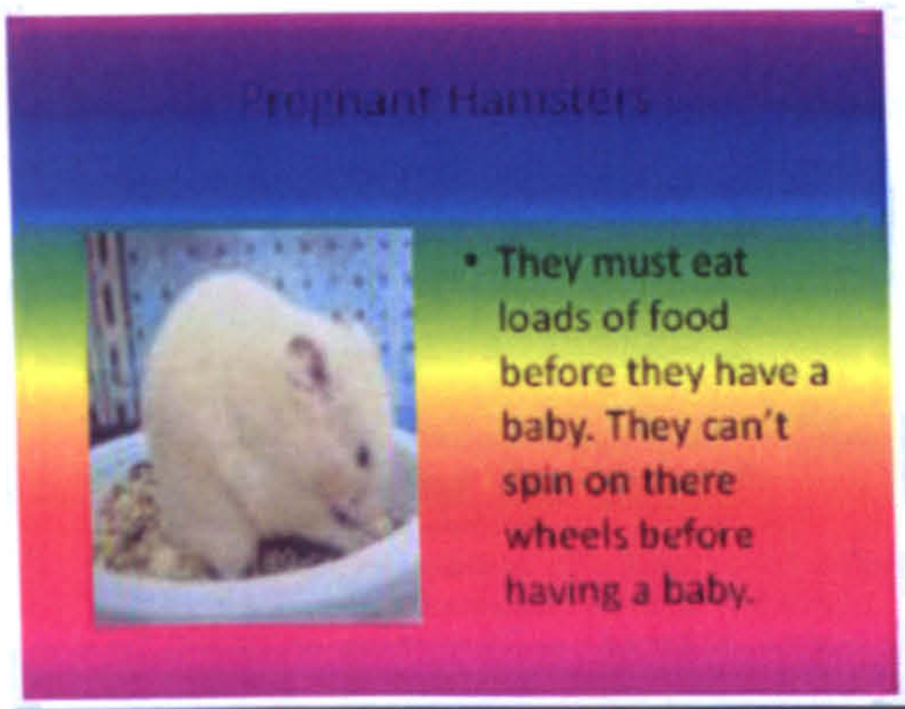
Morpurgo, M. (2005). *Kensuke's kingdom.* London: Ergmont.

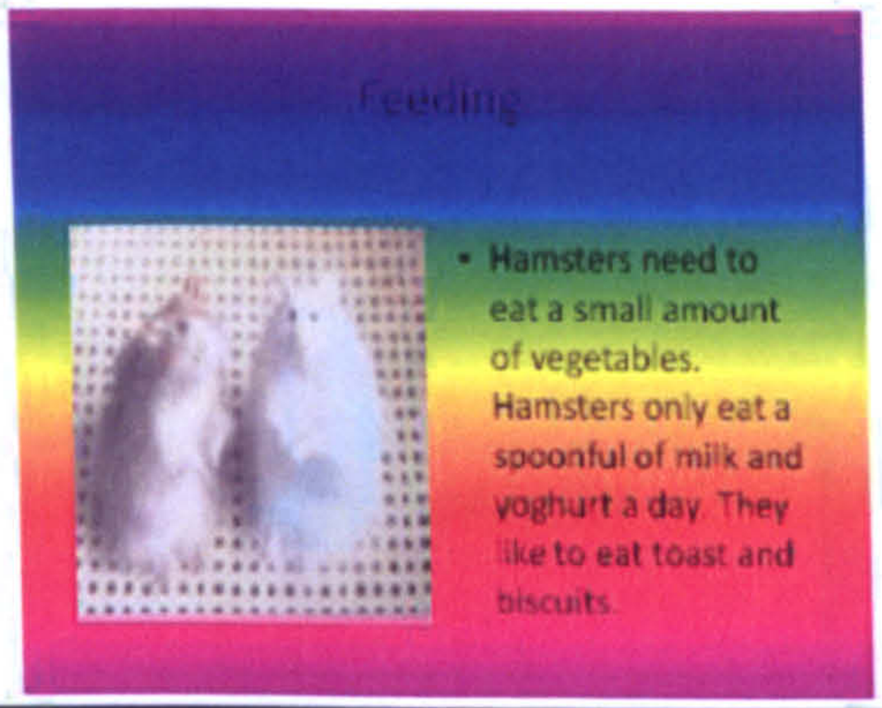
Perdue, G. (2001). *Adam's Starling*. Dublin: O'Brien Press.

