

Computer Assisted (Language) Learning (CA(L)L) for the Inclusive Classroom

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ABSTRACT

Title: Computer Assisted (Language) Learning (CA(L)L) for the Inclusive Classroom

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Post-Primary Schools in Ireland are inclusive with a mix of students with diverse abilities in the classroom, including students with learning and literacy difficulties, such as dyslexia. This poses a strong challenge: how to create inclusive curricula and materials that cater to the needs of diverse students?

The objective of this research is to investigate whether integrating Computer Assisted (Language) Learning (CA(L)L) into the curriculum can produce inclusive curricula that cater to the needs of all students (with and without learning difficulties). The research focuses on students with dyslexia and the Junior Certificate (JC) curriculum.

Mainstream and learning support teachers and students in two Irish Post-Primary schools took part in questionnaires to investigate which ICTs they use for class work. Three broad types of ICT were highlighted: general ICT tools, tools designed for students with special needs and online curriculum materials. Teachers and students then undertook a three-month project investigating how they used these ICTs. Teachers and students then took part in focus groups to develop design guidelines for developing curriculum-focused CA(L)L materials for diverse students. These guidelines were used to develop curriculum-focused CA(L)L materials for an inclusive classroom. The materials were integrated into classroom activities in two schools and evaluated through qualitative questionnaires, observation and focus groups.

The research shows that (i) a CALL methodology can be successfully used for a project focused on overcoming first language difficulties, (ii) there is a lack of online curriculum-focused materials which cater to the needs of students with learning difficulties, (iii) CA(L)L materials for diverse students can be successfully integrated into an inclusive classroom, and (iv) teachers can develop their own CA(L)L materials successfully.

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Looking forward to meeting you Bump.

For my Granny Evelyn

ACRONYMS

ADDIE	Analysis, Design, Development, Implementation, Evaluation
CAL	Computer Assisted Learning
CALL	Computer Assisted Language Learning
CA(L)L	Computer-Assisted (Language) Learning
DAI	Dyslexia Association of Ireland
ESL	English as a Second Language
ICT	Information Communication Technology
JC	Junior Certificate
LS	Learning Support
LS/R	Learning Support / Resource (Teacher)
MS	Microsoft
NCCA	National Council for Curriculum and Assessment
RS	Resource Support
SLD	Specific Learning Difficulty
SN	Special Needs

TERMINOLOGY

Computer Assisted Learning

“Computer-Assisted Learning” is used in the broadest sense where some form of ICT is used to aid the teaching and learning process.

Computer Assisted Language Learning (CALL)

CALL software is language-learning software (e.g., web-based, CD-ROM, interactive) that has lessons and exercises designed and developed for the particular needs of a target group. CALL is a means of aiding the work done in the classroom by the teacher and can also be a means of independently learning a language.

Computer Assisted (Language) Learning

“Computer-Assisted (Language) Learning (CA(L)L) means CALL with a language element that is not traditional second language acquisition.

Development

“Development” refers to the actual creation and testing of the materials.

Diverse Students

“Diverse students” refers to the many types of students that are present in the mainstream inclusive post-primary school.

Evaluation

“Evaluation” means measuring the integration of the materials developed.

Information Communication Technology (ICT)

“ICT” is used in the broadest sense to refer to the use of computers to support curriculum work.

Implementation

“Implementation” refers to the deployment of the materials in schools.

Learning support and Resource Teachers

“Learning support and resource teachers” refers to teachers who cater for students with learning delays or with a high-incidence disability such as mild general learning disability and dyslexia. They add to the support given by the class teacher. Some of teachers involved in the project were both subject and learning support teachers.

Materials and Resources

The terms ‘materials’ and ‘resources’ are used throughout the thesis to refer to both existing materials and materials developed within this project.

Post-Primary School

“Post-Primary school” or “Secondary school” refers to the school that students attend from ages 12/13 to 17/18 years old.

Special Needs

“Special needs” refers to needs of a certain group of students in learning support or in resource.

Subject Teachers

“Subject teachers” refers to teachers who teach a particular subject.

Teachers

“Teachers” refer to all teacher types found in a mainstream school: English, Geography and History subject teachers, learning support teachers and resource teachers.

Testing

“Testing” means checking that the materials developed work as they should prior to deployment.

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CHAPTER 1: Overview

1.1 Introduction

This thesis presents the research and findings on the design and development of curriculum-focused Computer Assisted (Language) Learning (CAL(L)) materials and their integration into the post-primary school curriculum in the Republic of Ireland (2006-7) with the aim of benefitting mainstream students and students with dyslexia and varying learning difficulties.

This chapter outlines the motivation for undertaking the research and the methodology used. It explains the research questions and provides a brief overview of the answers to those questions resulting from the research reported in this thesis.

Section 1.2 provides the background to the project. Section 1.3 defines the research question: can curriculum-focused CA(L)L materials be successfully integrated into the post-primary school curriculum to cater to the needs of diverse students? Section 1.4 defines that I mean by Computer Assisted (Language) Learning (CA(L)L). Section 1.5 presents the project objectives, requirements and constraints. Section 1.6 outlines the research methodology and project outline. Section 1.7 clarifies some of the main terms used in this dissertation. Section 1.8 lists the research publications resulting from this project. Section 1.9 presents the main findings from this research project with regard to the research questions.

1.2 Background to the Project

During my time as a learning support teacher (2002-3) in a post-primary school in Ireland, I became aware of the lack of resources for post-primary school students with learning difficulties such as dyslexia. In my small group sessions, we covered curriculum topics ahead of their mainstream class. The aim was that students would find the topic a little easier when they covered it later with their mainstream teacher. I was given use of the school's various ICT programs, most of which were aimed at much younger students.

I have a background in designing and developing Computer Assisted Language Learning (CALL) materials for learning French and German in a blended learning

primary school environment (Greene & Keogh 2002). The motivation for the research presented in this thesis is that students with learning difficulties such as dyslexia may benefit from using curriculum materials adapted to their particular needs.

In order to initially test the research hypothesis in 2003, I decided to carry out a short pilot study with the students in the support groups using some Hot Potatoes (2003) exercises infused with curriculum units and multimodal content to determine whether they found this useful. The students enjoyed the materials and I found that the students were covering the curriculum quickly with me ahead of their mainstream class. I became interested in developing a project like this on a bigger scale to test whether it was possible for more materials to be created and whether mainstream teachers could create their own materials to do this.

I approached two schools I had worked with on previous studies to see if they would be interested in this project. I also held discussions with the Dyslexia Association of Ireland with regard to highlighting the subjects that needed the most attention.

School A was classed as a disadvantaged school and had over 800 female students. School B was a mainstream school and had over 400 male and female students.

I carried out ICT questionnaires in both schools followed by a 3-month ICT Integration project. Observation was carried out to see how teachers and students were using the ICTs that were currently available to them. A small number of teachers and students took part in focus groups to develop design guidelines for curriculum-focused materials for an inclusive classroom including dyslexic students. These guidelines were used to create sample exercises for three types of curriculum-focused CA(L)L materials: Clicker Exercises, Hot Potatoes Exercises and Logged Exercises. Teachers and students were closely involved in the design (and resulting development) of the tools. Teachers were provided with training so that they could create their own materials based on the design guidelines. These materials were then assessed through observation, surveys and focus groups using a Computer Assisted (Language) Learning based evaluation framework.

1.3 Defining the Research Question

Blin and Levy (2003) provided guidelines on how to formulate research questions in CALL. The guidelines include the need to state the research question clearly, to avoid being overly ambitious and to focus on one particular context. The research question that this project investigates is formulated as follows:

- Can curriculum-focused CA(L)L materials be successfully integrated into the second level curriculum to cater for the needs of diverse students?

Each of the terms included in the research question are explained in Section 1.6 Terminology below.

The research question is further broken down into several sub-questions:

- Can a Computer Assisted Language Learning (CALL) research methodology be successfully applied to “first language content” rather than second language?
- What ICTs are being used by teachers and students and how are they using them?
- Can teachers create appropriate CA(L)L materials?
- Why is there a lack of age-appropriate curriculum-focused materials for students with learning difficulties?
- How useful (or not) are the materials developed within this project?

The research question outlined above identifies the overall objective of the project. The major aim was to investigate whether curriculum-focused ICT materials can be integrated into the second level curriculum successfully to cater to the needs of different types of students. Success depends on the usefulness of the materials developed.

1.4 Computer Assisted (Language) Learning (CA(L)L)

Computer Assisted Language Learning (CALL) software is language-learning software (e.g., web-based, DVD, interactive) that has lessons and exercises designed and developed for the particular needs of a target group. CALL is usually aimed at

second language acquisition. Levy (2001) stated that nothing can compare to a teacher-learner classroom environment. Ideally, CALL should be used in conjunction with the classroom-based curriculum in a blended learning scenario to provide the best possible learning environment.

Similarly, Computer Assisted Learning (CAL) describes an integrative approach whereby the CAL program does not actually replace classroom content but is introduced into the course as a learning resource. Often, this takes the form of self-study which takes place outside the main curriculum hours. CAL can be aimed at any subject material.

I use the term Computer Assisted (Language) Learning (CA(L)L) to describe the use of a CALL methodology to develop first language curriculum materials for diverse student groups (including dyslexia). The word 'Language' is in parentheses to denote the fact that the normal second language acquisition aim is replaced by the aim of helping students with learning and literacy difficulties to overcome challenges they face in their first language. I therefore use the acronym CA(L)L to describe the materials I designed (Chapter 6) and developed (Chapter 7) within this research project.

1.5 Objectives, Requirements and Constraints

1.5.1 Objectives and Requirements

The materials developed as part of this research project should be made available to other researchers and teachers after the completion of the project. Sometimes materials developed in a project are custom-made to such an extent that they cannot be used outside the project. While the materials here are developed to be curriculum-specific, they had to be easily adaptable to other curricula.

The curriculum-focused materials developed in this thesis are meant to complement the work done in class in a blended-learning environment. A blended learning environment means that both traditional classroom teaching and ICT materials are used in tandem. ICT materials are not meant to take over from the teacher or be used as a 'filler' to keep students occupied. The materials should be able to be used both in

the classroom and at home by the students. Importantly, they are meant to enhance the learning experience rather than detract from it.

The Irish education system adopts an inclusive class approach where students of diverse abilities are taught in the same classroom. While some students have extra learning support outside of the mainstream classroom, these students spend the majority of the school week with their peers. Any ICT materials developed within this project have to cater to the needs of three student groups that are present in the inclusive mainstream environment: mainstream students of all levels, students with dyslexia and students in learning support and resource classes. There are many levels of ability within these groups. The aim is to develop learning materials incorporating feedback from these groups that can be used by the whole classroom (i.e. by students from the three groups) together in an inclusive manner.

1.5.2 Constraints

There are a number of limiting constraints when working with teachers and students in the learning support area. There are very few CA(L)L projects that focused on developing materials for students with special needs to inform this research (Sivin-Kachala 1998, Watts & Lloyd 2004). During the initial ICT integration (Chapter 5), it was very difficult to get access to the tools in use at that time. The tools in question (Dragon Naturally Speaking (2006): speech recognition software, Read and Write Gold (2006): text-to-speech software) are expensive and schools can usually borrow them from the Department of Education's Education Centres (Education Centres 2006). During both the initial integration of available ICT and the implementation of the CA(L)L materials developed within this research (Chapter 8), access to computer labs, crashing websites and Internet connectivity were significant problems. Ideally, technology should not dictate what resources are developed, however it is important to take into account what technology is available to the target group. With regard to this issue, some of the CA(L)L materials developed (Chapter 7) within this research were designed to be used offline.

A major constraint was the number of participants. It proved difficult to get a fully representative and statistically significant number of teachers and students involved in the project. Two schools participated in the project. However, not all students in learning support and resource support in those schools were involved in the project.

The numbers depended on which teachers decided that their classes would get involved. Parental consent also had to be acquired.

An important constraint was to guarantee the confidentiality and anonymity of the schools, teachers and especially, students, involved in the project. No exam results could be used within this research so the results are based on qualitative evaluation rather than quantitative evaluation from exam results.

1.6 CA(L)L Research Methodology

One of research questions defined above asks whether it is possible to use a Computer-Assisted Language Learning (CALL) research methodology for a project that is not CALL in the traditional sense. The CALL and CAL fields are detailed in Chapter 3.

1.6.1 Project Methodology

This project follows a common software engineering model called ADDIE (Sommerville 2004) which is the basis for Colpaert's RBRO CALL research methodology. Figure 1.1 shows the structure of the ADDIE Model. Chapter 2 (Research Methodology) describes Colpaert's 2004 RBRO CALL Model in detail and the reasons for choosing a CALL model.

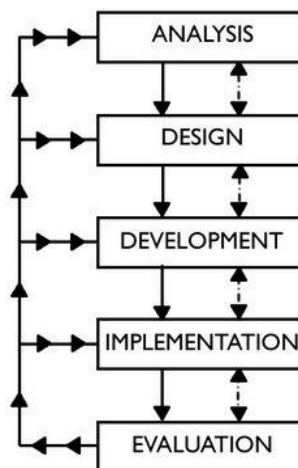


Figure 1.1: The ADDIE Model (Sommerville 2004)

The Analysis Phase, or Needs Analysis, is described in Chapters 3-5 of this thesis.

Chapter 3 (Literature Review) provides a summary of the pilot study that is introduced in Section 1.2, which was the motivation to carry out this research. Chapter 3 also provides a literature review on key areas relevant to the success of a CA(L)L research project. The review includes:

- Special Education within the Irish Education System
- Dyslexia
- Computer Assisted Language Learning (CALL)
- Computer Assisted Learning (CALL)
- Relevant CA(L)L Research
- Online Curriculum-Focused Tools
- Government ICT in Education Policy

The literature review shows the diverse range of ability in the mainstream Irish classroom. The overview of dyslexia provides information of how dyslexia is diagnosed in Irish schools and the difficulties experienced by students and parents moving from primary to post-primary school education. The review includes research on the neurological bases of dyslexia and the characteristics of students with dyslexia. The key finding is that dyslexia is a difference in cognition and learning (Singleton 2000).

Chapter 3 goes on to give a brief history of the CALL field and a discussion of whether CALL should be used as a tutor or a tool. The key finding is that ideally, CALL should be used as a tool, which means it is used in conjunction with classroom based activities. The Analysis Phase continues with an overview of the CAL field. The review of relevant CA(L)L research shows that there are very few studies that focus on integrating curriculum-focused CA(L)L to cater to the needs of an inclusive classroom including students with dyslexia. However, there are relevant research projects including dyslexia research and tool and website design for special needs that were important to learn from while carrying out this research.

Chapter 3 then presents a review, carried out in 2010, of online curriculum-focused tools:

- Skool.ie
- TeachNet.ie
- Scoilnet.ie

This review shows that each of these websites have only a small amount of curriculum resources specifically catering for students with learning difficulties such as dyslexia.

Chapter 3 concludes with a review of government ICT in education policy. The Investing Effectively in Information Communication Technology in Schools 2008-13 report (DES 2008) says that Irish teachers are willing to engage with the integration of ICT and there has been a high participation rate in ICT professional development courses. The conclusion of this study, however, is that while all schools are equipped with some computers and have limited internet access, a lack of sufficient investment has resulted in inadequate ICT equipment and levels of broadband internet (Section 3.10).

The Analysis Phase continues into Chapter 4 (Use of ICTs in Two Selected Post-Primary Schools). Mainstream teachers (including those who do some learning support / resource work) students and learning support teachers and students from two schools took part in a questionnaire to ascertain what ICTs are being used in the classroom. School A was classed as a disadvantaged school and had over 800 female students. School B was a mainstream school and had over 400 male and female students. The surveys were open to all teachers and students in the school.

Three types of ICT were identified from the questionnaires:

- General-purpose ICTs (e.g. Word Processors)
- Focused-special needs ICTs (e.g. Read and Write Gold)
- Online curriculum-focused websites (e.g. Teachnet, Skool.ie)

Chapter 4 showed that teachers are under-utilising available ICTs. Teachers were more likely to use ICTs to prepare work to be printed out for use in class rather than have students use the ICT themselves. A key finding from Chapter 4 is that learning support teachers reported using primary school programs for their students. While

mainstream teachers and students accessed online curriculum-focused materials, learning support teachers and students reported that the language level and presentation of the content was inappropriate. Following the initial project phase described in Chapter 4, teachers and students in the two schools took part in focus groups to determine what kind of curriculum units could be enhanced by the ICTs listed above.

Chapter 5 (Initial Deployment of ICT Materials in Two Selected Post-Primary Schools) presents the implementation of the initial ICT integration in the two schools. The teachers and students were split into three groups and each group was given one of the three types of ICT listed above for a period of 3 months.

Teachers and students then answered questionnaires and took part in focus groups to analyse the impact of the ICT on teaching and learning. A key finding is that the learning support teachers and students did not continue to use the online curriculum materials that are available because (i) they could not find content aimed at students with learning difficulties and (ii) the content available was too difficult. Another key finding was that while mainstream teachers were using online materials, they were not using them as frequently as indicated by the initial ICT questionnaires described in Chapter 4. The teachers and students took part in focus groups to discuss the implementation. During the focus groups, teachers and students developed design guidelines for curriculum-focused CA(L)L materials that cater to diverse students (including those with dyslexia) in mainstream classroom. All of the outputs from the Analysis Phase are summarised on Colpaert's GLDT grid at the end of Chapter 5.

Chapter 6 (Design of Curriculum-Focused CA(L)L Materials for Diverse Students) outlines the design of the curriculum-focused CA(L)L materials for the English, History and Geography curricula that are suitable for a diverse range of students in an inclusive classroom environment. These subjects were chosen in consultation with the Dyslexia Association of Ireland (DAI) as areas that are particularly difficult for dyslexic learners due to their focus on language. They advised me that these subjects prove the most challenging in terms of vocabulary, the text-heavy focus and the essay-writing involved in the subjects. The Design Phase takes all the outputs from the Analysis Phase into account. In particular, the design guidelines that the teachers and students created were adhered to. This ensures that the focus of the design is on the

learner and their specific needs and language difficulties. Three types of ICT were designed:

- Clicker Exercises
- Online Exercises (Hot Potatoes exercises)
- Online Exercises (Logged exercises)

Chapter 7 (Development Curriculum-Focused CA(L)L Materials) describes the Development Phase of the CA(L)L materials. Clicker and Hot Potatoes are programs that schools can download under a school license. The Online Logged Exercises were developed by the researcher using .Java programming (.jsp) and XML.

Chapter 8 (Implementation of Curriculum-Focused CA(L)L Materials) details the Implementation Phase of the research project. The CA(L)L curriculum materials were integrated in the two schools for three months. A key detail of the implementation phase was that teachers and students were trained how to use the materials. The teachers were also taught how to create their own materials in Clicker, Hot Potatoes and the Logged Exercises using the design guidelines.

Chapter 9 (Evaluation and Results) presents the Evaluation Phase of the curriculum CA(L)L materials. Mainstream and learning support teachers and students answered survey questionnaires and took part in focus groups to analyse whether the new materials impacted on their teaching and learning. Results showed that while mainstream teachers and students noted an improvement over previous online materials, the real benefit was the students with learning difficulties such as dyslexia. The resources included multimodal activities and were deemed age- and content-appropriate. A key finding from the evaluation was that learning support teachers were motivated to, and indeed, were successful in creating their own student-centred curriculum-focused CA(L)L materials.

1.6.2 Project Chronology

Table 1.1 shows when each phase of the project was undertaken. I was a learning support teacher in a post-primary school for one year. During this time I carried out the pilot study with students. I began my PhD study in October 2003. The Analysis

Phase was carried out from 2005-2006. This phase includes the ICT questionnaires, initial ICT integration and focus groups. The Design Phase overlapped with the Analysis Phase slightly due to the ICT evaluations and feedback from the focus groups contributing to the Design Phase on an on-going basis. The development of the sample Clicker, Hot Potatoes and Logged Exercises took place in January 2007 with more samples and training for teachers throughout the Implementation Phase. The evaluation of the project results took place in 2007.

	2002		2003		2004		2005		2006		2007		2008		2009		2010		2011		2012	
	Sept-Dec	Jan-June	Oct-Dec	Jan-Dec	Jan-Dec	Jan-Dec	Jan-June	Sept-Dec	Jan-June	Jul-Dec	Jan-Dec	Jan-Dec	Jan-Dec	Jan-Dec	Jan-Dec	Jan-Dec	Jan-Dec	Jan-Dec	Jan-Dec	Jan-Dec	Jan-Dec	Jan-Oct
Learning Support Teaching (Ch1&3)																						
Pilot study (Ch3)																						
Research (Ch2-9)																						
Analysis (Ch3-5)																						
Design (Ch6)																						
Development (Ch7)																						
Implementation (Ch8)																						
Evaluation (Ch9)																						
Write-up																						

Table 1.1: Project Chronology

1.7 Terminology

“Curriculum-focused” in this thesis means materials focused on the prescribed English and History curriculum for the Irish Junior Certificate Programme (JCP 2006). Students are aged 13-15 during the Junior Certificate school years. “CA(L)L materials” refers to the Clicker, Hot Potatoes and Logged Exercises developed within this research. “ICTs” refer to any of the programs used in the project such as the curriculum-focused websites and word processors. “Integrated” means incorporating the resources and materials into the curriculum in a seamless manner. “Second level” means post-primary school where students range from age 12-18 years old. “Needs” presents what a particular student requires to access the curriculum fully. “Diverse students” is used to refer to the various groups of students within this research: mainstream students, dyslexic students, students in learning support and students in resource classes.

This thesis refers to “diverse students” throughout. The term “diverse students” refers to the many types of students that are present in the mainstream inclusive post-primary school. “Post-Primary school” refers to the school that students attend from ages 12/13 to 17/18 years old. “Teachers” refer to all teacher types found in a mainstream school: subject teachers, learning support teachers and resource teachers. “Computer-Assisted Language Learning (CALL) is language-learning software (e.g., web-based, CD, DVD interactive) that has lessons and exercises designed and developed for the particular needs of a target group. CALL is a means of aiding the work done in the classroom by the teacher and can also be a means of independently learning a language.

“Computer-Assisted Learning” (CAL) is used in the broadest sense where some form of ICT is used to aid the teaching and learning process. “Special needs” refers to a group of students with special educational needs. “Subject teachers” refers to teachers who teach a particular subject. “Learning support and resource teachers” refers to teachers who cater for students with learning delays or with a high-incidence disability such as mild general learning disability and dyslexia. They add to the support given by the class teacher. The Computer-Assisted Language Learning design framework (Colpaert 2004) is used for this project even though this project involves first language. “CA(L)L” refers to the use of CALL in a project where the project aim is to help students overcome difficulties in their first language rather than second language acquisition. “CA(L)L tools” means both CALL tools and CAL tools. The terms ‘materials’ and ‘resources’ are used throughout the thesis to refer to both existing materials and materials developed within this project. “Development” refers to the actual creation and testing of the materials. “Implementation” refers to the deployment of the materials in schools.

1.8 Publications

The research carried out within this project resulted in a number of publications:

- Greene, C. (2010) Design Guidelines for Developing Curriculum-Focused ICT Materials for Diverse Students. ICCHP 2010, Vienna University of Technology, Austria. Computers Helping People with Special Needs 12th

International Conference Proceedings. Lecture Notes in Computer Science Volume 6179, 2010, pp. 495-502.

- Greene, C. (2008) The Impact of Information Communication Technologies (ICTs) on Diverse Students and Teachers at Second Level. ICCHP 2008, University of Linz, Austria. Springer Lecture Notes Volume 5105/2008 0302-9743 (Print) 1611-3349 (Online) Springer Berlin / Heidelberg pp. 207-214.
- Greene, C. (2006) Computer-Assisted Language Learning (CALL) for Dyslexic Students. ICCHP 2006, main conference and the Young Researcher's Consortium, University of Linz, Austria. Springer Lecture Notes Volume 4061/2006 ISSN 0302-9743 pp. 793-800.
- Greene, C. (2006) Re-using features of English as a Foreign Language (EFL) materials for special needs students of the same age group. Presented at and published by: DigitalStream Conference Proceedings 2006. University of California, Monterey Bay, CA, USA.
- Greene, C. (2005) Computer Aided Language Learning for Special Education In: Reach, Journal of Special Needs Education in Ireland, 116-123 Vol. 18 No. 2 January 2005. ISSN 0790-8695.
- Greene, C., Keogh, K., Koller, T., Wagner, J., Ward, M. & van Genabith, J. (2004) Using NLP Technology in CALL Symposium organised by the NLP and Speech Technologies in Advanced Language Learning Systems Special Interest Group, Venice, Italy.

1.9 Main Findings

This chapter presented an overview of the research which investigates whether curriculum-focused ICT materials can be integrated successfully into an inclusive classroom to cater for the needs of diverse students including those with dyslexia.

The main findings from the research project described in this thesis are now presented with regard to the research questions stated:

Can a Computer Assisted Language Learning (CALL) research methodology be successfully applied to “first language content” rather than second language?

The research project shows that Colpaert’s CALL RBRO Model can be successfully applied to a project which is not traditionally CALL. A CALL methodology was successfully followed in this project because the project has a strong language focus. The aim of the CA(L)L curriculum-focused materials is to help dyslexic students to overcome difficulties in their first language as opposed to second language acquisition.

Warschauer (1996) termed the phrase “Integrative CALL” which is a perspective which seeks both to integrate various skills (e.g., listening, speaking, reading, and writing) and also integrate technology more fully into the (language) learning process. Integrative CALL principles that specifically helped in the design and development of the CA(L)L materials for first language content and diverse students (including those with dyslexia) in this project include:

- Student/learner-focus
- Meaningful purpose
- Sufficient level of stimulation (cognitively and affectively)
- Multiple modalities (to support various learning styles and strategies)
- High level of interaction (student-computer and teacher-student)

A CALL methodology was successfully applied to this project because CALL is driven by both pedagogy and research. CALL is ideally done by teachers and researchers who are carrying out research in the classroom in a blended learning environment and researchers who are working closely with teachers and students. This focus was important because this research project takes place with all student groups together in an inclusive classroom.

Colpaert’s CALL RBRO Model was useful for this project because it is learner-centric. The Analysis Phase and GLDT grid include a full needs analysis of the

students, teachers, parents and the environment they are in, prior to design and development. This model encourages the researcher to be user-focused and not create materials that are not needed. This concept is very important for this research project because the CA(L)L materials need to be able to adapted for the different needs of the various student groups in an inclusive classroom.

CALL evaluation metrics which are learner-focused contributed to the successful use of a CALL methodology. Chapelle (1991) evaluation metrics state that learning potential should be the main evaluation criterion. She also includes learner fit and meaning focus which are important for this project. The ICT4LT (2005) evaluation metrics focus on feedback to the learner and the level of content. Both Felix (2005) and Hubbard (2005) emphasise that it is very important to include what training is provided for teachers and students. Colpaert's evaluation criteria focus on whether the learner uses the materials as intended and is satisfied with them.

What ICTs are being used by teachers and students and how are they using them?

Chapter 4 (Use of ICT in Two Post-Primary Schools in Ireland) investigated which ICTs were being used in the classroom and at home by mainstream and learning support teachers and students to support the Junior Certificate and Leaving Certificate curriculum.

Three types of ICT were identified from the questionnaires were first introduced in Section 1.6.1:

- General-purpose ICTs (e.g. Word Processors)
- Focused-special needs ICTs (e.g. Read and Write Gold)
- Online curriculum-focused websites (e.g. Teachnet)

The results from Chapter 4 showed that teachers are under-utilising available ICTs. While an average of 80% mainstream students and students with learning difficulties reported using word processors and search engines at home to do their homework only 3% of students said they used them regularly in school.

Teachers were more likely to use ICTs to prepare work for the classroom (e.g. printing materials from the internet) rather than have students use the ICT themselves in the classroom in a blended learning environment. Teachers reported a lack of access to computer labs as a reason for not using ICTs more frequently. These results makes sense in context of the Investing Effectively in ICT 2008-13 Report (DES 2008) which stated the lack of consistent funding for computer labs and resources hinders the uptake and integration of ICT in Irish Education (Section 9.9).

Results from Chapter 4 showed that only 50% of students in learning support had used a focused special needs tool such as Read and Write Gold (2006) or Dragon Naturally Speaking (2006). All of those tools are available on loan from the Department of Education and Skills Education Centres. However, in reality they are difficult to get for a significant amount of time as many schools are looking for them. 50% of learning support teachers reported that they relied of subject-independent tool-technology rather than curriculum-focused materials.

Furthermore, Chapter 4 showed a lack of age- and content-appropriate tools for students with a learning difficulty such as dyslexia. An average of 20% of mainstream students had used online curriculum focused websites at home with much lower levels of use during school time. Students in receipt of learning support reported that they did not use these websites in school and only 3% of them had ever used the websites at home. Similarly, only 3% of learning support teachers reported using these websites. Learning support teachers reported using primary school programs which had the correct language level for students with literacy and learning difficulties however these were generally inappropriate as the content was aimed at much younger children.

Chapter 5 (Initial Deployment of ICT Materials in Two Post-Primary Schools) investigated the 3-month integration of the ICTs identified in the initial ICT questionnaires (Chapter 4). Results from the questionnaires and focus groups point to the fact that mainstream teachers did not use the online curriculum materials as frequently as was indicated in the initial questionnaires. Mainstream teachers reported allowing their diverse students to use the online curriculum websites in the computer lab if it was available. More frequently, the teacher used the sites in the classroom using the teacher computer / projector to illustrate a point.

Both mainstream and learning support teachers reported that the online curriculum materials were not suiting the needs of the students in their classroom who had a literacy or learning difficulty such as dyslexia. The reasons given were that not many resources on the websites were tagged as special needs appropriate and much of the content and presentation style of the mainstream materials was too difficult. 80% of the learning support teachers found the online materials lacked interactivity while 25% reported website crashes and labs not being available. As a result, all learning support teachers discontinued using the online curriculum-focused materials.

100% of mainstream teachers said they used general-purpose ICTs for homework preparation. In the focus groups, teachers explained this was because the students had indicated they used word processors and search engines for their homework in the initial ICT surveys.

Just 10% of learning support teachers found Read and Write Gold and Dragon Dictate helpful for small group sessions. This may point to my focus on “curriculum-focused content” when talking to the teachers. In the focus groups, one teacher said they did not find Dragon Dictate useful as it was subject-independent however she did find it useful for a student dictating a written text which is the purpose of the software.

Can teachers create appropriate CA(L)L materials?

The teachers and students involved in the initial integration of ICTs study (Chapter 5) took part in focus groups to discuss the implementation and to develop design guidelines for curriculum-focused CA(L)L materials that cater to diverse students (including those with dyslexia) in the mainstream classroom.

Chapter 6 (Design of Curriculum-Focused CA(L)L Materials) described how these design guidelines were used to design and develop the CA(L)L Materials. The researcher developed and gave the teachers a sample database of the three types of exercises: Clicker Exercises, Hot Potatoes Exercises and Logged Exercises. The teachers were given training on how to use all three systems. The teachers were shown how to develop their own Clicker and Hot Potatoes exercises. Unfortunately, the

Logged Exercises could not be adapted by the teachers due to the technology used for logging student progress.

80% of mainstream and 100% of learning support teachers were happy to create new Clicker Exercises and apply the design guidelines to the Hot Potatoes Exercises. Students liked Hot Potatoes because the design (60%) and content (90%) were both appropriate to them. The teachers felt the time adapting the Hot Potatoes Exercises with the design guidelines was worthwhile (80%). The feedback from the learning support students indicated that they had a positive experience (80%) with the materials developed by their teachers. Students reported that the level of difficulty was appropriate (90% for mainstream and 90% for learning support) for the learner as the content was developed by their teachers.

Why is there a lack of age-appropriate curriculum-focused materials for students with learning difficulties?

Chapter 3 (Literature Review) showed that students undergo a downwards shift in the level of learning support they receive when they move from primary school to post-primary school. The amount of ICT resources developed for this age group also appears to drop.

Chapter 3 also presents an analysis of Online Curriculum Focused Websites (Scoilnet, TeachNet and Skool) carried out in 2010. These websites use a tag like “Special Needs Resource” to indicate which materials are appropriate for students receiving learning support. Results show that there are very few curriculum materials on the websites marked in this way. These websites create some of their own materials however also rely on teachers to submit their teaching resources. Results from the questionnaires reported on in Chapter 4 and 5 show that no learning support teachers had contributed materials. If this result is an indicator of a trend across Ireland, it could be one reason why there are so few materials. Teachers should be encouraged to share any materials they develop for their classes.

The Chapter 4 results showed that support teachers reported using primary school programs Learning support teachers also preferred to use content-independent tools to

work with students as the content provided by tools out there is not appropriate or is simply unavailable.

How useful (or not) are the materials developed within this project?

Chapter 9 (Evaluation and Results) presented the evaluation of the curriculum-focused CA(L)L materials developed within this research. The evaluation of the Clicker Exercises showed that teachers were motivated to create the design guidelines and to be involved in the design of the materials and the content. One key finding was that teachers used these materials the most as they could use them offline. This was due to internet connectivity problems. Teachers liked the fact that they could allocate exercises to particular students. Students liked that they were involved from the beginning and enjoyed using the Clicker grids to create essays on key topics.

The evaluation of the Hot Potatoes Exercises in Chapter 9 showed that teachers were again happy to be involved in the design of the materials and the content. Teachers liked the fact that they could allocate exercises to particular students based on whether they had particular language issues to overcome or based on their learning style. Students liked that the exercises were age- and content- appropriate, were online and they could do them at home.

The evaluation of the Logged Exercises in Chapter 9 showed that teachers found the materials useful, especially the student logs. Teachers liked the fact they could allocate exercises to their students automatically. Once a student logged in, they received a list of exercises appropriate to them. Students liked that the exercises were online and they could do them at home. One drawback was the teachers would have liked the option to edit the materials themselves like with the Clicker Exercises and the Hot Potatoes Exercises.

Can curriculum-focused CA(L)L materials be integrated successfully into the post-primary school Junior Certificate curriculum to cater to the needs of diverse students?

Chapter 8 (Implementation of Curriculum-Focused CA(L)L Materials) described the CA(L)L integration in the two schools. The Implementation focused on History, Geography and English curricula for the Junior Certificate. The decision to narrow the subjects was due in part to time constraints that surfaced in the initial ICT integration (Chapter 5). Three types of resources were developed for these curricula: Clicker Exercises, Hot Potatoes Exercises and Logged Exercises.

Results from the Clicker evaluation showed that 80% of mainstream and learning support students and 80% of teachers indicated that they had a positive experience with the software. The students liked Hot Potatoes because the design (60%) and content (90%) were appropriate to them. 80% of teachers felt the time adapting the Hot Potatoes Exercises with the design guidelines was worthwhile. The feedback from the students and teachers indicated that they had a positive experience (80%) with the software. 100% of learning support students liked the Logged Exercises because they received more detailed feedback on some of the exercise types. They could also enter paragraph answers which teachers could review later. The students were involved in the design of the exercises. 60% of mainstream teachers and 59% of learning support teachers found that they would have liked to create their own materials to add to the Logged Exercises already there.

This Chapter has set out the aims of the project and a short overview of the findings. Section 1.2 provided background information on the project and the project motivation. Section 1.3 presented the main research question: *Can curriculum-focused ICT materials be integrated successfully into the second level curriculum to cater for the needs of diverse students?* Section 1.4 defined that I mean by Computer Assisted (Language) Learning (CA(L)L). Section 1.5 presented the project objectives, requirements and constraints. Section 1.6 outlined the research methodology and project outline. Section 1.7 clarified some of the main terms used in this dissertation. Section 1.8 listed the research publications resulting from this project. Section 1.9 presented the main findings from this research project with regard to the research questions.

CHAPTER 2: Research Methodology

2.1 Introduction

This chapter describes the methodology adopted in this research project. The CALL literature provides a number of design models and frameworks including Hubbard (1996), Chapelle (1995, 1998, 2001), Levy (1999) and Hémard (1997). While Hubbard (1996) presented a “framework for the description and analysis of methods”, Colpaert (2004) preferred to focus on constructing a design model aimed at research purposes within a software engineering cycle framework. I have decided to instantiate Colpaert’s RBRO design model in my research, as the RBRO model provides stronger focus on design compared to earlier CALL frameworks.

One of the research questions is to investigate whether a CALL research methodology can be applied successfully to first language content and not second language acquisition.

Section 2.2 introduces the standard Analysis, Design, Development, Implementation and Evaluation (ADDIE) (Sommerville 2004) Software Development Model which is otherwise known as the Waterfall Model. Section 2.3 briefly describes Colpaert’s RBRO Design Model. This model is instantiated in an updated ADDIE model which highlights the roles of Technology and Theory. Section 2.4 explains why I chose a CALL research model. Each phase of the model is then described in detail. Section 2.5 outlines the Analysis Phase. Section 2.6 describes the Design Phase. Section 2.7 describes the Development Phase. Section 2.8 describes the Integration Phase. Section 2.9 describes the Evaluation Phase. Section 2.10 summarises and presents the main findings from Chapter 2.

2.2 The Standard ADDIE Model

This section reviews the Analysis, Design, Development, Implementation and Evaluation (ADDIE) (Sommerville 2004) model that is often followed in Software Engineering and that has inspired Colpaert’s RBRO CALL Design Model. The model was first introduced in Figure 1.1. and is reproduced in Figure 2.1.

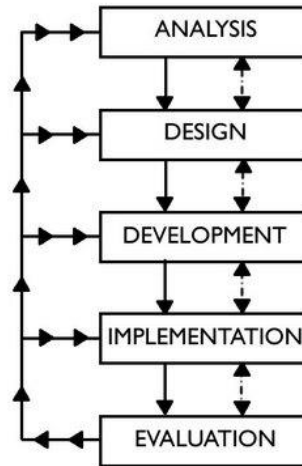


Figure 2.1: The ADDIE Model (Sommerville 2004) (Reproduced from Figure 1.1)

Analysis is the most important step in the process. It helps the researcher to determine the basis for all future decisions. A mistake that many make is not conducting a proper analysis at the beginning. The Analysis stage identifies the audience, limitations or opportunities, or other important points that will be useful in the design process. The Design process is the brainstorming step. This is where the developer uses the information obtained in the Analysis phase to design an object or a process that meets the needs of the target audience. The Design phase can take different forms depending on the project. The Development phase focuses on building the outcome of the Design phase. The Implementation phase includes the deployment of the materials developed in the chosen environment. The Evaluation phase plays an important role in the beginning and at the end of the process. In the project developed in this thesis, the evaluation objectives take into account the objectives and expectations of the learner at the beginning of the project. When looking at the process, the developer must avoid the thought that it is structured in a chronological order. Rather, the ADDIE Model is a continuous circle with overlapping boundaries as represented in Figure 2.2.

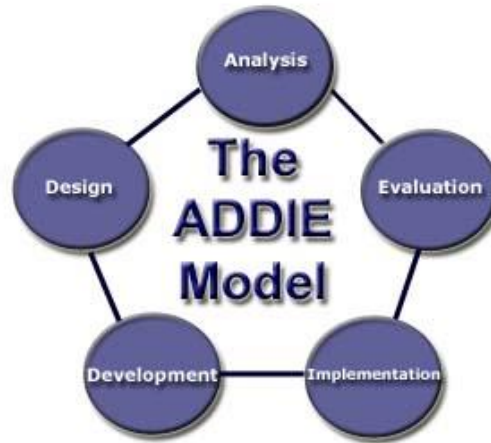


Figure 2.2: The ADDIE Loop Model

2.3 Colpaert's RBRO CALL Design Model

Colpaert (2004) presents a Research-Based Research-Oriented (RBRO) model for Computer-Assisted Language Learning (CALL). Under this paradigm, CALL development is based on previous research findings and aims to contribute to CALL research. Colpaert's version of the ADDIE Model is based on an engineering loop in which the output of each phase serves as input to the next phase e.g. the completed Analysis Phase feeds into the Design Phase. The Design Phase fits into the ADDIE model with the additions of Theory and Technology. One important feature of Colpaert's model is that the Evaluation Phase provides feedback to Technology and Theory. The feedback to Theory is a central component of the model and reflects the objective that a Research-Based Research-Oriented (RBRO) CALL project can and should inform CALL theory. Colpaert's ADDIE Model, also known as the Language Courseware Engineering Loop, is shown in Figure 2.3.

2.4 Selection of Colpaert's Model

As this research project focuses on CA(L)L rather than Computer-Assisted Language Learning (CALL) as in Colpaert's model, why did I choose to use a CALL methodology?

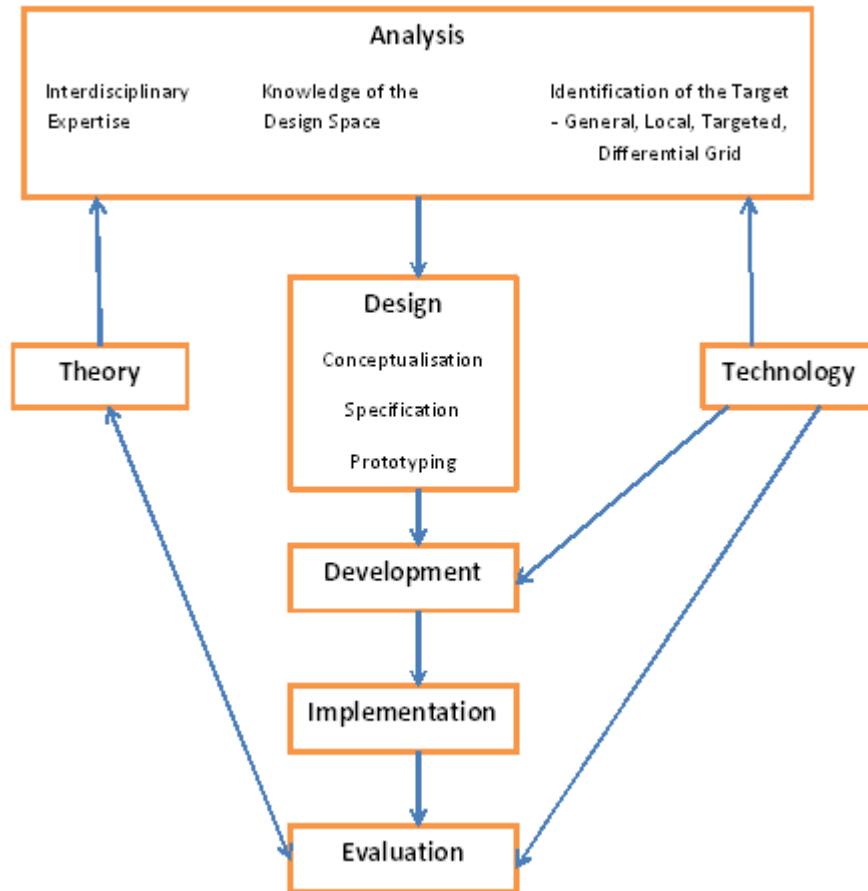


Figure 2.3 Colpaert's (2004) Language Courseware Engineering Loop

Chapter 3 reviews both the CALL and CAL fields with a focus on research relevant to the project described in this thesis. The choice to use a CALL methodology was due to a number of factors:

- This research project has a strong language focus.