Strong, J. (1996). *The hundred-mile-an-hour-dog*. London: Young Puffin Modern Classics.

White, E.B. (1952). *Charlotte's web*. London: Puffin Books.

APPENDIX I Sample Slides from the 3rd/4th Class PowerPoint Presentation 'Our Pets'





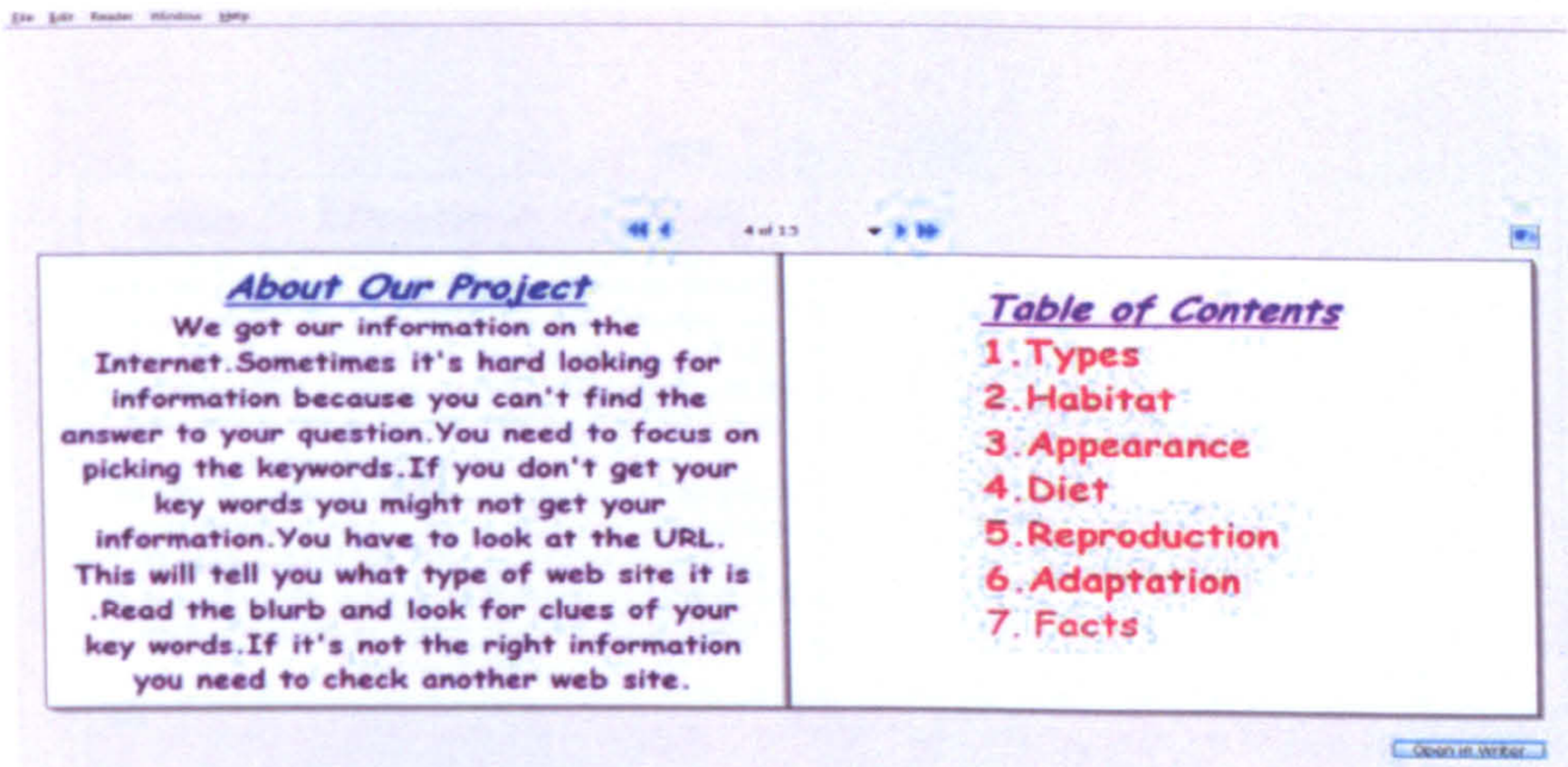
Group 4 Hamsters

Group 5 Cats

Group 6 Birds

APPENDIX J Sample Pages from the 3rd/4th Class Reale Books 'Birds and Their Environments'

Group 4 Penguins



File Edit Reader Window Help

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Looking for information on the Internet

Looking for information on the Internet helps you find out what you want to know.You have to look at the URLS -a commercial site .com, a network site .net and a .org site -this ia an organisation. You can rely on a dot org site but you need to check another web site to see if the other page is telling you the truth.Read the blurb and the heading might help you as well.

Go onto the Internet and type in your key words ,press Google serach and when your search terms come up read the blurb and the URL.Then go into the one that you think will help you the most.If that doesn't work go onto another web site or change your key words -maybe narrow it down.