The mainstream students and students with learning difficulties are not learning a language as in traditional CALL however many of the dyslexic students involved in the project have difficulties reading and writing in their first language. These difficulties are exacerbated by the fact that traditional classroom teaching methods are mostly text based (books and written homework). This format does not suit dyslexic students because they have a difference in cognition and learning style (Singleton

2000). Dyslexic students prefer other types of content modalities and presentation to text such as videos, mind-maps and pictures. I felt that using CALL techniques would be beneficial to dyslexic students who are having some difficulties with their first language. All of the CA(L)L materials designed (Chapter 6) and developed (Chapter 7) in this project use CALL principles such as keeping text to a minimum, focusing on one concept at a time and design specific to the target audience.

- CALL is driven by both pedagogy and research.

CALL is generally undertaken by researchers who are carrying out research in the classroom in a blended learning environment and researchers who are working closely with teachers and students. This research project takes place with all student groups together in an inclusive classroom. The aim of the project is to develop CA(L)L materials that can be used in the classroom by the teachers and a diverse set of students.

- Colpaert's CALL RBRO Model is learner-centric.

Colpaert's CALL RBRO Model is learner-centric. Colpaert's Analysis Phase takes into account a full needs analysis in the context of the environment the research is taking place in. Colpaert's Analysis Phase guides the researcher to focus on the needs of each stakeholder group involved in the project in a structured way: e.g. students in learning support, mainstream students and teachers. The separation of Analysis from Design is helpful and ensures that the needs are determined before the design process commences. The Analysis Phase is described in the GLDT grid that captures every party involved in the research from the actual learner, to the teachers, parents, schools and invested parties such policy makers. This model encourages the researcher to be user-focused and not create materials that are not needed.

- Colpaert's RBRO Design Model is based in the ADDIE Model.

Another reason I chose Colpaert's RBRO Design Model was because it is based in the ADDIE Model (Sommerville 2004). The ADDIE model is based on one of the standard Software Engineering design models that have been used successfully for many years in the field of software development (e.g. Sommerville, 2004). While development of curriculum-focused materials should not be technology-driven or technology-focused, the structure that the ADDIE model brings to courseware development can contribute to successful materials development. As mentioned above, Colpaert's Analysis Phase guides the researcher to focus on the needs of each stakeholder group involved in the project. The subdivision of the Design Phase into Conceptualisation, Specification and Prototyping is useful in dealing with this potentially complex phase in all types of design.

Although the Colpaert model does not explicitly state it as a separate element, it does refer to the importance of testing and outlines eight stages of testing when developing CALL software. This is a useful contribution for CA(L)L research projects as well as CALL projects.

Colpaert's model makes this feedback loop explicit because the Evaluation Phase provides feedback to Technology and Theory. This is as important for CA(L)L as it is for CALL research. Colpaert's model is based on the lifecycle engineering loop and is informed by previous models. This is important as it avoids one of the criticisms sometimes levelled at CALL and CAL projects, namely that practitioners reinvent the wheel, without undertaking the necessary background research on previous CALL projects to build on findings in the CALL literature to date.

- CALL evaluation metrics are learner-centric.

Chapelle's (1991) evaluation metrics state that learning potential should be the main evaluation criterion. She also includes learner fit and meaning focus which are important for this project. The ICT4LT evaluation metrics focus on feedback to the learner and the level of content. Both Felix (2005) and Hubbard (2005) state it is very important to include what training is provided for teachers and students. Colpaert's

evaluation criteria focus on whether the learner uses the materials as intended and is satisfied with them.

2.5 Analysis Phase

Colpaert's Analysis phase entails gathering all information about all relevant epistemological, empirical, actorial, contextual, technological, feasibility-related, and perceptive aspects, facts, findings, principles, and considerations about the context of the project before starting to design an application or tool. Colpaert's Analysis phase is based on three components: interdisciplinary expertise, knowledge of the design space and identification of the target. These can be expressed in the form of a grid of system requirements called a General, Local, Differential, Targeted (GLDT) grid. This grid captures key players in a CALL research project: learners, teachers, pedagogy, technology, content and other interested parties, and considers their requirements at a general, local, differential and targeted level. This information is used as input to the Design Phase.

2.5.1 GLDT Analysis Grid

The Analysis Phase can be considered as the predesign phase, or the design-input phase. Colpaert's analysis model is based on three components: interdisciplinary expertise, knowledge of the design space, and identification of the target, further detailed below.

Interdisciplinary Expertise

Interdisciplinary expertise captures what developers should know about the relevant disciplines that are involved in the development of a software tool. These include the participant background, topics being studied, pedagogy, CALL, CAL, Software Engineering and design knowledge.

Knowledge of the Design Space

Knowledge of the design space refers to how developers can understand the various components that are involved in the development of learning resources. How can

developers form accurate ideas about the learner, the teacher, other actors, the available infrastructure and the learning situation?

Identification of the Target

Identification of the target asks what can be feasibly changed by using the system and whether the resources exist to implement these changes.

The next step is to translate this description into an operational grid of system requirements (GLDT). This grid is based on four levels of General, Local, Differential, and Targeted requirements:

- General Requirements

General requirements include both higher level and lower level considerations that must be considered in relation to (language) courseware engineering in general, such as generally accepted and valid facts and findings about (language) pedagogy, teachers, learners, content, and technology.

- Local Requirements

Local requirements are circumstances, characteristics, or features which are specific to a particular design space or context and which must be respected as such. The learning situation (infrastructure, location, available content, available technology and media), the (language) method used, common characteristics of learners (and teachers), and the role of other actors should be described in detail.

- Differential Requirements

Differential requirements are parameters which reflect differences within a particular context or design space (e.g., learner type A versus learner type B, teacher type A versus teacher type B, classroom type A versus classroom type B) or expected changes within that context (e.g., operating system, computer infrastructure, teaching method and teacher attitude). All aspects subject to such change should be identified and described.

- Targeted Requirements

Targeted requirements are factors amenable to improvement, aspects that can and should be improved by the system to be developed. Specific reading or writing skills, reducing anxiety and dyslexia are obvious examples, however possible improvements concerning teachers, (language) pedagogy, technology, content, and related actors should also be taken into account. It is the precise delineation of these factors that will lead to the system focus.

When the Analysis phrase is completed, each cell in the GLDT grid (shown in Table 2.1) should be completed.

	General	Local	Differential	Targeted
Learner				
Teacher				
Pedagogy				
Technology				
Content				
Other actors				

Table 2.1 Colpaert's GLDT Grid

Colpaert (2004) provides guidance questions to help the researcher fill out the grid. For each row in the GLDT Grid these are briefly discussed below.

2.5.1.1 Learner

This section of the grid focuses on the learner component of the Analysis Phase. The guidance questions for each level are:

- G: What are generally accepted findings and principles for learners?
- L: What are common characteristics of the learners in this particular design space?
- D: Which distinctions must be made within this design space, or which elements are subject to change?

- T: Which characteristics are amenable to improvement (e.g. vocabulary, topics, skills)?

The General level deals with accepted knowledge about (language) learners, regardless of the particular context. The Local level reviews characteristics of learners in the particular design space or context under consideration. The Differential level considers what elements are different within this context and which elements can be changed. The Targeted level asks what aspects can be improved within this particular differential design space.

2.5.1.2 Teachers

This section of the grid considers the requirements of (language) teachers. The guidance questions for each level are:

- G: What findings and principles are generally accepted for teachers?
- L: What are common characteristics of teachers in the design space?
- D: Which distinctions must be made within this design space, or which elements are subject to change?
- T: Which characteristics are amenable to improvement?

The General requirements include accepted findings and principles for language teachers, regardless of the particular (language) context in which they teach. The Local requirements focus on the particular requirements of the selected design space. The Differential requirements ask what can be different within this design space, while the Targeted requirements look at those aspects of the design space that are open to improvement.

2.5.1.3 Pedagogy

The Pedagogy component of the GLDT grid focuses on the pedagogical issues involved in (language) courseware development. The guidance questions for each level are:

- G: What are generally accepted findings and principles for learning and teaching?
- L: Which learning/teaching method is currently being used within the design space?
- D: Which distinctions must be made within this design space, or which elements are subject to change?
- T: Which aspects are amenable to improvement?

The General level captures the accepted pedagogical findings for (language) learning and teaching, while the Local level looks at the methods currently being used in the design space. The Differential level considers what elements are different within this space. The Targeted level asks which aspects of pedagogy could be improved.

2.5.1.4 Technology

The Technology component considers all aspects relating to technology and includes both hardware and software issues. The guidance questions for each level are:

- G: What does a SWOT analysis of technology in learning show? What does a SWOT evaluation determine about existing comparable courseware?
- L: What infrastructure and equipment are available in the design space? What courseware has been used before?
- D: Which distinctions have to be made within the design space or what is subject to change (e.g. operating systems, network types, processor type, software versions)?
- T: Which aspects are amenable to improvement (e.g., less network traffic, faster execution)?

The General level reviews a Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis of technology in (language) learning. The Local level reviews what technology is available in the design space and what (language) courseware has been used previously. The Differential level investigates the technology characteristics which are distinct within the design space and what can be changed. The Targeted level identifies those aspects that can be improved within the use of technology.

2.5.1.5 Content

The Content component focuses on questions relating to actual courseware content.

The guidance questions for each level are:

- G: What content is available worldwide?
- L: What kind of content is being used in this design space (e.g. textbook, syllabus)?
- D: Which distinctions must be made within this design space, or which elements are subject to change?
- T: Which aspects are amenable to improvement?

The General level reviews what content is available at a worldwide level, while the Local level identifies what kind of content is currently being used in the design space. The Differential level considers what elements can vary or are subject to change within this design space. The Targeted level identifies those areas that can be improved.

2.5.1.6 Other Actors (e.g. Content Providers, Native Speakers, Parents, Training Managers, Software Providers, Policy Makers)

The Other Actors component of the GLDT considers the requirements of the other stakeholders in the language courseware development process. These include, however are not limited to, content providers, native speakers, parents, training managers, software providers and policy makers. The guidance questions for each level are:

- G: What is their generally accepted overall role during implementation, use, and evaluation?
- L: What is their presence and role in the design space?
- D: Which types of actor can be distinguished and which actor characteristics are subject to change?
- T: What is amenable to improvement (e.g. teacher guidance, parent control, mediated communication with native speakers)?

The General level identifies the usual role of these actors in the deployment, use and evaluation of language learning courseware. The Local level considers their role within the particular design space of the project. The Differential level asks which types of actor can be identified within the design space and what characteristics can be changed. The Targeted level reviews what aspects pertaining to those actors can be improved.

2.5.2 The Analysis Phase for this Project as Presented in this Thesis

Table 2.2 shows the ADDIE model mapped to the various stages of the project with the associated timeline.

Phase of Project	2005	2006		2007	
	Jan-Dec	Jan-June	Sept-Dec	Jan-June	Jul-Dec
Analysis					
Literature review (Ch3)					
Initial ICT surveys & Focus Groups (Ch4)					
Initial ICT Integration (Ch5)					
Surveys & Design Guideline Focus Groups (Ch5)					
Design					
Design of materials with teachers (Ch6)					
Development					
Development of sample materials (Ch7)					
Implementation					
Deployment in School A & B (Ch8)					
Evaluation					
Surveys & Focus Groups (Ch9)					

Table 2.2 ADDIE Model mapped to the stages of the project

Table 2.3 shows the various stages of the project mapped to the methods used.

Stage	Method used	Comment
ANALYSIS PHASE		
Literature review (Ch3)	GLTD Grid (Colpaert 2004)	All findings feed into the Design Phase.
ICT Survey (Ch4)	Survey design (Converse & Presser 1986) British Dyslexia Association's Style Guide (2006)	Guidelines such as using thick paper followed and question design.
Focus Groups (Ch4)	Focus group design (Temkin 2009)	Feedback on ICT use.
Initial ICT integration (Ch5)	Observation (Ragin 2004)	Feedback on actual use of ICTs.
Survey (Ch5)	Survey design (Converse & Presser 1986) British Dyslexia Association's Style Guide	Feedback on actual use of ICTs.
DESIGN, DEVELOPMENT AND IMPLEMENTATION PHASES		
Focus Groups (Ch5)	Focus group design (Temkin 2009)	Design guidelines developed.
Meetings with teachers (Ch6 and Ch7)	Description of project.	Follow up meetings with individual teachers also.
Curriculum-focused integration (Ch8)	Observation (Ragin 2004)	Feedback on use of tools developed and integration.
Survey (Ch9)	Survey design (Converse & Presser 1986)	Further feedback on tools.
Focus Groups (Ch9)	Focus group design (Temkin 2009)	Evaluation.

Table 2.3 Stages mapped to Methods used

The Analysis Phase for this project is described in Chapter 3 (Literature Review), Chapter 4 (Use of ICT in Two Post-Primary Schools) and Chapter 5 (Initial Deployment of ICT Materials in Two Post-Primary Schools).

Chapter 3 contains the literature review. The literature review brings together much of the information collected for the Analysis Phase. Important information gathered such as the background of the students involved in the project, Computer-Assisted (Language) Learning, special education in Ireland and related research all contributed to the interdisciplinary expertise and the identification of the target sections of the Analysis Phase. All of these factors fed into the Design Phase because it was important to know as much as possible about the potential users, teachers and their environment before designing anything for them to use.

Chapter 4 outlined the surveys undertaken in the two selected post-primary schools to find out what ICTs students and teachers were using. This work contributed to the knowledge of the design space. Key information vital for the design phase such as which online materials they used, available infrastructure and teaching methods were garnered during this stage of the project.

Chapter 5 outlined the initial integration of ICT in the two schools. This integration provided information on how the students and teachers interacted with the selected ICTs and how this affected their learning environment. This work contributed to both the knowledge of the design space and the identification of the target. This pilot study was an excellent opportunity to observe the classes ahead of the next integration. Questionnaires and focus groups to create design guidelines were carried out that delineated how the curriculum materials should be designed.

All of the outputs of the Analysis Phase are represented as a GLDT Grid at the end of Chapter 5. All outputs fed into the Design Phase (described further in Chapter 6).

2.6 Design Phase

The Design Phase takes the requirements outlined in the Analysis Phase and produces a Design plan that feeds into the Development Phase. The Design Phase is comprised of three stages: Conceptualisation, Specification and Prototyping.

Conceptualisation is a combination of concept development and the application of usefulness criteria. Concept development involves the identification of personas (learner-types from the Analysis Phase), the hypothesisation of practical goals, the formulation of scenarios as to how a user will use the system, and the description of system tasks. Personas are users with common goals that have been identified in the Analysis Phase. Colpaert lists four usefulness criteria: usability (is it usable by the target users), usage (actual vs. intended use), user satisfaction and didactic efficiency.

Conceptualisation feeds into Specification. Specification describes (a) the back-end - the system structure in terms of components and their interaction and (b) the front-end - the user interface with screen design, menu systems, and navigation.

The purpose of prototyping is to test discrete functionalities, to evaluate to what extent available technologies allow developers to realise functionalities, and to what extent dedicated technologies should be developed. Prototyping is carried out only on those components that developers are unsure about and want to test the feasibility of certain technological aspects. Prototyping involves testing sections and versions of the software on a number of different users: fellow developers, teachers and finally when the product is ready, the students, for the Implementation and Evaluation Phase.

Colpaert argues that the Design phase should be (largely) technology independent and involve rapid prototyping. The Design Phase as carried out in the research reported in this thesis is described in Chapter 6 (Design of Curriculum-Focused CA(L)L Materials). This phase included applying the design guidelines and working closely with teachers and students to create relevant and useful curriculum materials. These materials were then tested via prototypes before being made available.

2.7 Development Phase

The Development Phase implements the plan produced in the Design Phase and includes coding and testing. This phase is technology dependent and will vary for each project. Colpaert outlined eight stages of testing that were carried out in the development of the DIDASCALIA courseware (Colpaert, 2004). They are pre-testing, routing testing, content implementation testing, operational testing (debugging by external users), content testing, beta-testing, real world testing and research evaluation. While Colpaert does not go into detail about each test stage, it is useful having it clearly stated as part of development, as testing is generally scantily reported in CALL literature. The Development Phase for this project is described in Chapter 7 (Development of Curriculum-Focused CA(L)L Materials). This work included the coding and testing of the Logged Materials and the development of the Clicker and Hot Potatoes exercises. All materials were tested with a smaller group from the focus groups before being shared with the wider participant group.

2.8 Implementation Phase

The Implementation Phase refers to the actual deployment of the developed system in the target learning and teaching environment. This phase describes the environment the software is being introduced into, e.g. types of school, classroom vs. computer labs. This phase describes how the participants are using the software. The Implementation Phase as undertaken in the research reported in this thesis is described in Chapter 8 (Implementation of Curriculum-Focused CA(L)L Materials). The implementation in the two selected schools mostly took place in labs rather than classrooms due to computer availability.

2.9 Evaluation Phase

Colpaert's Evaluation Phase is mainly summative evaluation which feeds into a working hypothesis for the next development. Colpaert prefers iterative implementations and summative evaluations over formative evaluations (which

usually take place using iterative user prototyping), as using this model, development costs are reduced to a minimum.

Further summative evaluation can be seen in Chapelle (2001) where she advocates the use of six principles in evaluating CALL software. In order to adjust them to the CA(L)L scenario described in this thesis (History, Geography and English curricula materials aimed at an inclusive environment of mainstream students, dyslexic students and students with other learning difficulties), I have adapted these to focus on ‘content’ rather than ‘language’:

- Learning potential: the degree of opportunity present for beneficial focus on form.
- Learner fit: the amount of opportunity for engagement with the content under appropriate conditions given learner characteristics.
- Meaning focus: the extent to which learners’ attention is directed toward the meaning of the content.
- Authenticity: the degree of correspondence between the CA(L)L activity and target content activities of interest to learners out of the classroom.
- Positive impact: the positive effects of the CA(L)L activity on those who participate in it.
- Practicality: the adequacy of resources to support the use of CA(L)L activity.

The Evaluation Phase for this project is described in Chapter 9 (Evaluation and Results). The materials are evaluation in a number of ways including from a software engineering point of view.

2.10 Conclusion

To conclude, one of the research questions of this project is to investigate whether a CALL research methodology can be applied successfully to first language content and not second language acquisition. This chapter introduces the Colpaert’s RBRO Design Model which is the CALL research methodology adopted in this research project. The model is instantiated by the ADDIE Model.

Colpaert's CALL RBRO Design Model was chosen because:

- This research project has a strong language focus.
- CALL is driven by both pedagogy and research.
- Colpaert's CALL RBRO Model is learner-centric.
- Colpaert's RBRO Design Model is based in the ADDIE Model.
- CALL evaluation metrics are learner-centric.

CHAPTER 3: Literature Review

3.1 Introduction

This chapter presents a literature review of the main areas involved in this research: special education and ICT within the Irish education system and specific learning difficulties. A review of Computer Assisted Language Learning (CALL) and Computer Assisted Learning (CAL) is then presented along with research relevant to the project described in this thesis.

To illustrate the context and original motivation for the research described in this thesis, Section 3.2 gives a short overview of the pilot study I carried out during my time as a learning support teacher. Section 3.3 demonstrates how the findings of this chapter contribute to the Analysis Phase of the adopted research methodology (Colpaert 2004). Section 3.4 presents an overview of special education in the Irish education system. Specific Learning Difficulties (SLDs) are detailed in Section 3.5 with a focus on dyslexia and the associated characteristics. Dyslexia is focused on because this is the student group that lacks appropriate learning / curriculum materials in the post-primary school environment. Section 3.6 gives a brief history of Computer-Assisted Language Learning (CALL). Section 3.7 presents an overview of Computer Assisted Learning (CAL). Section 3.8 presents a review of relevant CA(L)L research projects. Section 3.9 gives an overview of online curriculum-focused materials. Section 3.10 provides an overview of current ICT policy within the Irish education system. The findings from this chapter that feed into the Design Phase (Colpaert 2004) are summarised in Section 3.11.

3.2 Pilot Study

During my time as a learning support teacher in a post-primary school in Ireland (2002-3), I became aware of the lack of ICT resources for teenagers with learning difficulties. My role was to cover curriculum topics in advance that the students would cover later in their mainstream classroom. I had access to the school's store of ICT resources. Most of these resources were aimed at primary school age students. These ICT programs or word processing tools were used for most general literacy work.

With my background in developing a CALL tool for learning of beginners French and German in a primary school blended-learning environment (Greene & Keogh 2002) I decided to carry out a small pilot project with five students in learning support. I carried out a questionnaire on their ICT use and developed some Hot Potatoes (2003) exercises for curriculum units. The curriculum materials were useful to the students and helped me, as the teacher, explain concepts with videos and pictures and every day examples, instead of just text. I also found that the students were covering the curriculum quickly with me ahead of their mainstream class and were motivated to use the ICT with me (Dörnyei 1998). I became interested in developing a project like this on a bigger scale to investigate if it was possible for more materials to be created and whether mainstream teachers could create their own materials to do this. In order to take this further, a literature review on the subject was required.

3.3 Methodology: Analysis

This literature review was carried out as part of the Analysis Phase of Colpaert's Design Model (Colpaert 2004).

Colpaert's Analysis phase requires all relevant information and findings to be gathered before starting to design an application or tool. For this research project which investigates whether integrating ICT makes the curriculum more accessible for all, there are many areas that need to be investigated prior to working with schools. The main areas looked at in this literature review are:

- Special Education within the Irish Education System
- Specific Learning Difficulties
- Computer-Assisted (Language) Learning (CA(L)L)
- Current online-curriculum focused materials
- CA(L)L research in related areas
- ICT in Education Policy

3.4 Special Education within the Irish Education System: Setting the Scene

This research project takes place in two Irish post-primary schools. In order to better understand the school environment this section reviews special education provision in the Irish classroom.

The Organisation for Economic Co-Operation and Development report (OECD 2010) suggests that in 2007 Ireland was spending 4.7% of its Gross Domestic Product (GDP) on education. The OECD average for that year was 5.7%. This placed Ireland 30th out of 33 countries for the amount of overall wealth invested in education in 2007. In 2007, Ireland spent 1.2% of GDP on third-level while the OECD average was 1.5%. The study also revealed that average annual expenditure on a post-primary school student is 30 per cent higher than at primary level. The Association of Secondary Teachers Ireland (ASTI) described the level of investment in education in Ireland as deeply depressing (ASTI 2010). Cuts such as these, even during Ireland's "boom time", had a direct effect on special education provision in Ireland with the number of special needs assistants and learning support teachers being cut across primary and post-primary school. In the latest OECD report (2012), Ireland has increased its education spend to 6.3% (ahead of the average 6.2%). However, with population numbers on the rise, funding is being allocated to new school buildings. The National Council for Special Education (NCSE 2012) announced that resource teaching time for children with learning difficulties is being reduced by 15 minutes per week, which is a reduction of 5 per cent. This comes on top of a 10 per cent cutback in 2011, meaning special needs pupils will have lost 45 minutes of learning support since the 2010-2011 academic year. The number of resource teacher and learning-support posts the government can allocate to primary schools was capped at 9,950 in December 2010 to meet the terms of the EU-IMF bailout. The NCSE announced that there will be no further cuts in the number of special needs assistants, which was capped at 10,575 in 2011. The NCSE also announced that a major strategic review of special educational supports in schools has been underway since earlier this year at the request of the Minister for Education and Skills and they will report to the minister in 2013.

These cuts in special needs provision are significant when one concludes that ten percent of people in Ireland have some form of dyslexia and a further significant

percentage has other reading, writing or learning difficulties (DES 2010a). Some parents may have realised that they have a dyslexic child before the child goes to school. Indicators can be a difficulty pronouncing words, reversing or substituting parts of words, disorganisation, trouble repeating nursery rhymes, spelling a word different ways, not hearing fine differences in words e.g. 'pin' for 'pen' and sequential difficulties such as reciting the alphabet. Parents may also notice that the child is otherwise very bright and can express themselves very well orally. The next section summarises how special needs provision is allocated in primary and post-primary education.

3.4.1 Primary School vs. Post-Primary School Allocation

Primary education in Ireland lasts from approximately age five to age twelve. For dyslexic students the teacher/parent may notice that the child is having problems with the teaching methods for reading. A meeting is usually set up between the teacher and parents to discuss an assessment. Parents can either pay for a private assessment with an educational psychologist or access the National Educational Psychology Service (NEPS 2012) through the Department of Education. If dyslexia is diagnosed the child is likely to be eligible for an exemption from Irish language classes if they have an average IQ (92 or higher), and their reading skills fall into the lowest 10th percentile of all students (Skooool.ie 2012). If the student is exempt from Irish they may be taken out of class for learning support during this time.

Children with special educational needs may be in ordinary classes in mainstream primary schools or in special classes in these schools. They may get help from learning support and resource teachers and from Special Needs Assistants (SNAs).

Depending on the severity of the dyslexia or learning difficulty, some children may be eligible to attend special reading tuition schools. Special reading schools are full-time primary schools, provided by the Department of Education and Science free of charge. The regular school curriculum is followed, with the exception of Irish. The current Pupil-Teacher ratio is 9:1 in these classes (Citizens Advice, 2012). This has been reduced from 11:1 in 2005. Children usually attend for one to two years only and then return to their regular primary school.

A number of primary schools now have 'reading units' where the focus is on phonics, where one or more classes are devoted to students with specific reading difficulties. Where these are not available, students with reading difficulties are taken out of classes by resource or learning support teachers. There are 9,950 teachers working directly with children with special educational needs in the primary school system. Schools may be able to get funding from the National Council for Special Education (NCSE) to buy special equipment to help children with special needs.

A learning support teacher service is generally available to all primary schools and the National Council for Curriculum and Assessment (NCCA 2010) has produced Learning Support Guidelines for children with mild, moderate and severe learning difficulties. The guidelines are published as a digital-pack containing a CD-ROM and an accompanying 32-page overview booklet. The CD-ROM contains 44 eBooks, along with a general introduction that looks at some of the wider issues that affect the teaching and learning of students with general learning disabilities. These guidelines provide strategies for overcoming particular difficulties. They also include the procedures for identifying and selecting children who might be having difficulty with the curriculum and who need supplemental teaching. It is the learning support teachers who provide this extra teaching.

Further psychological assessment does not occur until the learning support teacher and the class teacher have tried to address the child's problems. Children who continue to have difficulty coping with the curriculum can be psychologically assessed by NEPS and may be eligible for resource teacher support. The Department of Education has issued a circular, Sp. Ed 02/05 (DES 2005) which sets out in detail how teaching resources for children who need additional support in mainstream primary schools are organised. This has been supplemented by circular 0036/2006 (DES 2006) and circular 0048/2008 (DES 2008).

Primary schools get a general allocation to meet the needs of children with "high incidence" special needs (NDA 2012). This includes dyslexia and learning support needs. The school must make an individual application for resource teaching hours for children with 'low incidence' special needs, such as hearing impairment, visual impairment and autistic spectrum disorders. This application is made to the National Council for Special Education (NCSE) which has about 80 Special Educational Needs

Organisers (SENOs) based all around the country. The NCSE has issued Guidelines for Primary Schools and Special Schools in Processing Applications for Resources for Pupils with Special Educational Needs (NCSE 2009).

Learning support/resource teachers are appointed to provide support under the general allocation arrangements. Resource teachers provide individual support to pupils with low incidence disabilities. The circulars set out the rules for the qualifications and recruitment of such teachers.

There is a general allocation of additional teaching resources to help schools to make suitable provision for:

- pupils who are eligible for learning-support teaching
- pupils with learning difficulties
- pupils who have special educational needs arising from high incidence disabilities (borderline-mild general learning disability and specific learning disability).

Learning difficulties include pupils with mild speech and language difficulties, mild social or emotional difficulties and mild co-ordination or attention control difficulties associated with identified conditions such as dyspraxia (impairment or immaturity of movement), attention deficit disorder (ADD), and attention deficit hyperactivity disorder (ADHD). Pupils with these conditions who have been assessed as being in the low incidence category get individual support.

Each school decides how the resources for high incidence support are used and how they are divided among the students who need such support. The additional teaching may be provided in the classroom or in small separate groups. Some pupils may need additional one-to-one teaching for a specified period.

Special classes for pupils with specific speech and language disorders are attached to mainstream primary schools. Pupils who meet specific criteria may be eligible for such classes. Schools may apply to the Special Educational Needs Organiser (SENO) to establish these classes. Schools must have at least 5 eligible pupils in order to retain a class. A full-time teacher is assigned to each special class and the average pupil/teacher ratio is 7:1. Eligible pupils may spend up to 2 years in a special class. An

enhanced capitation grant is paid in respect of each pupil enrolled in these classes. The Health Service Executive (HSE) funds the provision of speech and language therapy services for the children attending these classes. If a school has such a class and there are places to spare, these places may be offered to a maximum of 2 pupils who do not meet the eligibility criteria however who could benefit from enrolment in the class. This must be supported by the recommendation of a speech and language therapist and/or a psychologist.

Pupils who meet the criteria for classes however for whom a special class is not available, qualify for additional teaching support. Pupils with mild speech and language difficulties may qualify for teaching support from the school's general allocation of teaching resources. Special needs assistants (SNAs) work with children who need extra non-teaching support perhaps because of a physical disability or behavioural difficulties.

Once a child moves from primary to post-primary school there is less special needs support available to them. The National Council for Special Education (NCSE 2012) announced another 5% cut in resource hours for students. There is a need for resources for post-primary schools students with dyslexia to make up for this gap that has formed. Table 3.1 outlines the differences in primary and post-primary school special education allocation for dyslexic students.

Parents have to pay or wait for a new assessment if they want their child exempted from Irish in post-primary school. Private assessment costs 350 Euro. Many parents cannot afford private assessment and so must wait for the National Educational Psychology Service (NEPS). Meanwhile, the student will be in mainstream classes without any learning support. Once the student has been assessed and learning difficulty has been identified, the student will be taken out of class for learning support where the student works on reading and writing skills. Teenagers who have dyslexia may have had phonics training in the early years of primary school, learning support in reading units, or extra tuition for their learning needs outside of school hours e.g. with the Dyslexia Association of Ireland.

Difference	Primary	Post-Primary
Age	5-12	12-18
Access to assessment	Consultation with teacher NEPS service or private assessment	New assessment needed on entering post-primary school. Up to two year wait for the NEPS service.
Resource hours	5% cut in 2010	8% cut in 2010
Structure of day	One main teacher in the same classroom. Access to special needs assistant.	Student moves to different classrooms & teachers. Access to SNA reduced.
ICT resources	Special education ICT tools aimed at primary school children.	Many primary school ICT tools are used for dyslexic post-primary school students due to the language level. The content is not appropriate however.

Table 3.1 Primary School versus Post-Primary School Allocation

However, the school-based support does not necessarily continue on to post-primary school. Dyslexic students need a secure organised learning environment, which primary school for the most part provides: one teacher all day, the same peers, daily recurrence of the same subjects in the same order, learning support at the same time every day. In post-primary school, the student moves from class to class all day, experiences differing teaching styles of approximately nine teachers, has a much larger student group to interact with and may be taken out of classes for learning support. Dyslexic students can miss out on important elements of a subject curriculum they need for exams. There may be a stigma attached to attending learning support classes and the student can lose self-confidence and motivation.

Post-Primary school students with special educational needs may attend a mainstream post-primary school. They may be in ordinary classes with the support of a learning support/resource teacher and/or a special needs assistant or may be in a special

class. Over 2,300 full-time equivalent teachers support students with special educational needs in post-primary school schools with 534 of these being learning support teachers. School management and teachers in post-primary schools can access Inclusion of Students with Special Educational Needs Post-Primary Guidelines on the website of the Department of Education and Skills (DES 2010b).

The following support services are available for students with disabilities and special educational needs attending post-primary schools:

- Resource teaching
- Special needs assistants
- Equipment grants

Resource teachers are allocated by the National Council for Special Education (NCSE) with an 8% cut in 2012.

Post-Primary school pupils with dyslexia are normally integrated into ordinary classes. In such situations, they may receive additional tutorial support from the learning support teacher, guidance counsellor and subject teachers.

There are special classes for students with special educational needs attached to a number of post-primary schools. These classes usually cater for the learning needs of students with a mild or moderate level of learning disability.

There are special schools throughout the country for students with general learning disabilities. These schools provide education for students from 5 to 18 years who have a general learning disability at a mild or moderate level.

Students usually take the Junior Certificate and Leaving Certificate examinations. Students with specific disabilities may be exempt from part of the examination in a particular subject. In such cases, the certificates awarded may note that the student has not sat an element of the examination. The annotation is made where a core area of a subject is not assessed, or where the mode of assessment used has the same effect. For example, students with dyslexia may have spelling and grammar waivers in language subjects and their certificates would note this. The Equality Tribunal has ruled that this annotation is contrary to the Equality Acts. The Equality Authority appealed the

decision in 2010 however it was rejected. Therefore annotations are still present on the leaving certificate of students who had spelling and grammar waivers.

This distinct drop in support that post-primary school students experience needs to be addressed. The development of extra ICT and CA(L)L resources for this group could help to address some of the support that they are missing since primary school.

3.5 Dyslexia

There is a large drop of resource hours and special need assistance when students move from primary school to post-primary school. This thesis focuses on dyslexic students due to the general lack of resources available to students with special needs in post-primary school. This decision was cemented after discussions with the Dyslexia Association of Ireland (DAI) who also pointed out that language- and writing- heavy subjects (English, History, Geography) were the most challenging for dyslexic students.

The pilot study (Section 3.2) indicated that the group of dyslexic students I was working with benefitted from the Hot Potatoes exercises developed. This section now outlines the main types of dyslexia and their related characteristics as this information is essential for developing curriculum-focused materials for this group.

It is not easy to define dyslexia and there is no universally agreed definition of dyslexia in pedagogy, psychology, neurology or education. The word dyslexia is derived from the Greek "dys" (meaning poor or inadequate) and "lexis" (words or language). The word dyslexia therefore means 'difficulty with words'. Dyslexia manifests itself as a difficulty in reading, in writing and spelling and expressing ones thoughts on paper. It can affect memory and concentration, and sometimes maths, music, foreign languages and self-organisation.

The Report of the Task Force on Dyslexia (SESS 2001) defines dyslexia in the following way:

“Dyslexia is manifested in a continuum of specific learning difficulties related to the acquisition of basic skills in reading, spelling and/or writing, such difficulties being

unexplained in relation to an individual's other abilities and educational experiences. Dyslexia can be described at the neurological, cognitive and behavioural levels. It is typically characterised by inefficient information processing, including difficulties in phonological processing, working memory, rapid naming and automaticity of basic skills. Difficulties in organisation, sequencing and motor skills may also be present.”

The Dyslexia Association of Ireland (DAI) state that developmental dyslexia is inherited, only slightly more common in males than females and that one is born with it. It would seem that people with dyslexia share a cluster of genes, which may, it is believed, account for the variations in the nature and extent of specific learning difficulties.

There are no official figures for dyslexia prevalence in Ireland however studies internationally would suggest that approximately 8-10% of the population are likely to be affected (DAI 2012). There has been a lot of research in recent years on the cause of dyslexia (Slaughter 2001, O'Brien B.A. et al. 2012).

Experts are not agreed, however, on the underlying causes of dyslexia. The prevalent research (Slaughter 2001) considers that a phonological deficit is the root cause of dyslexia. Evidence from brain imaging suggests that people with dyslexia do not activate the left hemisphere (the language side) in the brain as much when reading as non-dyslexic readers, and that there is less engagement of the areas of the brain which match letters with sounds (Serafini et al. 2000).

3.5.1 How Dyslexia is Diagnosed

Educational Psychologists in Ireland (NEPS) administer the Wechsler Intelligence Scale for Children-III Test (WISC-III) to assess a student for dyslexia and other specific reading disorders. This is a battery of tests for 6 to 17 year olds that evaluate intellectual abilities. The WISC-III consists of two scales, the Verbal Scale and the Performance Scale. Each of these scales has several subtests (see Figure 3.2).

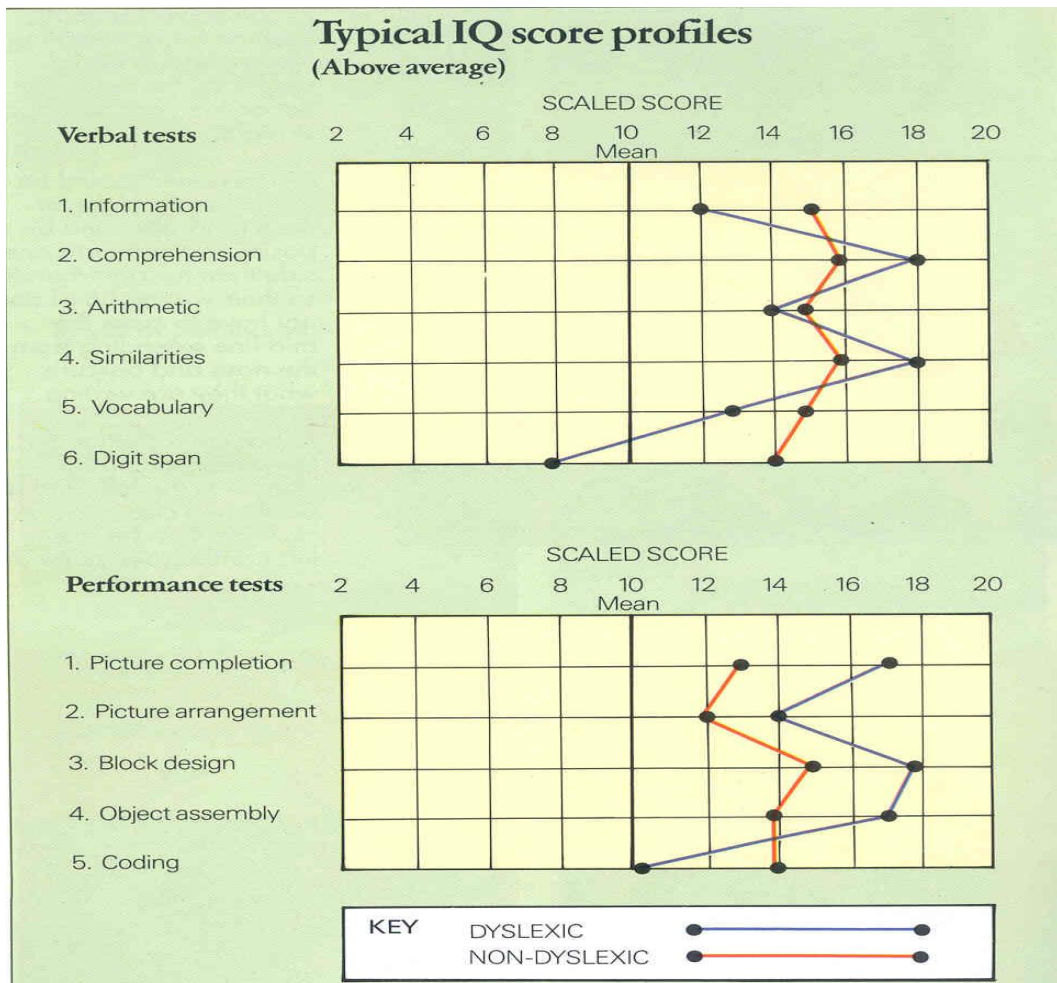


Figure 3.1 Typical IQ Score Profiles - Hornsby (1995)

Figure 3.1 above shows the average scores of dyslexic people and non-dyslexic people on the Verbal and Performance tests, which make up the WISC-III. Each group has its own typical profile, which is shown by the shapes of the interconnecting lines. Very significant clues for the diagnosis of dyslexia are the low scores in the Digit Span and Coding tests. These indicate a lack of short term memory for abstract symbols (letters), shapes and numbers (Hornsby 1995).

3.5.2 Neurological Bases of Dyslexia

The neurological basis of dyslexia is now well established and reflected in current definitions of the condition. It is somewhat less clear which neurological disorders contribute to dyslexia and a number of factors are considered in the research literature.

The International Dyslexia Association 2012 describes dyslexia as a neurologically-based condition:

"Dyslexia is a neurologically-based, often familial disorder which interferes with the acquisition of language. Varying in the degrees of severity, it is manifested by difficulties in receptive and expressive language, including phonological processing, in reading, writing, spelling, handwriting and sometimes arithmetic. Dyslexia is not the result of lack of motivation, sensory impairment, inadequate instructional or environmental opportunities, however may occur together with these conditions. Although dyslexia is a lifelong condition, individuals with dyslexia frequently respond successfully to timely and appropriate intervention"

This definition highlights the neurological basis of dyslexia along with the fact that research (Dyslexia Research Trust 2005) indicates that dyslexia tends to run in families. According to Hornsby (1995:157) 88 percent of dyslexic people have close family with the condition. The biology of dyslexia has been investigated in a range of studies that have confirmed a difference in brain anatomy, organisation and functioning. Dyslexia is said to be commoner in people who have weakly established lateralisation and are neither strongly right or left handed (Dyslexia Research Trust, 2005). Brain imaging techniques, as well as encephalographic recording of the electrical activity of the brain, and even post-mortem examination, all reveal a range of functional and structural cerebral anomalies in persons with dyslexia (Habib 2000).

Slaughter (2001) argues that a phonological deficit is the root cause of dyslexia. In broad terms, for most people, the left hemisphere is the verbal, logical and controlling half, while the right hemisphere is the non-verbal, practical, intuitive side. The main language areas are situated in the left half of the brain however there is a small language area in the right hand side of the brain. Evidence from brain imaging suggests that people with dyslexia do not activate the left hemisphere in the brain as much when reading as non-dyslexic readers, and that there is less engagement of the areas of the brain, which match letters with sounds (Serafini et al. 2000)¹. Galaburda and Kemper (1979) found unusual arrangements of cells in a dyslexic man who died in his twenties, which suggested that the language areas were distributed more equally

¹ Note: At the same time, even though dyslexic people use less of the left hemisphere of the brain when processing language, they use more overall brain area (Richards et al 1999).

than usual on either side of the brain. As dyslexics use both sides of their brain for language tasks (Habib, 2000), this may cause a confusing traffic jam of nerve signals to build up in the connection between the two halves of the brain, the corpus callosum, which could hamper a dyslexic's understanding and expression of verbal or written speech (Hornsby 1995 p. 161).

Yet another view (Nicolson et al. 1999) is that the role of the part of the brain, which controls balance (the cerebellum) is crucial and that differences in this area make it difficult for children with dyslexia to acquire automaticity in reading/writing tasks and may further inhibit the development of language dexterity and motor skills. Another theory (Montfort 2004) is disassociation disorder, where there is a missing or inactive connection between Wernicke's area (incoming linguistic information) and Broca's area (outgoing linguistic information) and the visual (reads information in from the page) and motor cortex (activates the muscles for writing). Experts do agree that dyslexia describes differences in the way in which the brain processes information, and while there may be differences in the way in which the brain works, this does not imply any abnormality, disease or defect.

3.5.3 Dyslexia as a Difference in Cognition and Learning

Although dyslexia is defined as a disability under the Irish Equal Status Act (2000), it is not a 'disease' nor can it be 'cured'. Singleton (2000) argues that the neurological differences found in dyslexia may confer advantages for some individuals (e.g. in visual or perceptual skills), which may to some extent explain the apparent paradox that some individuals who have problems with elementary skills such as reading and writing can nevertheless be highly gifted in other areas (e.g. Einstein was dyslexic). The deficit model of dyslexia is now steadily giving way to one in which dyslexia is increasingly recognised as a difference in cognition and learning.

3.5.4 Types of Dyslexia

According to Baddeley (1982), there are two main branches of dyslexia: Specific Developmental Dyslexia and Acquired Dyslexia. Specific Developmental Dyslexia refers to a disorder of suspected congenital or hereditary origin, in contrast to acquired dyslexia, which is a disorder resulting from brain injury after the onset of reading

(Frith, 1986). My research is focused on developmental dyslexia, or dyslexia. The term 'developmental' does not mean that the disorder will disappear with maturity. 'Specific' is intended to connote a disorder limited specifically to language rather than involving a general learning problem (Duggin 1994).

A lot of the recent research into dyslexia (O'Brien B.A. et al. 2012) has concentrated on the area of dyslexia sub-typing. Psychological research on acquired dyslexia has tended to confirm the existence of two broad sub-types. These involve (a) people displaying difficulties with whole-word reading (referred to as 'surface dyslexia' or 'semantic dyslexia'), and (b) people displaying difficulties with phonological processing and non-word reading (referred to as 'deep dyslexia', or 'phonological dyslexia').

Phonological Dyslexia

The majority of dyslexics show poor word identification due to poor print-to-sound conversion, also known as grapheme-phoneme links. Dyslexic people have difficulty segmenting individual phonemes within words and blending separate speech sounds to produce words. This particular problem of segmenting individual sounds is also called poor auditory discrimination. Short-term memory (STM) can become overloaded by decoding grapheme-phoneme links, which have not become automatic. It takes a lot of energy to understand each word and it takes a long time for these grapheme-phoneme links to become part of a dyslexic's long-term memory (LTM). This results in dyslexic people being able to read words that are already familiar to them (in their LTM), while having trouble reading unfamiliar or novel words. This can lead to difficulties with non-words such as 'tord', which may be misread as a real word such as 'cord'. Dyslexics may also misread actual words as other ones that look similar e.g. reading 'cat' as 'car'. Poor STM can result in difficulty with sequencing tasks such as reading a text and possibly show up as Attention Deficit Disorder (ADD) due to the level of concentration needed. Spelling difficulties are common in people with this subtype of dyslexia as they spell phonetically. This means they can miss out silent letters and often do not follow spelling rules.

Semantic Dyslexia

Semantic dyslexia is a difficulty in rapidly naming things and occurs more often in spoken language than in reading. The first characteristic is that the dyslexic person may be able to name an object however it may be easier to call it a "thing" than to correctly blend the phonemes to create the correct sound name for the object. The second characteristic is that the dyslexic may choose an antonym, synonym, or a subordinate of a word instead of the words proper. For example, they may misread, 'dog' as 'fox' but know that they meant 'dog'. One theory to account for this is given by McConville (1998), who states that dyslexic people think mainly in three-dimensional pictures rather than words. Possibly because of the phonological problems, it is easier to picture the physical dog rather than the word.

Some dyslexic people have trouble reading function words such as, "of", "an", "not", and "and". Firstly, this is due to how similar a lot of these words are, e.g. "if" and "of". Secondly, when a difficult content word is spotted coming up in a sentence, there is a natural tendency to look ahead to it and pay less attention to the (smaller) function words leading up to it and thirdly, getting the small 'linking words' in a sentence right (like "to", and, "so") relies very much on knowing the meaning of the whole sentence. If a student spends so much time on fighting with each word that they lose the meaning of the sentence, then they will tend to miss the abstract function or linking words that give semantic meaning to the text (Morgan 1986).

Double Deficit Hypothesis

In the Double Deficit Hypothesis, phonological deficits and semantic deficits are depicted as two independent sources of reading dysfunction. This results in three impaired subtypes, the two subtypes with single deficits and one double-deficit subtype, characterised by both deficits. Sharma (1996) goes further, proposing more specific sub-types (along with phonological and semantic sub-types):

- Literal Dyslexia - reading "lice" as "ice" or "like"
- Neglect Dyslexia - reading "alphabetically" as "betically"
- Dyslexia With Dysgraphia
- Dyslexia Without Dysgraphia
- Spelling Dyslexia - taking one second to read each additional letter, vs. 30 milliseconds for a non-dyslexic person.

Most recent research (IDA 2002) assumes that there are many “dyslexias”, and each person with dyslexia may have a different cluster of symptoms. Most of the extra sub-types above can be categorised as knock-on effects of phonological dyslexia, semantic dyslexia or the double deficit hypothesis (Dyslexia in Ireland Website 2005).

3.5.5 Reading Development Stages

Dyslexic children do not access the reading development stages in the same way as a ‘normal’ reader (Frith, 1985). There is also a delay in how children with dyslexia transverse each stage of reading. It is important to set out the reading development stages of a ‘normal’ reader and how dyslexic students have difficulties. This information will be used to inform the design of language content for curriculum resources for dyslexic teenagers.

Frith (1985) proposed three stages in relation to learning decoding strategies in the reading and spelling development of ‘normal’ readers; logographic, alphabetic and orthographic. Each of the three stages includes the development of word identification skills that lead to enhanced word knowledge, thereby furthering reading development. Table 3.2 summarises the differences in how dyslexic and non-dyslexic readers access the reading development stages.

Logographic Stage

The child acquires a small sight vocabulary of written words. The child has visual recognition of words as units (pictures). This may not mean that the child can reproduce these words accurately and as a result the child can easily misspell words they can read. Dyslexic children can have difficulties with the logographic stage of reading because it puts a lot of pressure on STM, which can be quite weak and can rapidly become overloaded.

Alphabetic Stage

The child tackles the sound/symbol correspondence. By practising spelling, the child learns that spoken words can be broken down into phonemes that map onto letters. The child can attempt to read words they have not seen before. Dyslexic children can have difficulties with the alphabetic stage as they have phonological deficits and find

the letter-blending task difficult. In logographic languages such as Chinese, children do not go through this stage.

Orthographic Stage

The child possesses and comprehends knowledge of the letter-sound relationship as well as structure and meaning. Thus, as well as being aware of rules, the child can use cues and context in the text. Using the alphabetic strategy, the child learns to recognise words as orthographic units. Word recognition occurs by accessing stored internal representations of abstract letter-by-letter strings. Spelling shifts from phonetic, to transitional, to correct spellings. Dyslexic children will not acquire this level of reading as quickly as other children due to difficulties with the first two stages, short term memory (STM) and phonological deficits.

Reading Stage	Non-dyslexic Reader	Dyslexic Reader
Logographic Stage	The reader has visual recognition of words as units (pictures).	STM can become overloaded very quickly remembering these units.
Alphabetic Stage	The reader learns that spoken words can be broken down into phonemes that map onto letters. The reader can attempt to read words they have not seen before.	Dyslexic readers find the letter-blending task difficult due to phonological deficits.
Orthographic Stage	The reader learns to recognise words as orthographic units. Word recognition occurs by accessing stored internal representations of abstract letter-by-letter strings.	Delays in the first two stages as well as STM and phonological deficits cause delays acquiring this stage.

Table 3.2 Dyslexia and the Reading Development Stages

3.5.6 The Characteristics of Dyslexia

In this section, I summarise my findings from my research into the primary and post-primary characteristics of dyslexic students. My teaching experience, literature review and survey questionnaires have fed into this summary. The impact for the design of curriculum-focused materials is also discussed.

3.5.6.1 Primary Characteristics

Poor Short-Term Memory

There is a marked inefficiency in the working or short-term memory (STM) of dyslexic people, which can affect many aspects of speaking, reading and writing (Frith, 1985). These difficulties can include problems in retaining letter-sound associations (which will affect acquisition of phonic skills), lexical access errors or delays (which will result in incorrect words being used or read or in a slow-down of the process). Memory problems may also cause problems in retaining the meaning of text, failure to organise learned facts effectively, disjointed written work or omission of words and phrases because the individual has lost track of what s/he is trying to express. Many of these difficulties cause problems for accessing Frith's reading development stages discussed above.

The impact of the user group having STM means that for the design of curriculum-focused materials, each exercise should only deal with one concept and the text instructions should be kept short.

Defective Phonological and Visual Access and Processing of Data

Many researchers (Johnson & Mykelbust (1967), Bowers & Wolf (1993)) agree that in dyslexia there is a problem with the cognitive ability to link the shape and/or sound of alphabetical symbols with their semantic meaning as represented in memory. This is evident when a student is reading.

Due to this difficulty, it is important to use dyslexia-friendly fonts and design for any materials developed in this project. Kurnian & Conroy (2007) demonstrated that dyslexic readers do not read any slower than non-dyslexic readers when these guidelines are adhered to.

Directional Confusion

The image that falls on the retina is upside down and back to front. It is up to the brain to interpret the nerve signals from this image so that we perceive the object as it really is, the right way round and the right way up. The brain does not have much trouble in analysing the shape of solid objects such as a chair, because from whichever angle it is viewed, it can only be a chair. Analysing abstract symbols like letters and numbers is more difficult for dyslexic readers because by switching the same shape around one can get different letters and numbers (Hornsby 1995).. The ‘b’ shape, for example, turns into ‘d’ when turned back to front, becomes ‘q’ if ‘d’ is turned upside down, and ‘p’ if ‘q’ is flipped back to front – four letters for one shape (Hornsby 1995).

Directional confusion means that the design layout of curriculum-focused materials has to be strictly left-right on screen. All instructions should read from the left rather than having extra text on the right-hand side of the screen. Minimal text should be used in the materials.

Sequencing Difficulties

Sequencing difficulties cause problems for dyslexic readers (Murphy, 2004). Poor short-term memory can result in sequencing difficulty i.e. perceiving something in sequence and also remembering the sequence. If a student has forgotten the items that were first, they cannot easily continue with a sequencing task. Therefore tasks like reading and writing and any kind of organising tasks, which involve several steps, are difficult to complete.

For dyslexic students who have this difficulty, it is important that the materials developed only deal with one task with one step e.g. watch a short video, answer exercise.

Defective Fine Motor Skills

Defective fine motor skills often accompany dyslexia (Ott 1997) and are thought to make reading or manipulating quantities of text difficult for the dyslexic. More obviously, writing becomes a laborious and energy-consuming job.

The impact of fine motor skills is that the design should not include too many click-through steps. Students can type answers or click on answers which help relieve some of the difficulties students with fine motor skills have.

Attention Deficit to a Greater or Lesser Degree

Although attention deficit does not necessarily always accompany dyslexia (Richards et al. 1999), it is often present to a greater or lesser degree. Due to physiological problems or just plain frustration or fatigue, coping with the reading/writing task requires greater amounts of energy and concentration from the dyslexic than from the normal individual. According to Richards, dyslexic children use five times more of the overall brain area than other children while performing a simple language task.

Curriculum-focused materials have to be designed to keep a range of students engaged for a class period. This ranges from students with dyslexia to mainstream non-dyslexic students. The personas (discussed in Chapter 6) set out the range of students that should be catered for by the materials. Multimedia content should be used to engage visual learners.

3.5.6.2 Secondary Characteristics

A culmination of the primary symptoms discussed above can lead to the following secondary symptoms in dyslexic teenagers (Wahl 1996):

- Depression
- Frustration
- Defeatist attitudes
- Poor self esteem
- Poor organisation skills

The primary and secondary characteristics have to be taken into account when designing content and curriculum materials that must cater to the needs of dyslexic students. In particular, text must be kept short, multimedia should be employed and only one task should be introduced at a time. This should therefore motivate students

and help reduce the secondary characteristics, in particular, frustration, lack of self-esteem and poor organisational skills.

3.6 Computer-Assisted Language Learning (CALL)

My background in Computer Assisted Language learning (CALL) (outlined in Section 1.2) led me to run a small pilot study (Section 3.2) investigating whether CALL materials would be useful for a small group of dyslexic teenagers. This pilot study proved successful and I decided to investigate this idea on a larger scale. This section gives a background to the CALL research area and the important phases CALL has gone through in the recent past.

CALL software is language-learning software (e.g., web-based, CD-ROM, interactive) that has lessons and exercises designed and developed for the particular needs of a target group. CALL is a means of aiding the work done in the classroom by the teacher and can also be a means of independently learning a language. CALL is most often aimed at second language acquisition however this thesis aims to apply CA(L)L to the educational needs of students having difficulty with their first language. An overview of the CALL discipline is given here.

3.6.1 A Brief History of CALL

This section provides a brief review of the history of CALL from the 1950's to the present. In order to understand how CALL courseware can be used in the area of dyslexia, we must first look at how language-teaching methodologies have shaped CALL projects for the past fifty years. The history of CALL programs can be roughly sub-divided into three main stages: Behaviourist CALL, Communicative CALL, and Integrative CALL (Levy 1997). Each stage corresponds to a certain level of technology as well as the pedagogical approach at the time.

Behaviourist CALL was conceived in the 1950s and implemented in the 1960s and 1970s. It was based on the behaviourist learning model (Skinner, 1938). CALL programs featured repetitive language drills, referred to as drill-and-practice (or "drill-and-kill"). The computer was viewed as a mechanical tutor which never grew tired or judgmental and allowed students to work at an individual pace. Though behaviourist

CALL eventually gravitated to the personal computer, it was first designed and implemented in the era of the mainframe. The best-known tutorial system, PLATO (University of Illinois 1960), was not designed to cater to all of the language learners' needs. Its role was to cater for 'the more mechanical types of vocabulary and grammar drill, thereby freeing class time for more expressive activities' (Hart 1981).

The next stage, communicative CALL, emerged in the late 1970s and early 1980s, at the same time that behaviourist approaches to language teaching were being rejected at both the theoretical and pedagogical level, and when new personal computers were creating greater possibilities for individual work (Warschauer & Healey 1998). Communicative Language Teaching (CLT) began to come to the fore. This was more an approach to teaching and learning rather than a method. Its aims were to make communicative competence the goal of language teaching.

Proponents of communicative CALL stressed that computer-based activities should focus more on using forms in communicative situations than on the forms themselves, teach grammar implicitly rather than explicitly, allow and encourage students to generate original utterances rather than just manipulate prefabricated language, and use the target language predominantly or even exclusively (Jones & Fortescue 1987).

Popular CALL software developed in this period included text reconstruction programs. Those programs allowed students working alone or in groups to rearrange words and texts to discover patterns of language and meaning e.g. the Athena Language Learning Project (ALLP) set up by Massachusetts Institute of Technology (MIT) in 1983.

Although communicative CALL was seen as an advance over behaviourist CALL, it too began to come under criticism. By the late 1980s and early 1990s, critics pointed out that the computer was still being used in an ad hoc and disconnected fashion and thus "finds itself making a greater contribution to marginal rather than central elements" of the language learning process (Kenning & Kenning, 1990, p. 90). This corresponded to a broader reassessment of communicative language teaching theory and practice. Many teachers were moving away from a cognitive view of communicative teaching to a more constructivist social or socio-cognitive view, which placed greater emphasis on language use in authentic social contexts. Task-based,

project-based, and content-based approaches all sought to integrate learners in authentic environments, and also to integrate the various skills of language learning and use. It also encourages a more constructivist approach with students taking a more active role in their own learning and the teacher becoming more of a facilitator in the learning process. This led to a new perspective on technology and language learning, which has been termed integrative CALL (Warschauer, 1996), a perspective which seeks both to integrate various skills (e.g., listening, speaking, reading, and writing) and also integrate technology more fully into the language learning process. In integrative approaches, students learn to use a variety of technological tools as an on-going process of language learning and use. Bax's view (Bax 2003) of Integrated CALL implies a process of normalisation that has still not been achieved in language teaching and learning. Only when ICT is regarded by most teachers and learners in the same way as other technological aids that form part of our daily lives will it be considered *normal* and no longer regarded with fear and awe and expected to deliver more than it can realistically achieve.

Integrative CALL design principles that are important to note include:

- Student/learner-focus
- Meaningful purpose
- Sufficient level of stimulation (cognitively and affectively)
- Multiple modalities (to support various learning styles and strategies)
- High level of interaction (student-computer and teacher-student)

3.6.2 Computer as a Tool or as a Tutor

There is a distinction made in the CALL field between the roles CALL courseware can play in language teaching and learning: tool or tutor (Levy 1997). The essence of Taylor's (1980) original definition of the tutor is that the computer evaluates the learner, and then provides content and exercises on that basis. Evaluation of the student by the computer is what sets the computer tutor apart from the tool. The computer as tutor may make its judgement known to the student immediately through displaying feedback.

If the courseware is being used as a tool, it is used in conjunction with classroom teaching and complements what is being taught in the classroom in what is referred to as blended learning.

“The tool role for the computer is fundamentally non-directive. Tools are neutral, and how they are used is not predetermined. Since guidance is not available via the computer program, if language learners use tools, they will need to learn how to use them to best effect.” (Levy 1997).

In broad terms, if the courseware is designed as a tutor, learning is assumed to be autonomous. The student and computer interact outside the conventional language classroom without the help or feedback of a teacher.

However, in the context of using a CALL tool, Levy states that ‘the learner has the responsibility’ (1997), and ‘the human is in control of the tool’ which Blin (1999) uses in her argument stating that the computer tool is more likely to promote learner autonomy. This is a different type of autonomy because the student is not being directed by the computer (without a teacher), they are using the tool to direct their own learning. They are constructing their own learning situations and possibly interacting with other students via the computer.

It is not assumed that when the computer is being used as a tool, the computer work must be completed in the classroom, though this may often occur. The function of the computer as a tool is to enhance or improve the efficiency of the work of the teacher or student. Skinner (1954) discusses his belief in the separateness of the work of the mechanical device and the work of the teacher. There is no suggestion of the teacher working together with the machine and the learner to create an effective learning environment. The idea is that the teacher is somehow inferior to what the computer can provide which perhaps reflects the prevailing knowledge at the time. Contrary to this position, in my research I am in agreement with Levy, who at the ‘CALL Seminar: Building Bridges between Disciplines and between Research and Teaching (2001)’, in Dublin City University, said that nothing can compare to a teacher-learner classroom environment. Ideally, CALL should be used in conjunction with the classroom-based curriculum to provide the best possible learning environment.

3.7 Computer Assisted Learning (CAL)

While CALL deals with a second language usually, this project looks at students' first language. The process is similar however as dyslexic students are having difficulties with their first language. Both CALL and CAL, otherwise termed CA(L)L in this thesis, attempt to present language in its most accessible form for a particular group. A background to the Computer Assisted Learning (CAL) research field is presented in this section.

There is an abundance of terms used to describe using a computer to help learning. These include:

- E-learning
- Computer-Based Learning (CBL)
- Computer-Based Training (CBT)
- Internet-Based Training (IBT)
- Web-Based Training (WBT)
- Computer-Aided Instruction (CAI)
- Computer Assisted Learning (CAL)
- Computer Aided Learning (CAL)

E-learning includes all forms of electronically supported learning and teaching, including educational technology across many subjects. The information and communication systems serve as specific media to implement the learning process. The term E-learning is often used to reference out-of-classroom educational experiences via technology. Abbreviations such as CBT (Computer-Based Training), IBT (Internet-Based Training) or WBT (Web-Based Training) have been used as synonyms to e-learning. E-learning is the computer and network-enabled transfer of skills and knowledge. E-learning applications and processes include Web-Based Learning (WBL), Computer-Based Learning (CBL), Virtual Learning Education (VLE) opportunities and digital collaboration. Content is delivered via the Internet, intranet/extranet, audio or video tape, satellite TV, and CD-ROM. It is self-paced or and includes media in the form of text, image, animation, streaming video and audio.

CBL involves the development of a computer program with no provision, intentional or otherwise, for the re-evaluation of the current methods of teaching and the subject itself. Computer Aided Learning (CAL) produced under these conditions is actually a computer program whose content consists of little more than lecture notes (StudyNet 2012). CAL in this context could be used for distance education.

Two terms are *described by the acronym CAL*:

- Computer Assisted Learning (CAL)
- Computer Aided Learning (CAL)

Both terms are synonymous. There are more references to Computer Aided Learning on the internet however Computer Assisted Learning is more commonly used in academic papers. Since the mid- 1980s CAL has been increasingly used to describe the use of technology in teaching.

CAL is also used to describe a more integrative approach whereby the program does not actually replace classroom content but is introduced into the course as a learning resource. This takes the form of self-study which takes place outside the main curriculum hours. The term CAL used in this context is an “add on” resource for student self-study whose success in terms of usage is dependent upon a number of student centred factors, not least their self-discipline and motivation.

Computer Aided Learning also describes an educational environment where a computer application is used to assist the user in learning a particular subject. This means that the program is not alone in furthering this aim and that there are other methods involved. CAL is an aid to an overall learning strategy – which in itself is a conglomeration of other methods of instruction, (e.g. the lecture, tutorial sheets and text books.

Much of the CAL literature is focused on CAL as a resource to be used outside of the classroom and not in a blended learning environment. From a CAL perspective, Moebs & Weibelzahl (2006) define blended learning as the mixture of online and face-to-face meeting in one integrated learning activity. Akkoyunlu & Soylu (2006) describe blended learning as a variety of delivery methods which combine face-to-face meeting in a traditional classroom with teaching online to achieve the course

objectives. Graham (2005) stated that blended learning is an approach which integrates the face to face teaching and computer mediated instruction in a pedagogical environment. This means that, while the option is there for learners to work on materials alone, the main focus is that teacher and learners can work on the materials together. This allows the students to obtain feedback from their teacher, which is much better than feedback from a computer. Falloon (1999) has shown that ICT use is most effective at enhancing learning outcomes when packaged with expert teacher knowledge of subject matter and pedagogical understanding of the potential uses of ICT.

CAL systems to aim to:

- deliver content electronically to the student
- use multi-modal and / or interactive activities
- improve learner motivation
- enhance learner independence
- give direct feedback to students
- free up teacher time

In summary, Computer Assisted Learning is an integrative technology, which describes an educational environment where a computer program:

- is used to assist the user in learning a particular subject
- refers to an overall integrative approach of instructional methods and
- is part of the bigger teaching and learning picture
- comes about after re-assessment of the current teaching methods.
- treats the computer as an aid to an overall learning strategy with other methods such as worksheets, lectures and text-books.

3.8 Relevant CA(L)L Research

Both Computer Assisted Language Learning (CALL) and Computer Assisted Learning (CAL) bring important characteristics to the CA(L)L research project

described in this thesis. Chapter 2 sets out the reasons for the choosing the Colpaert's CALL RBRO Model.

While there are no studies aimed at the integration of curriculum-focused CA(L)L materials for diverse student groups (including dyslexia) in post-primary school, there are some interesting research findings that were taken into consideration during the research carried out in this thesis. Table 3.3 sets out the main findings from these studies and their influence on this project. A more detailed discussion of these studies is outlined below.

Williams et al. (2006) carried out a review of past studies on use of ICT for people with special education needs (SEN) to inform a major research project on using ICT to facilitate self-advocacy and learning for SEN learners. They carried out a literature review, encompassing academic journals in education, information science and social sciences, and government reports. Information was gathered on the perceived benefits of ICT in SEN, and the use of some specific applications with people having various conditions. A number of usability studies, mainly Internet and web technologies, were also outlined. Although the literature shows a great number of ICT initiatives for people with all kinds of disabilities, there has been a surprising lack of research into the usability of the various applications developed, and even less concerning those with learning difficulties. The review of the existing literature indicates a lack of attention to the application of ICT for people with SEN, compared to other groups such as the visually impaired. Findings highlighted the need for more research on usability aspects of current and potential applications of ICT for people with SEN.

While there is a lack of research on investigating whether the integration of ICT enhances the curriculum for all students, there has been research on developing tools for people with specific learning difficulties that could potentially be used in the classroom. Korhonen (2008) developed a spell-checker for dyslexic people. Korhonen hypothesised that the spell checking needs of dyslexic writers differ from those of non-dyslexic writers and that those needs are not adequately met by existing spell checkers. They adapted spell-checkers to try to meet these needs so that they would increase the ability of the spell checkers to both detect and correct the spelling errors of dyslexic writers. This research was taken into account while deciding on the functionality of the proposed curriculum focused materials during the design phase.

Ultimately the teachers did not feel spell checking was appropriate for the group because the focus was on access to learning materials.

In their review of the literature on Computer-Assisted Learning, particularly Integrated Learning Systems, and outcomes with respect to literacy and numeracy, Parr and Fung (2000) found that effectiveness of computer-assisted learning has not been conclusively demonstrated. To date, it has been shown to be less effective, on average, than other forms of intervention in education. Parr and Fung found that computer-assisted learning software is underpinned by an older, neo-behaviourist theory of learning, one that has been displaced in the classroom by more social constructivist views of learning. Results from their evaluations of integrated learning systems showed highly variable results, with independent evaluations tending to be less favourable. The best results were for basic maths skills; there is little evidence of gains in reading. Integrated learning systems, in their current form of neo-behaviourist, mastery learning, support the gaining of basic procedural knowledge. There is evidence that students may not be able to apply such knowledge without teacher intervention and that such knowledge may not generalise to school or system curriculum assessment tasks. This is an interesting piece of research with the focus of my own research project on reading. This was a strong influence for the use of blended learning so that CALL was not the only means of learning.

Sivin-Kachala (1998) assessed the effect of computer technology on learning and achievement by analysing 219 individual research studies conducted from 1990 to 1997 across all learning domains and all learner ages. He reported that a) students in technology rich environments experienced positive effects on achievement in all major subject areas; b) students in technology rich environments showed increased achievement in preschool through higher education for both regular and special needs children; and c) students' attitude toward learning and their own self-concept improved consistently when computers were used for instruction. However, he acknowledged that the level of effectiveness of educational technology is influenced by the specific student population, the software design, the educator's role, and the level of student access to the technology. This research study was useful for the observational phase as I was interested in finding out if the curriculum-focused materials would affect student morale and motivation.

Habib et. al (2012) carried out a study with dyslexic students in higher education use of Virtual Learning Environments (VLE). Habib found that the students experienced a number of challenges associated with VLE use, including information overload, imperfect word processing tools, inadequate search functions, and having to relate to more than one system at a time. This was very important work for the identification of the target. Again key issues were highlighted as not using too much text to overload students and dealing with only one concept at a time.

Sepehr & Harris (1995) carried out a small-scale study to explore primary teachers' use of software in supporting pupils' learning. The study used questionnaires for 56 teachers and interviews for nine of those teachers who had responded. The teaching approach used by the teachers was related to the type of software that they used (64 programs were identified). The software was categorised into drill and practice and content-free groups. Sepehr & Harris argued that the 'holistic' and 'active learning' approaches to reading have been closely associated with content-free software and the findings of this study confirm this. The teachers who used whole book approaches to teaching preferred content-free software. The whole book approach represents the 'holistic' and 'active learning' approaches to teaching reading, where children are taught to read whole words rather than words being segmented into phonemes. Teachers preferring structured phonetic approaches preferred drill and practice programs. This study was interesting as it outlined the survey process in a school and so it was useful for my upcoming study. Their theory on phonetics is a new one in dyslexia and linguistics and it was useful to understand before the content for the curriculum focused materials were developed.

Watts & Lloyd (2004) carried out a study on the use of innovative ICT in the active pursuit of literacy. This paper investigated the classroom interventions using a particular form of ICT, and assesses gains in pupil learning that accrue from its use. The research took place in eight UK schools with 219 11-year-old children. The study took place during the "The Literacy Hour" which is part of the UK Government's National Literacy Strategy: guideline requirements of schools to spend an hour a day on literacy to meet centrally established and monitored targets. The children were presented with a series of journalistic tasks and classroom activities that they resolve through the use of a compact and coordinated information system. The results

demonstrated that children can become self-directive and very active – exploratory – learners in a very short period of time. Watts & Lloyd conclude that a lesson to be learned from the study relates to the management and organisation of classroom teaching in the face of systems that promote rapid devolution of learning to the learner. This study's results are very exciting for this research study in that they show that students became self-directive in their learning. I am interested in finding out whether this outcome will present in this study and whether it will apply to all or any of the students.

Fawcett et al. (2008) developed a computer-based spelling remediation for dyslexic children. The "*SelfSpell*" program provides a multi-media environment for dyslexic children which uses synthesised speech to augment the written text. They established that by encouraging users to enter a rule to help them remember how to spell each word, *SelfSpell* was very effective in improving spelling ability. The evaluation study reported here confirmed the efficacy of the rule-based approach using a group of 11-year-old dyslexic children with severe impairments in spelling. Of particular theoretical significance, however, was the finding that use of a mastery learning technique for learning spellings was just as effective as the rule-based approach. These findings are interpreted in the light of Frith's influential framework for the development of reading and spelling ability (Frith 1985 – see also Section 3.5.5 of this thesis). It is suggested that the multimedia presentation approach may provide a uniquely effective method for helping dyslexic children to acquire the 'alphabetic' stage of linguistic processing.. As mentioned previously, teachers decided that a spelling aid was not appropriate however this study still helped in highlighting the important role of multimedia presentation of content in the design process.

Hughes et al. (2004) carried out exploratory research, undertaken to inform the design of a selection of web-based taster courses for less widely taught languages. 687 school students, aged 14-18, were asked to identify a web site that they liked and to state their main reason for liking it. They were invited to include recreational sites and told that their answers could help with web design for the taster courses. To explore the reasons, two focus groups were conducted and student feedback on the developing taster course site was collected. Students nominated search engines and academic sites, sites dedicated to hobbies, enthusiasms, youth culture and shopping. They liked

them for their visual attributes, usability, interactivity, support for schoolwork and for their cultural and heritage associations, as well as their content and functionality. Hughes et al. state that the students involved emerged as sensitive readers of web content, visually aware and with clear views on how text should be presented. These findings informed design of the taster course site and added to knowledge about school students' use of the web and about designing web-based learning materials. The findings from this study highlighted the importance of the students being involved in the design of the content and curriculum focused materials. This study showed that students are much more interested in they are involved in every phase of the work.

Kurnian & Conroy (2007) describe problems people with dyslexia experience with reading online material, and some technological aids available to help them e.g. screen readers. Three groups of university students participated in the user study of comprehension tasks using five online articles of varying complexity (as measured through Flesch-Kincaid readability grade). The study found that students with dyslexia are not slower in reading than students without dyslexia when the articles are presented in a dyslexia friendly colour scheme, however these students with dyslexia fare worse in answering correctly the questions related to the passages they read when the complexity increases. With regard to designing the curriculum focused materials, this study showed the difference using dyslexia friendly fonts and colours can have. It also highlighted again the importance of keeping the text straight-forward and uncomplicated.

Sidhu & Manzura (2011) propose an effective conceptual courseware development model specifically for dyslexic children. Five essential features are identified to support this model, namely, interaction, activities, background colour customisation, directional text reading (left-right) identification, and simple instructions. A prototype courseware based on the proposed model was developed and tested with a small sample of dyslexic children from selected schools in Malaysia. The evaluation showed positive results in terms of performance whereby 60% of the users showed improvement in their performance, 30% showed unchanged results and 10% displayed a decrease in performance. The five features are adhered to all in materials developed as a part of this research project. This study took place after my own research however they were common issues that were highlighted in the focus groups.

Study	Finding	Analysis	Influence on Project
Williams et al. (2006)	Lack of research in usability & lack of ICT for SEN.	Need for more research on the implementation of ICT in the SEN environment.	Focus on whether the tools developed in this project are useful.
Korhonen (2008)	Spell-checking needs of dyslexic writers are different.	This functionality was explored for the tools developed in this project.	Teachers in focus groups decided spell-checking was not appropriate.
Parr and Fung (2000)	CAL effectiveness for reading not shown.	Students may not apply knowledge without teacher intervention.	The blended learning approach was adopted.
Sivin-Kachala (1998)	ICT has positive effect on attitude, achievement & self-worth.	Interested in finding out if curriculum-focused materials do the same.	Observation and focus groups undertaken.
Habib et. al (2012)	Dyslexic students experience information overload.	Important not to use too much text or switch between systems.	Each exercise in the tools deals with one concept at a time.
Sepehr & Harris (1995)	Active learning is associated with content-free software.	Phonetic approach not useful for this project.	Whole-word approach undertaken in this project.
Watts & Lloyd (2004)	Learners became self-directive.	Is self-directive learning appropriate?	Will the dyslexic students become self-directive?
Fawcett et al. (2008)	Multimedia presentation important for dyslexic children.	Multimedia may help overcome alphabetic stage.	Use of slideshows, pictures and videos integrated.
Hughes et al. (2004)	Students had clear views on how content should look.	Students became more website aware.	Students should be involved in the design of tools.
Kurnian & Conroy (2007)	Dyslexic readers not slower reading online when dyslexia-friendly colour scheme & fonts used.	Results did not hold if complexity increased.	Keep text simple & short in tools. Use dyslexia-friendly colours & fonts.
Sidhu & Manzura (2011)	Interaction, activities, colours, left-right reading & simple instructions are effective for dyslexic children.	Three five features also arose during the focus groups with teachers and students.	Students need interactive and multimedia materials with the appropriate design.

Table 3.3 Findings from Relevant Studies

3.9 Online Curriculum-Focused Tools

The final phase of this project focuses on the development of online curriculum focused tools based on teachers' design guidelines. This section outlines current online curriculum focused tools.

The main area where curriculum-focused ICT materials have been developed is in the online teaching resources area such as Skoool.ie and TeachNet. This review focuses on the Junior Certificate (JC) English and History resources available in 2010 that cater to students with learning difficulties such as dyslexia. Students and teachers involved in the project described in this thesis used Skoool.ie and Teachnet.ie during the initial deployment of ICT materials phase in 2007 (Chapter 5). Scoilnet was launched in 2007 and students in the same groups reviewed these materials in 2007/8 (Greene 2008 and 2010). Scoilnet is not included in the initial ICT questionnaire (Chapter 4) and integration (Chapter 5) results as it was a very early version of the website and the Scoilnet results were acquired after the CA(L)L implementation, so they did not contribute to the Design Guidelines (Chapter 6). The review of Scoilnet carried out in 2010 is included here for completeness. Table 3.4 outlines the findings from the three websites surveyed.

Curriculum-focused	Analysis
Skooool.ie	No specific special needs section. Revision sheets and drag-and-drop exercises. Focus on exam guides.
TeachNet.ie	Special needs resources can be searched for with only one History unit (and no English units) tagged as special needs. Not all special needs resources are tagged correctly.
Scoilnet.ie	Three out of 295 junior certificate resources were tagged as special needs. Not all special needs resources are tagged correctly.

Table 3.4 Findings from Curriculum-focused Websites

Skooool.ie is a website focused on the Irish Junior and Senior Cycle curricula. It does not have a specific Special Needs section. Skooool.ie leverages the expertise of teachers in their fields, as well as key members of the syllabus and examination boards for the sourcing and development of content.

The English section split into Poetry, Media Studies and improving your English. The History section consists of a 3D environment called “Explore Thinking Worlds” which is a learning game based on life in a medieval town. Both the English and History sections have an exam guide, model answers and past paper analysis.

The TeachNet Ireland (<http://www.teachnet.ie>) project grew out of the TeachNet US model developed by Teachers Network, New York (www.teachersnetwork.org). Following a successful pilot by the NCTE during the 1999 – 2000 school year, it was officially launched in 2001. TeachNet’s goal is to develop a supportive environment to encourage Irish teachers to publish quality curriculum content on the Internet. TeachNet also develop materials themselves for the site. The resources database within the Junior Certificate section can highlight which resources are suitable for students with special needs. Within the History section, only one resource was highlighted as appropriate, with none highlighted in the English resources.

Scoilnet is the Department of Education and Skills official portal for education. It was developed by the NCTE under the ICT in Schools Programme (DES 2007). The Teacher and student sections are split in Junior Certificate (JC), Leaving Certificate (LC).

In September 2010, via the JC History resource-finder, 295 history resources were found. When the special needs box is ticked, this is reduced to three resources. One is an external website on World history timelines, one is worksheets on Anglo-Saxons and Vikings. The third is an interactive site exploring primary sources. While the primary sources website seems quite advanced, the JC history special needs resource-finder misses out on some appropriate resources that are available in the JC history section such as pictorial information of castle features in a medieval castle which is a curriculum staple.

366 English resources were found via the English resource-finder. Of these, 44 are found under the Special Needs-adapted search. These resources are a mix of lesson

ideas for comprehensions, study skills for dyslexic students, summaries of novels and themes of JC poems.

It should be noted that just because a resource was not tagged as special needs appropriate does not mean it is not appropriate. The way resources are tagged however does have an impact on teachers who are doing searches for materials for their students. For example, in the TeachNet website, there is a resource that links to the BBC English website which has some resources for students with special needs. However, on TeachNet the resource is not highlighted as being special needs appropriate.

3.10 Government ICT in Education Policy

An important ‘actor’ relevant to the Analysis Phase is the government and their school ICT policy. This section outlines the government’s policy with regarding to ICT spend and their goals for the technology in the Irish classroom. This information is also needed for the knowledge of the design space section of the Analysis Phase.

The ICT in Schools Programme commenced in 1998, following the publication of the three year programme Schools IT 2000 - A Policy Framework for the New Millennium by the Department of Education and Science in November 1997 (DES 1997). The core objectives of the ICT in Schools Programme were to ensure that all pupils have the opportunity to achieve computer literacy and to equip themselves for participation in the information society. Furthermore, teachers are supported to develop and renew their professional skills, so as to enable them to utilise ICTs as part of the learning environment.

The Schools IT 2000 project aimed to ensure that every pupil at primary and post-primary school education had the opportunity to achieve computer and Internet literacy. It had three main strategies for achieving its objectives:

- Development of a technology infrastructure: through the provision of multimedia computers and Internet access to schools

- Development of a skills infrastructure: through the provision of training to over 20,000 teachers in the use of ICT
- Development of a support infrastructure: providing advice and guidance to schools, supporting ICT-led innovation in teaching and learning, provision of curricular resources and information through the development of Scoilnet and the development of multimedia tools

This was followed from 2001 – 2003 with the Blueprint for the Future of ICT in Education Programme (DES 2000). The Schools Internet Access Scheme ran in parallel to these two initiatives while Computer Networking Grants were paid in 2004. Between 1998 and 2004, the Department invested some EUR157m under the Programme, comprising EUR108m in capital investment and EUR49m in current investment (NCTE 2010).

The Blueprint for the Future of ICT in Irish Education (2000) sought to advance the use of ICT in education by expanding the ICT capital provision to schools, increasing access to, and use of Internet technologies, further integrating ICT into the school curricula and improving professional development for teachers. It showed that, while all schools are equipped with some computers and have limited internet access, a lack of sufficient and sustained investment over recent years has resulted in inadequate and ageing ICT equipment in schools, no provision for technical support and inadequate levels of broadband internet.

The Investing Effectively in ICT in Schools Report (2008) reported on the impact of ICT and showed that progress has been made on two fronts in particular. Firstly, teachers have demonstrated their willingness to incorporate ICT in their teaching by their high participation rates in ICT professional development programmes and, secondly, integration of ICT in learning and teaching has taken place in schools, albeit limited to a level commensurate with the level of ICT investment. The report set out key investment objectives and related recommendations:

- Continuing professional development
- Software and digital content for learning and teaching
- ICT equipment – additional and replacement
- Schools broadband and services

- Technical support and maintenance
- Implementation structures and supports
- Innovative practice and research

One of the key investment goals set out in the report is the provision of on-demand access to curriculum-relevant digital content and tools. This lack of materials became quite evident throughout the research presented in this thesis. The objective and recommendations from the report are:

Objective: To ensure that there is an adequate supply of innovative, high quality and Irish curriculum-related digital teaching and learning material available to teachers and students at all levels.

Recommendations:

- Put in place a wide-ranging strategy for the specification, development and distribution of digital content for learning. This should:
- Enhance existing web portal facilities (Scoilnet) for distributing classroom-focused digital content
- Provide access to Irish curriculum-relevant digital content for all teachers and students
- Support the sharing and creation of content by teachers and students
- Facilitate strategic partnerships with Irish public bodies and agencies and other content holders for content-sharing and creation
- Centralise licensing agreements and implement purchasing frameworks for software.

The National Centre for Technology in Education (NCTE) was established in 1998 as the lead implementation agency for the Schools ICT Programme. The NCTE was charged with overall responsibility for the national implementation of ICT policy including the provision of a range of school supports for ICT in primary and post primary schools and the direction of a regional ICT advisory service. The NCTE was set up under a Memorandum of Agreement between the Department of Education and Dublin City University (DCU) and is located on the DCU campus. Since its

establishment, the NCTE's work plan has focused on the key operational responsibilities deriving from IT 2000 - A Policy Framework for the New Millennium.