My name is Diana I have glasses and I am 10. My name is Sienna and I am 9. We love horse riding.

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Reproduction

1.Where do Peacocks lay their eggs?

2.How long does a peacock be pregnant for?

3.How do peacocks have babies?

4.What colour are peacock eggs?

5.When a male and a female peacock mate do they stay together forever?

6.Are peacock babies fat when their born?

7.When a male + female peacock have babies do they leave it alone and wonder off?

Reproduction

1.Peacocks lay their eggs on the ground and spend the time on the ground to prepare it for her babies and waits for her eggs to hatch.

2.28 days.

3.There are usually 4 - 6 eggs laid at a time. the eggs are laid 2 days apart usually in the afternoon.

4. Their eggs are a light tan.

5.When they see the dark side of eachother.

6.Some are fat and some are skinny.

7.18-22 months old is when they leave.

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Group 6 Owls

APPEARANCE

Owls have large eyes and head.

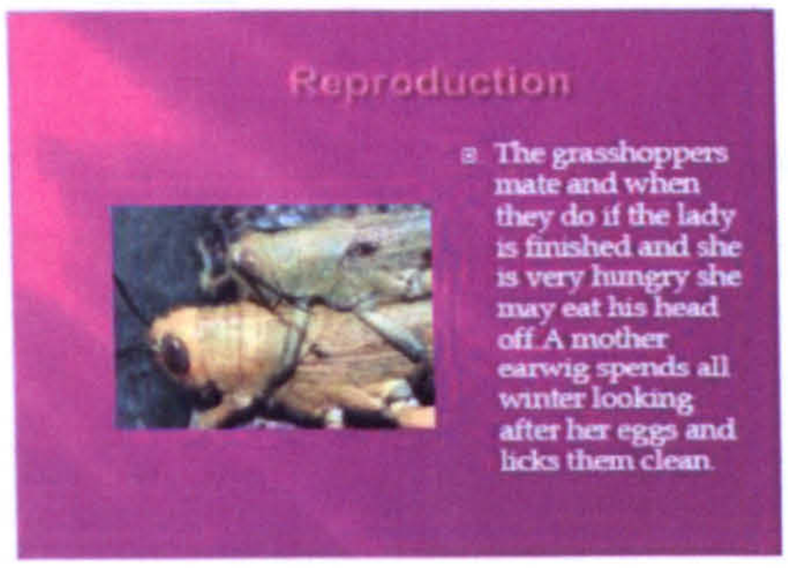
Owls are far sighted.Barn *Owls* have flat heart shaped heads.*Owls* lay 4-6 eggs.Their hearing is excellent and they use their ears to find rodent prey.