The Framework includes the Scoilnet platform as mentioned previously as well as the Technology Integration Initiative (TII) which comprises a number of programs which promote and support the integration of ICT infrastructure into schools. The initiative provides relevant and up to date ICT advice and supports to schools on a range of technology related areas. The initiative also coordinates the Schools Broadband Programme, which provides broadband connectivity, content filtering, webhosting, and security services to all Primary and Post Primary schools. The NCTE has also put a training programme together for teachers for professional and pedagogical skills.

The Digital Content initiative focuses on the availability and provision of digital resources that are relevant to the Irish curriculum. This includes the evaluation of independently produced software products and extends to collaborations with partners to produce resources for key areas of the curriculum. The special needs area of the NCTE strives to ensure that the needs of students with special educational needs, and their teachers, are integrated into all the main ICT initiatives. The development and dissemination of information and advice for teachers is the focus of this initiative.

The Investing Effectively in Information and Communications Technology in Schools 2008-2013 report (2008) states that when used well, ICT enriches learning and enhances teaching. The report says that ICT invigorates classroom activities and is a powerful motivational tool that encourages learners to progress in more personalised and self-directed ways.

The EU report, Benchmarking Access and Use of ICT in European Schools (2006), has shown that 82% of Irish classroom teachers had used computers in class in the 12 months prior to the survey date. However, Ireland falls below the EU25 average in terms of use in '25-50% of lessons' (8% vs. 20.2%) and in 'more than 50% of lessons' (7.5% vs. 16.5%). Nonetheless, 91% of Irish teachers acknowledge that there are significant learning benefits for pupils using computers in class and say that pupils are

more motivated and attentive when computers and the internet figure as part of lessons.

The study also confirms that Irish teachers have positive attitudes about the different applications for ICT in teaching. Ireland is placed around EU25 averages on attitudes that ICT should be used by pupils to do exercises and practice (79%), letting pupils retrieve information in a self-directed manner (79%) and for collaborative and productive work by pupils (82%).

However, Ireland ranks at the very bottom in Europe when it comes to teachers' satisfaction with the ICT infrastructure: 85% of Irish teachers wish there was better support and maintenance for ICT in our schools. Schools do not have access to a basic level of equipment and technical support to enable full ICT integration to take place. The absence of multi-annual funding makes it difficult for schools to plan for ICT development. Teachers do not have access to sufficient digital content and digital content tools relevant to Irish school curricula.

These ICT reports are important to gain insight into the design space. Since the development of Scoilnet, a lot more resources are available to students. The Benchmarking Access and Use of ICT in European Schools (2006) had interesting results showing that Ireland's teachers are not using ICT as often as their European counterparts. This report showed, however, that teachers acknowledge the significant learning benefits of ICT so this indicates that it may be more a problem of infrastructure rather than other problems.

3.11 Main Findings

This chapter presented the key literature areas that are relevant to the work of this thesis. Colpaert's Model (Colpaert 2007) requires that all information, facts and investigations from the Analysis Phase feeds directly into the Design Phase (Chapter 6). It was important to understand the background to special education and ICT in Irish education, and the needs associated with Specific Learning Difficulties (SLDs). It was vital to investigate what online curriculum materials are available and what research has been carried out in this area prior to working with schools.

Section 3.1 introduced the chapter. Section 3.2 gave a short overview of the pilot study carried out in 2003 motivating the research presented in this thesis. Section 3.3 showed how the findings of this chapter fit into the Analysis Phase (Colpaert 2004). Section 3.4 presented an overview of special education in the Irish education system. Specific Learning Difficulties (SLDs) were detailed in Section 3.5 with a focus on dyslexia and its characteristics. Section 3.6 gave a brief history of Computer-Assisted Language Learning (CALL). Section 3.7 presented an overview of Computer Assisted Learning (CAL). Section 3.8 reviewed relevant CA(L)L research projects. Section 3.9 gave an overview of online curriculum-focused materials. Section 3.10 provided an overview of current ICT policy within the Irish education system. The main findings from this chapter that feed into the Design Phase are summarised below.

The sections on special education in the Irish education system indicated that while the average annual expenditure on a post-primary school student is 30 per cent higher than at primary level (OECD 2010), there are more supports for primary school students with special needs than for post-primary school students. Primary schools have special reading units and access to more learning support teachers. A particularly important point is that it can be difficult to obtain access to a new assessment when a student moves to post-primary school. The post-primary school environment is also more challenging to a student with special needs as they have a number of teachers and there is not the same level of routine as at primary level.

The sections on Specific Learning Difficulties (SLDs) demonstrated how dyslexia is a moving away from being seen as a deficit, to being acknowledged as a difference in cognition and learning. This section presents the types of dyslexia and various characteristics associated with dyslexia that may affect classroom teaching and learning. These show what tools may be useful to address these needs.

The section on Computer-Assisted Language Learning (CALL) provides a background to the research area that produced Colpaert's Design Model. This section presents the different types of CALL and looks at the issue of whether CALL should be a tool for a student to use along with a classroom teacher or should it be a tutor-style application? I agree with Levy (2007) in that CA(L)L should be used as a tool to complement the classroom-based curriculum to provide the best possible learning environment for the student.

The online curriculum-focused tools section presents two of the main resources used by teachers and students; Skoool.ie and TeachNet.ie. While these websites have many resources for the History and English curricula, there is a lack of resources appropriate for students with special needs. This section reviewed what kinds of materials are available.

The CALL review indicates that there has not been much research into the integration of ICTs for SLDs and even less for curriculum-focused materials. All the work is done by teachers who are working with online websites such as TeachNet.ie. This shows that investigation of whether ICT improves access to the curriculum for students with SLDs should be carried out.

The CAL review demonstrated that CAL is used to assist the user in learning a particular subject and treats the computer as an aid to an overall learning strategy with other methods such as worksheets, lectures and text-books.

The CA(L)L research overview noted that there is no research in integrated CA(L)L curriculum materials into post-primary schools for diverse students including those with dyslexia. However there were interesting projects in related areas that were important to learn from before beginning the research detailed in the subsequent parts of the thesis.

The Government ICT in Education Policy section shows the last 12 years of progress in ICT in education in Ireland. Based on the findings of this chapter it is clear that students undergo a fundamental shift when they move from primary school to post-primary school. This was an important issue for me when developing ICT materials for students in Junior Certificate because I needed to be aware that not every potential student with special needs in the class may have received a new evaluation since moving to post-primary school. The findings on specific learning difficulties helped me to get the background for possible student 'personas' which are described in the Design Chapter (Chapter 6). It also helped me to learn about the characteristics of special needs students and what kind of problems they are facing in accessing the curriculum. The findings on online curriculum-focused websites helped me find out what issues students and teachers are facing when they try to access online materials. The findings from the related research questions helped me to design my own

materials by showing me what gaps there were in the existing materials. The findings from the ICT policy section helped me to understand the limitations of integrating ICT into education.

CHAPTER 4: Use of ICT in Two Selected Post-Primary Schools

4.1 Introduction

This chapter presents the questionnaires and focus groups carried out in two Irish post-primary schools to find out what Information Communication Technology (ICT) is being used by mainstream teachers and students and learning support teachers and students to support the Junior Certificate (JC 2006) curriculum.

Section 4.2 discusses how this chapter fits into the Analysis Phase (Colpaert 2004) of the project methodology. Section 4.3 sets out why these questionnaires and focus groups were undertaken. Section 4.4 describes the schools that took part in the project. The participant numbers are also presented. Section 4.5 discusses survey design and the approach I took. Section 4.6 describes the focus group design. The Student Survey Questionnaires are described in Section 4.7. Section 4.8 describes the Teacher Survey Questionnaires. Section 4.9 presents the results from the questionnaires and focus groups. Section 4.10 presents an overview of the findings for the Design Phase.

4.2 Methodology: Analysis

This chapter describes questionnaires that were completed by post-primary school teachers and students on the use of ICTs in two selected post-primary schools in Ireland. These questionnaires were carried out as a part of the Analysis Phase of Colpaert's Design Model (2004).

Colpaert's RBRO Design Model is discussed in detail in Chapter 2 (Research Methodology). All of the outputs of the Analysis phase are represented on the GLDT Grid at the end of Chapter 5 (Initial Deployment of ICT Materials in Two Selected Post-Primary Schools). The ICT questionnaires and the results obtained from the two participating schools provide important information for populating the GLDT grid.

4.3 Why Carry out these Questionnaires and Focus Groups?

Chapter 3 reviews research projects that dealt with developing ICT materials for students with literacy and learning difficulties. Williams et al. (2006) found that, although the literature shows a great number of ICT initiatives for people with all

kinds of disabilities, there has been a surprising lack of research concerning those with specific learning difficulties. The review of the existing literature indicates a lack of attention to the application of ICT for people with special education needs, compared to the other groups of disabled people such as e.g. visually impaired. Furthermore, the literature review showed that, of the small number of research projects developing ICTs for students with special needs, even less developed curriculum-focused ICT resources.

It was important to find out what ICTs were being used in the classroom and at home to support the Junior Certificate (JC 2006) curriculum by mainstream students and students with learning difficulties such as dyslexia. In order to obtain this information, two survey questionnaires were developed and administered in two schools in Ireland (see Section 4.4 for details). The surveys focus only on *what* ICTs the students and teachers use currently. The question of *how* they use these tools is investigated in Chapter 5 (Initial Deployment of ICT Materials in Two Selected Post-Primary Schools).

4.4 School and Participant Descriptions

Figure 4.1 shows the initial contact with the schools.

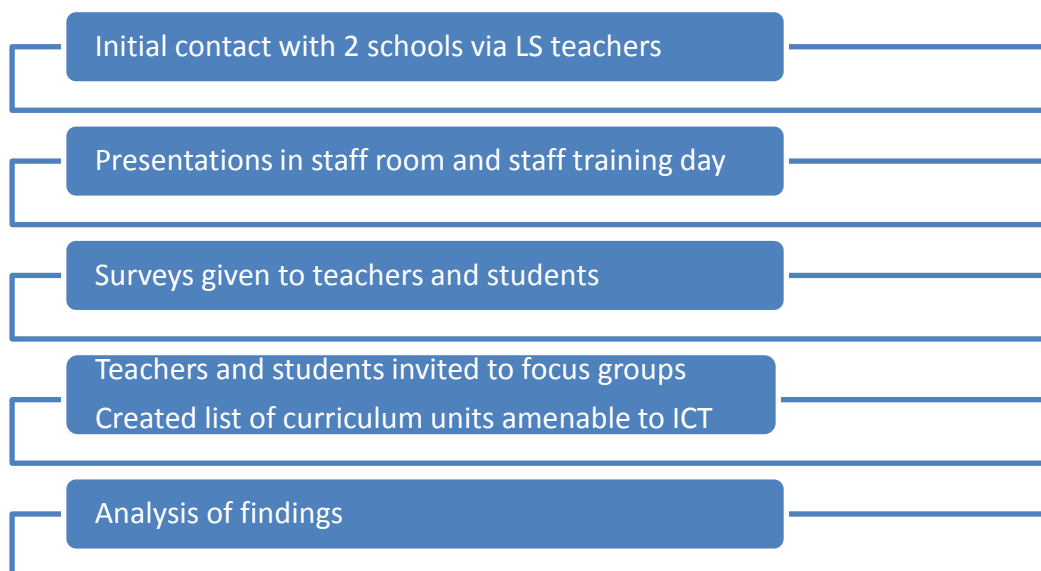


Figure 4.1: Contact with Schools for ICT questionnaire

Two schools were involved in the ICT questionnaires in 2006. Both schools were known to me from previous projects and I approached the schools to ask whether they would be interested in taking part in the studies. The teacher contacts were both learning support teachers and were very interested in taking part in the studies. My introduction to the teachers in both schools was in a large teacher meeting setting. In one school, I addressed the teachers in the staff room and in other school I talked to all teachers during a staff training day. I clearly set out the purpose of my study with a focus on the initial ICT survey. I gave copies of the survey to all teachers present and explained that it was a voluntary study for teachers and students. I left a number of copies in the staff room. I also gave the teachers the student surveys for their classes. The two learning support teacher contacts ensured that questionnaires returned by students with learning difficulties would be highlighted. The two teacher contacts were wonderful advocates of the study and helped me to get the surveys answered and returned to me. It was also explained that the entire study was voluntary and parents would be asked for their consent. The study was open to all students and teachers in the schools.

Once I collected the surveys (Table 4.1) I had the names of teachers. On the survey they were asked whether they would like to take part in a focus group and also whether they would like to take part in the ICT integration project. Teachers selected a number of students for focus groups which included those with dyslexia.

School A was classed as a disadvantaged school and had over 800 female students. The surveys were open to all teachers and students in the school.

As it is important for this research to distinguish between mainstream students and students with special needs, learning support teachers gave the surveys to their students in their learning support groups. The teachers indicated to me which student surveys were completed by students in learning support. The students in this and the other groups remained anonymous.

School B was a mainstream school and had over 400 male and female students. All teachers and students in the school were invited to participate in the surveys. Again, learning support teachers in the school indicated which student surveys were completed by students in learning support.

Not all mainstream teachers and students and learning support (learning support) teachers and students in the schools took part in the questionnaires. Reasons for this included:

- Teachers stating they do not use ICT at all / No interest
- Absence from school during questionnaire distribution
- Time constraints

Table 4.1 shows the number of teachers and students who took part in the ICT questionnaires from School A, School B and the total participants. As the study was open to the whole school there were a mix of first to fifth year students who took the questionnaire.

Participant type	School A	School B	Total
Mainstream teachers	27	18	45
Learning support & resource teachers	7	6	13
Mainstream students	163	261	424
Learning support & resource students	18	25	43

Table 4.1: ICT Questionnaire Participants

4.5 Qualitative Survey Design

Qualitative research can be broadly characterised as the study of a small number of cases primarily using subjective observational techniques (Ragin 2004); examples include survey questionnaires, focus groups, expert review, observation and participant debriefings (O'Connor 2005).

Questionnaires are employed in this research to first allow participants to list which ICTs they use before selecting from a list of ICTs. This method was employed to investigate which ICTs teachers and students would name themselves before seeing a list of possible ICTs. Observation is used during both the 3-month project described in Chapter 5 (Initial Deployment of ICT Materials in Two Selected Post-Primary Schools) where teachers and students use the ICTs highlighted during this chapter and

during the 3-month Deployment Phase of the ICT materials designed and developed during this project described in Chapter 8 (Implementation of Curriculum-Focused CA(L)L Materials). Focus groups are employed after both deployment phases along with survey questionnaires to follow up on issues highlighted by the teachers and students. Temkin (2009) encourages the use of focus groups as the researcher can interact with the participants, pose follow-up questions or ask questions that probe deeper.

Converse & Presser (1986) set out how to design a standardised questionnaire. They set out principles such as avoiding double negatives, leading questions and long questionnaire introductions when setting questions. These principles were used to develop the questionnaires. There is intentional repetition in the survey questions. The participants are asked to name the ICTs that they use so that ICTs that are not on the list can be identified and added for future use.

The British Dyslexia Association's Style Guide (2006) gives guidelines for presenting written text to dyslexic students:

- Paper should be thick enough to prevent the other side showing through.
- Matt paper should be used instead of glossy paper.
- White backgrounds should be avoided as white can appear dazzling.
- Cream or soft pastels are the best background colours.
- Use a plain font (Arial, Trebuchet, Comic Sans).
- Use dark-coloured font on a light (not white) background.
- Font size should be 12-14 point.

All of the questionnaires in this survey were presented on thick cream paper, using the black Arial font in size 12.

4.6 Description of the Focus Groups

Teachers were asked on their survey whether they would like to take part in a focus group to discuss the survey in more. Teachers who wanted to participate added their name in that section of the survey detail (Tables 4.4 and 4.5). I contacted the teachers in question to arrange a time that suited most. The teachers selected a number of students for a student focus groups (Tables 4.6 and 4.7). The student focus group

contained a mixture of mainstream and learning support students. A schedule of questions was prepared ahead of the focus groups (Appendix D). Some of the questions were the same as the questionnaire as I wanted to promote discussion on those topics. The student focus groups lasted one class session (40 minutes) and teacher focus group lasted one hour. I took notes on what the teachers and students said. The focus group numbers and findings are outlined together in Section 4.9.

4.7 Description of Student Questionnaires

The aim of the student questionnaires is to find out how often the students state that they use ICT in the classroom with their teacher as well as on their own and what ICTs they are using to support their curriculum work. I was very clear with the students that the questionnaire was about ICTs used for curriculum work. When I could not be present when the questionnaire was given out, I asked the teacher in charge to make this clear. The questionnaire asked the students the following:

- How often do you use a computer for class work with your teacher?
 - Every day 3 times a week 2 times a week
 - Once a
 - 2 times a month Once a month Rarely

- How often do you use a computer for homework on your own?
 - Every day 3 times a week 2 times a week
 - Once a week 2 times a month Once a month Rarely

- Do you have a computer at home? Internet?
- What ICTs do you use in the classroom with your teacher? Please name any software packages e.g. MS PowerPoint, Dragon Naturally Speaking
- What ICTs do you use at home for homework / study?
- Which of the following ICTs do you use at home and/or at school for schoolwork? Please tick boxes where appropriate. Please name any other ICTs or websites not listed (see Table 4.2).

ICT Type	School	Homework	Neither
Microsoft Word	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Microsoft PowerPoint	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Microsoft Excel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Interactive whiteboard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overhead projector	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Laptop computer / Desktop	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comprehension tool e.g. summarises text for you	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vocabulary tool e.g. introduces new words	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Text Reader e.g. computer reads out the text on screen	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Text prediction tool e.g. suggests word endings	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Display tool e.g. tool for logging all exercises completed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mind map tool e.g. helps you to create mind-maps	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Google / search engine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Online thesaurus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wikipedia	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
http://www.teachnet.ie/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
http://www.skool.ie/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Social networking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Table 4.2: List of ICTs from student ICT questionnaires

4.8 Description of Teacher Questionnaires

The aims of the teacher survey questionnaire are to ascertain how often teachers use ICT to develop teaching materials and how often they use ICT in the classroom. The questionnaires also aim to determine which ICTs are commonly used. The teacher survey questionnaires asked the teachers the following:

- Are you a mainstream teacher? / Learning support teacher? / Resource teacher? / Other?

- What subjects do you teach?

- Where do you get the material for your classes? Develop yourself? Curriculum guidelines? Resource materials / books? Internet?

- How often do you use ICT in the classroom with students?
 - Every day 3 times a week 2 times a week
 - Once a week 2 times a month Once a month Rarely

- How often do you use ICT to prepare curriculum teaching materials for the classroom?
 - Every day 3 times a week 2 times a week
 - Once a week 2 times a month Once a month Rarely

- What ICTs do you use in the classroom with your students? Please name any software packages e.g. MS PowerPoint, Dragon Naturally Speaking

- What ICTs do you use to prepare curriculum materials for the classroom? Please name any software packages e.g. MS PowerPoint, Dragon Naturally Speaking

- Do you use any websites for help with content preparation? (e.g. TeachNet)

- Which of these ICTs do you use for content preparation, during class with students or for setting homework? Please tick boxes where appropriate. Please name any other ICTs or websites not listed (see Table 4.3).

ICT Type	Content preparation	Students use during class	Setting homework	Never
Microsoft Word	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Microsoft PowerPoint	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Microsoft Excel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Interactive whiteboard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overhead projector	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Laptop computer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comprehension tool e.g. summarises text for you	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vocabulary tool e.g. introduces new words and their meaning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Text Reader e.g. computer reads out the text on screen for you	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Text prediction tool e.g. suggests word endings (like your predictive text on your	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Display tool e.g. tool for logging all exercises completed or homework	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mind map tool e.g. helps you to create mind-maps for a particular subject to help when you're revising.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Google / search engine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Online thesaurus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wikipedia	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
http://www.teachnet.ie/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
http://www.skool.ie/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Table 4.3: List of ICTs from teacher ICT questionnaires

- Would you like to sign up to take part in a three-month project to investigate the usefulness of the ICTs that are currently available to your post-primary school?

4.9 ICT Questionnaire and Focus Group Results

This section presents the results of the Teacher ICT Questionnaire and Student ICT Questionnaire and the focus groups that were held after the deployment phase to follow up on the results. The results from the opening questions in the Student Questionnaire are presented in Section 4.9.1. The results from the opening questions in the Teacher Questionnaire are presented in Section 4.9.2. This is followed by the results of the ‘Types of ICT’ used, broken down by mainstream and learning support / resource teachers and students in Section 4.9.3. Tables 4.4 and 4.5 show the details for the two teacher focus groups and Tables 4.6 and 4.7 show the student focus group details. The number represents the number of participants in each focus group. The students came from first to fifth year classes.

Teacher Focus Group (School A)				
Type	No.	Duration	Notes	Important comments
Mainstream	3	60 mins	Lively debate.	Mainly use general ICTs.
Learning Support	4			Using primary-school ICT tools.

Table 4.4 Teacher Focus Group School A

Teacher Focus Group (School B)				
Type	No.	Duration	Notes	Important comments
Mainstream	2	60 mins	A little quiet & went through surveys.	Using online sites for revision
Learning Support	3			Using special needs focused tools.

Table 4.5 Teacher Focus Group School B

Student Focus Group (School A)				
Type	No.	Duration	Notes	Important comments
Mainstream	4	40 mins	2 students talking more than others.	Use ICT more at home.
Learning Support	3			Use internet for homework.

Table 4.6 Student Focus Group School A

Student Focus Group (School B)				
Type	No.	Duration	Notes	Important comments
Mainstream	3	40 mins	Good conversation.	Using general ICTs for homework.
Learning Support	3			Using screen reader tools in school.

Table 4.7 Student Focus Group School B

During the teacher focus group, the teachers were split up into pairs to discuss curriculum units that could be amenable to the various ICTs. These units were then developed into the sample materials for the initial ICT integration study.

4.9.1 Student Questionnaires and Focus Groups – Opening Questions

- How often do you use a computer for class work with your teacher?

70% of mainstream students reported that they rarely use a computer for class work with their teacher in the classroom. 27% of mainstream students said they used a computer once a month and 3% said they used a computer in class two times a month.

46% of students in learning support said they use computers twice a week with their teacher. 14% of learning support students said they used a computer once a week with their teacher.

Learning Support students are using ICT more frequently than their mainstream counterparts. This may be due to their small teacher-student ratio and small classroom setting. Most small learning support classrooms have at least one computer compared to mainstream classrooms. As learning support students are used to working with ICT, they should be comfortable in the ICT integration studies.

- How often do you use a computer for homework on your own?
- Do you have a computer at home? Internet?

46% of mainstream students said they used a computer for homework once a week. 18% of learning support students said they used a computer for homework once a week. In the focus groups, it was clear that the students were using the internet for homework. It is clear that mainstream students are using computers at home more than in school.

- What ICTs do you use in the classroom with your teacher? Please name any software packages e.g. MS PowerPoint, Dragon Naturally Speaking

Mainstream students mentioned word processors and learning support students mentioned word processors and text readers. Microsoft Word and Reading for Literacy were two programs highlighted. No curriculum materials were mentioned in this result.

- What ICTs do you use at home for homework / study?

Mainstream students mentioned word processors, search engines and social networking (Bebo 2006) and learning support students word processors and search engines. Nearly all mainstream students mentioned “Bebo”. An interesting point is that learning support students did not mention social media in this result.

Table 4.8 summarises the student opening questions with commentary.

Opening Question	Mainstream student (MS)	Learning support student (LS)	Comment
How often do you use a Computer in school?	70% rarely 27% once a month 3% twice a month	46% twice a week 14% once a week	LS students using ICT more frequently than MS students. This is due to their small teacher-student ratio. LS students should be comfortable with ICT in the studies.
How often do you use a Computer for homework?	46% once a week	18% once a week	Focus group: comment that students were using the internet for homework. MS students using computers at home more than school.
What ICTs do you use with your teacher?	Word processors	Word processors Text readers	“MS Word” & “Reading for Literacy” were highlighted. No curriculum materials mentioned.
What ICTs do you use at home?	Word processors Search Engines Social Networking	Word processors Search engines	Nearly all mainstream students mentioned “Bebo”. LS students did not mention social media in this result.

Table 4.8: Student Opening Questions

4.9.2 Teacher Questionnaires – Opening Questions

- Are you a mainstream teacher? / Learning support teacher? / Resource teacher? / Other?

45 mainstream teachers and 13 learning support / resource teachers took part in the questionnaires. Some of the mainstream teachers also did some resource teaching. This represents a diverse group of students for the questionnaires.

- What subjects do you teach?

Mainstream teachers who took part in these surveys taught many different subjects across the Junior Certificate and Leaving Certificate curriculum. Eight of the learning support teachers also taught English as a Second Language (ESL). This cross-over is interesting for further studies; would materials developed for an inclusive classroom be used in teaching ESL?

- Where do you get your material for your classes? Develop yourself? Curriculum guidelines? Resource materials / books? Internet?

In the questionnaires, teachers answered textbooks. In the focus groups, 10% of mainstream teachers mentioned that they follow curriculum guidelines (NCCA 2006) and the subject textbooks (50%). 75% of mainstream teachers in the focus groups said they have built up course materials over years of teaching. 22% of mainstream teachers use the Internet for extra material to support the curriculum.

Prior to taking the questionnaire, learning support teachers and resource teachers reported that they carry out two different types of work with students in their small group sessions. Learning support teachers work closely with subject teachers to help students to cope with the workload and content in their mainstream classes. Many of the students have an exemption from Irish so learning support classes take place during this time. The other area of work is general literacy needs that are subject-independent. Learning support teachers use textbooks (47%) for content and (67%) reported re-working the text material for their learning support classes. 15% of learning support teachers also reported looking up the Internet for literacy and subject resources. It is clear that all teachers who took part in the survey put a lot of extra time into creating their own materials for their students. They also use the internet for printing resources.

- How often do you use ICTs with your students?

Only 7% out of the 22% of mainstream teachers who accessed online curriculum websites let the students use the resources in class, e.g. Skoool.ie (2006). 100% of learning support teachers reported using a computer with students every day. 50% mainstream teachers reported using a computer with students two times a month. 20% of mainstream teachers reported using a computer with students once a week. This result seems to indicate more ICT use than the students indicated in their survey.

- How often do you use ICT to prepare curriculum teaching materials for the classroom?

Teachers are using ICT regularly for preparing classwork. 100% of learning support teachers reported using a computer for content preparation once a week. 51% of mainstream teachers used ICT to prepare content once a week with 14% of mainstream teachers also setting homework for students using ICT.

- What ICTs do you use in the classroom with your students? Please name any software packages e.g. MS PowerPoint, Dragon Naturally Speaking

Mainstream teachers reported using MS PowerPoint (50%) and MS Word (21%).

100% of learning support teachers reported using general word processors and 15% of learning support teachers report using special needs-focused tools such as Clicker (2006), Dragon Naturally Speaking (2006), Kurzweil (2006) and Reading for Literacy (2006).

- What ICTs do you use to prepare curriculum materials for the classroom? Please name any software packages e.g. MS PowerPoint, Dragon Naturally Speaking

50% of Mainstream teachers reported using MS PowerPoint and 21% reported using MS Word to prepare curriculum materials. 22% of mainstream teachers reported using online curriculum-focused tools. Only 7% out of this 22% let the students use the resources in class e.g. Skoool.ie (2006). In the focus groups, it was evident that teachers were printing materials off the websites rather than students use the sites in the classroom.

100% of learning support teachers reported using general word processors and 15% of learning support teachers report using special needs-focused tools such as Clicker (2006). 23% of learning support teachers reported using Google (2006) to find resources for literacy teaching. During the focus group, it was clear that teachers are printing materials from online resources rather than students using the online materials in the classroom.

- Do you use any websites for help with content preparation? (e.g. Skoool.ie)

22% of mainstream teachers reported using Teachnet (2006), Skoool.ie (2006) and the BBC Learning Website (2006).

23% of learning support teachers reported using Google (2006) to search for relevant subject resources and general literacy support resources. English resources teachit.co.uk (TeachIt 2006) and schoolhistory.co.uk (SchoolHistory, 2006), which are British websites, were highlighted by one mainstream teacher during this survey.

15% of learning support teachers reported trying curriculum-focused websites. In the focus groups the learning support teachers said they do not use them often because there is a lack of content-appropriate materials for their learning support students. Many of them are using content-independent tools or primary schools programmes. The primary school programmes are at the correct language level however the content is aimed at much younger children.

- Would you be willing to take part in a three-month project to investigate the usefulness of the ICTs that are currently available in post-primary school schools in Ireland?

91% of both mainstream and learning support teachers indicated they would take part in the initial three-month integration of ICT project in the questionnaires.

Table 4.9 summarises the teacher opening questions with commentary.

Opening Question	Mainstream	LS teacher	Comment
Type of teacher?	45	13	Diverse group of teachers.
What subjects do you teach?	JC and LC subjects	8 also taught EFL	A large range of all subjects. Could materials be useful for EFL students?
Where do you get your teaching materials?	10% Curriculum guidelines 50% textbooks 75% personal materials 22% internet	47% textbooks 67% re-working texts 15% internet	All teachers put a lot of extra time into creating their own materials for their students. They also use the internet for printing resources.
How often do you use ICTs with your students?	50% twice a month 20% once a week	100% every day.	This result seems to indicate more ICT use than the students said in their survey.
How often do use ICT to prepare classwork?	51% once a week 14% setting homework	100% once a week.	Teachers are using ICT regularly for preparing classwork.
What ICTs do you use in the classroom?	MS Word and MS PowerPoint	General ICTs and Special Needs	“Dragon Naturally Speaking” mentioned.
What ICTs do you use to prepare classwork?	22% online, while mainly MS Word	General ICTs and Special Needs focused	Focus group: teachers are printing materials from online resources rather than students using the online resource.
Do you use websites to help with content prep?	TeachNet, Skooool.ie, BBC	Lack of appropriate content.	TeachIt.co.uk mentioned in focus groups. Resources were re-worked.

Table 4.9: Questionnaire Results from Teacher Opening Questions

4.9.3 Types of ICTs

Table 4.10 shows students' questionnaire results broken down by mainstream students (MS) and students in learning support / resource (LS):

ICT Type	School		Homework	
	MS	LS	MS	LS
Word Processor	19%	100%	46%	19%
Microsoft PowerPoint	35%	19%	0%	0%
Microsoft Excel	23%	5%	5%	0%
Interactive whiteboard	0%	0%	0%	0%
Overhead projector	30%	16%	0%	0%
Laptop computer / Desktop	30%	93%	18%	18%
Comprehension tool e.g. summarises text for you	0%	46%	0%	0%
Vocabulary tool e.g. introduces new words and their meaning	0%	54%	0%	0%
Text Reader e.g. computer reads out the text on screen for you	0%	77%	0%	0%
Text prediction tool e.g. suggests word endings	0%	14%	0%	0%
Display tool e.g. Area to save and view work	0%	0%	0%	0%
Mind map tool e.g. helps you to create mind-maps for a particular subject to help when you're revising	0%	0%	0%	0%
Google / search engine	3%	3%	89%	81%
Online thesaurus	0%	0%	0%	5%
Wikipedia	0%	0%	30%	5%
http://www.teachnet.ie/	2%	0%	47%	0%
http://www.skool.ie/	5%	0%	73%	2%
Social networking (Bebo)	0%	0%	92%	63%
Other:				

Table 4.10: Student ICT Questionnaire Results

Table 4.11 shows the teachers' ICT questionnaires results broken down by mainstream teacher (MS) and Learning support / Resource Teacher (LS):

ICT Type	Content preparation		Students use during class		Setting homework	
	MS	LS	MS	LS	MS	LS
Word Processor	51%	100%	4%	100%	14%	0%
Microsoft PowerPoint	22%	0%	8.8%	0%	0%	0%
Microsoft Excel	4%	0%	4%	0%	4%	0%
Interactive whiteboard	0%	0%	0%	0%	0%	0%
Overhead projector	22%	0%	22%	0%	0%	0%
Laptop computer / Desktop	22%	31%	16%	62%	0%	0%
Comprehension tool	0%	15%	0%	31%	0%	0%
Vocabulary tool	0%	15%	0%	31%	0%	0%
Text Reader	0%	0%	0%	54%	0%	0%
Text prediction tool	0%	0%	0%	31%	0%	0%
Display tool	0%	0%	0%	0%	0%	0%
Mind map tool	0%	0%	0%	8%	0%	0%
Google / search engine	80%	23%	0%	0%	56%	0%
Online thesaurus	27%	0%	0%	0%	0%	0%
Wikipedia	22%	0%	0%	0%	0%	0%
http://www.teachnet.ie/	21%	5%	0%	0%	21%	0%
http://www.skool.ie/	22%	5%	8%	4%	22%	0%
Curriculum-focused content tool	62%	15%	22%	0%	22%	0%
Other: Clicker word processor	0%	8%	0%	7.6%	0%	0%
Other: BBC Learning Website	67%	0%	0%	0%	0%	0%
Other:						

Table 4.11: Teacher ICT Questionnaire Results

Results in Tables 4.10 and 4.11 indicate that overall there is little use of available ICT resources to support class work in both the mainstream and learning support areas.

While 51% of mainstream teachers respondents said they used a word processor to prepare content for class only 4% of them use a word processor during class time or have students use a word processor during class. However, 14% of mainstream teachers said they have set homework that uses word processors so they must be aware that students have access to and are using word processors. Conversely, 100% of learning support teachers use a word processor to prepare content for, and used word processors in, learning support classes. None of the learning support teachers set homework that needs to be done on a word processor. 19% of mainstream students and 100% learning support students stated they use a word processor in school to support coursework. Furthermore, 46% of mainstream students and 19% of learning support students use a word processor for homework.

With 22% of mainstream teachers using Microsoft PowerPoint (and overhead projector) for content preparation and 9% stating they have had students use it in class, I was expecting more than the reported 35% of mainstream and 19% of learning support students to have used PowerPoint in school. However, it is not clear whether the students are referring to a teacher using PowerPoint or using PowerPoint themselves in school. None of the students reported using PowerPoint at home.

Just over 4% of mainstream teachers reported using Microsoft Excel for content preparation, in the classroom and setting homework. Again, mainstream students reported higher figures, with 23% of mainstream students and 5% of learning support students stating they used Excel in school. 5% of mainstream students and no learning support students reported using Excel for homework.

There was no interactive whiteboard in either of the schools so no one reported using one in class or at home.

22% of mainstream and 31% of learning support teachers stated that they used a laptop/desktop to prepare content for the classroom. The learning support figure is at odds with 100% of them that stated using a word processor for content preparation. Perhaps this difference is to do with how often the word processor is used. It seems probable from these results that the 100% refers to having used a word processor

rather than using a word processor frequently. 16% of mainstream teachers said they have students using a laptop/desktop during class. Laptop/desktop use is much more frequent in learning support classes with 62% of learning support teachers reporting their use during class by students. 30% of mainstream students said they use a laptop/desktop in school and 18% for homework. 93% of learning support students reported using a laptop/desktop in school and 18% reported using one for homework.

No mainstream teachers or students reported using a comprehension tool or a vocabulary tool. 15% of learning support teachers used both tools for content preparation and 31% have students using it in class. The student results correlate with no mainstream students having reported using either tool and 46% of learning support students using a comprehension tool and 54% using a vocabulary tool in class.

Again, no mainstream teachers or students reported using a text reader while 54% of learning support teachers reported that students used one in their learning support classes. 77% of learning support students said they used a text reader in class.

While 31% of learning support teachers said they used a text prediction tool similar to how a mobile phone text tool works, only 14% of learning support students reported using one. None of mainstream teachers or students reported using a text prediction tool in school or for homework.

None of respondents reported using a display tool where one could save and view work. Out of all the respondents, only 8% of learning support teachers reported having used a mind-map tool with students in class. None of the students reported using this however they may have been unclear what it was or the students who used it may not be in the sample.

80% of mainstream and 23% of learning support teachers reported using a search engine such as Google for content preparation. While none of the teachers reported using a search engine in class with students, 56% of teachers reported they set homework that could make use of a search engine.

Only 3% of mainstream and 3% of learning support students report using a search engine in school however 89% of mainstream and 81% of learning support students use a search engine for homework.

22% of mainstream teachers reported using online thesauruses (27%) and Wikipedia (22%). 30% of mainstream students and 5% of learning support students reported using it for homework.

Mainstream teachers are using online curriculum materials for content preparation and homework tasks: TeachNet.ie (21%) and Skoool.ie (22%). Even though the teachers are using it for content preparation and homework, only 4% of them have students using Skoool.ie during class time. Very small numbers of mainstream students report using these websites during school time (averaging 4%). From these figures, it seems that teachers are looking up content online and printing it as opposed to using interactive student modules that are available on these websites. Mainstream students do use TeachNet.ie (47%) and Skoool.ie (73%) for homework. None of the learning support students reported using these websites in school and an average of 3% had used them for homework. This correlated with the number of learning support teachers (5-7.6%) using these websites for content preparation.

62% of mainstream teachers and 15% of learning support teachers said they use a curriculum-focused content tool. 22% of mainstream teachers let students use the tool too while none of the learning support teachers allow their students to use a curriculum-focused tool during class time.

92% of mainstream students and 63% of learning support students said they used social networking at home to help with homework.

7% of mainstream teachers named the BBC Learning Website (2006) as a resource they use for content preparation while 8% of learning support teachers named Clicker (2006) which is a word processor for content preparation and 8% allowed their students to use it in class.

In the learning support area, it is clear that learning support and resource teachers do not use these online curriculum materials to support their work in the classroom. While 15% of learning support teachers have used a curriculum-focused tool, none of them are actually using the resources in their classes. This question will be investigated during the next phase of the project (Chapter 5). It is also clear that many of these teachers are not making use of ICTs that are developed specifically for

students in learning support with only just 54% of the learning support teachers using these in class with students.

4.10 Main Findings

Section 4.2 discussed how this chapter fits into the Analysis Phase (Colpaert 2004) of the project methodology. Section 4.3 set out why these questionnaires were undertaken. Section 4.4 described the schools that took part in the project. The participant numbers are also presented. Section 4.5 discussed survey design and the approach I took. Section 4.6 describes the focus groups. The Student Survey Questionnaires were described in Section 4.7. Section 4.8 describes the Teacher Survey Questionnaires. Section 4.9 presented the results.

The surveys point to three main tool types being used by teachers and students in post-primary schools today:

- General ICT tools (e.g. word processors)
- Special Needs-Focused Tools (e.g. text readers)
- Online curriculum-focused materials (e.g. Skoool.ie curriculum materials)

Although the numbers involved in this survey are small, these questionnaire results have clearly shown the gaps in the use of ICT. They indicate a dichotomy between use for preparation and during class time. While 46% of students use computers and the Internet at home once a week to support homework, they are not using these resources in school. 80% of students are using online materials to support their homework however they are not using them in the classroom. 8% of mainstream teachers who are using online materials are printing the materials from these websites for use in the classroom however are not using the sites in the classroom (via overhead projectors for example). Teachers are printing work off for the students however they could actually be allowing the students to complete the work online as many of the students have the Internet at home and are using the sites frequently.

The results show that 50% of learning support teachers and students rely on tool technology that is subject-independent. Only 4% of learning support teachers and 2% of students are using curriculum-focused materials in school or at home.

Chapter 4 showed that teachers are under-utilising available ICTs. Teachers were more likely to use ICTs to prepare work to be printed out for use in class rather than have students use the ICT themselves. A key finding from Chapter 4 is that learning support teachers reported using primary school programs for their students. While mainstream teachers and students accessed online curriculum-focused materials, learning support teachers and students reported that the language level and presentation of the content was inappropriate.

The next phase of the project was to find out exactly how teachers and students are using these ICT resources during a three-month project described in Chapter 5 (Initial Deployment of ICT Materials in Two Selected Post-Primary Schools).

CHAPTER 5: Initial Deployment of ICT Materials in Two Selected Post-Primary Schools

5.1 Introduction

This chapter presents the questionnaires that were carried out in two Irish post-primary schools (20060 to investigate the impact of integrating currently-available ICTs (highlighted in Chapter 4) into the classrooms of mainstream (MS) and learning support (LS) teachers to support the Junior Certificate curriculum (JC 2006). This chapter also presents the design guidelines for teachers to create their own materials that were developed with the teachers and students during focus groups.

Section 5.2 discusses how this chapter fits into the Analysis Phase (Colpaert 2004) of the project methodology. Section 5.3 describes the participant numbers. The three types of ICT are described in Section 5.4. Section 5.5 discusses the deployment of three different types of ICT in the two post-primary schools for three months. The mainstream and learning support teacher and student questionnaires are described in Section 5.6. Section 5.7 describes the focus groups and Section 5.8 discusses the survey and focus group results. Section 5.9 presents the design guidelines developed with the teachers and students from the focus groups. Sections 5.10 and 5.11 present the full Analysis Phase findings in the form of Colpaert's GLDT grid. Section 5.12 summarises the main findings from the chapter.

5.2 Research Methodology: Analysis

This section describes questionnaires that were completed by post-primary school teachers and students on how they used three types of ICT in post-primary schools in Ireland to support the JC curriculum:

- General ICT tools (e.g. word processors)
- Special Needs-Focused Tools (e.g. text readers)
- Online curriculum-focused materials (e.g. Skoool.ie curriculum materials)

These questionnaires were carried out as a part of the Analysis Phase of Colpaert's Design Model (Colpaert 2004). The Analysis Phase consists of gathering all possible information about the Design space.

This study was undertaken because results in Chapter 4 show that while teachers in both schools participating in the study are using word processors or search engines to find content, they are not using other tools that are available to them in the classroom with students. Learning support teachers in particular are not availing of online materials. Many learning support teachers are not using tools that are designed for students with special needs consistently. This study looks at what happens when these tools are being used in the classroom consistently for three months.

DCU ethics guidelines were followed and parental consent forms were required from all participants in the integration.

5.3 School Participants

Mainstream (MS) and Learning Support (LS) teachers from two Irish post-primary schools that took part in ICT questionnaires (described in Chapter 4) were invited to take part in a three-month study to analyse the impact of these ICTs on their classroom teaching. From the initial questionnaires (Chapter 4) there was a 20% drop in mainstream teachers taking part in this study. There was an 8% drop in learning support teachers (which represents 1 teacher), a 14% drop in mainstream students and a 5% drop in learning support students. There is overlap in the number of students as some students took part in more than one ICT-type study due to their subject teachers being involved. Table 5.1 presents the participants in the Impact of Available ICTs study. The teachers (and their corresponding Junior and Leaving Certificate students) were split into three groups by the researcher for the study according to ICT types.

Participant type	General ICTs	Focused Special-Needs ICTs	Online curriculum-focused ICTs	Total
	Group A	Group B	Group C	
MS teachers	12	12	12	36
LS teachers	4	4	4	12
MS students	119	120	124	363
LS students	13	14	14	41

Table 5.1: Impact of ICT project participants broken down by ICT type

5.4 ICT Types

Each of the three groups was given one of the following types of ICT to integrate into their teaching:

- Group A
 - General ICTs (MS Word 2006, MS PowerPoint 2006)
- Group B
 - Focused ICT tools for special needs students (Read and Write Gold 2006, Dragon Naturally Speaking 2006)
- Group C
 - Online curriculum-focused materials (TeachNet 2006, Skoool.ie 2006)

5.4.1 Curriculum Enhanced with General ICTs

Group A was given general ICTs to integrate into the curriculum such as word processors and software. Group A was made up of 12 mainstream teachers, 4 learning support teachers, 119 mainstream students and 13 learning support students.

5.4.2 Curriculum Enhanced with Focused Special Needs Tools

Group B was given tools that were developed to help students with special needs in mind. Group B was made up of 12 mainstream teachers, 4 learning support teachers, 120 mainstream students and 14 learning support students. The tools used were Read and Write Gold (2006) and Dragon Naturally Speaking (2006).

Read and Write Gold is a screen-reader. Screen reading software will read any text on the computer screen, such as a webpage or a document. It can also read out passages of a textbook which have been scanned into the computer. The reading voice and reading speed can be adjusted; words can be read word-by-word, in sentences or continuous passages. Text scanned in can be converted to an audio file format.

Dragon Naturally Speaking (2006) is voice recognition software, which was originally designed so that astronauts could use computers while tucked up in their space suits

(DAI). It is ideally suited for older students and adults who have to produce extended pieces of written work such as long essays. All instructions can be given verbally; the computer will type as you speak. Dragon Naturally Speaking is the most commonly used programme of this type. There is an initial training period where the programme learns about the user's voice, and the accuracy does improve with usage, as each time the programme is used it learns more about the user's voice, speech patterns and the vocabulary commonly used. A compatible digital voice recorder can be used with Dragon; this means that documents can be created by voice anywhere, and when the digital recorder is synced with the PC, Dragon can then transcribe the document.

5.4.3 Curriculum Enhanced with Available Online Curriculum Materials

Group C was given curriculum-focused online materials to integrate into the curriculum which included sample materials designed by the researcher. Group C was made up of 12 mainstream teachers, 4 learning support teachers, 124 mainstream students and 14 learning support students. The online websites that were used were TeachNet (2006) and Skool.ie (2006).

TeachNet Ireland funds Irish teachers throughout Ireland to publish curriculum units that demonstrate the integration of ICT into classroom teaching. TeachNet Ireland is an initiative of St Patricks College Drumcondra, run in association with the Teachers Network New York. Teachers are trained on how to best disseminate technology integration into classroom teaching and to create interactive curricula for publication on the <http://www.teachnet.ie/> website.

Skool.ie is collaboration between AIB Bank (2006), The Irish Times (2006), and Intel Ireland (2006). It focuses on the Irish Junior and Senior Cycle curricula and is exam-focused. Skool.ie leverages the expertise of teachers as well as members of the syllabus and examination boards for the sourcing and development of content.

5.5 Deployment in Schools

As all teachers and students were invited to take part in this project, the teachers finally involved taught a number of different subjects across the JC curriculum.

Meetings were arranged with teachers in the two schools to discuss the nature of the deployment. I met with the teachers who took part in the first focus group and then met again with a larger teacher body in both schools in the staff room. A presentation was given about the project and we had discussions about how these ICTs could be integrated into curriculum units. Figure 5.1 shows the initial contact with the schools.

During the focus group at the end of Chapter 4, teachers were put into pairs or small groups according to their subject and encouraged to brainstorm ideas on how JC curriculum units in their subject could be further enhanced by ICT.

Teachers focused only on curriculum units that they planned to cover with their students in the next three months. I tried to split the learning support teachers among the groups of mainstream teachers. This was not always possible as the meetings depended on the availability of teachers.

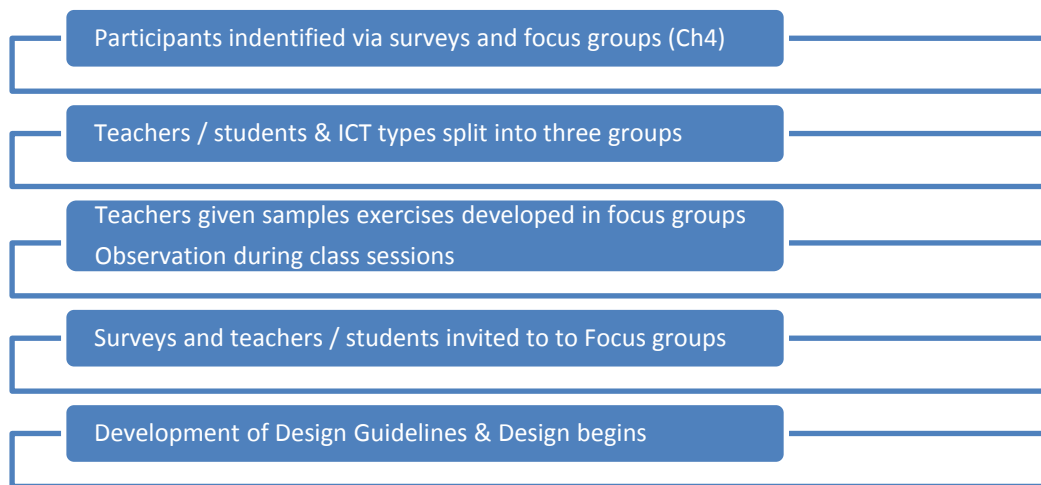


Figure 5.1: Contact with Schools for ICT Integration

Each teacher was given time to come up with a short list of curriculum units and related activities involving ICTs in the classroom which were then discussed as a group. The groups were a mix of mainstream and learning support. The suggestions ranged across using the three types of ICT. As not all teachers had access to every type of ICT, teachers may not have been able to try each idea.

For example, suggestions for the English JC curriculum novel included:

- Ask students to prepare PowerPoint presentation in pairs on the main themes
- Scan novel and use Read and Write Gold to read it
- Allow students time to look up extra resources online
- Allow essays to be handed in using MS Word
- Show YouTube (2006) critiques of the novel by fellow students around the world
- Create memory maps on chapters with key quotes on MS Word or PowerPoint
- Teacher presentation on exam technique and exam question language for discussing your novel
- Project – review information on this novel online (on set sites) and present a synopsis.

Most of the ICTs allocated for the project were available in the school however versions of Read and Write Gold and Dragon Naturally Speaking had to be borrowed from education centres. These pieces of software proved difficult to obtain. As a result, each teacher did not begin and end the three-month study at the same time.

Both schools were happy for me to be involved in observation work and classes were chosen so I could observe each ICT type.

This meant me going into a classroom or lab once every two weeks to observe:

- teacher use of the software
- student use of the software
- technical issues
- impact of the technology and teaching style and content
- impact of the technology on learning style
- impact on student relationships

Notes were taken during these observation sessions on how the teachers used the software in practise and how the students interacted with the materials.

The observation of the General ICTs, Special-Needs Focused Tools and Curriculum-Focused online materials in the mainstream classrooms showed that students had no major technical difficulties after the first week. Some extra in-class training and guidance was needed the first observation sessions so that teachers felt comfortable teaching a normal class with these new tools. Teachers were observed setting homework that required ICT. In the smaller learning support sessions teachers were working closely with the students on the materials for the majority of the time.

However, there was a significant problem in that the online curriculum focused websites did not have appropriate resources for learning support students. This resulted in the learning support teachers not using this resource.

There were some issues that there was not enough work to keep everyone in the classroom occupied. These issues were difficult to resolve because of the scope of the integration became too broad. Only so many sample materials could be created.

Many of the students had not used one or more of the ICT tools before and enjoyed trying out the new tools. The students seemed mostly engaged in the work however again issues of not enough resources developed came into play.

After the three months of integrating the tools, teachers and students completed questionnaires and took part in focus groups to discuss questionnaire results in depth and to develop design guidelines for developing curriculum-focused ICT materials for diverse students in an inclusive post-primary school.

Table 5.2 shows a summary of the observation sessions.

Observation 1 School A				
Type	No.	Duration	Notes	Observation
Inclusive class	27	40 mins	Using General ICTs	Teachers allowed students to submit homework via MS Word.
Observation 2 School A				
Type	No.	Duration	Notes	Observation
Learning support	3	40 mins	Using Special Needs Focused	Many had not used these tools before & found them useful.
Observation 3 School B				
Type	No.	Duration	Notes	Observation
Learning support	4	40 mins	Using Online Resouces	Content was not appropriate to students.

Table 5.2: Observation during the ICT Integration

5.6 Teacher and Student Questionnaires

After the three-month study, the three groups of mainstream and learning support teachers as well as students were given a questionnaire depending on which of the three types of ICT they had been given.

Under the question asking about when students and teachers used each ICT, the surveys shown here include content preparation and homework as options. In the actual questionnaires in Appendix B, only teachers were asked about using ICT for content preparation and only students were asked about using ICT for homework.

5.6.1 Curriculum Enhanced with General ICTs

Table 5.3 shows the questionnaire given to mainstream and learning support teachers and students with General ICTs integrated into the curricula.

MS Word	When did you use it?	<input type="checkbox"/> Content preparation <input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class	Comments: (More spaced provided on actual questionnaire)
MS Word	For what? e.g. which module was used	(More space provided on actual questionnaire)	Comments:
MS Word	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
MS PowerPoint	When did you use it?	<input type="checkbox"/> Content preparation <input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class	Comments: (More space provided on actual questionnaire)
MS PowerPoint	For what? e.g. which module was used	(More space provided on actual questionnaire)	Comments:
MS PowerPoint	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:

Table 5.3: Questionnaires on General ICT tools

5.6.2 Curriculum Enhanced with Focused Special Needs Tools

Table 5.4 shows the questionnaire given to mainstream and learning support teachers and students with focused special needs tools integrated into the curricula.

Read and Write Gold	When did you use it?	<input type="checkbox"/> Content preparation <input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class <input type="checkbox"/> Homework	Comments: (More space provided on actual questionnaire)
Read and Write Gold	For what? e.g. which module was used	(More space provided on actual questionnaire)	Comments:
Read and Write Gold	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
Dragon Naturally Speaking	When did you use it?	<input type="checkbox"/> Content preparation <input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class <input type="checkbox"/> Homework	Comments: (More space provided on actual questionnaire)
Dragon Naturally Speaking	For what? e.g. which module was used	(More space provided on actual questionnaire)	Comments:
Dragon Naturally Speaking	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:

Table 5.4: Questionnaire on Focused Special Needs Tools

5.6.3 Curriculum Enhanced with Available Online Curriculum Materials

Table 5.5 shows the questionnaire given to mainstream and learning support teachers and students with online curriculum materials integrated into the curricula.

TeachNet	When did you use it?	<input type="checkbox"/> Content preparation <input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class <input type="checkbox"/> Homework	Comments: (More space provided on actual questionnaire)
TeachNet	For what? e.g. which module was used	(More space provided on actual questionnaire)	Comments:
TeachNet	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
TeachNet	Content	<input type="checkbox"/> Age-appropriate <input type="checkbox"/> Content level appropriate <input type="checkbox"/> Interactive	Comments:
Skool.ie	When did you use it?	<input type="checkbox"/> Content preparation <input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class <input type="checkbox"/> Homework	Comments: (More space provided on actual questionnaire)
Skool.ie	For what? e.g. which module was used	(More space provided on actual questionnaire)	Comments:
Skool.ie	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
Skool.ie	Content	<input type="checkbox"/> Age-appropriate <input type="checkbox"/> Content level appropriate <input type="checkbox"/> Interactive	Comments:

Table 5.5: Online curriculum materials questionnaire

5.7 Focus Groups to Discuss Surveys Results and Deployment

Once the deployment was completed and the questionnaires were collected, mainstream and learning support teachers were invited to take part in focus groups (Tables 5.6 to 5.9 below) to discuss the results and to give feedback on the deployment. The teachers were also advised that the focus groups would work on developing design guidelines to develop curriculum-focused CA(L)L materials for diverse students.

Student focus groups were also completed with mainstream students and learning support students to obtain their feedback on the deployment and capture their input into the design guidelines for the new curriculum-focused CA(L)L materials to be developed in later parts of the research project.

Teachers indicated on their survey whether they would like to take part in a focus group to discuss the survey in more detail. I contacted the teachers in question to arrange a time that suited most. The teachers selected a number of students for a student focus group. The student focus group contained a mixture of mainstream and learning support students. A schedule of questions was prepared ahead of the focus groups (see Appendix D). Some of questions were the same as the questionnaire as I wanted to promote discussion on those topics. The student focus groups lasted one class session (40 minutes) and the teacher focus group was two class sessions (1 hour 20 minutes). I took notes on what the teachers and students said and put these up on the board.

The teacher focus group were then split into pairs to work on design guidelines. I facilitated this process by writing the focus group comments up on the board about their ICT integration. Each group then reported on the guidelines they felt were the most appropriate to be used in developing design guidelines for curriculum-focused materials. I took note of these guidelines on the board. This was followed by a group discussion to flesh out the guidelines. This teacher focus group worked closely with me in the design of the materials and tested the materials.

5.8 Results from Questionnaires and Focus Groups

This section presents the results from the questionnaires and the focus groups on the three month deployment of the three types of ICT: General ICTs, Online Curriculum-Focused Materials and Focused ICT tools for students with special needs. Mainstream and learning support teachers and students who took part in each deployment were given the same questionnaire. It is important to differentiate mainstream and learning support replies, so the teachers indicated which questionnaires were completed by students receiving learning support. Tables 5.6 and 5.7 show the details for the two teacher focus groups and Tables 5.8 and 5.9 show the student focus group details and participant numbers and the findings for the design guidelines.

Teacher Focus Group (School A)				
Subject	No.	Duratio	Notes	Important comments
English	1	80 mins	Discussion of ICT integration & development of design guidelines.	Use exam questions as content.
History	1			Materials don't have to be online.
Geography	1			Use mind-maps if possible.
Learning Support	1			Content-level should be adapted.

Table 5.6 Teacher Focus Group School A for Design Guidelines

Teacher Focus Group (School B)				
Subject	No.	Duration	Notes	Important comments
English	1	80 mins	Discussion of ICT integration was useful follow up to surveys.	Feedback for teachers & students.
History	1			Teachers can create their own materials.
Learning support	1			Use dyslexia-friendly colours & fonts.

Table 5.7 Teacher Focus Group School B for Design Guidelines

Student Focus Group (School A)				
Type	No.	Duration	Notes	Important comments
Mainstream	3	40 mins	Students really enjoyed being involved in design.	Use age-appropriate materials.
Learning support	3			Use multimedia & interaction.

Table 5.8 Student Focus Group School A for Design Guidelines

Student Focus Group (School B)				
Type	No.	Duration	Notes	Important comments
Mainstream	2	40 mins	Students helped with suggestions for guidelines.	Students should design the
Learning support	2			Keep text to a minimum.

Table 5.9 Student Focus Group School B for Design Guidelines

5.8.1 General ICTs

The results of the ICT deployment study in Table 5.10 below on the use of MS Word by mainstream teachers show that 25% of mainstream teachers used MS word for content preparation. 50% of mainstream teachers used it during class time as a teaching tool. 100% reported that they allowed their students to use MS word in lab time if they got access to a lab and 75% said they set homework that required using MS Word. 100% of mainstream teachers reported that it was easy to use. 83% of mainstream teachers used MS Word for students to write their essays. Teachers reported that MS Word was most helpful for essay writing and reports on works such as novels or plays. 100% of teachers reported that they used PowerPoint in the classroom however in focus groups, it transpired that most teachers just used it themselves in class. Two teachers reported students giving presentations as a part of a

History project. Mainstream teachers stated that the ICTs were most useful for project work or homework where students could work on their own.

In the focus groups, mainstream teachers talked about the how difficult it was to get lab time to use their ICT. This was clear during the observation sessions where one session was cancelled because a lab became suddenly unavailable due to another school issue. This was a significant issue for all teachers except one in the focus groups. This one teacher said there were a number of “home classrooms” where she worked out of most of the day which had one computer in the room. In this case, when the teacher could not get lab time, she used the general ICTs to present materials with MS PowerPoint. MS Word was also used to create mind-map on her projection screen so that the whole class participated.

ICT	When used?	Easy to	For?
MS Word	25% Content preparation 50% Teacher during class 100% Students during class	100% Yes % No	83% Essay writing 75% Timelines (novel, play) 75% Notes 75% Important quotations
MS PowerPoint	100% Content preparation 100% Teacher during class 83% Students during class	100% Yes % No	100% Virtual sites visit e.g. Vikings 100% Students synopsis of TV/film 50% Mind map for poems / plays 25% Timelines (novel, play)

Table 5.10: General ICT Results – Mainstream teachers

Results presented in Table 5.11 show that 83% of students used Microsoft Word for homework. The homework included essay writing and study revision. 100% reported that their teachers used PowerPoint in school. In the focus groups, mainstream students reported enjoying being able to submit typed homework to their teachers.

This result showed that the students enjoyed the integration of the general ICT tools into classroom activities and their willingness to partake in the curriculum-focused integration. The results show that mainstream students do use their ICTs more at home and during this study they were given an opportunity to use it in class also.

ICT	When used?	Easy to use?	For?
MS Word	70% Teacher during class 100% Students during class 85% Homework	100% Yes % No	100% Essay writing 75% Timelines (novel, play) 90% Notes 90% Important quotations
MS PowerPoint	100% Teacher during class 83% Students during class 58% Homework	75% Yes 25% No	100% Virtual sites visit e.g. Vikings 100% Students synopsis of TV/film 70% Mind map for poems / plays

Table 5.11: General ICT Results – Mainstream students

Results in Table 5.12 show that learning support teachers integrated ICT into their curriculum. 100% of teachers reported using MS Word and MS PowerPoint for content preparation and in the class with their students. They also allowed student to complete film reviews on MS Word and mind maps on MS PowerPoint during class time with the teacher. During the observation sessions, it was noted that learning support teachers always had access to a computer in their usual “home classroom”. There were occasions during the study where this room became unavailable to them. Learning support teachers worked closely with their students and worked through the materials sitting beside the student. One teacher had all three of her students working together on the ICT. In the focus groups, one teacher indicated that the students took

turns using the ICT while the others worked on another piece of work. This was an interesting finding as the aim was to move towards an inclusive classroom environment where everyone worked together. This proved difficult to do in reality due to the infrastructure restraints.

ICT	When used?	Easy to use?	For?
MS Word	100% Content preparation 100% Teacher during class 100% Students during class 75% Homework	100% Yes % No	75% Teacher notes on class work 75% Student notes on class work 100% Key points
MS PowerPoint	100% Content preparation 100% Teacher during class 75% Students during class 75% Homework	100% Yes % No	100% Virtual sites visit 75% Students synopsis of TV/film 100% Mind map for poems / plays

Table 5.12: General ICT Results – Learning support teachers

Table 5.13 shows that learning support students reported that they used both MS Word and PowerPoint at home and at school. Examples students gave during the focus groups were giving presentations on their film in class and presentations on a history assignment.

During the observation it was evident that the students enjoyed working with the materials and were confident using word processors.

ICT	When used?	Easy to use?	For?
MS Word	100% Teacher during class 100% Students during class 75% Homework	100% Yes % No	75% Student notes on class 100% Essay homework 75% Add images to notes
MS PowerPoint	100% Teacher during class 83% Students during class 58% Homework	100% Yes % No	100% Virtual sites visit 100% Students presentation: TV/film 100% Mind map for novel

Table 5.13: General ICT Results – Learning support students

5.8.2 Online Curriculum-Focused ICT Materials

Table 5.14 shows that mainstream teachers found the online curriculum websites (Skooool.ie, TeachNet) very beneficial. In the focus groups, technical difficulties were mentioned as a serious issue and this was also noted in the observation sessions. Websites crashed and some exercises did not work. Teachers still printed some materials for class when they could not get access to a lab for students. Teachers felt that the materials were age- and content- appropriate to their students. In the focus groups, teachers reported that the students with learning difficulties in their classroom struggled with the language level of the content. Teachers reported that the two sites were 23% interactive and this text-heavy style was inappropriate for students with dyslexia.

Table 5.15 reports that mainstream students had similar results to the mainstream students. They reported a lack of interactivity but said the content was suitable for their needs and age-appropriate.

Table 5.16 shows that learning support teachers used the online curriculum websites for content preparation. In the focus groups, it became evident that the teachers did not continue using these materials for the full 3 months as they could not find resources

appropriate to their students' needs. Teachers reported editing information from TeachNet and Skoool.it for their purposes. Significantly, teachers reported that some of the resources they used were not tagged as 'special needs appropriate' on the sites even though they were useful resources that the learning support teachers could use.

ICT	When used?	Easy to use?	Content?
TeachNet	100% Content preparation 50% Teacher during class 75% Students during class 50% Homework	66% Yes 34% No	100% Age-appropriate 100% content level appropriate 25% interactive
Skoool.ie	100% Content preparation 50% Teacher during class 58% Students during class 50% Homework	50% Yes 50% No	100% Age-appropriate 91% content level appropriate 25% interactive

Table 5.14: Online Curriculum Materials Results – Mainstream teachers

ICT	When used?	Easy to use?	Content?
TeachNet	50% Teacher during class 50% Students during class 85% Homework	75% Yes 25% No	90% Age-appropriate 100% content level appropriate 25% interactive
Skoool.ie	50% Teacher during class 58% Students during class 50% Homework	80% Yes 20% No	92% Age-appropriate 91% content level appropriate 36% interactive

Table 5.15: Online Curriculum Materials Results – Mainstream students

ICT	When used?	Easy to use?	Content?
TeachNet	100% Content preparation 25% Teacher during class 25% Students during class 0% Homework	66% Yes 34% No	25% Age-appropriate 0% content level appropriate 25% interactive
Skooool.ie	25% Content preparation 25% Teacher during class 25% Students during class 0% Homework	50% Yes 50% No	50% Age-appropriate 50% Not age-appropriate 0% content level appropriate 25% interactive

Table 5.16: Online Curriculum Materials Results – Learning support teachers

Table 5.17 reports that learning support students said that the online curriculum materials were age-appropriate. The same students reported that the materials were quite difficult and not very interactive. Students used the online curriculum materials at home as well as in school with their teacher. Results from the evaluation show that 100% of learning support teachers did not continue to use the available online curriculum materials (such as Skooool.ie) for the three months because the content was not suitable for their dyslexic students and students in learning support in key areas such as poetry and plays in the English curriculum. The content level was found to be too difficult and the materials were complicated to use and needed a lot of adaption for their students. 75% of learning support teachers stated that there was a lack of interactivity. It became evident that while mainstream teachers reported using online materials for revision and homework assignments and history project work, 100% of learning support teachers said they had to put significant effort into adapting the content to their students. Another problem that 25% of learning support teachers reported was that it was not always viable to use online materials due to websites/computers crashing and labs being unavailable for class-time. During observation it was clear that the students struggled with the curriculum-focused

materials. This was not appropriate resource so teachers decided to stop using it. These teachers moved onto the general ICTs.

ICT	When used?	Easy to use?	Content?
TeachNet	50% Teacher during class	66% Yes	100% Age-appropriate
	50% Students during class	34% No	0% Not age-appropriate
	50% Homework		20% content level appropriate
Skooool.ie	50% Teacher during class	50% Yes	100% Age-appropriate
	58% Students during class	50% No	20% content level appropriate
	50% Homework		25% interactive

Table 5.17: Online Curriculum Materials Results – Learning support students

5.8.3 Focused ICT Tools for Special Needs Students

Table 5.18 shows that 25% of mainstream teachers reported they found Dragon Naturally Speaking useful for project work once the system was trained. Students trained on the system and recorded themselves talking about a topic which was displayed as text. 33% of teachers reported that they used Read and Write Gold with the students who had literacy difficulties within their classroom. Teachers allow students to work on another ICT such as MS Word in a computer lab while students with literacy difficulties opened Read and Write Gold. Teachers reported that there was no stigma attached to students Read and Write Gold as everyone was working at their own computer privately with the teacher walking around helping everyone. This was an interesting finding because the aim of the curriculum-focused project is to move towards an inclusive environment where students work together on materials aimed at different levels.

ICT	When used?	Easy to use?
Read and Write Gold	33% Teacher during class	50% Yes
	50% Students during class	50% No
	0% Homework	
Dragon Naturally Speaking	25% Teacher during class	25% Yes
	75% Students during class	75% No
	0% Homework	

Table 5.18: Focused ICT Tools Results – Mainstream teachers

Table 5.19 shows that 25% of mainstream students found it interesting to integrate Dragon Naturally Speaking into their classroom activities. While teachers and students used it for project work, I believe that this particular resource was not needed to enhance an inclusive classroom. There was a lot of training needed on the resource which mainstream students really did not need to be using. During the observation, not a lot of work was actually covered in the class. Too much time was taken up with the process of getting the ICT to work properly.

ICT	When used?	Easy to use?
Read and Write Gold	0% Teacher during class	75% Yes
	0% Students during class	25% No
	0% Homework	
Dragon Naturally Speaking	25% Teacher during class	50% Yes
	75% Students during class	50% No
	0% Homework	

Table 5.19: Focused ICT Tools Results – Mainstream students

Table 5.20 shows that 100% learning support teachers reported using both Read and Write Gold and Dragon Naturally Speaking very helpful for small group sessions or one-on-one. 75% reported that it was difficult to use. While all of the learning support teachers had used a text reader, only 17% used one every day. 100% of learning support teachers reported it is very hard to get these tools as they are very expensive. Both learning support and mainstream teachers reported in the focus groups that they had to do too much extra work to use Dragon Naturally Speaking e.g. training voices. This tool is very expensive and takes a lot of training time on the student's voice to work appropriately.

ICT	When used?	Easy to use?
Read and Write Gold	100% Teacher during class	50% Yes
	100% Students during class	50% No
	0% Homework	
Dragon Naturally Speaking	100% Content preparation	25% Yes
	100% Teacher during class	75% No
	100% Students during class	
	0% Homework	

Table 5.20: Focused ICT Tools Results – Learning support teachers

Table 5.21 shows that the real benefit of these tools was for the student receiving learning support. When the class group is much smaller, there is more time to train the system on the students' voices. In the focus groups, teachers indicated that this is a good product to use if you have a lot of time to work individually with one student rather than a larger group.

ICT	When used?	Easy to use?
Read and Write Gold	75% Teacher during class	100% Yes
	100% Students during class	0 % No
	0% Homework	
Dragon Naturally Speaking	75% Teacher during class	40% Yes
	100% Students during class	60% No
	0% Homework	

Table 5.21: Focused ICT Tools Results – Learning support students

5.9 Design Guidelines

During the focus groups to discuss the ICT deployment questionnaire results, teachers were asked to help develop design guidelines for new curriculum-focused ICT materials that cater to diverse students in inclusive mainstream post-primary school schools.

The feedback from the focus groups on the initial ICT surveys, and the deployment and evaluation of those initial ICTs pointed to a lack of appropriate curriculum materials for teenagers in learning support. Mainstream teachers at the focus group said they benefited the most from available online curriculum-focused materials. 100% of learning support and resource teachers stated that the curriculum-focused materials online were not appropriate for their specific groups.

Design guidelines proposed by the teachers during the focus groups for developing curriculum-focused ICT materials for diverse teenagers including those with learning difficulties (including dyslexia) included:

- Content level should be adapted depending on student literacy level
- Modules should cover one task only
- Age-appropriate material is vital
- Students should participate in design of materials

- Use dyslexia-friendly colours and fonts
- Keep text to a minimum
- Use pictures, graphs and videos to illustrate ideas
- Use exam question examples (exam paper wording)
- Materials do not need to be online due to problems with websites crashing
- Use mind-maps to reinforce material
- Teachers should be able to create their own materials
- Feedback for teachers and students

The guidelines were used in the subsequent parts of the research described in this thesis to design and develop curriculum-focused materials that aim to cater to the needs of diverse students in an inclusive classroom including students with dyslexia (Chapter 6 and 7).

5.10 Outputs from the Analysis Phase

All of the outputs from the Analysis Phase (Chapters 3, 4 and first half of Chapter 5) are taken as inputs into the Design Phase (Chapter 6).

Colpaert's analysis model (described in detail in Chapter 2) is based on three components: Interdisciplinary expertise, knowledge of the design space and identification of the target. I briefly recap and summarise the contributions, covered in the previous chapters, to each of these in the sections below.

5.10.1 Interdisciplinary Expertise

Interdisciplinary expertise was first introduced in Section 2.4.1. It captures what researchers should know about the relevant disciplines that are involved in the design and development of a software tool. In this project, these include an overview of special education in Ireland, dyslexia, pedagogy, CALL, CAL, relevant research projects, online curriculum-focused websites and government ICT policy in Ireland.

Reviewing special education in Ireland showed the difficulties students with literacy and learning difficulties face in accessing resources that they need and gave a

background to the environment this this research is being carried out in. The findings on specific learning difficulties and related characteristics highlighted the various needs of students in an inclusive classroom and helped to outline ‘personas’ which are described in the Design Chapter (Chapter 6). The findings on online curriculum-focused websites highlighted how many resources are available for mainstream and learning support teachers and students. Key research projects in the field were reviewed. Their methodologies, gaps in software and findings were taken on board when designing my own materials. The findings from the ICT policy section helped me to understand the possible limitations of integrating ICT into a post-primary school system that has limited resources. The full outputs of the literature review are presented in Section 3.11 (Main Findings).

5.10.2 Knowledge of the Design Space

Knowledge of the design space refers to how developers can understand the various components that are involved in the design and development of learning resources. How can developers form accurate ideas about the learner, the teacher, other actors, the available infrastructure, pedagogical traditions, teaching method, textbooks, learning situation, and the sociocultural background? A specific problem for courseware engineering, is that courseware developers have rarely used courseware personally while developers of office-like programs are often advanced users.

Levy (1999) advises that a researcher should define the design space and not just the principles that a developer should follow. This is not in opposition to the ADDIE model, however complementary as it clearly defines the design context in a particular project.

The pilot study that I carried out when I was a learning support teacher (2002-3) gave me insight into the Design Space of this research project. I gained invaluable knowledge about the ICT infrastructure in schools, teaching methods in learning support and research teaching and experience of working with students with literacy and learning difficulties.

The Initial ICT questionnaires (Chapter 4) highlighted the three main tool types being used by mainstream and learning support teachers and students in post-primary schools today.

The Initial ICT deployment (Chapter 5) gave me insight into how teachers and students were using the ICTS available to them and identify the gaps in the ICTs. It gave me insight into the learning situation and how not every students use ICTs in the same way. Colpaert says as design space broadens from the specific (e.g. learning support students within a class) to the more general (e.g. all students in a class), it becomes harder to understand and cater to user requirements.

5.10.3 Identification of the Target

Identification of the target asks what can be feasibly changed by using the system and whether the resources exist to implement these changes.

The Initial ICT Integration (Chapter 5, Sections 5.2 - 5.8) showed that most teachers are open to ICT and using internet resources. However, it was clear that the learning support teachers were more engaged with the project. They were motivated to be involved to design specific materials and create a database of learning resources suitable for their dyslexic students.

There were some Internet problems with sites crashing during the Initial ICT Integration. It was difficult to know just how much the teachers were really going to use the materials in the curriculum as it stands. The syllabus is still text focused as are the exams at the end. With the announcement in 2012 that the Junior Certificate Programme is changing to a continuous assessment model, this may be more suitable to dyslexic students.

The outputs are represented on Colpaert's General, Local, Differential, Targeted (GLDT) grid. The GLDT Grid was introduced in Chapter 2 and is reproduced below in Table 5.22.

The GLDT grid summarises all the findings from the Analysis Phase for input into the Design Phase. The input for this research project's GLDT grid comes from the following:

- Pilot study (Chapter 3)
- Literature review (Chapter 3)
- ICT surveys (Chapter 4)
- Initial ICT deployment (Chapter 5, Sections 5.2 - 5.8)
- Survey and focus group results (first half of Chapter 5)

The GLDT grid is a living document. A living document or dynamic document is a document which may be continually edited and updated. When the Analysis Phase is completed, each cell in the GLDT grid will be completed (see Table 5.30).

	General	Local	Differential	Targeted
Learner				
Teacher				
Pedagogy				
Technology				
Content				
Other actors				

Table 5.22: Colpaert's GLDT Grid (reproduced from Table 2.1)

Colpaert's guidance questions (see Chapter 2) to help the researcher fill out the GLDT grid are used here. The relevant questions are printed here in bold face in the sections below.

5.11 GLTD Grid Mapped to this Project

5.11.1 Learner

This section of the grid captures the learner component of the Analysis Phase. It takes as input all information gathered about the learners during the Analysis Phase (Chapters 3, 4 and earlier sections of 5). This takes into account everything learnt about the learners from the early pilot study, literature review (Chapter 3) and initial

ICT questionnaires (Chapter 4). Feedback from questionnaires and focus groups that took place after the initial deployment of ICTs in schools (Chapter 5) is also included.

General: What are generally accepted findings and principles for learners?

The General level deals with accepted knowledge about learners, regardless of the particular context.

Children, teenagers and adults who have special educational needs are the focus of the General level of the grid. During the literature review (Chapter 3) an overview of special education in the Irish education system was presented. Specific Learning Difficulties (SLDs) were detailed with a focus on dyslexia and the associated characteristics.

The outputs that feed into the GLTD grid and the Design Phase are the awareness of how dyslexia is diagnosed, the types of SLDs and taking into account both primary and secondary characteristics of dyslexia. This information along with understanding that dyslexia is a difference in cognition and learning rather than a disability feed into the Design Phase.

Local: What are common characteristics of the learners in this particular design space?

The Local level captures characteristics of learners in the particular design space or context under consideration.

The two post-primary schools participating in this project have a mainly inclusive approach of mainstream students and students with learning difficulties learning together in the classroom. The outputs from the literature review (Chapter 3) show the assessment process, or “red tape”, students and parents have to undertake to avail of this learning support. It is evident that there may be students in the regular classroom who have not been assessed or do not have learning support hours allocated even though perhaps they should. An important observation is that the level of support in primary school is higher than at post-primary school. Students moving from

primary to post-primary school also encounter a less structured environment than they were used to.

The pilot study (2003) carried out while I was a learning support teacher and the literature review (Chapter 3) highlighted the characteristics and needs of students in this particular context.

The ICT surveys (Chapter 4) showed that all students are using ICTs more outside school than in school. The results from the initial integration of ICT (Chapter 5) show that students are open to using internet resources to support learning.

Differential: Which distinctions must be made within this design space, or which elements are subject to change?

The participants in this project are a mix of mainstream learners and learners in need of learning support as well as their teachers. The literature review sets out the different types of dyslexia and learning difficulties as well as the range of difficulties associated with each. The key factor that became evident from working with students was that there is a wide range of ability in the classroom and any materials developed should allow for that range. One element subject to change was the learners' access to ICT within school-time as that did fluctuate during the project depending on lab availability.

Targeted: Which characteristics are amenable to improvement (e.g. vocabulary, topics, skills)?

In this context, there are ample opportunities for helping the learner. There is room for improvement in both primary and secondary characteristics associated with learning difficulties. Providing interesting resources that allow the students to learn in a way that suits them and at their own pace can enhance their learning experience and lessen frustration and poor self-esteem. Table 5.23 provides a high-level summary of the learner component of the GLDT grid.

General	Local	Differential	Targeted
<ul style="list-style-type: none"> • Context of SLDs in Irish education • Characteristics of learners with SLDs 	<ul style="list-style-type: none"> • Moving to less support at 2nd level • Understand the red tape around getting resource support • Pilot study showed needs of these particular students • Using ICT outside school more than in 	<ul style="list-style-type: none"> • Wide range of ability in each group • Access to resource support 	<ul style="list-style-type: none"> • Need interesting resources • Room for improving learning experience • Aim to decrease frustration

Table 5.23: GLDT Grid for Learners

5.11.2 Teachers

General: What findings and principles are generally accepted for teachers?

The General requirements include accepted findings and principles for language and other subject teachers, regardless of the particular context in which they teach. In this project, this has been amended for mainstream and learning support / resource teachers.

Post-Primary school teachers have received training for their particular subjects in university. Most teachers who are working in resource or learning support have completed further study in these areas, however some teachers have not had the opportunity to do this.

As schools in Ireland aim to be inclusive, the system works best with teachers who are amenable to different learning styles in their classroom. Another important consideration is the degree of fit and flexibility between the teacher's teaching style and that of the school. If they are closely aligned or teachers have a relatively high

degree of freedom in how to run classes, the teaching experience is more likely to be productive.

Local: What are common characteristics of teachers in the design space?

The Local requirements focus on the particular requirements of the selected design space.

The teachers in the two schools fall into two groups: mainstream subject teachers and learning support / resource teachers. The common characteristic of the teachers involved in this project is that they were motivated to participate so they can improve the learning experience for all of their students.

New post-primary school teachers receive some training on how to integrate ICT into the classroom during teacher training in university. The Investing Effectively in ICT 2008-13 Report (DES 2008) identified a need for an overall framework however no specific action was taken in the field of ICT in initial teacher training.

Differential: Which distinctions must be made within this design space, or which elements are subject to change?

The Differential requirements ask what can be different within this design space.

The ICT questionnaires carried out in Chapter 4 showed the varying degrees to which teachers are using general ICTs, online curriculum focused materials and subject-independent tools.

During the deployment of ICT materials described in Chapter 5, some teachers decided not to go ahead with the initial deployment phase and others stopped using the materials during the project due to a number of issues such as time constraints and content-appropriateness.

Students will have a different experience depending on their teacher and this is something to be taken into account. One other important consideration is the need for the teacher to be able to cater for students of different abilities in the classroom. This will vary from year to year, and sometimes, even during the year. Bright students will need to be challenged, while weaker students must be kept on-board. Moreover, the

number and ratio of students with special needs also play a role in maintaining balance in the classroom. For example, if the number of special needs students is high, it means that the teacher must orient more of her teaching time towards this group than might otherwise be the case.

Targeted: Which characteristics are amenable to improvement?

The Targeted requirements look at those aspects of the design space that are open to improvement.

Teachers are generally favourably disposed towards resources that will help students and make learning more enjoyable and beneficial for them. At the moment, there are very few suitable resources available for the students in the current design space, especially resources that are linked to the curriculum. Therefore, there is a need for resources to complement classroom teaching. These resources could either be specifically linked to the syllabus (e.g. the textbook that the teacher uses in class) or tools that are aimed at the target learner group. A high-level summary of the teacher component of the GLDT grid is shown in Table 5.24.

General	Local	Differential	Targeted
Desirable traits: <ul style="list-style-type: none"> • Motivation • Ability to motivate • Match between teacher and environment 	<ul style="list-style-type: none"> • Receive ICT training however varying attitudes to use • Need to deal with differing abilities and attitudes 	<ul style="list-style-type: none"> • Time constraints • Varying classroom scenario as there are different levels of ability in each group of students 	<ul style="list-style-type: none"> • Few suitable resources for students in learning support • Curriculum-focused materials needed

Table 5.24: GLDT Grid for Teachers

5.11.3 Pedagogy

The Pedagogy component of the GLDT grid looks at the pedagogical issues involved in language courseware development. The guidance questions for each level are:

General: What are generally accepted findings and principles for learning and teaching?

The General level reviews the accepted findings for (language) learning and teaching. Below, I have adapted Colpaert's model from CALL to CA(L)L.

Davies (2002) warns against seeing technology as a panacea. It is important that CA(L)L projects adopt a blended learning approach (Clarey 2007); a mix of classroom teaching and associated work on the computer. Materials developed within a CA(L)L project should not aim to take the place of the teacher; they should aid the work of the teacher in a blended learning environment and integrate smoothly into the classroom setting.

It is important to ensure that ICT materials that are being developed as part of a CA(L)L project can be integrated into the curriculum because teachers and students spend the majority of their time on the curricula and have little time for extra work outside of that. Within the project reported in this thesis, this is essential, as the aim of the research is to investigate whether ICT materials can be developed to blend into the curriculum seamlessly (or at least non-intrusively). One issue that comes up here is whether the class can continue normally if a curriculum lesson is taking place in a computer lab or with an overhead projector.

It is important to consider the deployment of the materials developed during the project at an early stage in the project lifecycle. Even though there are significant constraints in this project, such as number of participants in the project and the lack of fully representative quantitative information, it was important to deploy the materials in the schools and evaluate them using qualitative methods.

Another key feature in CA(L)L development is to involve all the relevant groups from the beginning. In this project, all the relevant teacher and student types (mainstream, learning support and resource) took part in the research.

Local: Which learning/teaching method is currently being used within the design space?

The Local level looks at the methods currently being used in the design space.

According to the ICT questionnaires described in Chapter 4, teachers are using a number of different ICT tools to support teaching and learning (general and online) however they are not using them regularly. The learning support teachers surveyed reported that they used general ICTs more frequently as the online materials were either not content- or age-appropriate.

Teachers are mainly following the curriculum texts with a few notable exceptions of some mainstream teachers printing out some homework materials from online sites. Teachers were more likely to use the materials like this rather than in the classroom on the computer. This was due to time constraints, unavailability of the computer lab, concerns that students would not concentrate and technical problems.

Differential: Which distinctions must be made within this design space, or which elements are subject to change?

The Differential level considers what elements are different within this space.

School A is a registered DEIS school (disadvantaged) and School B is not. The teachers are either mainstream teachers or teachers that do learning support / resource. Some of the learning support teachers also taught mainstream subjects. Each teacher had their own way of curriculum delivery and some were more used to using ICT than others.

Targeted: Which aspects are amenable to improvement?

The Targeted level asks which aspects of pedagogy could be improved.