MOVEMENT

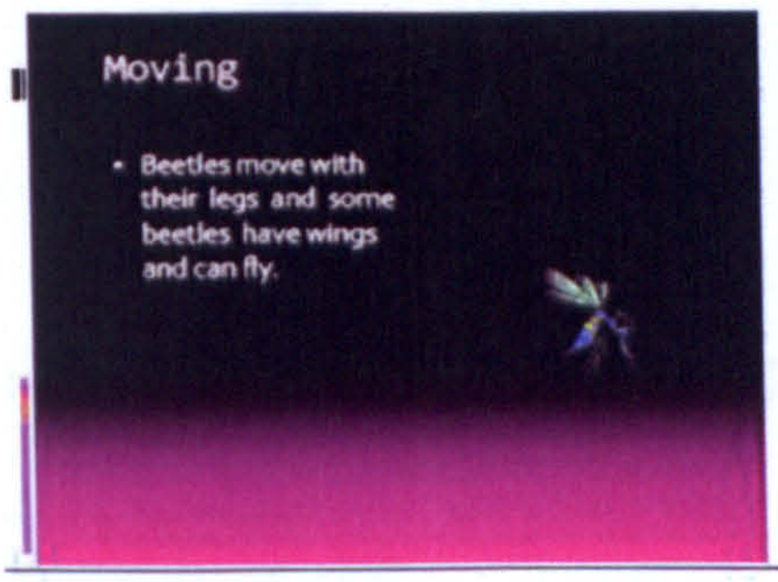
how can an owl stay in the air ?

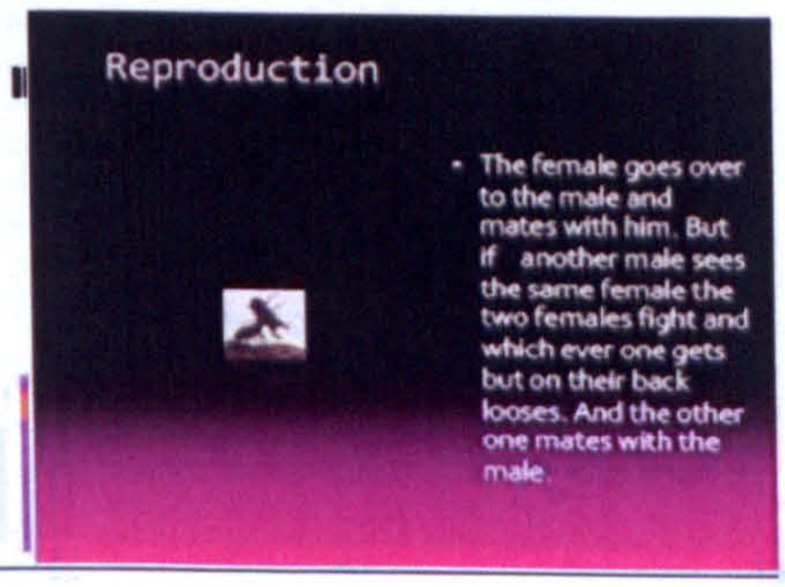
they can stay in the air by flapping their wings.They only hunt at night to catch their food because they can see in the night.And the rats and mice do be running around.

APPENDIX K Sample Slides from the 5th/6th Class PowerPoint Presentation 'Life in the Undergrowth'

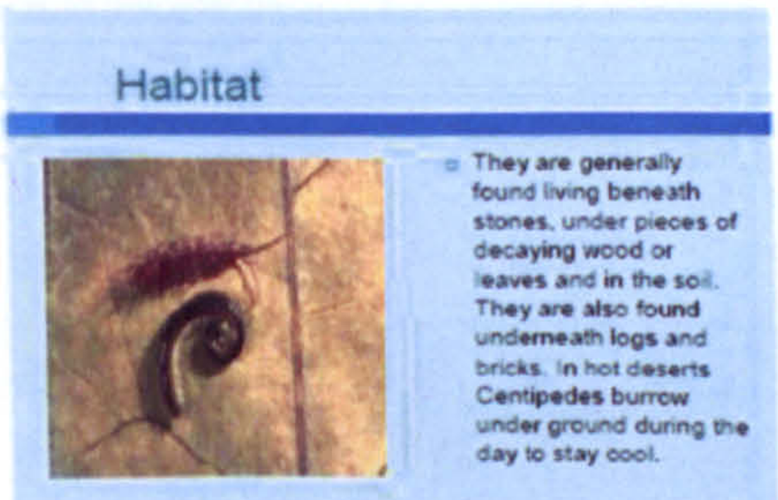


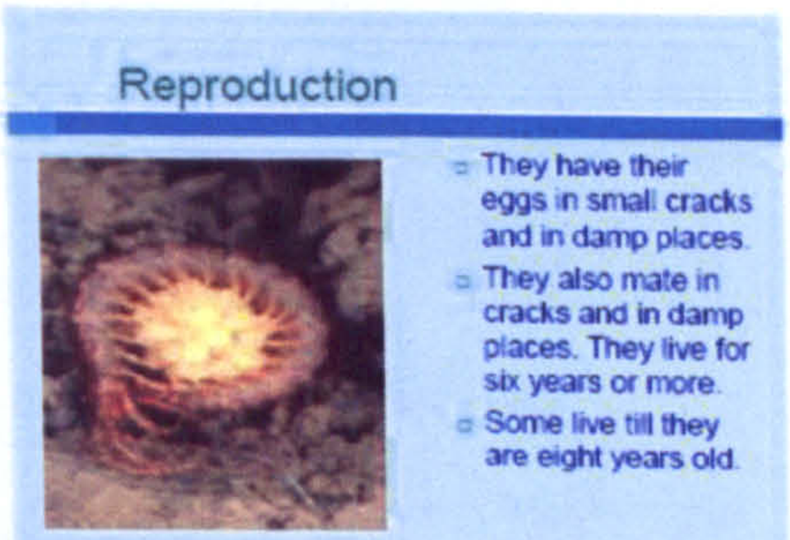
Group 1 Grasshoppers and Earwigs





Group 2 Beetles

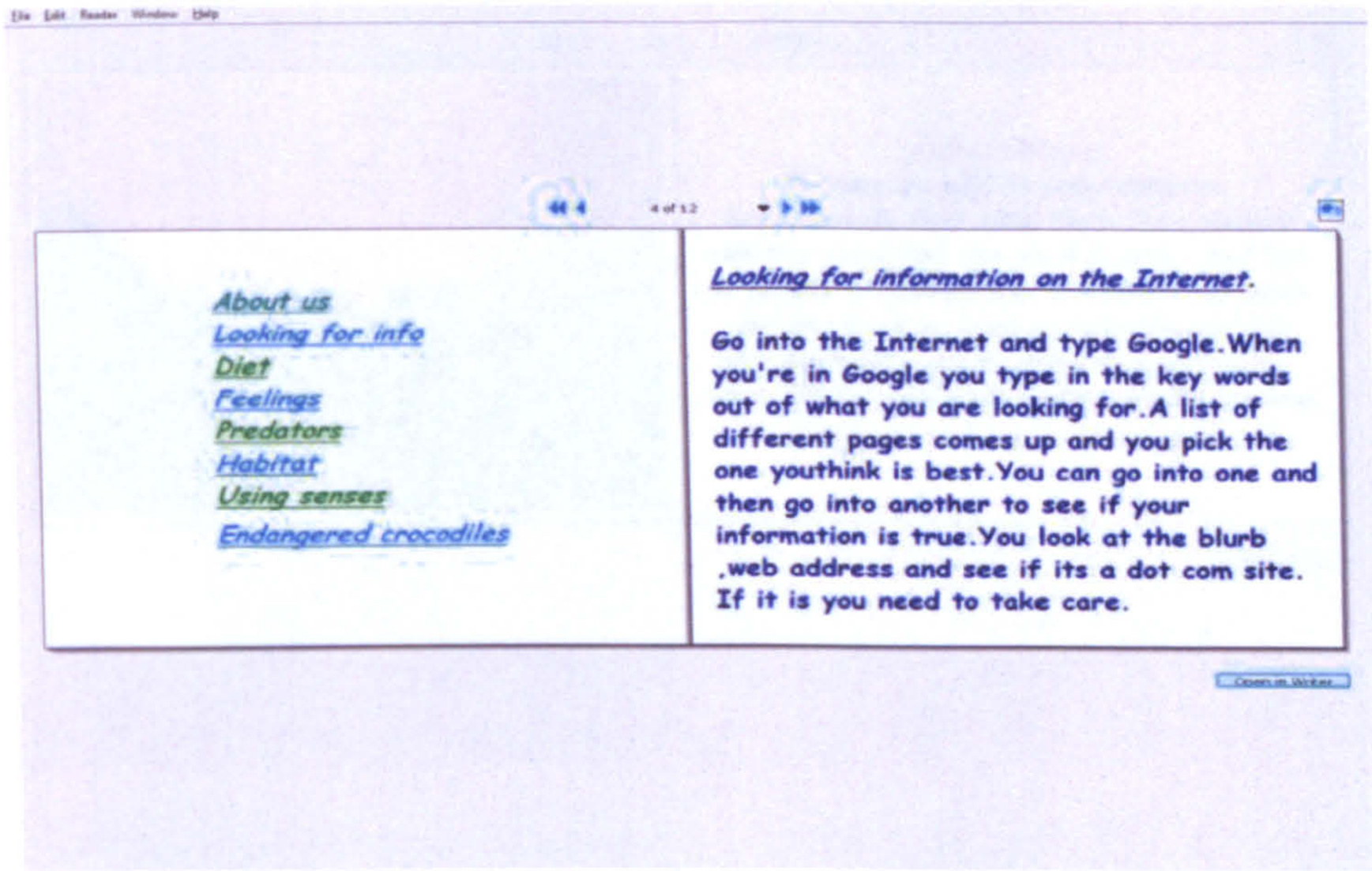


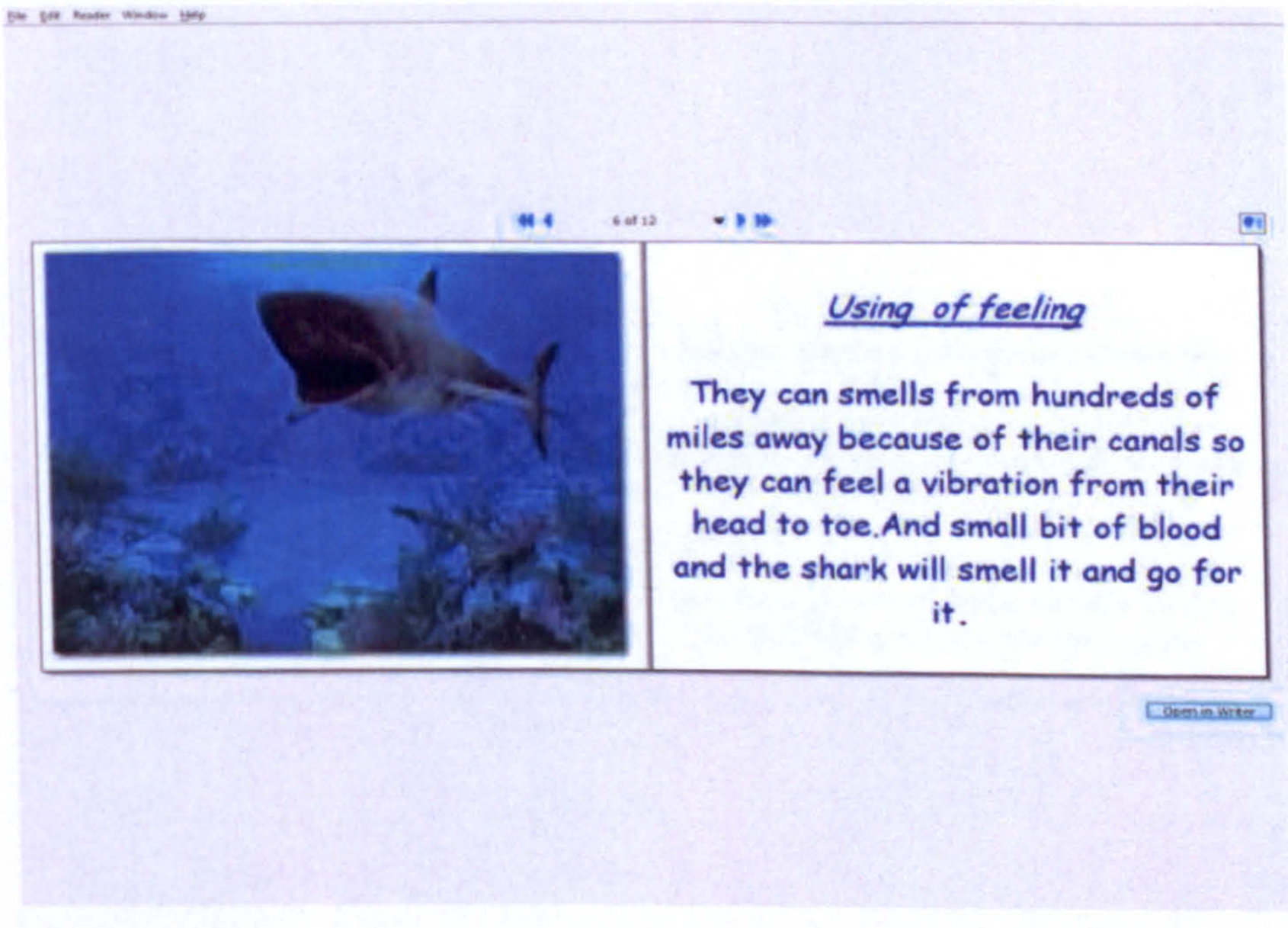


Group 3 Millipedes and Centipedes

APPENDIX L Sample Pages from the 5th/6th Class Reale Books 'Animals and Their Adaptations to Their Environments'

Group 1 Oceans Biome: Sharks and Dolphins





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Desert Biome

It does be cold in some deserts. Some camels feet stop them from sinking into the sand.And the sand does be real hot so people or animals can't walk on the sand. And you have to wrap up because you can get sun burna nd you have to wear shoes. Some desert don't have water so i'll say you would have to bring a lot of water.

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Our Endangered Animal

pergrine falcon is endangered because the farmers are putting down pestisides to kill the snails and after the snails eat the pestisides the pergrine falcon eats the snails and then the pestisides goes into the pergrine falcon and they were dieing and that is why they were becoming extint but now they are not as extint as they used to be but they are still a bit endangered.