One area within the teaching that is amenable to improvement is the ability to handle learners of different abilities and learning styles. Currently, when a teacher teaches a class of 20 – 30 students all at the same time, she must try and balance the different needs of each student. This is hard to do, especially if the students are not particularly interested in the material or have a negative attitude towards the subject. CA(L)L

resources could help in this regard, by providing material that caters for students of different levels and different learning styles such as dyslexic students. The material can be presented in different ways and the teachers and students can select how to actually use the materials. Another area open to improvement is that of providing a forum for reinforcement learning. Given the crowded timetable, students only have a limited amount of time available to study each subject during the day. Providing them with a means of revising material that they have already covered in class, will enable students to go over what the teacher has taught them and enable any student to catch up if they had difficulty understanding the material in class. Given the patient, private environment of CA(L)L materials, students can work at their own pace and no-one need know what particular materials students are working on or if they are only at the beginning of a section or repeat it many times.

In order to be able to cater for the needs of the mainstream students with no learning difficulties, there is a need for a resource that these students can use to try-out new material and to adopt an explorative learning approach. Table 5.25 shows the high-level grid for pedagogy.

General	Local	Differential	Targeted
<ul style="list-style-type: none"> • ICT is not a panacea • Blended learning approach is best • Relevant groups should be involved from early stage 	<ul style="list-style-type: none"> • Teachers using ICTs, however not regularly • Mainly textbook with some printed (online) materials 	<ul style="list-style-type: none"> • Differing teaching styles and subjects • Different training background • Disadvantaged school vs. non-disadvantaged school in project 	<ul style="list-style-type: none"> • Handle learners of different abilities and attitudes • Forum for reinforcing learning • Explorative learning

Table 5.25: GLDT Grid for Pedagogy

5.11.4 Technology

The Technology component considers all aspects relating to technology and includes both hardware and software issues. The guidance questions for each level are:

General: What does a SWOT analysis of technology in learning show? What does a SWOT evaluation determine about existing comparable courseware?

The General level takes as input a Strengths-Weaknesses-Opportunities-Threats (SWOT) analysis of using technology to access the curriculum.

SWOT Analysis – General

Strengths

The ICT questionnaires in Chapter 4 and the initial ICT deployment in Chapter 5 highlighted some of the strengths of the use of technology in teaching and learning. There are three types of technology to consider here. First, there are general-purpose ICTs such as word processors which allow teachers to present materials in a new way. These technologies can provide access to learning resources that would otherwise be unavailable. These technologies are widely available and not specifically designed for mainstream or students with special educational needs. Second, there is technology specifically aimed at or used by students in learning support / resource classes. These allow students to dictate to the computer or scan texts. Third, there are curriculum-focused materials where students can access more resources on a particular subject.

Using technologies such as ICTs and CA(L)L allows learners to work at their own pace in school or at home. Chapter 3 showed how dyslexia is a difference in cognition and learning. Technology encourages students to learn and study in their own way with many options open to them. Resources can be made available in multi-media and interactive formats. Singleton (1994) has shown how Computer-Assisted Instruction (CAI) has been proven to help increase student motivation for dyslexic students and is useful for large classes and students of differing abilities. Technology gives teachers the opportunity to author their own content for their students. In fact, students can also get involved in helping to design materials.

Weaknesses

One of the main weaknesses of current curriculum-focused technology is the limited availability of resources. The findings from the questionnaires carried out in Chapters 4 and 5 show that there is a lack of age- and content-appropriate materials aimed at post-primary school students with learning difficulties such as dyslexia.

Schools and teachers also have a lack of time and money to develop (Levy, 1997) or acquire materials, lack of or limited hardware resources, wireless connections and lack of technical support. These can all have a negative impact on the learning process. Pennington (1996) claims that that the computer can sometimes encourage a form of anti-social behaviour that favours working in isolation from others. Learners may be “wrapped-up” in the CA(L)L program in isolation rather than learning to communicate with others. Furthermore, if learners use CA(L)L programs that are not checked for quality, they may be using programs that provide misleading or oversimplified content. Some CA(L)L programs may be developed from a generic template and in order to fit in such a template, the content providers have to simplify the contents or their related explanations. This can waste students’ time, confuse them and fail to meet their learning needs. Although progress is on-going, in general, CA(L)L programs have a problem in dealing with interactive learner input. It is easier to develop CA(L)L programs for output (reading and listening) than input (writing and speech).

Another weakness that can arise is the underutilisation of ICT resources. The ICT questionnaires carried out in Chapter 4 show that teachers were not accessing all of the ICT resources available to them in their schools. In principle, CA(L)L programs have the potential to provide the learner with a rich and stimulating learning environment, however users may not make full use of the software (Chapelle et. al., 1996; Cobb and Stevens, 1996). Although this can be partly overcome with user training and guidance, it is still a potential problem with CA(L)L resources. There are other weaknesses in terms of deployment (or use) of CA(L)L materials. These can be overcome with time, training and increased resources, however for the moment they are still an issue. They include slow server or internet access, server complications, unknown end-user configurations, potential need for plug-ins and technophobic students and teachers.

Opportunities

Computers are becoming increasingly more available and this naturally creates an opportunity for wider use of CA(L)L resources. Computers are also becoming more powerful and this will increase what they can do and how the learner can use them. Programs that previously took a long time to load-up, can now be loaded and executed much quicker and this improves the learner experience. Although there are still technophobic students and teachers, there are an increasing number of students and teachers that are comfortable with using computers in general and for learning in particular. This means that they will be more willing and interested in using CALL applications and will not consider it something out-of-the-ordinary to use a computer for accessing the curriculum.

Computers have much improved multi-modal and multi-media capabilities and this plays a great role in the CA(L)L materials that can be created for learners. Instead of drill practise exercises students can access videos and interactive exercises.

There is an opportunity to develop curriculum-focused materials that meet the specific needs of students of different abilities. All students can sit down with the same resource and be given access to materials designed for their needs, ability and learning style. There is also an opportunity to allow teachers to be able to create their own content for materials.

Threats

According to results from the questionnaires carried out in Chapter 4, some teachers doubt the benefits and may question whether or not ICT and CA(L)L is worth the effort involved . Teachers may feel that there is insufficient time available to them and their students and may not want to cede this precious time to ICT activities. Educational institutions, teachers and learners may expect too much from ICT tools and applications. Their unrealistic expectations cannot be met and they may end up disillusioned with CA(L)L in general and not recognise that it has an important role to play. Although computers are becoming ever more prevalent in society and in educational institutions, the ICT surveys in Chapter 4 showed there is still quite a

sizeable proportion of teachers who do not like using computers. Until their aversion to computers can be overcome, technophobes will find it challenging to enjoy and benefit from integrating ICT applications into the curriculum. Although computers are more readily available than before, there are still many people who have limited access to computers. Even among those who do have access, their computer use may be quite limited. This represents a threat to the use of ICT in many environments. Table 5.26 summarises the SWOT analysis of technology in accessing the curriculum.

**Local: What infrastructure and equipment are available in the design space?
What courseware has been used before?**

The Local level looks at what technology is available in the design space and what courseware has been used previously.

The ICT questionnaires (Chapter 4) show that three main tool types are being used by teachers and students in post-primary schools today:

- General ICT tools (e.g. word processors)
- Special Needs-Focused Tools (e.g. text readers)
- Online curriculum-focused materials (e.g. Skoool.ie curriculum materials)

There are often logistical issues with using a computer lab. The lab is not always available and there are sometimes issues with connectivity and technical problems.

Strengths	Opportunities
<p>Can provide access to learning resource that would otherwise be unavailable</p> <p>Learners can work at their own pace and place</p> <p>Learners can study in their own way</p> <p>Resources can be made available in multi-media and interactive formats</p> <p>Interactivity</p> <p>Potentially increased motivation</p> <p>Useful for large classes and students of differing abilities</p>	<p>Computers are more available</p> <p>Computers are more powerful</p> <p>Students and teachers are more computer literate</p> <p>Openness to new applications/learning modes</p> <p>Computers more accepted</p> <p>Multi-modal capabilities</p> <p>Teachers can create their own curriculum-focused CA(L)L</p>
Weaknesses	Threats
<p>Limited availability of resources</p> <p>Anti-social behaviour</p> <p>Underutilisation of resources</p> <p>Ineffective deployment</p> <p>Temptation to use ICTs for the wrong reasons</p> <p>Limitations in the deployment of ICT materials</p>	<p>Scepticism amongst educational institutions and teachers</p> <p>Unrealistic expectations: educational institutions, teachers, learners</p> <p>Technophobe teachers</p> <p>Availability and use of technology not uniform</p> <p>Environment and deployment dependent</p>

Table 5.26 SWOT Analysis of Technology in Accessing the Curriculum

Differential: Which distinctions have to be made within the design space, or what is subject to change (e.g. operating systems, network types, processor type, software versions)?

The Differential level investigates the technology characteristics which are distinct within the design space and what can be changed.

Both schools had access to a computer lab however this was not available for every class session. Teachers usually had one class per week in the lab. In one of the schools some teachers used overhead projectors to show materials from a single classroom computer.

Targeted: Which aspects are amenable to improvement (e.g., less network traffic, faster execution)?

The Targeted level looks at those aspects that can be improved.

In terms of what can be improved, there are several possibilities. One is to provide resources developed specifically with the target student population in mind. While lessons can be learnt from similar populations in other contexts, there are bound to be difficulties and teething problems when developing for this group. The developed resources must be pedagogically driven and robust. The need for pedagogically driven resources should be obvious. The need for robust resources arises from the fact that the teacher cannot be assumed to be a technological expert and the software must be able to cater for most eventualities, without the need for on-the-spot technical support (which in any case, will not be available). In the worst-case scenario, the software should abort gracefully and not impinge on the running of other programs on the machine in question. Any resources developed must take into account the actual technology available in the design space, however should have the capacity to grow as the technology is updated. Table 5.27 shows a high-level summary of the Technology component of the GLDT grid.

General	Local	Differential	Targeted
<ul style="list-style-type: none"> • SWOT analysis shows that ICT has a role in accessing the curriculum • Analysis of the context reveals that there are many challenges 	<ul style="list-style-type: none"> • Computers available, although actual access and usage rates are variable • Older technologies also in use 	<ul style="list-style-type: none"> • Labs not available all the time 	<ul style="list-style-type: none"> • Robust resources with capacity to grow with technological advances

Table 5.27: GLDT Grid for Technology

5.11.5 Content

The Content component looks at questions relating to actual courseware content. The guidance questions for each level are:

General: What content is available worldwide?

The General level reviews what content is available at a worldwide level.

The literature review presented in Chapter 3 gave a background to the CALL research area, CAL and online curriculum focused materials that are available. While there are many CAL projects there are very few focusing on special education as Williams et al. (2006) pointed out. There are more materials available for younger students and some post-primary school teachers are using these materials, as they are content-appropriate. Unfortunately, they are not age-appropriate as a result.

Local: What kind of content is being used in this design space (e.g. textbook, syllabus)?

The Local level identifies what kind of content is currently being used in the design space.

The ICT surveys in Chapter 4 show that three types of technology are being in post-primary schools in Ireland: General-purpose ICTs, special needs focused tools and online curriculum-focused materials.

The initial ICT deployment in Chapter 5 show that the two teacher types (mainstream and learning support / resource teachers) are using text books to follow the curriculum and a small amount of ICTs to support the curriculum. The results from the initial ICT deployment show that the learning support teachers did not find online curriculum materials useful for their students due to content inappropriateness.

Differential: Which distinctions must be made within this design space, or which elements are subject to change?

The Differential level considers what elements can vary or are subject to change within this design space.

The ICT surveys (Chapter 4) show that students are using ICT for their homework on a regular basis however this is not followed through in class time. They also showed that learning support teachers were not using online materials.

The initial deployment in Chapter 5 shows that every teacher uses materials differently. For example with Skoool.ie materials, some teachers brought their students into a lab and allowed them to use the site on their own. Others pointed to a particle exercise in the class that students could complete in their own time outside of class. The majority of teachers however, printed out an exercise and brought it into their classroom. This was partly due to lack of lab availability, concerns over concentration and teacher preference.

Targeted: Which aspects are amenable to improvement?

The Targeted level looks at those areas that can be improved.

The aim of this project was to test whether curriculum-focused materials can be integrated successfully into the classroom to cater to the varying needs of diverse

students. One area that was improved in the initial ICT deployment was teachers were made aware of some of the ICTs available to them. They were given a chance to try out some of these resources in their classroom. Following on from this, there is a need to be able to provide teachers with an easy mechanism for producing their own materials in a digital format. This would take the form of informing teachers of the CA(L)L authoring tools that are available (e.g. Hot Potatoes 2006, Malted 2000) and is further explained in Chapter 6 of this thesis. Table 5.28 shows a summary of the content component of the GLDT grid.

General	Local	Differential	Targeted
<ul style="list-style-type: none"> • Lack of age-appropriate materials • Not much CA(L)L research in this area 	<ul style="list-style-type: none"> • Three ICT types being used • Curriculum-focused online materials not suiting learning support groups • Mainly text book with small amount of ICTs 	<ul style="list-style-type: none"> • Difference between use of ICTs at home compared to school • Same materials used in a different way 	<ul style="list-style-type: none"> • Awareness of ICTs available • Provision of target-group oriented, curriculum-linked resources

Table 5.28: GLDT for Content

5.11.6 Other Actors (e.g. content providers, native speakers, parents, training managers, software providers, policy makers)

The Other Actors component of the GLDT considers the requirements of the other stakeholders in the language courseware development process. These include, however are not limited to, content providers, native speakers, parents, training managers, software providers and policy makers. The guidance questions for each level are:

General: What is their generally accepted overall role during implementation, use, and evaluation?

The General level looks at the usual roles of these actors in the deployment, use and evaluation of language learning courseware.

The literature review in Chapter 3 reviews the process parents have to go through to access learning support for students in post-primary school. Parents and educators work together to assess the needs of the students to make sure the most appropriate resources are provided.

As students and teachers begin to use ICTs more as a part of their course work, parents may need to allow use of ICTs to continue at home if it is not already the case.

The National Centre for Technology in Education (NCTE) has the responsibility to implement the national ICT policy and has an interest in the development of new resources for students with special needs. The Government Special Educational Needs Policy understands the need for integration of ICT however this is not as yet clearly articulated in the curriculum-focused area. The National Council for Curriculum and Assessment (NCCA) has developed guidelines for teachers of students with general (mild, moderate, severe and profound) learning difficulties.

Local: What is their presence and role in the design space?

The Local level considers their role within the particular design space of the project.

Due to resource limits, there are not enough learning support places available for all of the students that need them. This can create a worrying situation for parents and teachers.

Mainstream and learning support / resource teachers follow the guidelines specified by the NCCA for students with general learning difficulties. These include guidelines for each subject as well as approaches and methodologies for the integration of ICTs.

Differential: Which types of actor can be distinguished and which actor characteristics are subject to change?

The Differential level asks which types of actor can be identified within the design space and what characteristics can be changed. Results from the Initial ICT deployment questionnaires in Chapter 5 show that teachers use the NCCA guidelines

in different ways. One of the focus groups highlighted the fact that some subject teachers did not feel that the guidelines really applied to their class groups. They thought they were more for small learning support or resource groups outside of the main class group. The guidelines are supposed to promote an inclusive classroom.

Targeted: What is amenable to improvement (e.g. teacher guidance, parent control, mediated communication with native speakers)?

The Targeted level looks at what aspects pertaining to those actors can be improved. By creating materials that students can work on at their own pace, the aim is that parents will see their children engaging with their school work with less frustration and more enjoyment. The parents will become more aware of the ICTs that are available. An improvement to how the NCCA guidelines are used could be that teachers could create their own design guidelines for the development of specific resources for students. Table 5.29 shows the high-level GLDT grid for Other Actors.

General	Local	Differential	Targeted
<ul style="list-style-type: none"> • Parents are closely involved in the process • NCTE is implementing the ICT policy 	<ul style="list-style-type: none"> • Not enough resources for every student in need • NCCA guidelines for learning difficulties 	<ul style="list-style-type: none"> • Difference in how teachers perceive the NCCA guidelines 	<ul style="list-style-type: none"> • Awareness of ICTs for parents • Teachers creating their own design guidelines

Table 5.29: GLDT Grid for Other Actors

5.11.10 GLTD Grid

This section summarises the full GLDT grid in Table 5.30.

Learners			
General	Local	Differential	Targeted
<ul style="list-style-type: none"> Context of SLDs in Irish education Characteristics of learners with SLDs 	<ul style="list-style-type: none"> Moving to less support at 2nd level Understand the red tape around getting resource support Pilot study showed needs Using ICT outside school more than in 	<ul style="list-style-type: none"> Wide range of ability in each group Access to resource support 	<ul style="list-style-type: none"> Need interesting resources Room for improving experience Aim to decrease frustration

Teachers			
General	Local	Differential	Targeted
Desirable traits: <ul style="list-style-type: none"> Motivation Ability to motivate Match between teacher and environment 	<ul style="list-style-type: none"> Receive ICT training however varying attitudes to use Need to deal with differing abilities and attitudes 	<ul style="list-style-type: none"> Time constraints Varying classroom scenario as there are different levels of ability in each group of students 	<ul style="list-style-type: none"> Few suitable resources for students in learning support Curriculum-focused materials needed

Pedagogy			
General	Local	Differential	Targeted
<ul style="list-style-type: none"> • ICT is not a panacea • Blended learning approach is best • Relevant groups should be involved from early stage 	<ul style="list-style-type: none"> • Teachers using ICTs, however not regularly • Mainly textbook with some printed (online) materials 	<ul style="list-style-type: none"> • Differing teaching styles and subjects • Different training background • Disadvantaged school vs. non-disadvantaged school in project 	<ul style="list-style-type: none"> • Handle learners of different abilities and attitudes • Forum for reinforcing learning • Explorative learning

Technology			
General	Local	Differential	Targeted
<ul style="list-style-type: none"> • SWOT analysis shows that ICT has a role in accessing the curriculum • Analysis of the context reveals that there are many challenges 	<ul style="list-style-type: none"> • Computers available, although actual access and usage rates are variable • Older technologies also in use 	<ul style="list-style-type: none"> • Labs not available all the time 	<ul style="list-style-type: none"> • Robust resources with capacity to grow with technological advances

Content			
General	Local	Differential	Targeted
<ul style="list-style-type: none"> • Lack of age-appropriate materials • Not much CA(L)L research in this area 	<ul style="list-style-type: none"> • Three ICT types being used • Curriculum-focused online materials not suiting learning support groups • Mainly text book with small amount of ICTs 	<ul style="list-style-type: none"> • Difference between use of ICTs at home compared to school • Same materials used in a different way 	<ul style="list-style-type: none"> • Awareness of ICTs available • Provision of target-group oriented, curriculum-linked resources

Other Actors			
General	Local	Differential	Targeted
<ul style="list-style-type: none"> • Parents are closely involved in the process • NCTE implementing the ICT policy 	<ul style="list-style-type: none"> • Not enough resources for every student in need • NCCA guidelines for learning difficulties 	<ul style="list-style-type: none"> • Difference in how teachers perceive the NCCA guidelines 	<ul style="list-style-type: none"> • Awareness of ICTs for parents • Teachers creating their own design guidelines

Table 5.30: GLDT grid for the Analysis Phase

5.12 Main Findings

Section 5.2 discussed how this chapter fits into the Analysis Phase (Colpaert 2004) of the project methodology. Section 5.3 described the schools that took part. The participant numbers were presented. The three types of ICT were described in Section 5.4. Section 5.5 discussed the deployment of three different types of ICT in two post-primary schools for three months (2006). The mainstream and learning support

teacher and student ICT deployment questionnaires were described in Section 5.6. Section 5.7 described the focus groups and Section 5.8 discussed the survey and focus group results. Section 5.9 presented the design guidelines developed with the teachers and students from the focus groups. Sections 5.10 and 5.11 presented the full Analysis Phase findings (from Chapters 3, 4, and the first half of 5) in the form of Colpaert's GLDT grid.

During the study, I carried out observation in the classrooms to see how the teachers and students were interacting with the materials. These sessions were very helpful at the beginning as extra technical support was needed. After this initial period, students were working on the materials assigned by theirs. After the deployment study, the three groups of mainstream and learning support teachers' students were given a questionnaire depending on which of the three types of ICT they had been given.

Once the deployment was completed and the questionnaires were collected, mainstream and learning support teachers were invited to take part in focus groups to discuss the results and to give feedback on the ICT deployment. The teachers were also advised that the focus groups would work on developing design guidelines to develop curriculum materials for diverse students.

Student focus groups were also completed with mainstream students and learning support students to get their feedback on the ICT deployment and to collect input from the students into the design guidelines.

The feedback from the focus groups on the initial ICT surveys, and the deployment and evaluation of the initial ICTs pointed to a lack of appropriate curriculum materials for Junior Certificate students in learning support. A key finding is that while mainstream teachers were using online materials, they were not using them as frequently as indicated by the initial ICT questionnaires. During the focus groups, teachers and students developed design guidelines for curriculum-focused CA(L)L materials that cater to diverse students (including those with dyslexia) in mainstream classroom.

The guidelines were used to design and develop curriculum-focused materials that aim to cater to the needs of diverse Junior Certificate students in an inclusive classroom including students with dyslexia (described in detail in Chapter 6 and 7 below).

The outputs from the Analysis Phase of Colpaert's RBRO Model were then captured and summarised in the GLDT Grid. Colpaert's GLDT grid focuses on designing for the learner and takes into account all of the interested parties in a CA(L)L research project such as teachers, parents and education authorities and informs the Design Phase in Colpaert's Design Methodology discussed in Chapter 6 below.

CHAPTER 6: Design of Curriculum-Focused CA(L)L materials for Diverse Students

6.1 Introduction

This chapter presents the design of curriculum-focused CA(L)L materials to help all students, including those with literacy and learning difficulties such as dyslexia, to access the English, Geography and History Junior Certificate curriculum (JC 2006). This chapter first applies Colpaert's Design Decisions to the research project. The design of online CA(L)L curriculum materials and CA(L)L Clicker (2006) materials, which took all the input from the Analysis Phase (Chapters 3-6) into account, is then presented.

Section 6.2 discusses how this chapter fits into the Design Phase (Colpaert 2004) of the project methodology. Section 6.3 describes Colpaert's design decisions. Section 6.4 presents salient parts of Colpaert's RBRO Design model as instantiated to specifics of the research carried out in this thesis. Section 6.5 discusses the design of the curriculum CA(L)L Clicker Exercises and Section 6.6 describes the design of the online curriculum CA(L)L materials. Section 6.7 presents the main findings from the chapter.

6.2 Research Methodology: Design

This chapter describes the design of curriculum-focused CA(L)L materials to help all students, including those with literacy and learning difficulties such as dyslexia, to access the English, Geography and History Junior Certificate curriculum (JC 2006). Three sets of CA(L)L materials were designed. One set of CA(L)L curriculum materials is designed to be used offline due to technical issues which arose in the schools during the initial ICT deployment (Chapter 5):

- CA(L)L Clicker Exercises

Two of the CA(L)L materials are designed for online use:

- Online CA(L)L Hot Potatoes Exercises
- Online CA(L)L Logged Exercises

Colpaert's RBRO Design Model is discussed in detail in Chapter 2. The model is reproduced in Figure 6.1. Design is considered to be a working hypothesis which can be verified and validated (or adjusted) after each implementation and evaluation.

The information gathered in the Analysis Phase of the model provides the ground work for the Design Stage. Key information such as who the users are and their various needs inform all aspects of the Design Phase. All the outputs from the Analysis Phase are presented in the GLDT Grid in Section 5.25.

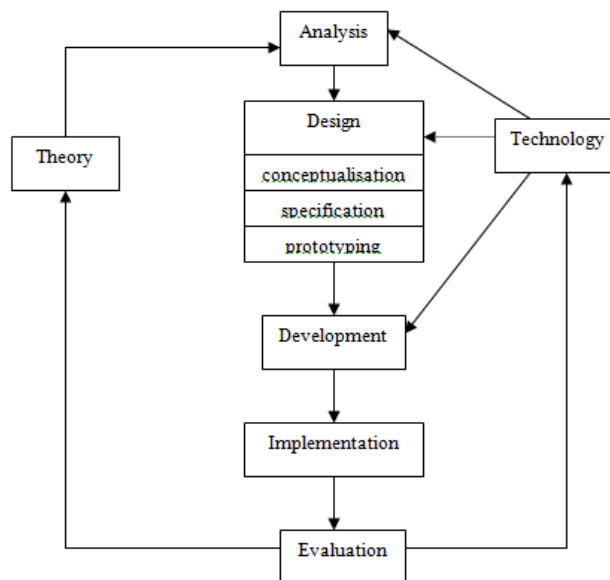


Figure 6.1 Colpaert's (2004) Language Courseware Engineering Loop (see also Figure 2.3)

6.3 Colpaert's Design Decisions

Colpaert names ten design decisions listed in Table 6.1.

Issue	Choice	Decision
1	Development as research or not	Development as research
2	Real-world vs. lab-based	Real-World
3	Local vs. large-scale use	Large scale
4	Design loop vs. engineering loop	Engineering loop
5	Analysis vs. Design	Separate Analysis from Design
6	Design vs. Development	Separate Design from Development
7	Design and Technology	Technology should not shape the concept
8	Design and theory	Theory should inform design
9	Design and language method	Method should be chosen before design
10	Design stages	Staged and systematic approach

Table 6.1: Colpaert's Design Decisions

Issue 1: Development as research or not

When applied, the proposed design model should yield reusable deliverables as models and methodologies based on empirical findings during analysis, design, development, implementation, and evaluation. The design model should be an instrument for developers who want their work to be considered research by courseware engineers. This project is development as research. The findings from this research can be used by other researchers.

Issue 2: Real-world versus laboratory-based

The design model should be oriented towards real-world development as it should offer a solution for a problem. This project is carried out and evaluated in two schools in a real-world setting. Teachers and students have used all of the materials after the Implementation Phase ended.

Issue 3: Local versus large-scale use

The proposed model should tackle the complexity of large-scale application and it should allow local developers to adopt a professional approach. This project is carried out and evaluated in a local real-world setting of only two schools however it could be offered to the wider school population.

Issue 4: Design loop versus engineering loop

Colpaert's approaches design as a working hypothesis that can be verified and validated after implementation and evaluation. Some researchers consider iterative or evolutionary user-prototyping a panacea for all development problems. Certainly, iterative user-prototyping presents many advantages, such as a better view on mental models, acceptability, face validity, content appropriateness, and learning styles; however the prototyping approach also entails constraints. First, when this method is used, questions should be asked about the validity, relevance, and completeness of the information obtained and also about information extraction techniques. Second, iterative user-prototyping is geared toward a single development loop, based on a small number of users, and limited in how many actors and factors are likely to influence it in the case of real world implementation. User-prototyping approaches further seem less able to include empirical and epistemological findings and to lead to reusable and exchangeable concepts and components which can be (re)used by other CALL researchers and developers worldwide.

Because of these limitations, Colpaert bases his Design approach on the ADDIE model and gathers all possible information about the users and their context during the Analysis Phase. Only after implementation and evaluation does the model call for a new working hypothesis for new versions or new applications, which will be developed based on extensive user feedback. This project follows Colpaert's version of the ADDIE model for these reasons.

Issue 5: Analysis versus design

In Colpaert's approach, the Analysis stage is clearly separated from the Design stage. The Analysis Phase is not the point at which to deal with the concept or the system to be developed. Rather, the focus is on the target, scope, or goal. The Analysis phase

can be considered the predesign phase, or the design-input phase. During this phase, the development will gather all possibly relevant epistemological, empirical, actorial, contextual, technological, feasibility-related and perceptive aspects, facts, findings, principles, and considerations that should be taken into account in the targeted design space or language learning and teaching context. Factors, relevant to the work reported in this thesis, are presented in detail in Chapters 3-5.

Systems to be developed should respect general findings, while also being aware of local circumstances, differences, and potential changes. More importantly, they should focus on aspects which, in that context, can be improved. This is why the Analysis phase should clearly identify general, local, and differential aspects and also specify which aspects can be changed or improved by the system. The Analysis Phase of this project was carried out first (Chapters 3-5) and all the findings fed into the Design Phase.

Issue 6: Design versus development

Design does not include the actual writing of source code or programming. When designers instead provide detailed and accurate specifications of concepts and conduct preliminary tests on available technology, development becomes exponentially less expensive and more independent from technology. The Design of the logged exercises (Section 6.7) in this project is largely technology independent.

Issue 7: Design and technology

The appropriate point for checking technology against availability, strengths, and weaknesses occurs during the Analysis phase. During the Design phase, the developer tests discrete (isolated) elements of the architecture for their suitability as prototypes. Colpaert's model does not take into account the effect of strengths and opportunities (affordances) of the technology present, as technology available should not inform the design. In this project, I found that my design was affected to a certain extent by knowing what technology was available in the schools from the Analysis Phase.

Issue 8: Design and theory

Theory should inform design on the level of available knowledge for the analysis and also on the level of methodologies for decision making during the design process itself. Many researchers have mentioned the scarcity of operational frameworks, knowledge, and expertise which should inform design. This consensus among CALL developers confirms the need for design models whose applications will yield deliverables that are valid for further research and development.

Issue 9: Design and language method

Design should take into account the existing or chosen learning and teaching method specified during the Analysis stage. Because technology in Colpaert's model does not interfere with the actual shaping of the concept itself, no new learning or teaching method should be decided upon during the Design stage, as is the case in this project.

Issue 10: Design stages

Colpaert's design model is based on three successive stages: conceptualisation, specification, and prototyping. Following the ADDIE model, each step in the process is justified and verifiable. Goal-oriented conceptualisation requires for the elaboration of a concept based on personas (examples of users) and their goals, and the subsequent application of usefulness criteria. Ontological specification should deliver object models or classes and their interrelationship. Finally, during prototyping, discrete elements of the architecture are tested on available technologies to make the most appropriate decision for development environments, programming languages, and other technologies to be used during development.

6.4 The RBRO Design Model as Instantiated to Specifics of the Research Described in this Thesis

Colpaert's Design Model is a working hypothesis for pedagogy-driven, research-oriented development, based on all available facts, findings, and considerations. The

design model is situated within the broader model of a language courseware engineering lifecycle (ADDIE).

Colpaert's Design Method is not an iterative loop of progressive clarification, however a systematic progression through successive stages. Design is a process which needs some kind of input and delivers some kind of output. The RBRO design model is subdivided into three stages: conceptualisation, specification, and prototyping. Conceptualisation is the elaboration of a concept, specification is the description of its architecture in terms of components and their interaction, and prototyping means the testing of discrete topics using available technologies.

6.4.1 Conceptualisation

How does a designer proceed from system requirements to solution concepts? Colpaert is not driven by affordances, advantages, strengths, and opportunities of technologies, however rather by concentrating on a pedagogy-driven approach. Conceptualisation consists of two concurrent and iterative activities: concept development and the application of usefulness criteria as shown in Figure 6.2.

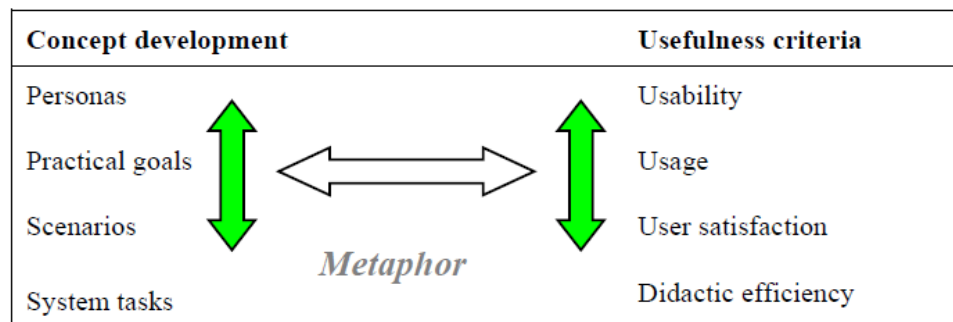


Figure 6.2: Colpaert's Conceptualisation

Concept development as an iterative process means where a CA(L)L system is developed during repeated walk-throughs of four steps: the identification of personas, the hypothesisation of practical goals, the formulation of scenarios, and the description of system tasks.

To identify personas, I had to fully understand the diverse nature of the student population in an Irish post-primary school. This was carried out through the earlier ICT studies in the schools as well as the literature review of specific learning difficulties and dyslexia.

The identification of personas (defined as types of user with common goals) results from a previous actor-analysis: learner type A, learner type B, teacher type A, teacher type B and parents. Cooper (1998) introduced the use of personas as a practical interaction design tool. He gives names to his personas so that, during conceptualisation and overall design, designers, developers, content authors, and others on the development team can communicate more efficiently. An example applied to this project could be:

- John (learner type A): is in receipt of some extra learning support during Irish class however otherwise is fully engaged in the other mainstream subjects. John likes using computers.

Personas should be identified, not only for learners, however also for teachers and other actors involved.

Courseware design should be geared toward the realisation of these identified personas' practical goals. As far as the designer is concerned, practical goals are a hypothetical compromise between pedagogical ('corporate') goals and personal goals.

To create practical goals, it was necessary to conduct the focus group interviews after the initial ICT questionnaires and the initial ICT integration.

Formulating this compromise is a delicate part of the design process—and perhaps it is most difficult for the following reasons:

- Learners, parents and certainly teachers are aware of the pedagogical goals, however they are not always aware of their personal goals.
- They are not always aware of the fact that there is often a conflict or contradiction between pedagogical goals and their personal goals.

- They do not know that in the case of conflicting goals, compromises can be worked out and formulated. This aspect is, of course, a basically psychological problem.
- Explicitly asking users about their goals can be deceptive. Designers can and should, at least during the Analysis phase, question or interview the targeted users about their background, profile and needs, however not about their goals.
- Practical goals are the result of a thorough analysis, not necessarily in the users' minds, however certainly in the designer's mind.

For example, the designer should try to formulate practical goals for John and other personas, if they want different types of users to employ the system. These users' common practical goals can be reduced to the cognitive and social dimensions.

Scenarios describe how personas will use the system to be developed. Cooper (1998) distinguishes between daily use, necessary use, and edge-case scenarios:

- Daily use scenarios describe useful, important and frequent actions. For these actions, customisation, finishing and shortcuts are more useful than help facilities and tutorials.
- Necessary use scenarios describe actions which must be performed, however which are not frequent. In this case, extensive help facilities are more useful than ergonomic aspects such as shortcuts, customization and finishing.
- Edge case scenarios describe situations or outcomes that occur in extreme cases. These scenarios can be included during development, however they should not play a significant role during design.

The next step is translating the scenarios into system tasks. The developer should give special emphasis to the integration of tools.

The evolving concept should be checked, iteratively or not, against the following usefulness criteria:

- *Usability* includes all criteria that will impact whether a system can be used by the targeted users: availability, accessibility, price, installation modalities and face value.
- *Usage* represents the criteria which should guarantee that the actual use corresponds to the intended use, or at least to a pedagogically sound use, taking into account the varying requirements for first use (ergonomics), continued use (location, duration and modalities) and long-term use.
- *User satisfaction* means all criteria which should assure that the user will continue to employ the program for a long time and that he/she is as satisfied as possible. These criteria include: acceptability, user-friendliness, content quality, software quality, hardware compatibility, self-confidences and self-image.
- *Criteria for optimising didactic efficiency* have the goal of increasing the efficiency and effectiveness (learning effect) of the learning and teaching process. These criteria include teacher fit, learner fit, compatibility with the learning method, interaction on rich and varied content.

Chapelle (2001) advocates the use of six principles in evaluating CALL software which I also considered during the Design Phase. I have adapted these to represent ‘content’ rather than ‘language’ to suit the CA(L)L scenario targeted in this thesis:

- Learning potential: the degree of opportunity present for beneficial focus on form.
- Learner fit: the amount of opportunity for engagement with the content under appropriate conditions given learner characteristics.
- Meaning focus: the extent to which learners’ attention is directed toward the meaning of the content.
- Authenticity: the degree of correspondence between the CA(L)L activity and target content activities of interest to learners out of the classroom.
- Positive impact: the positive effects of the CA(L)L activity on those who participate in it.
- Practicality: the adequacy of resources to support the use of CA(L)L activity.

For each exercise type I designed with the teachers I considered what would be checked for in a CALL evaluation. For example these six principles look at how much opportunity there is to focus on the actual content, how the exercises relates to an individual, the student's awareness of learning as opposed to 'time on the computer', the usefulness of the exercise to be developed, the possible positive impact of a particular exercise. I also was aware of the environment the exercise was going to be used in so that influenced how it would look and what technology could be used.

The output of this conceptualisation process is the detailed description (in natural language) of a system, its behaviour upon interaction as a way to realise the users' goals, and a description of how the developer has applied the usefulness criteria.

6.4.2 Specification

Conceptualisation feeds into Specification. Specification describes:

- The *back-end*: the system structure in terms of components and their interaction. This can be done in natural language and graphics, or e.g. in Unified Modelling Language (UML).
- The *front-end*: the user interface with screen design, menu systems, and navigation.

6.4.3 Prototyping

Specification describes the back-end — the system structure in terms of components and their interaction and (b) the front-end — the user interface with screen design, menu systems, and navigation.

The purpose of prototyping is to test discrete functionalities, to evaluate to what extent available technologies allow developers to realise functionalities, and to what extent dedicated technologies should be developed. Prototyping is carried out only on those components that developers are unsure about and want to test the feasibility of certain technological aspects. Prototyping involves testing sections and versions of the

software on a number of different people: fellow developers, teachers and finally when the product is ready, the students, for the implementation and evaluation cycle.

Colpaert argues that the Design phase should be (largely) technology independent and involve rapid prototyping.

6.5 Design of Curriculum-Focused CA(L)L Clicker Exercises

Clicker consists of a talking word processor called ‘Clicker Writer’ and a ‘Clicker Grid’. The grid has ‘cells’ containing letters, words or phrases that the user can click on, to send them into Clicker Writer – so students can write all or part of their sentences without actually writing or using the keyboard. Clicker comes with pictures to illustrate common words as well as a function to use your own pictures too. Students can have pictures in the Clicker Grid and click on them to send them into Clicker Writer, so they can write with pictures as well as words.

The design of the Clicker exercises is divided into three stages: conceptualisation, specification, and prototyping. Conceptualisation is the elaboration of a concept, specification is the description of its architecture in terms of components and their interaction, and prototyping means the testing of discrete topics using available technologies.

6.5.1 Conceptualisation of Clicker Exercises

Conceptualisation consists of two concurrent and iterative activities: concept development and the application of usefulness criteria.

6.5.1.1 The Identification of Personas

The identification of learner types or personas was carried out during the literature review and pilot project. The generic personas are identified so that design caters to the needs of these types of user. The learner types identified were:

- John (learner type A): is in receipt of some extra learning support during Irish class however otherwise is fully engaged in the other mainstream subjects. John likes using computers.
- Sarah (learner type B): is a dyslexic student receiving the maximum learning support hours available to her.
- Adrian (learner type C): is an average mainstream student.
- Imelda (learner type D): is a high-achieving mainstream student.

6.5.1.2 Hypothesisation of Practical Goals

Courseware design should be geared toward the realisation of these identified personas' practical goals. As far as the designer is concerned, practical goals are a hypothetical compromise between pedagogical ('corporate') goals and personal goals. Designers can and should question or interview the targeted users about their background, profile and needs, however not about their goals during the Analysis Phase. Practical goals are the result of a thorough analysis, not necessarily in the users' mind, but in the designer's mind. Practical goals for this project were garnered from the focus group interviews.

For example, the designer should try to formulate practical goals for John and other personas, if they want different types of users to actually employ the system:

- John (learner type A): is in receipt of some extra learning support during Irish class but otherwise is fully engaged in the other mainstream subjects. John likes using computers.

Practical goal: John needs time to work on the Clicker exercises at his own pace during allocated class time.

- Sarah (learner type B): is a dyslexic student receiving the maximum learning support / resource hours available to her.

Practical goal: Sarah needs to work through the Clicker exercises with her teacher during class time.

- Adrian (learner type C): is an average mainstream student.

Practical goal: Adrian will use the materials for revision during allocated class / lab time.

- Imelda (learner type D): is a high-achieving mainstream student.

Practical goal: Imelda likes to be challenged and will access some extra content during class time.

6.5.1.3 Formulation of Scenarios

Scenarios describe how personas will use the system to be developed. Recall that following Cooper (1998), we distinguish between daily use, necessary use, and edge-case scenarios.

The teachers who took part in Schools A and B agreed to use the CA(L)L Clicker Exercises on a frequent basis. Teachers were given a tutorial on Clicker and given sample exercises so they could produce their own exercises (more details in Chapter 8 Implementation). The teachers were shown how to access the database of materials on the Learning Grids website and how to create their own materials using the Design Guidelines (presented in Chapter 5). As a result, there were three overall types of Clicker exercises used by the teachers:

- A Small Database of Clicker Grid Sets
- Sample Exercises created by the researcher
- Create-your-own Clicker Exercises.

The CA(L)L Clicker Exercises were stored in student folders on the two schools' local servers. When a student opens their personal folder, they have access to the exercises deemed appropriate by their teacher for their related persona type. The sample exercises were split into four levels to cater for the four persona types described. The content and levels were agreed with teachers. Levels A and B only gave students access to one exercise at a time so that level A students' could work at their own pace

and then ask the teacher to check their work if needed and level B students can work with their teacher on the exercise. Level C and D students are given access to a number of exercises at the same time so they can direct their own learning.

All students in the inclusive classrooms worked on the CA(L)L Clicker exercises together. Due to the private nature of CA(L)L, students were not aware of what materials their peers were working on. This scenario also allows the teacher to use one resource with all students that caters to the individual needs of each of the students.

6.5.1.4 Description of System Tasks

The next step is translating the scenarios into system tasks. Teachers used three types of Clicker Exercise described above: Small database of Clicker Grid Sets Exercises, Sample exercises, and Create-your-own Clicker Exercises. Students, depending on their persona-type, accessed either one exercise at a time or were given access to a number of exercises so they could move on when they are finished.

Small Database of Clicker Grid Sets

Clicker has a database of curriculum materials available on <https://www.learninggrids.com>.² There are only a few sets of materials that are suitable to the Junior Certificate syllabus because the majority of materials are not aimed at the Irish education system. While some of the exercises are aimed at 9-11 year olds (e.g. there are no materials for 12 years old and up covering the American Revolution) most of these materials could be used due to the nature of the materials.