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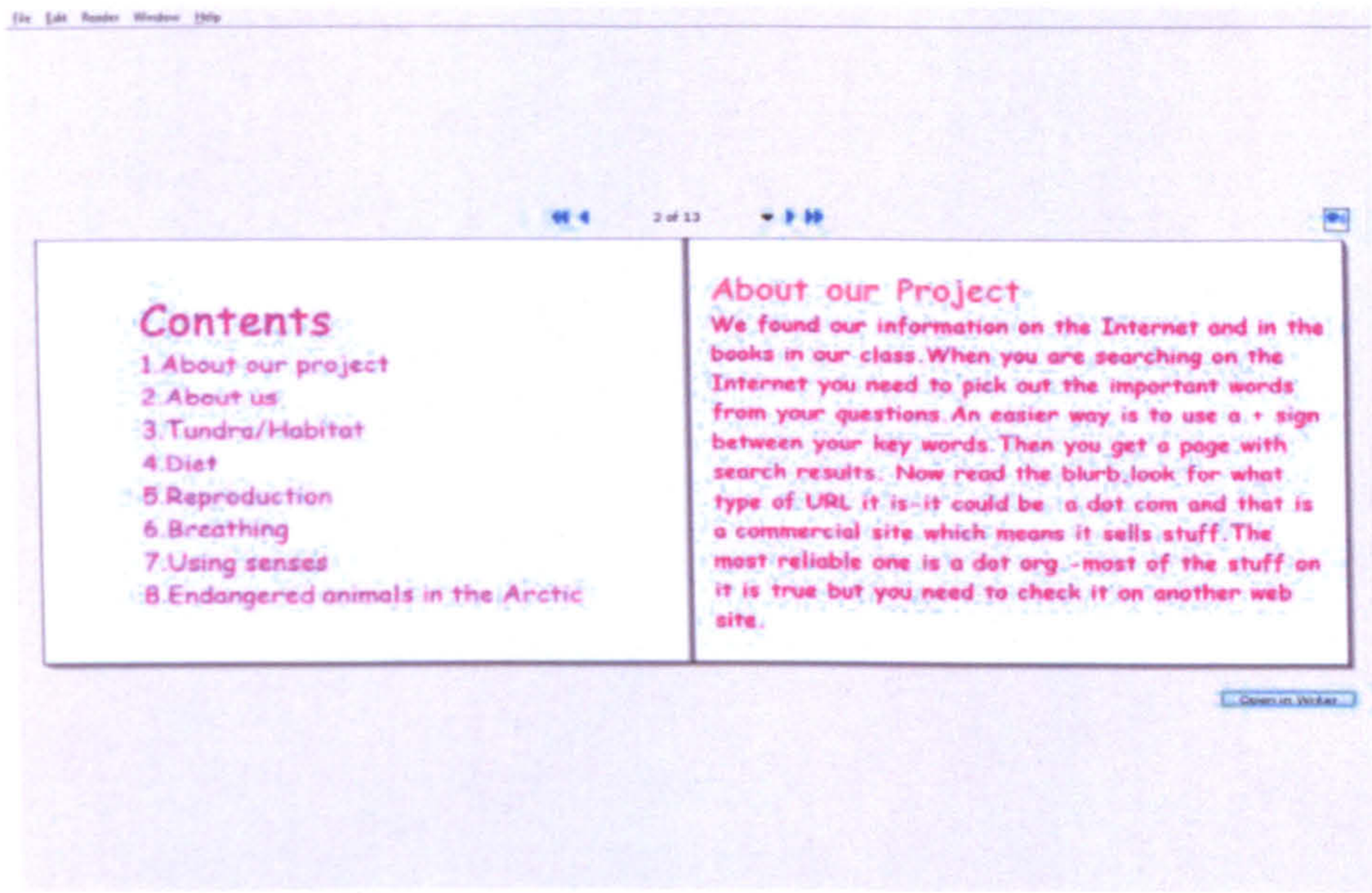

Contents

About our Project

We found our information on the Internet and in the books in our class. When you are searching on the Internet you need to pick out the important words from your questions. An easier way is to use a + sign between your key words. Then you get a page with search results. Now read the blurb, look for what type of URL it is- it could be a dot com and that is a commercial site which means it sells stuff. The most reliable one is a dot org -most of the stuff on it is true but you need to check it on another web site.

TUNDRA/HABITAT

The tundra is a cold place. Peguins, polar bears and other animals live in the tundra. Polar bears adapt to the cold because they have thick fur. **Penguins have blubber to keep them warm and they have webbed feet to keep them from sinking in the ice.**