Clicker Grids are sets of words arranged in tabs in alphabetic order to support writing about a particular topic. The teachers were directed to the grids that had content for topics on their syllabus. For example, words describing the Vikings are given in Figure 6.3. Students can click on words to add them to their narrative in a Clicker Writer word processor.

² Accessed in 2007

Viking Words A - Z

This Clicker Grids Set provides word banks to support writing about the Vikings. The words are sorted alphabetically.



A [Clicker resource](#).

Figure 6.3: Clicker Grid Set on the Vikings

Table 6.2 below gives examples of Clicker Exercises (available in 2007) that had appropriate content for the JC subjects covered by participating teachers.

Subject	Exercises available for these areas of the syllabus
History	Revolutionary movements (French), an ancient civilisation (Rome), the Vikings.
Geography	Rivers, coastal features, urbanisation.
English	Descriptive writing, letter writing, writing about poetry.

Table 6.2: Syllabus exercises that were available on learninggrids.com in 2007

These Clicker exercises were accessed at the Learning Grids website or the CD of learning grids that comes with Clicker if it was available. The CD was often a better choice as the exercises did not have to be downloaded.

Sample Exercises

I created 30 initial example Clicker grids for the History, English and Geography Syllabus adhering to the Design guidelines agreed upon with teachers and students during the Analysis Phase (Chapter 5):

- Content level should be adapted depending on student literacy level

The sample exercises were split into four levels (A-D) to cater for the four persona types described. The content and levels were agreed with teachers and teachers could change how the exercises were allocated.

- Modules should cover one task only

Each CA(L)L Clicker Exercise deals with only one curriculum unit. Students who received Levels A and B materials, had access to one exercise at a time so that level A students can work at their own pace and then ask the teacher to check their work if needed and Level B students can work with their teacher on the exercise. Students who received Level C and D exercises are given access to a number of exercises at the same time so they can direct their own learning.

- Age-appropriate material is vital

This issue was very important. As shown in Chapter 5, age-appropriateness is not guaranteed just because the materials are aimed at the Junior Cert curriculum. In the use of materials such as Skooool.ie, many of the teachers felt that the materials were not appropriate for their students who had a learning difficulty. Teachers adapted the language level to suit dyslexic learners, students with literacy difficulties and average learners. The Clicker Grids uses multimedia content appropriate to the curriculum topic so that students with different learning styles could use a range of exercises. While the language level is adapted in Levels A and B, the content can still be appropriate to teenagers doing post-primary school work.

- Student should participate in design of materials

Students helped to create the sample exercises: choosing content and the type of exercise appropriate for a particular piece of content.

- Use dyslexia-friendly colours and fonts

Clicker allows the user to change the colours for exercises so dyslexia friendly fonts (Trebuchet MS) and colours (British Dyslexia Association's Style Guide) were adhered to.

- Keep text to a minimum

Instructions were kept to short, precise sentences.

- Use pictures, graphics and videos to illustrate ideas

Clicker allows teachers and students to insert pictures and graphics into Clicker Writer.

- Use exam question examples (exam paper wording)

Exam question content was used in a number of exercises.

- Materials do not need to be online due to problems with websites crashing

These exercises were kept on the local school server in both schools.

- Use mind-maps to reinforce material

Teachers and students were shown how to create grids containing words and pictures pertaining to particular curriculum unit e.g., while studying a poem in class, students created mind-maps of the key themes in the poem using Clicker.

- Teachers should be able to create their own materials

Teachers were provided with training on how to access the database of grids on the LearningGrids.com website. These grids were also downloaded to the local school server. Teachers were provided with training on how to create their own CA(L)L Clicker Exercises using the Design Guidelines to create curriculum-focused materials. This training included how to edit the background colours, multimedia and fonts so that they cater to the needs of dyslexic students. Teachers were given PDFs of past Junior Certificate ordinary and higher level papers to use for creating exercises.

- Feedback for teachers and students

Clicker does not provide feedback to the user. As this tool is designed to be used in school in a blended learning environment, the students could receive feedback on their progress from their mainstream or learning support teacher.

Create-Your-Own Clicker Exercises

Once the teachers had used the sample exercises and some of the exercises from the Learning Grids database, they moved on to create their own exercises for their students adhering to the persona types and the Design Guidelines. Teachers were tasked to choose elements of the syllabus not covered by the exercises so far, e.g. within the English JC syllabus, the novel the students were covering at the time.

Both the Sample Exercises and the Create-Your-Own Exercises adhered to the design guidelines. The Clicker Grid exercises designed used dyslexia-friendly background colours e.g. light cream, light blue. The Trebuchet font was used in all grids and all background text. The amount of text was kept to a minimum in the exercises. The CA(L)L Clicker exercises included multimedia in the form of pictures and videos. Teachers used the grids to create mind-maps and reviews of poems, novels and essays. The grids created included questions and vocabulary from the Junior Certificate exam papers so that dyslexic students could familiarise themselves with these terms. As the content was curriculum-focused and designed with these particular student groups in mind, all students were using age-appropriate materials.

Table 6.3 summarises the Conceptualisation Phase for the Clicker Exercises.

Concept Development Activity	Information	
Personas / learner types	Persona A	A student in receipt of some learning support.
	Persona B	A dyslexic student with substantial learning support.
	Persona C	An average mainstream student.
	Persona D	A high-achieving mainstream student.
Practical goals	Persona A	Needs time to work on material alone.
	Persona B	Needs to work with their teacher with the materials.
	Persona C	To use the materials for revision.
	Persona D	To be challenged.
Scenarios	“Daily” frequent or	All students will use the materials during inclusive class time on a frequent basis. Teacher will use three types of Clicker Exercise: Small database of Clicker Grid Sets, Sample exercises, and Create-your-own Clicker Exercises.
System tasks	Clicker exercises	Teachers can use the sample exercises, create new CA(L)L Clicker exercises using the design guidelines or have the option to use a small database of ready-made curriculum content.

Table 6.3: Conceptualisation Phase for Clicker exercises

6.5.1.5 Usefulness Criteria

The evolving concept should be checked, iteratively or not, against the following usefulness criteria: Usability, Usage, User Satisfaction and Criteria for optimising didactic efficiency. Table 6.4 shows how the Concept Design was checked against Usefulness Criteria.

- Usability

The design of the Clicker Exercises took into account the limitations with regard to computing resources. Clicker was available to both schools through the Education centres so it would not cost extra money. As there were problems with the internet connection sometimes in one of the schools, Clicker exercises could always be used as they were not online.

- Usage

The teachers agreed to use the Clicker exercises for three months regularly. It was unknown exactly how often the resources would be used. The Clicker exercises were designed to be used in the classroom.

- User satisfaction

The concept design took into account input from focus groups and from previous projects with a similar group and age-group. Design guidelines developed during the Analysis Phase were employed.

- Criteria for optimising didactic efficiency

The Clicker exercises focus on curriculum content in a classroom environment. They allow teachers to input content and also allow teachers to use a small database of content that had already been created.

Usefulness Criteria	Notes	
Usability	Concept design takes into account the resource restrictions.	
Usage	Teachers to use the materials for three months regularly.	
User Satisfaction	Concept design takes into account focus groups and previous projects with this age-group.	
Didactic efficiency	Learning potential	Focus on curriculum content.
	Learner focus	System is designed to cater to a range of learners.
	Meaning focus	Focus on curriculum content.
	Authenticity	Use in classroom only so integrated into classroom activities but not learning outside of the classroom.
	Positive impact	Focus groups and previous projects point to students enjoying using the materials.
	Practicality	The clicker exercises are designed taking the resource constraints into account while at the same time factoring in the potential future changes.

Table 6.4: Checking Concept Design against Usefulness Criteria (Clicker exercises)

6.5.2 Specification of Clicker Exercises

Conceptualisation feeds into Specification. Specification describes:

- The *back-end*: the system structure in terms of components and their interaction.

- The *front-end*: the user interface with screen design, menu systems, and navigation.

Back-end

The Clicker Software was not developed as part of the research; rather it is an existing tool that was used and populated with appropriate content. Clicker was chosen as it is a support tool for this diverse student group as teachers can be taught to create their own exercises with it.

Clicker's automatically linked grids allow teachers to structure a piece of writing, with each grid containing words for different sentences. Teachers can also structure words within a grid – Clicker lets teachers force the order in which cells are used, by disabling groups of cells until a cell from another group has been used.

A database of ready-made curriculum-focused Learning Grids is available on the CD or from the Learning Grids website (Screenshot 6.1).



Screenshot 6.1: The Learning Grids website for Clicker

Front-End

- A Small database of Clicker Grid Sets

A database of curriculum content is available on the Learning Grids Website. A small amount of materials is appropriate to the JC History syllabus.

- Sample exercises

I created a number of sample grids were for English, History and Geography curricula and showed teachers how to use Clicker.

- Create-your-own Clicker Exercises.

Teachers were shown how to create their own Clicker exercises during training. Students, depending on their persona-type, accessed either one exercise at a time or were given access to a number of exercises so they could move on when they are finished.

6.5.3 Prototyping of Clicker Exercises

The initial sample exercises were developed with teachers and students to agree content and design. As Clicker is a standalone service, no discrete elements needed to be tested.

6.6 Design of Curriculum-Focused CA(L)L Online Materials

As with the CA(L)L Clicker Exercises (Section 6.5), the design of the online materials is divided into three stages: conceptualisation, specification, and prototyping. Conceptualisation is the elaboration of a concept, specification is the description of its architecture in terms of components and their interaction, and prototyping means the testing of discrete topics using available technologies. There are two types of online

materials: Hot Potatoes (2006) exercises and Logged Exercises that I developed from scratch.

6.6.1 Conceptualisation

The key distinguishing aspect of the Online Materials compared to the Clicker Exercises is that the students have the option to access the materials at home. Conceptualisation of the Online Materials consisted of two concurrent and iterative activities: concept development and the application of usefulness criteria.

6.6.1.1 The Identification of Personas

The personas are the same for the Clicker Exercises except that these personas also need the option of accessing the materials at home as well as at school.

6.6.1.2 Hypothesisation of Practical Goals

- John (learner type A): is in receipt of some extra learning support during Irish class but otherwise is fully engaged in the other mainstream subjects. John likes using computers at home and at school.

Practical goal: John will use the online materials at home as well as school to revisit topics covered that day.

- Sarah (learner type B): is a dyslexic student receiving the maximum learning support / resource hours available to her.

Practical goal: Sarah needs to work through the online materials with her teacher in school. Sarah can access the materials at home.

- Adrian (learner type C): is an average mainstream student.

Practical goal: Adrian will use the materials for revision during allocated class / lab time and at home.

- Imelda (learner type D): is a high-achieving mainstream student.

Practical goal: Imelda likes to be challenged and can access some extra content during class time and at home.

6.6.1.3 Formulation of Scenarios

Scenarios describe how personas will use the system to be developed. Following Cooper (1998), we again distinguish between daily use, necessary use, and edge-case scenarios.

The teachers who took part in Schools A and B agreed to use the Online Materials on a frequent (“daily”) basis. The materials consisted of two types: Hot Potatoes exercises and Logged exercises which the students could use in school or at home.

The Hot Potatoes exercises include interactive web-access based multiple-choice, short-answer, jumbled-sentence, crossword, matching/ordering and gap-fill exercises. Hot Potatoes acknowledges correct answers and leaves errors to be corrected. It also gives feedback on student results and teachers can edit the text of the feedback.

The Hot Potatoes exercises were stored on the schools’ local drives. Teachers were given sample exercises that were developed by the researcher which adhered to the design guidelines. Teachers were provided with training on how to create and edit Hot Potatoes exercises and how to link a number of exercises together. This training included how to change the background colours and text on the Hot Potatoes webpages created. Teachers were encouraged to produce exercises for the four persona types described. Teachers could also create exercises that did not fit into any persona if a student so needed. The language content and exercise levels were prescribed by the teacher. Teachers could decide how many exercises were linked together for their students to work on. This allowed students to work at their own pace and then ask the teacher to check their work if needed.

The Logged Exercises allow a student to log in to a system and complete exercises. Responses to exercises were logged and reported to the Teacher in a ‘teacher view’. The Hot Potatoes Exercises did not support this attribute and this motivated the design

and development of the Logged Exercises. The Logged Exercises allowed students to work on static materials and teachers could not edit these or create new content.

All students in the inclusive classrooms worked on the CA(L)L Hot Potatoes or the Logged Exercises together. While working on the Hot Potatoes Exercises, students did not know what exercises their peers had received. With regard to the Logged Exercise, students had a private login. This scenario also allows the teacher to maximise classroom efficiency by using one resource with all of the students in the classroom that can cater to the individual needs of each of the students.

6.6.1.4 Description of System Tasks

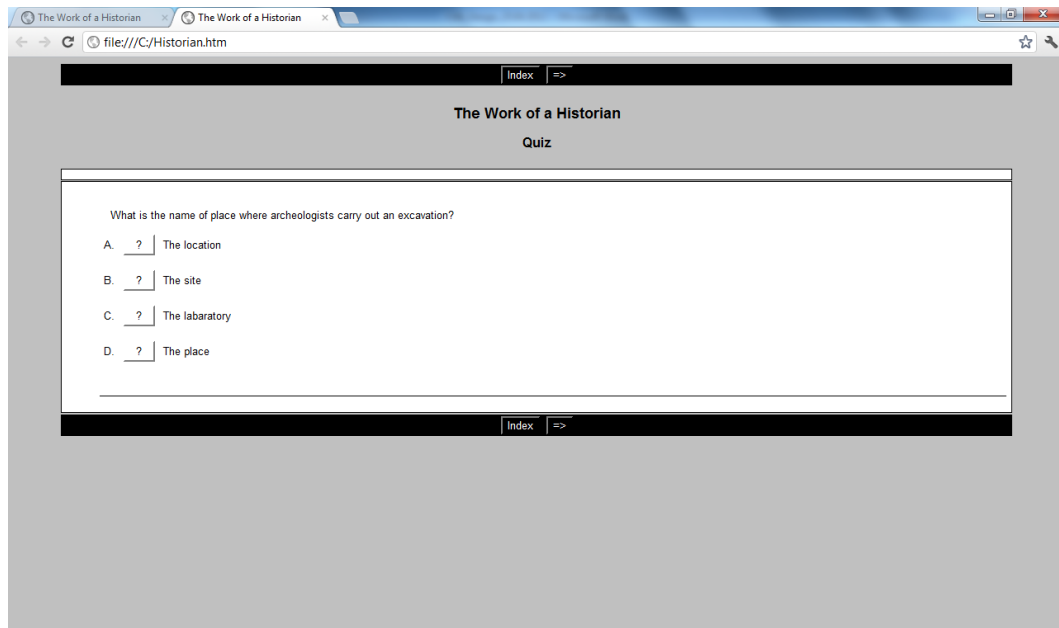
Hot Potatoes Exercises

Teachers were introduced to the Hot Potatoes 5 suite. The Hot Potatoes suite includes six applications, enabling one to create interactive web-based multiple-choice, short-answer, jumbled-sentence, crossword, matching/ordering and gap-fill exercises. Hot Potatoes was created by the Research and Development team at the University of Victoria Humanities Computing and Media Centre. Hot Potatoes acknowledge correct answers and leaves errors to be corrected. It also gives feedback on student results and teachers can edit the text of the feedback.

Teachers were given a Hot Potatoes tutorial. Teachers decided that the “Jumbled-Up” sentence exercise would not be appropriate for the content or a student group that includes students with dyslexia. Following the tutorial, teachers were given a few samples of Hot Potatoes exercises. Screenshot 6.2 shows how a generic Hot Potatoes exercise looks

Teachers were then shown how to adapt the CA(L)L Hot Potatoes exercises to incorporate the Design guidelines agreed upon with teachers and students during the Analysis Phase (Chapter 5). The sample exercises and the exercises designed and developed by teachers adhere to the design guidelines, repeated here in bullet form for convenience:

.



Screenshot 6.2: Example Hot Potatoes exercise on the work of a Historian

- Content level should be adapted depending on student literacy level

Teachers created the content for the CA(L)L Hot Potatoes Exercises. Teachers were mindful of the needs of particular students in their classroom while designing the content. Teachers also had final say on which exercises were given to each of the four persona groups (levels). Teachers could also create exercises that did not suit a particular persona if they had a student in their classroom with other needs. Each student was allocated exercises that were deemed appropriate for them by their teacher.

- Modules should cover one task only

Each of the Hot Potatoes Exercises only deals with one subject. Students who received Levels A and B Hot Potatoes exercises only had access to one exercise at a time. Level A students could work at their own pace and then ask the teacher to check their work if needed and level B students could work with their teacher on the exercise. Level C and D students were given access to a number of exercises at the same time so they could direct their own learning.

- Age-appropriate material is vital

Teachers used curriculum content and questions from previous exam papers. Teachers also used phrases and terms that they regularly use in class. The multimedia content was all related to the curriculum and was age-appropriate.

- Student should participate in design of materials

Teachers and students helped to create the sample Hot Potatoes exercises: choosing content and the type of exercise appropriate for a particular piece of content.

- Use dyslexia-friendly colours and fonts

During the Hot Potatoes tutorial teachers were shown how to change the colours for exercises so dyslexia friendly fonts (Trebuchet MS) and colours (British Dyslexia Association's Style Guide).

- Keep text to a minimum

Instructions were kept to short, precise sentences.

- Use pictures, graphics and videos to illustrate ideas

Teachers used a range of multimedia content (pictures, videos, slideshows) in the sample exercises. Hot Potatoes also has a range of exercise types such as multiple-choice, short-answer and gap-fill exercises.

- Use exam question examples (exam paper wording)

Exam question content was used in a number of exercises so that all students, particularly those with dyslexia and other literacy difficulties, could gain experience with these terms.

- Materials do not need to be online due to problems with websites crashing

While the Clicker exercises were not online, these exercises are online for the students to use at home as well as school.

- Use mind-maps to reinforce material

Unfortunately, mind-maps were not created with Hot Potatoes in this project.

- Teachers should be able to create their own materials

Teachers were provided with training on how to edit the sample Hot Potatoes exercises and how to create their own exercises adhering to the design guidelines to create curriculum-focused materials for diverse students. This training included how to add multimedia, edit the background colours and fonts so that they cater to the needs of dyslexic students. Again, teachers were given PDFs of past Junior Certificate ordinary and higher level papers to use for creating exercises.

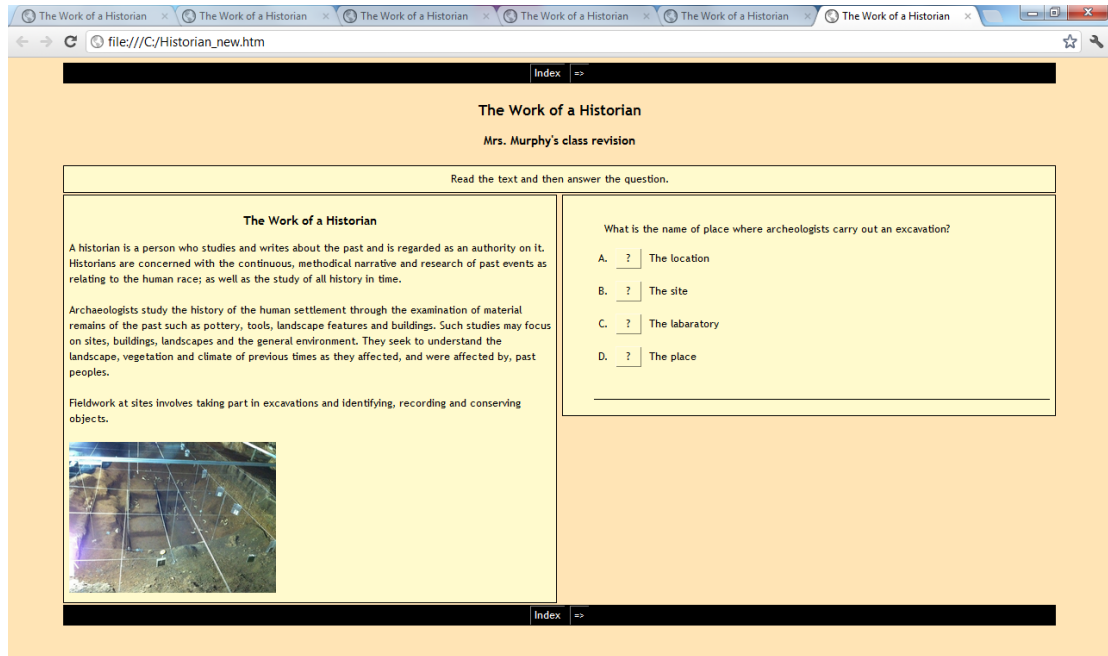
- Feedback for teachers and students

Hot Potatoes acknowledges correct answers submitted by students and leaves errors to be corrected. It also gives feedback on student results. Teachers can edit the text of the feedback so it less formal.

These design guidelines helped to transform the original ‘Work of a Historian’ exercise shown in Screenshot 6.2 previously into the enhanced exercise in Screenshot 6.3 below. The background colour has been changed to cream according to the British Dyslexia Association’s guidelines. The font (Trebuchet) is also the font recommended for screen-reading for dyslexic students. The text has been kept short. A video on the work of a historian has been added to the exercise.

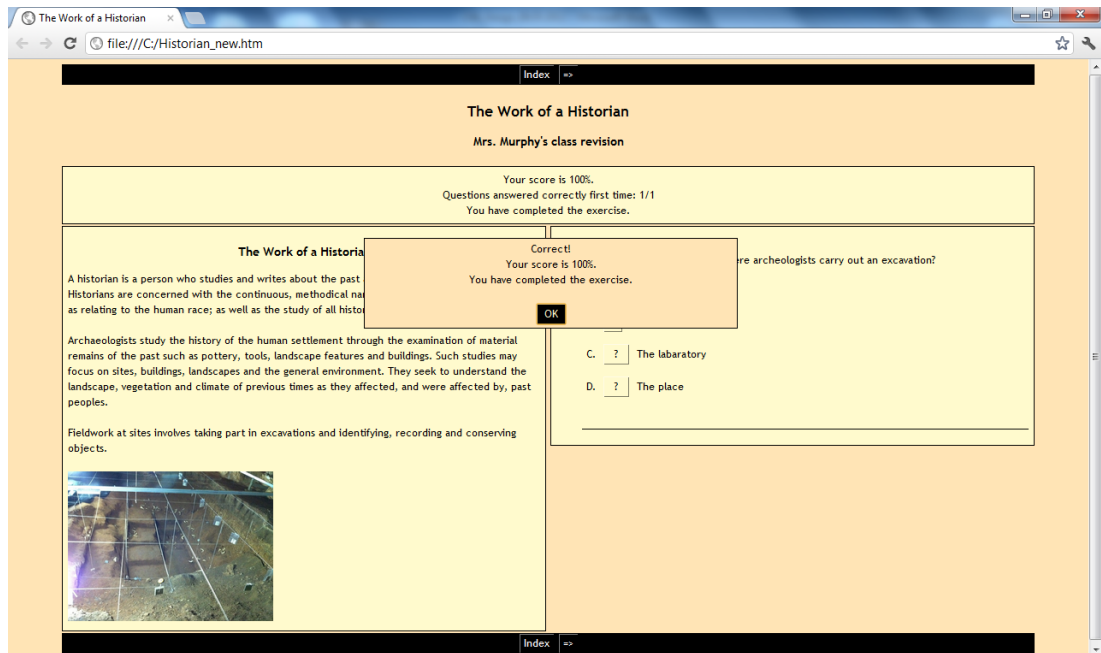
The teacher chose the content for the exercise from a Junior Certificate exam paper so that all students, especially those with dyslexia, can become accustomed to the

language used in exam papers. This particular exercise was deemed appropriate for levels A, C and D by the teacher who designed it. The teacher created a version with less text for the level B exercises.



Screenshot 6.3: The Work of a Historian using the Design Guidelines

An example of feedback given to students is shown below in Screenshot 6.4



Screenshot 6.4: Hot Potatoes Feedback

Logged Exercises

A number of Logged exercises were created for teachers and students using .jspx and java script³. As the Hot Potatoes exercises did not allow for student results to be kept, it was decided with teachers that a small number of logged materials would be created as an option so that both teachers could track students' progress. The Logged Exercises included short lessons including multimedia and related exercise such as gap-fill exercises and multiple choice.

The Logged exercises were created by using the Design guidelines agreed upon with teachers and students during the Analysis Phase (Chapter 5), repeated again below for convenience:

- Content level should be adapted depending on student literacy level

Teachers and students were involved in Focus groups and the design of the Logged exercises. Teachers worked closely with me on the curriculum units to be covered by the Logged exercises. Both mainstream and learning support teachers were then given the full database of Logged exercises.

I provisionally assigned personas to the materials however the teachers had the final say on how these were assigned. Both mainstream and learning support teachers gave me a list of student names (e.g. Gary H. or Gary L. with their assigned exercises). When the student logged into the system, they only received lessons and exercises deemed appropriate to their needs.

- Modules should cover one task only

Each lesson and related exercise covers curriculum topic only. There is only one task per Logged Exercise.

³ Java Server Page (JSP) is a technology for controlling the content or appearance of Web pages through the use of servlets, small programs that are specified in the Web page and run on the Web server to modify the Web page before it is sent to the user who requested it. Javascript is a scripting programming language.

- Age-appropriate material is vital

In the design of the Logged Exercise materials, text is kept short and the content focuses on exam vocabulary to reinforce this vocabulary so that students will be prepared for it when they reach the Junior Certificate exam. The multimedia was chosen by the teachers so it suited the age group of the students in their class.

- Student should participate in design of materials

Students are involved in the design and the content for the logged exercises.

- Use dyslexia-friendly colours and fonts

Dyslexia friendly fonts (Trebuchet MS) and colours (British Dyslexia Association's Style Guide) were used throughout the exercises.

- Keep text to a minimum

Instructions were kept to short, precise sentences.

- Use pictures, graphics and videos to illustrate ideas

A range of multimedia such as pictures, 3D graphics, videos, slideshows, (age-appropriate) cartoon animations were employed in the Logged Exercise lessons. The exercises included multiple choice and gap-fill exercises.

- Use exam question examples (exam paper wording)

Exam paper questions were used for the content so students could get accustomed to the vocabulary and style of questions.

- Materials do not need to be online due to problems with websites crashing

These materials are online as an option to see whether students would use the materials at home.

- Use mind-maps to reinforce material

Mind maps proved very difficult to implement and unfortunately were not integrated into the Logged exercises.

- Teachers should be able to create their own materials

Unlike the Clicker and Hot Potatoes CA(L)L exercises, teachers could not create their own Logged materials. A suitable interface was not developed as a part of this research.

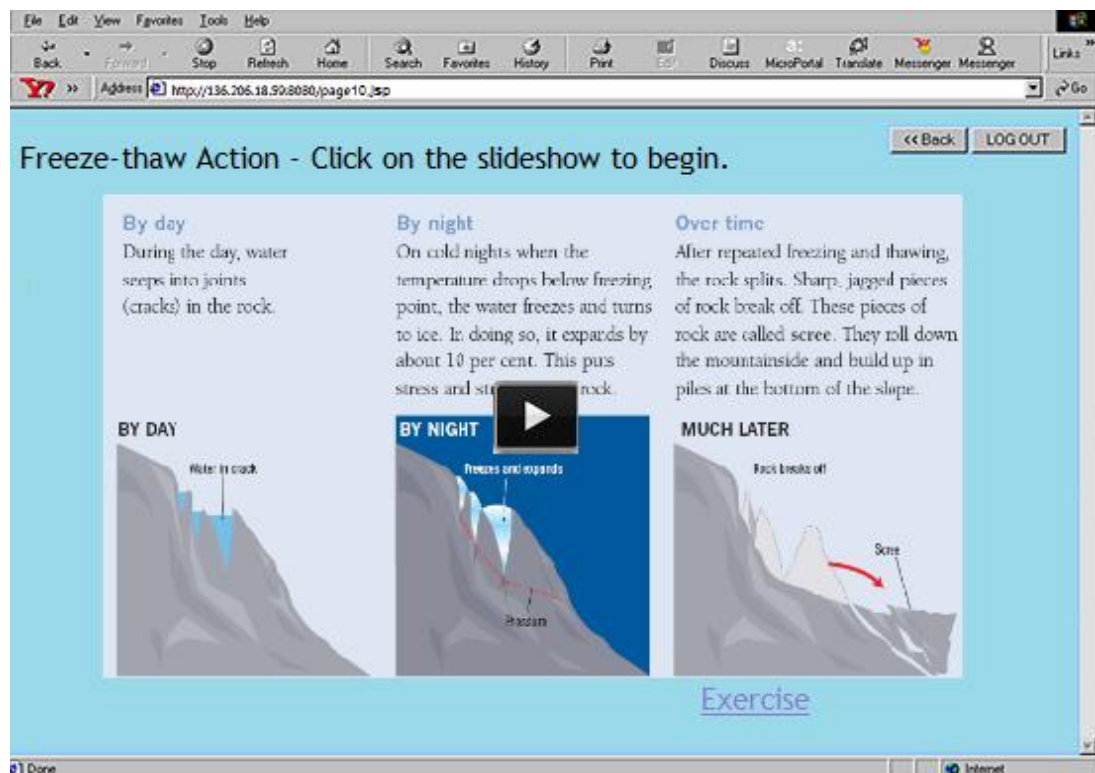
- Feedback for teachers and students

The Logged exercises provide feedback to the students on which answers they got right. Mainstream and learning support teachers can access a student page where they can see how many exercises students have completed. The teacher can also see logs on when students logged on e.g. at home. Teachers can also see what answers students got correct and the answers that they submitted to the system.

Screenshot 6.5 shows an example of a Logged Exercises that includes the design guidelines. The background colour is a light blue to adhere to the British Dyslexia Association's design guidelines. The font of the text is large and black to increase contrast. This lesson includes a slideshow about the effect of freeze-thaw action on rocks. Freeze-thaw action is one of the core elements of the Junior Certificate syllabus. The slideshow includes a small amount of text and images that show the freeze-thaw process in action. The exercise for this lesson consists of a few questions adapted from a Junior Certificate exam paper. The students can submit their answer to the teacher via the system.

As the content for exercises for persona type was designed in close collaboration with the mainstream and learning support teachers, the content was deemed appropriate for the students.

The students were involved in the design guidelines and the design of some of the Logged exercises. Therefore, students had a role in the age-appropriateness of the content and multimedia resources used.



Screenshot 6.5: Example of a Logged Exercise for a Geography Curriculum Unit

Teachers could not edit the materials or add to them as the Logged Exercises did not provide a user-friendly back-end. It was unfortunate that teachers could not edit the content however it also meant less work for the teachers and the content was ready to go for them.

Students registered for the system and logged in. They completed exercises similar to Hot Potatoes exercises and received more detailed feedback. They then were given

their results on each exercise. Their marks were recorded for teachers to review later. Teachers had the option to pass this information on to their students.

Table 6.5 shows how the curriculum-focused tools adhered to the design guidelines.

Design Guideline	Clicker	Hot Potatoes	Logged
Content level should be adaptable	Yes	Yes	Yes
Modules should cover one task only	Yes	Yes	Yes
Age-appropriate material	Yes	Yes	Yes
Students should participate in design of materials	Yes	Yes	Yes
Dyslexia-friendly colours and fonts	Yes	Yes	Yes
Keep text to a minimum	Yes	Yes	Yes
Use pictures, graphics and videos to illustrate ideas.	Yes	Yes	Yes
Use exam question examples	Yes	Yes	Yes
Use offline?	Yes	Yes	No
Use mind-maps to reinforce material	Yes	No	No
Teachers should be able to create their own materials	Yes	Yes	No
Feedback for teachers and students	No	Yes	Yes

Table 6.5: Curriculum-Focused Tools adhering to the Design Guidelines

Table 6.6 summarises the conceptualisation stage for the Online Materials.

Concept Development Activity	Information	
Personas / learner types	Persona A	A student in receipt of some learning support.
	Persona B	A dyslexic student with substantial learning support.
	Persona C	An average mainstream student.
	Persona D	A high-achieving mainstream student.
Practical goals	Persona A	Needs time to work on material alone.
	Persona B	Needs to work with their teacher with the materials.
	Persona C	To use the materials for revision.
	Persona D	To be challenged.
Scenarios	“Daily” or frequent	Students will use the materials during class time on a frequent basis and at home.
System tasks	Hot Potatoes exercises	Tool to display curriculum content online and interactive exercises at home or in school. Teacher could create new exercises and shown how to edit using the Design Guidelines.
System tasks	Logged exercises	System to display curriculum content lessons and exercises online adhering to the Design Guidelines so that students can access materials in school or at home.

Table 6.6: Conceptualisation Phase for Online Materials

6.6.1.5 Usefulness Criteria

The evolving concept should be checked, iteratively or not, against the following usefulness criteria: Usability, Usage, User Satisfaction and Criteria for optimising didactic efficiency.

- Usability

The design of the Online Materials tried to anticipate the limitations with regard to computing resources students encountered at home as well as school computer limitation which were highlighted in the earlier studies. The online materials were provided for free so it would not cost the school or students any money.

- Usage

The teachers agreed to use the Online Materials for three months regularly. It was unknown exactly how often the resources would be used. The Online Materials were designed to be used in the classroom and at home.

- User satisfaction

The concept design took into account information from focus groups and from previous projects with a similar group and age-group. Design guidelines developed during the Analysis Phase were employed.

- Criteria for optimising didactic efficiency

The Online Materials focus on curriculum content in a classroom or home environment. The content is static standard curriculum content which cannot be edited by the teachers.

Table 6.7 below shows how the Concept Design was checked against Usefulness Criteria.

Usefulness Criteria	Notes	
Usability	Concept design tries to take into account the unknown resource restrictions.	
Usage	Teachers and students to use the materials for three months regularly.	
User Satisfaction	Concept design takes into account focus groups and previous projects with this age-group.	
Didactic efficiency	Learning potential	Focus on curriculum content.
	Learner focus	System is designed to cater to a range of learners with exercises focused on each group.
	Meaning focus	Focus on curriculum content.
	Authenticity	Use in classroom and at home.
	Positive impact	Focus groups and previous projects point to students enjoying using the materials.
	Practicality	The online materials are designed taking the resource constraints into account while at the same time factoring in the potential future changes.

Table 6.7: Checking Concept Design against Usefulness Criteria (Online exercises)

6.6.2 Specification of Online Materials

Conceptualisation feeds into Specification. Specification describes:

- The *back-end*: the system structure in terms of components and their interaction.
- The *front-end*: the user interface with screen design, menu systems, and navigation.

6.6.2.1 Specification of Hot Potatoes Exercises

Back-end

Hot Potatoes 5 was downloaded from <http://hotpot.uvic.ca/> in each school. The latest version available from the website is now Hot Potatoes 6 however this was not available during the Implementation Phase (2007). More detailed information on downloading and set up is provided in Chapter 7 (Development of Curriculum-Focused CA(L)L Materials).

Front-End

The Hot Potatoes suite includes six applications, enabling one to create interactive multiple-choice, short-answer, jumbled-sentence, crossword, matching/ordering and gap-fill exercises for the internet. For example to create a quiz, the first step is to enter the questions and answers on the template. Users can edit the Hot Potatoes template or click on the html exercise that was created. The exercises can be kept on the local drive and linked together and / or put online.

6.6.3 Specification of Logged Exercises

Back-end

The software carries out six main functions:

- User log-in
- Registration of a new user
- Checking answers from either fill in the gap exercises or multiple choice and records a user's progress – i.e. their results from exercises
- User log-out which incorporates writing all of the final results to a file
- Teacher report on students
- Teacher option to view the answers to the exercises

Each of these functions will be described in some detail in Chapter 7 Development including the jsp's incorporated, java files and XML files which were read or written to.

Front-End

The Front-End was designed using the Design Guidelines from the Analysis Phase as shown in the System Tasks section. The Front-End includes log-in and all the pages students can access on the system. Screenshots are shown in Chapter 7 Development.

There are two fields in the login option (Screenshot 6.6), Username and Password. The students have will have been given a Username and Password and it is a simple process of entering their Username and Password.



Screenshot 6.6: Login – Logged Exercises

If the login is successful the user is welcomed and then given a list of exercises allocated to them. This allocation is done by the teacher based on persona type. If a

teacher has logged in, they can click on the teacher link to see the student's results, answers to exercises and see the lessons and exercises.

If this is the user's first time on the program, they can click on the 'First time User' link to find out about some of the features on the program.

On the first page, there is a link to background information on the project. In this section, there is information for the students on the use of ICT for learning.

Once the student has logged in they are presented with curriculum exercises selected by their teacher.

When a teacher is logged in, they can view the teacher page where they can view lessons and exercises, answers and student results. The teacher can see each of their students who have completed exercises and can click on their name to see a report.

6.6.4 Prototyping of Online Materials

Two teachers tested out the Hot Potatoes and Logged Exercises prior to the students. Both of these resources had been used in previous projects for different content (Greene & Keogh 2002) so the functionality was tested.

6.7 Main Findings

This chapter described Colpaert's Design model within the ADDIE framework. A short recap of findings from the Analysis was presented and how they fed into the Design.

Section 6.2 discussed how this chapter fits into the Design Phase (Colpaert 2004) of the project methodology. Section 6.3 described Colpaert's design decisions and Section 6.4 presented Colpaert's RBRO Design model instantiated to this project. Sections 6.6 and 6.7 discussed the design of the CA(L)L clicker exercises and online CA(L)L materials.

This chapter presented the design of curriculum-focused CA(L)L materials to help all students, including those with learning difficulties and dyslexia to access the English, Geography and History Junior Certificate curriculum (JC 2006). Colpaert's Design Decisions were then discussed and the RBRO Model was described with a focus on:

- Conceptualisation
- Specification
- Prototyping

The design of CA(L)L materials, which took all the input from the Analysis Phase (Chapters 3-6) into account, was then presented:

The Conceptualisation, Specification and Prototyping stages are set out then for each of three CA(L)L materials:

- CA(L)L Clicker Exercises
- Online CA(L)L Hot Potatoes Exercises
- Online CA(L)L Logged Exercises

The Clicker Exercises are not online and can be used by teachers and students in the classroom or lab when there are IT difficulties. They can also use them whenever they have access to the local server without internet access. The Hot Potatoes Exercises are designed to be used online. Teachers were given on training on how to adapt the materials to incorporate the design guidelines. The Logged Exercises host a student and teacher page where teachers can see what exercises students have completed.

The Front-End and Back-End of each system is described in detail. Examples of what the CAL(L) materials look like before and after the Design Guidelines are applied are also provided.

CHAPTER 7: Development of Curriculum-focused CA(L)L Materials

7.1 Introduction

This chapter describes the development of the CA(L)L Clicker and Online materials used by the teachers and students in this research project. The development difficulties are discussed. Section 7.2 describes the development of the CA(L)L Clicker Exercises and Section 7.3 describes the development of the two sets of CA(L)L Online Materials to cater to the needs of diverse student groups in the classroom including those with dyslexia. Section 7.4 describes the testing and Section 7.5 summarises the main findings from the chapter.

7.2 Development of Clicker Exercises

The development is described in terms of the back-end and front-end. In software design, the front-end is the part of a software system that interacts directly with the user, and the back-end comprises the components that process the output from the front-end. The separation of software systems into "front-ends" and "back-ends" is an abstraction that serves to keep the different parts of the system separated.

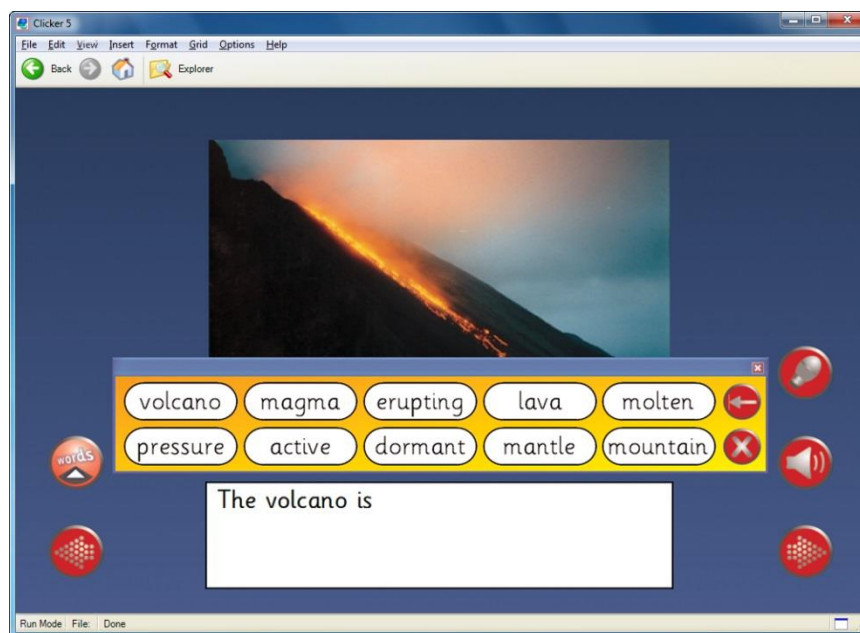
7.2.1 Back-end

Clicker 5 (2006) was used by both schools (the current version of Clicker is called Clicker 6 and can be accessed at <http://www.cricksoft.com>). Clicker is available to schools from their local Education Centres and each school must pay for a licence. Clicker must be downloaded from the internet or installed from a CD. Clicker 5 has the following minimum system requirements:

- Pentium II 400 MHz or greater
- Windows 2000, 7, Vista, XP
- 128 MB RAM
- 400 MB hard disk space
- A sound card for speech
- CD ROM drive

Clicker is a writing support and multimedia tool for students of all abilities. At the top of the Clicker screen is a word processor called 'Clicker Writer'. At the bottom of the screen is the 'Clicker Grid'. This has 'cells' containing letters, words or phrases that the user can click on, to send them into Clicker Writer – so students can write all or part of their sentences without actually writing or using the keyboard. A sample Clicker Grid is shown in Screenshot 7.1.

Clicker comes with realistic British English speech, so students can hear the words before they write by clicking on any word with the right-hand mouse button (or Control-click if using a Mac). Clicker Writer can also speak letters, words or sentences as a student writes as well as highlight the text as it is spoken.



Screenshot 7.1: Example of a Geography Clicker Grid

Words can be changed in a grid by holding down the Shift key and clicking on a cell, typing whatever is wanted, and Enter. The grid is instantly ready to use. Clicker Grids are so easy to make, so that teachers can create them in the classroom, with students helping to suggest words.

Clicker comes with pictures to illustrate common words as well as a function to use one's own pictures too. Students can have pictures in the Clicker Grid and click on them to send them into Clicker Writer, so they can write with pictures as well as

words. Pictures can appear instantly in cells when the user types into them. Pictures can also appear instantly as the user types into Clicker Writer. Clicker Grids can also contain recorded sounds and video.

Schools can buy the Clicker Animations CD which contains animations to illustrate words and phrases, and also includes ready-made Clicker Grids using these animations.

Schools that have Clicker can access free grids at the LearningGrids.com website. These resources are created by qualified teachers and can be searched for and downloaded straight into Clicker. Teachers can also edit any of the downloaded resources to suit their needs. They can add and delete cells, position them where they want, resize them and change the colours.

Clicker has a special Edit Mode to make it easy to create grids, including an Editing Toolbox, which contains all the tools required to tailor cells.

Clicker allows teachers to link grids using templates. All the grids created are automatically linked together in a sequence and teachers can move between grids using the Back and Forward arrows. Teachers can also set up cells to open other grids.

Clicker's automatically linked grids allow teachers to structure a piece of writing, with each grid containing words for different sentences. Teachers can also structure words within a grid – Clicker lets teachers force the order in which cells are used, by disabling groups of cells until a cell from another group has been used.

Teachers do not have to use Clicker Writer as they can also have full-screen grids. Teachers can use full-screen grids to create on-screen talking books.

A database of ready-made curriculum-focused Learning Grids is available on the CD or from the Learning Grids website (Screenshot 7.2, reproduced from Screenshot 6.1).



Screenshot 7.2: The Learning Grids website for Clicker (Reproduced from Screenshot 6.1)

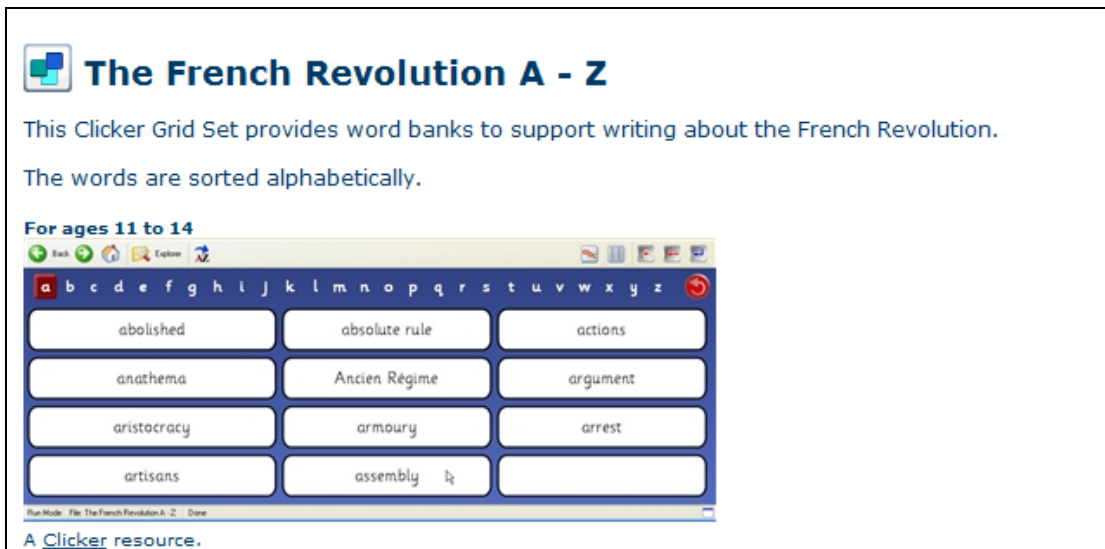
There were approximately 30 resources, appropriate to the Junior Certificate curricula in this project, on the Learning Grids website. Teachers were directed to these resources and shown how to download the grids.

Resources can be searched for by subject and age-range. A list of exercises appears based on the search criteria. Each exercise can be downloaded for use with the School's copy of the Clicker software.

7.2.2 Front-End

7.2.2.1 A Small Database of Clicker Grid Sets

A small database of Clicker Grid Sets is available on the Learning Grids Website. Exercises pertaining to the English, History and Geography Junior Certificate curricula were downloaded into a local school folder called "TeacherName_ClassName". Screenshot 7.3 below gives an example learning grid from the database that catered to the JC History syllabus.



Screenshot 7.3: Clicker Grid on a Revolution Movement

7.2.2.2 Sample exercises

I created a small number of sample grids to give to the teachers. Ten CA(L)L Clicker Exercises were created for each of the English, History and Geography curricula. I allocated some exercises to each persona described in Chapter 6 to show how the exercises could be split into groups of exercises that suit the particular learning styles of dyslexic students. Teachers then had the final say on assigning the exercises to personas.+

7.2.2.3 Create-your-own Clicker Exercises

Teachers were shown how to create their own Clicker exercises during training. Students, depending on their persona-type, accessed either one exercise at a time or were given access to a number of exercises so they could move on when they are finished.

The initial sample exercises were developed with teachers and students to agree content and design. As Clicker is a standalone service, no discrete elements needed to be tested.

7.3 Development of Online Materials

The Online Materials comprise Hot Potatoes Exercises and the Logged Exercises. The development is described in terms of the Back-end and Front-end.

7.3.1 Development of Hot Potatoes Exercises

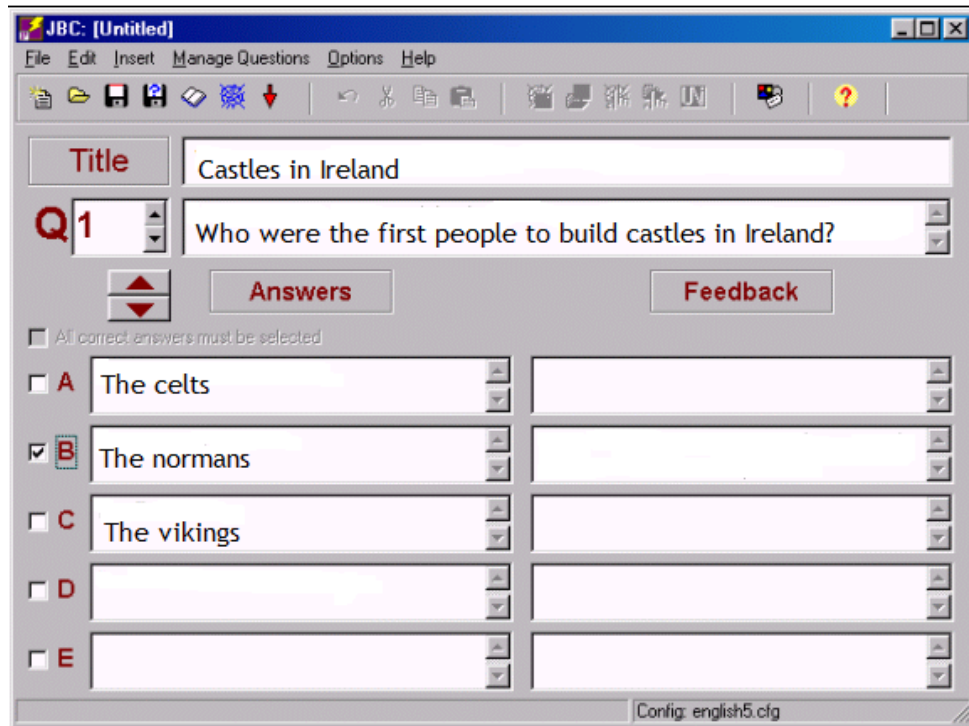
7.3.1.1 Back-end

It is relatively easy to install Hot Potatoes. Hot Potatoes 6 was downloaded from <http://hotpot.uvic.ca/>. The "Downloads" section includes the Hot Potatoes installer which has to run. The license agreement states that Hot Potatoes is free if the user works in an educational institution and makes material they create using the software generally available by putting it up on the Internet.

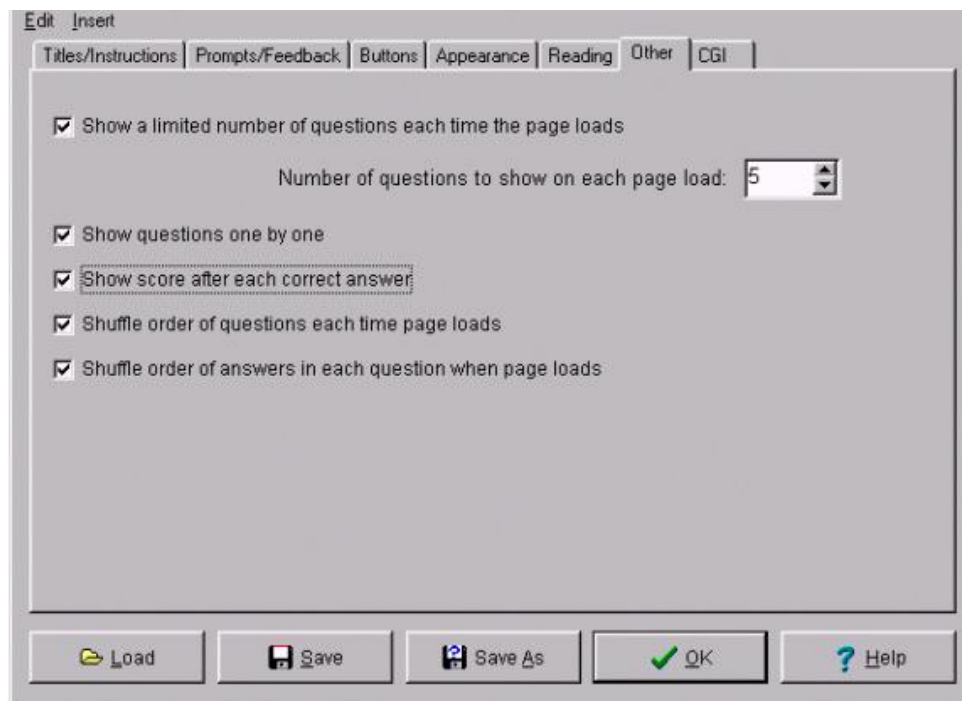
7.3.1.2 Front-End

The Hot Potatoes suite includes six applications, enabling one to create interactive multiple-choice, short-answer, jumbled-sentence, crossword, matching/ordering and gap-fill exercises for the internet. For example, to create a quiz, the first step is to enter the questions and answers on the template (see Screenshot 7.4).

The user must then select "Configure Output" from the Options menu. Here they will find a variety of interesting options that can be set for quizzes or whatever type of exercise the user is creating (Screenshot 7.5).



Screenshot 7.4: Hot Potatoes Quiz Template



Screenshot 7.5: Configuration Output

Once the exercise has been created the final step is to select Export to Web from the File menu and give the page a file name when prompted. Users can edit the Hot Potatoes template or click on the html exercise that was created. The exercises can be kept on the local drive and linked together and/or put online.

7.3.2 Development of Logged Exercises

The Clicker and Hot Potatoes exercises developed as part of this thesis use existing software, i.e. the Clicker and Hot Potatoes engines. By contrast, the software used for the Logged Exercises was developed from scratch.

7.3.2.1 Back-end

The software carries out six main functions:

- User log-in
- Registration of a new user
- Checking answers from either fill in the gap exercises or multiple choice and records a user's progress – i.e. their results from exercises
- User log-out which incorporates writing all of the final results to a file
- Teacher report on students
- Teacher option to view the answers to the exercises

Each of these functions will be described in some detail – the jsps incorporated, java files and XML files which were read or written to. The user login function is shown in Figure 7.1

User log-in

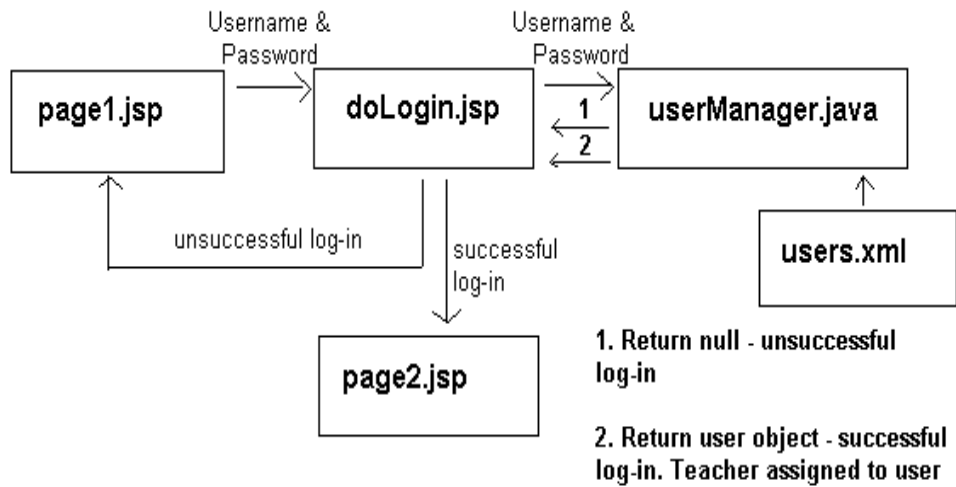


Figure 7.1: User Login Function

The user is presented with `page1.jsp` which contains the fields to enter their username and password. This was written in HTML, partly using FrontPage and partly hand-coded. This jsp holds login information for `doLogin.jsp` (Code Listing 7.1).

```
<form action="doLogin.jsp">.....</form>
```

Code Listing 7.1: Page1.jsp

This jsp takes in the username and password from `page1.jsp` and then calls the login method within the `userManager` class (Code Listing 7.2).

```
<jsp:useBean id="userManager" scope="application" class="userManager" />
<%
    String username = request.getParameter("username");
    String password = request.getParameter("password");
    User user = userManager.login(username, password);
...%>
```

Code Listing 7.2: doLogin.jsp

The login method must carry out 3 main tasks:

- Read in the user.xml file
- Take in the information from doLogin.jsp
- Compare the user information from doLogin.jsp with all of the nodes in the user.xml file, until a match is found, or there are no more user nodes left.

UserManager reads the XML file and processes it into a form that can be compared with the data the user entered in the login method (Code Listing 7.3).

```
<Users>
  <User>
    <username>Cara</username>
    <password>secret</password>
  </User>
  <User>
    <username>Gary</username>
    <password>secret2</password>
  </User>
</Users>
```

Code Listing 7.3: Sample from the User XML file

Login

If the details the user entered are matched correctly against some nodes in the users.xml file, then a user object is returned to doLogin.jsp. This reports a successful login, and will redirect the user to page2.jsp (the homepage). If however nothing is returned, (from an unsuccessful match where the username and/or password are incorrect, or the details are not found at all in the users.xml file) then doLogin.jsp reports that the username and password combination are invalid and provides the option to link back to page1.jsp and try again. For security reasons, no specific information concerning the *exact* error in entering the username/password is reported.

Registration of a new User

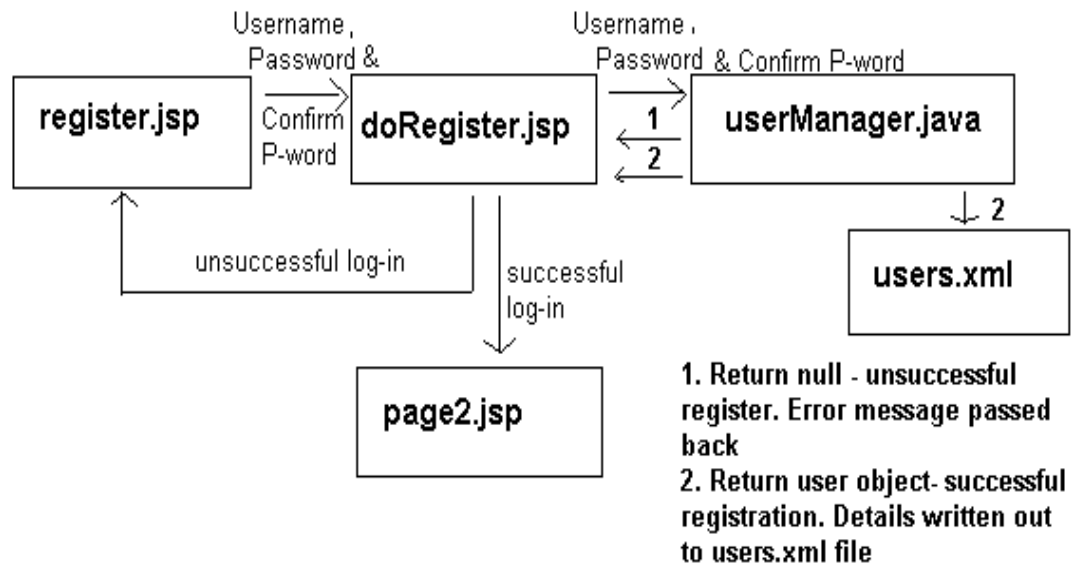


Figure 7.2: Registration of a New User Function

Page1.jsp also provides a link to register, which links to register.jsp. This page takes in a username, password and confirmation password from the user and works in much the same fashion as page1.jsp in log-in. DoRegister.jsp again retrieves this information from register.jsp and passes it to the register method in userManager.

The register method carries out a number of tasks:

- Checks that the user entered a username
- Checks that the user entered a password
- Checks that the user entered a confirmation password
- Checks that the password and confirmation password match
- If all of these checks are successful, the method persist is called, which writes out the new data to the user.xml file. If, however, any of the checks were unsuccessful, then null is returned and a relevant error message is passed back.

The important elements in register.jsp and doRegister.jsp are similar to those found above in page1.jsp and doLogin.jsp from log-in.

If any error message is returned during registration, it is very specific. Depending on which check has failed, the .jsp will return an error message stating as much. This is important for the user and does not represent any security risks. These error messages are output by doRegister.jsp and an option to return to the registration page is supplied.

If the details the user entered are all accepted, then a user object is returned to doRegister.jsp, which redirects the user to the homepage. Figure 7.2 shows the user registration function.

Checking Exercise Answers

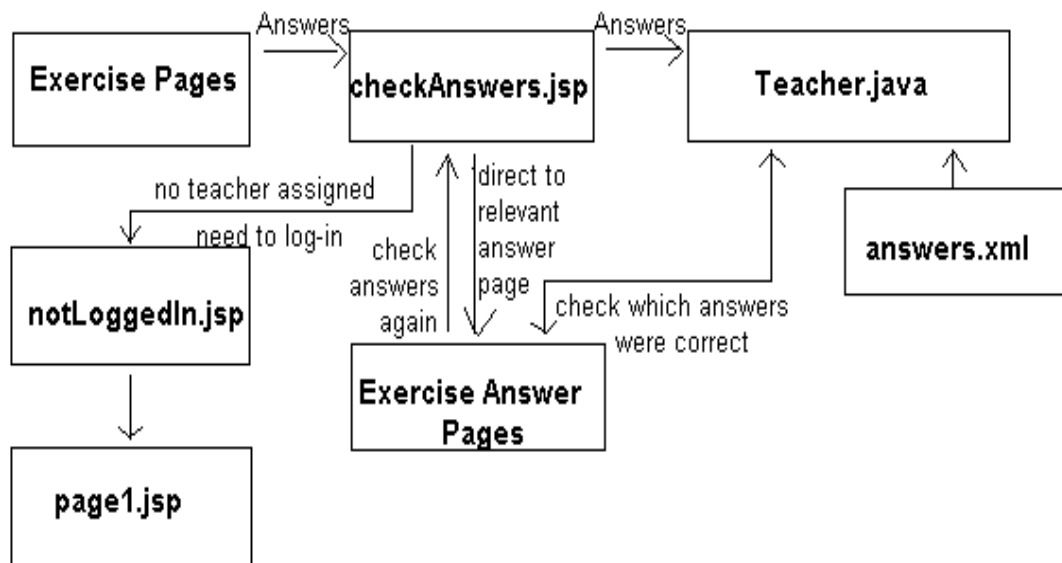


Figure 7.3: Check Answer Function

Every exercise page references checkAnswers.jsp. When the user clicks on the ‘Check your answers’ button, checkAnswers.jsp comes into play. CheckAnswers.jsp first makes sure that the user is logged in – i.e. that they have a ‘teacher’ assigned to them. Without a teacher, their answers cannot be recorded and checked. If the user is not

logged in, then they are directed to a not_logged_in error and given the option to link to page1.jsp and log-in.

If however the user is logged in, then their answers are passed to the Teacher class, where they are checked and whether they are correct or not is recorded. CheckAnswers.jsp then redirects the user to the answers page related to the page they have just come from.

The answers pages will output ticks and crosses for each gap, or else a message in the case of multiple choice exercises, stating whether the answer was correct or not. Each exercise page references checkAnswers.jsp (Code Listing 7.4).

```
<form action="checkAnswers.jsp">...</form>
```

Code Listing 7.4: Check Answers

In fill in the gap exercises, the user has the option to re-enter their answers as often as they want. Their original answer is maintained in the gap so that they can see what they entered initially and they can re-correct them as often as desired. The ‘teacher’ class contains 2 methods – isAnsweredCorrectly and getUserAnswer which facilitate outputting a tick or cross and retaining the original user answer.

The fill in the gap exercises output a tick or cross depending on whether the answer was correct (true) or not (false) (Code Listing 7.5).

```
<%  
  
if(teacher.isAnsweredCorrectly("hist1s1q1")) out.println("<img src=\"check.jpg\">");  
else out.println("<img src=\"x.jpg\">");  
  
%>
```

Code Listing 7.5: Answer Output

In multiple choice exercises, if the user’s answer was incorrect, the correct answer is provided for them. Multiple choice exercises do not allow the user to re-enter their answers again as there is only a choice of three answers anyway. The user’s own

answer remains ticked so that they can see which one they chose initially. Again, the `getUserAnswer` method within the 'teacher' class is used to facilitate this. The Multiple Choice Answer Pages retain the user's answer (Code Listing 7.6).

```
<input type="radio" name="hist1s3q1" value="1916">  
<%  
    if(teacher.getUserAnswer("hist1s3q1").equalsIgnoreCase("1916")) out.println("CHECKED");  
%>
```

Code Listing 7.6: Get User Answer

The Teacher class reads in the `answers.xml` file and transfers the data to a form that can be compared with the user answers.

It also contains the `checkAnswer` method which is called from `checkAnswers.jsp`. This method takes in the user answers and compares them against the answers from the `answers.xml` file. They are referenced by the name of the 'box' that is filled in – e.g. `hist2s2q4` – History exercise, lesson 2, section 2 question number 4.

The answers are compared and a score is kept in the user object for the results page for the teacher. Each question box is then set to true or false depending on whether it was correct or not.

There is also some error handling that goes on within `checkAnswer`. It calls another method called `trimAnswer`, which takes out excess spaces from answers that the user entered. This was causing problems for the user when an otherwise correct answer was marked wrong because there were extra spaces before, after or in the middle of multi-word answers. Figure 7.3 above shows the Check Answer Function.

User Log-out

Each page within the site has an option to logout. This links to `logout.jsp`. This passes the user object to `userManager` when it calls the `logout` method. The user object will

contain information about the user trying to logout. This information includes username, password and results information.

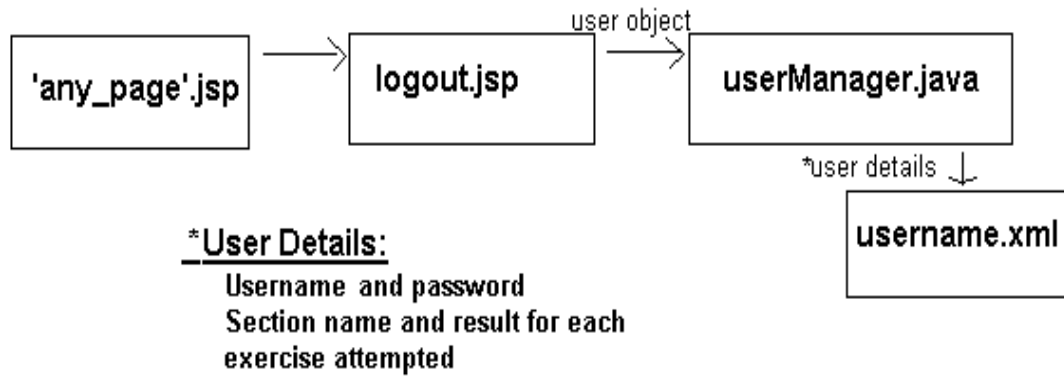


Figure 7.4: User Logout Function

The logout method takes in this user object and writes the results information, along with the username to a new XML file (Code Listing 7.7). Each user who has completed some exercises and has logged out, will have their own 'username'.xml file with their individual results. If the user has logged in before and already has their own .xml file, then the History in the .xml file will be retained and the new information combined with this will be written out to the file.

The logout method carries out the following actions:

- Creates a new .xml file for the individual user
- Writes out their username, each section attempted and the result users obtained for this section

```

<?xml version="1.0" encoding="UTF-8"?>

<?xml-stylesheet type="text/xsl" href="results.xsl"?>

<User>

    <username>Gary</username>

    <Results>
  
```

```

<section>
    <name>EngL3S1</name>
    <score>2</score>
</section>
<section>
    <name>HistL5S2</name>
    <score>3</score>
</section>
</Results>
</User>

```

Code Listing 7.7 Sample username.xml file

Logout.jsp will display a message stating that the user has been successfully logged out and give them the option to return to the log-in page. Figure 7.4 shows the User Logout Function.

Teacher Report on Students

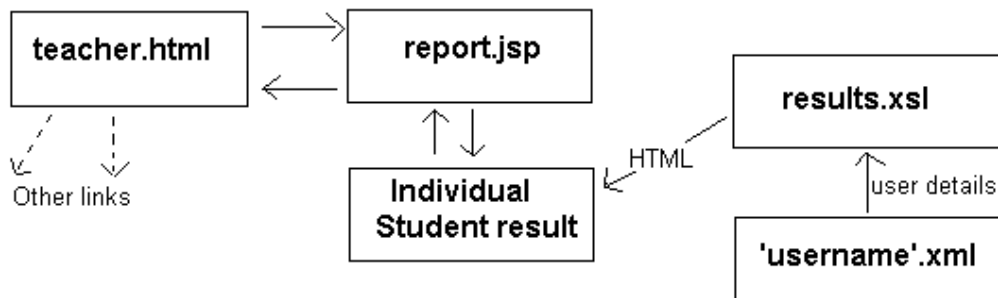


Figure 7.5: Teacher Report on Students Function

The teacher page provides an option to view the students’ results. Each student who has logged in and subsequently logged out will have their own ‘username’.xml file,

which was described above in the logout section. Figure 7.5 shows the Teacher Report on Students Function.

The report page is dynamically generated by reading in the users.xml file. This provides a list of students. It also makes any of the student names who have their own .xml file, into a link that will bring the teacher to the results page for that student. The results page is generated using an XSL, which takes in the XML information and converts it to HTML, so that it can be displayed. Results.xsl does not only convert the information into HTML, however also sorts the contents of the section/name (this is needed as the results are output in the order in which they are completed) into alphabetic order and also converts the section/name into something that would be more readable for a teacher i.e. HISTL1S1 – translates as History Lesson 1 Section 1, so the teacher sees ‘Vikings Exercise’ and also the type of exercise it was (fill the gap or multiple choice).

Teacher Option to View Answers to an Exercise

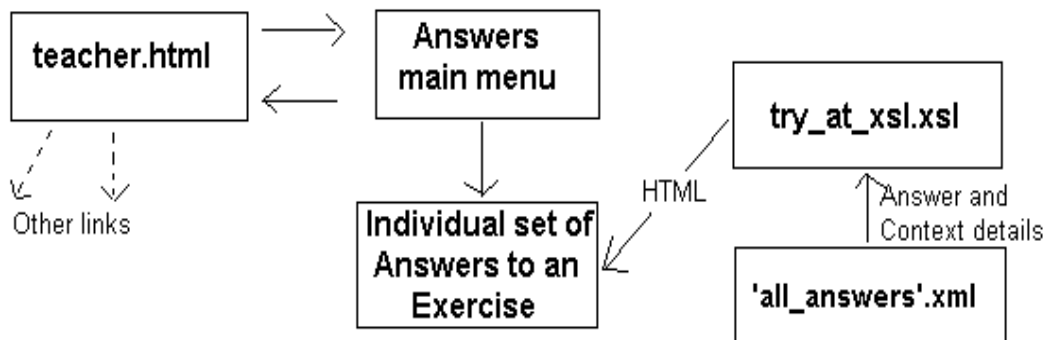


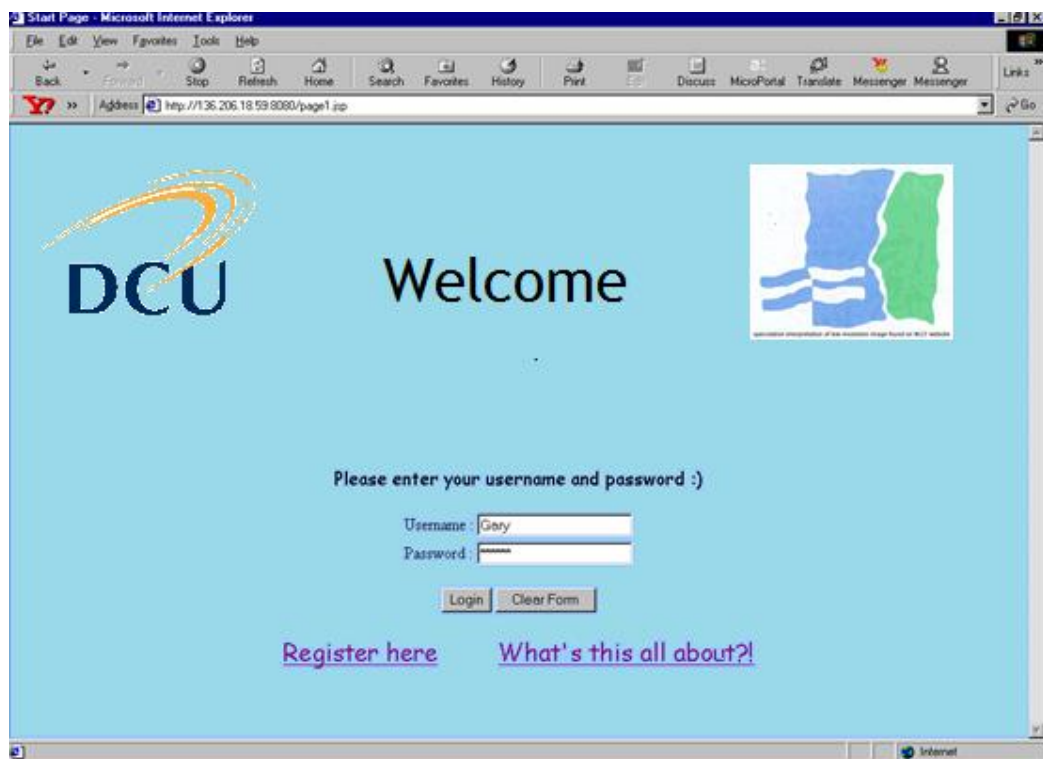
Figure 7.6: Teacher Option to View Answers to an Exercise Function

It is important to have an option for teachers to view the correct answers to the exercises, so that they can help their students where necessary. Figure 7.6 shows the Teacher Option to View Answers to an Exercise Function. The XML files contain contextual information too, so that the answer and surrounding sentence can be seen when viewed through the XSL file.

7.3.2.2 Front-End

Log-in

There are two fields in the login option, Username and Password. The students were given a Username and Password and it is a simple process of entering their Username and Password (Screenshot 7.6).



Screenshot 7.6: Login

After Logging In

Once a user clicks on the login button, one of two screens will appear.

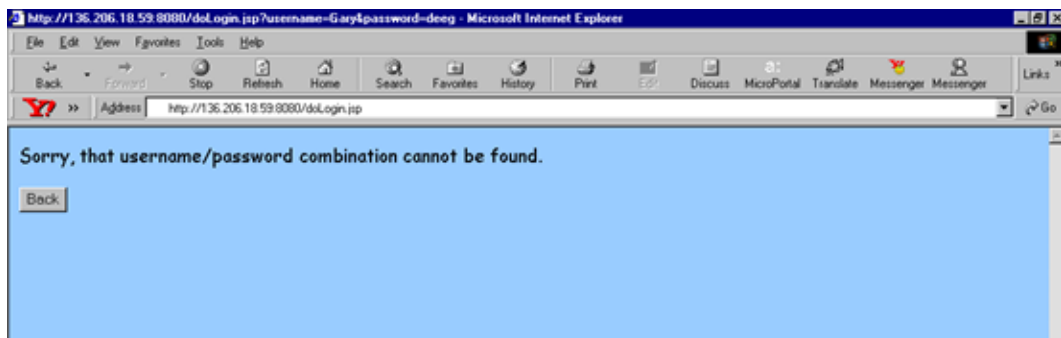
1) *Log-in Unsuccessful*

This screen comes up if either a wrong Username or Password or both was entered by the user. It is not specified whether it is the Username or the Password or both, that is

wrong or missing. There is a Back button on this page so the user can go back and try to log-in again (Screenshot 7.7).

2) *Log-in Successful*

This page comes up when the Username and Password are recognised. On this page, the user is welcomed and then given a list of exercises allocated to them. This allocation is done by the teacher based on persona type. If they are a first time user who has just registered, the user may click on the 'First Time User' link to find out about some of the features of the program.



Screenshot 7.7: Login Unsuccessful

If a teacher has logged in, they can click on the teacher link to see the student's results, answers to exercises and see the lessons and exercises. There is also the option of going back to login as well as a log-out button (Screenshot 7.8)



Screenshot 7.8 Login Successful

First Time User

If this is the user's first time on the program, they can click on the 'First time User' link to find out about some of the features on the program.

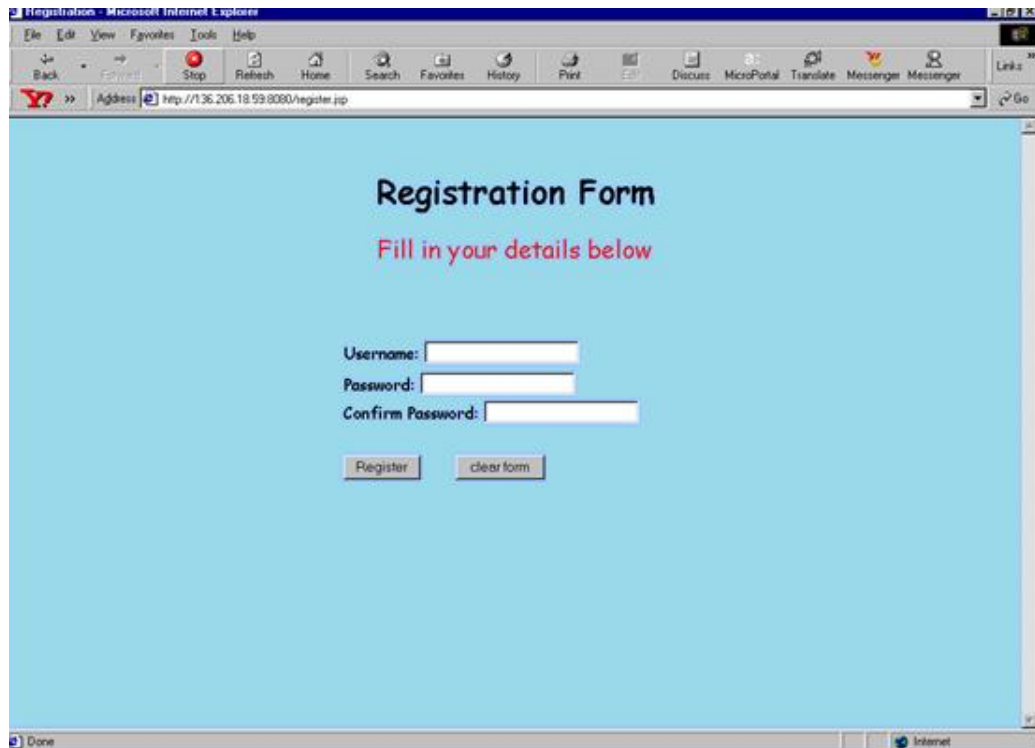
Teacher link

If a teacher has logged in, they can click on the 'Teacher' link to view the students' results.

Register

If the user is a new user and they do not have a Username and Password to log in with, they can click on the registration link on the first page and register (Screenshot 7.9). They simply fill in their details and if they make a mistake they can clear the form, and then they click on the register button when their details are correct. When they register they create a Username and Password for themselves and they are automatically logged into the program and made a member.

When they come back to the program later, they will be able to log in as a member.

A screenshot of a Microsoft Internet Explorer browser window. The title bar reads "Registration - Microsoft Internet Explorer". The address bar shows "http://136.206.18.59:8080/register.jsp". The main content area has a light blue background and contains the text "Registration Form" in bold black font, followed by "Fill in your details below" in red font. Below this, there are three input fields: "Username:", "Password:", and "Confirm Password:". At the bottom of the form are two buttons: "Register" and "clear form". The browser's status bar at the bottom shows "Done" and "Internet".

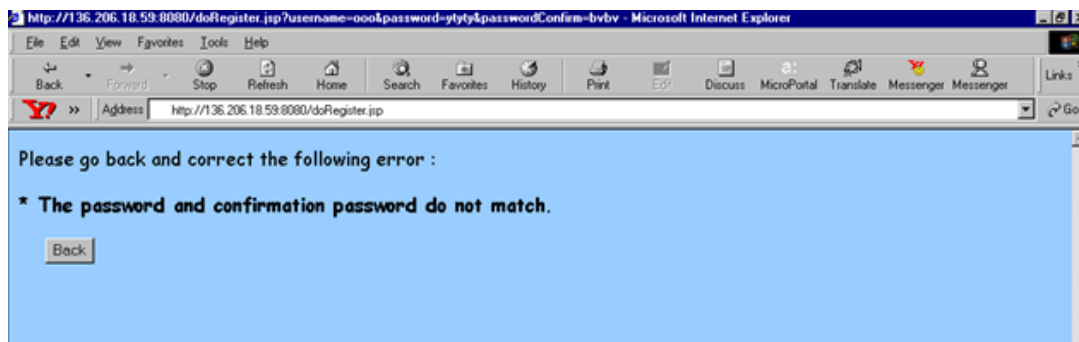
Screenshot 7.9 User Registration

If they make a mistake when they are registering, there are four possible error messages:

Please go back and correct the following error:

- The password and confirmation password do not match
- Please enter a password
- Please enter a username
- Please confirm the password

For example, the following screen shot shows a situation where the password and confirmation password do not match (Screenshot 7.10)



Screenshot 7.10 Registration Error

Background Information

On the CA(L)L Logged Exercise start page, there is a link to background information on the project. In this background section, there is information for the students on the use of ICT for learning.

For example, once the student “Gary” has logged in, he is presented with two English curriculum lessons, one on the class play “Romeo and Juliet” and one on the class novel “To Kill a Mocking Bird” (Screenshot 7.5) which have been selected for him by his teacher.

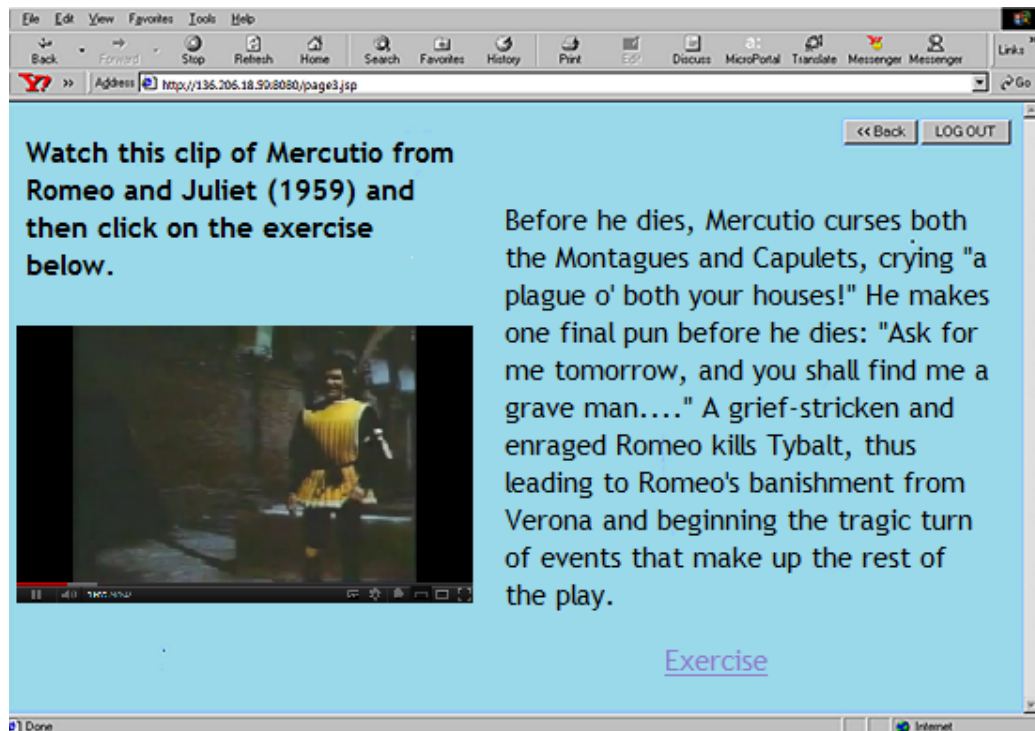
Screenshot 7.11 shows the Romeo and Juliet exercise which has allocated to students of persona type B. Students in this group receive learning support regularly (see Section 6.5.1.1 for more details on the personas developed during the design phase). The design guidelines were used when creating the CA(L)L Logged Exercises with collaboration with teachers and students. Note that the dyslexia-web font Trebuchet is used to adhere to the British Dyslexia Association’s guidelines. A light blue background with a black font is also used because most dyslexic people find a dark text on a light background easiest to read. The text size is large and kept to a minimum. The text for the exercise for persona type B (Screenshot 7.12) is from a

Junior Certificate exam paper. A clip from a film version of Romeo and Juliet is included as well as a short amount of text about a key turning point in the play. The Logged Exercise is deemed age- and content-appropriate because mainstream and learning support teachers and students were involved in the design and content of the Logged Exercises. The teachers decided which exercises would be allocated to each student based on their specific needs and learning style.

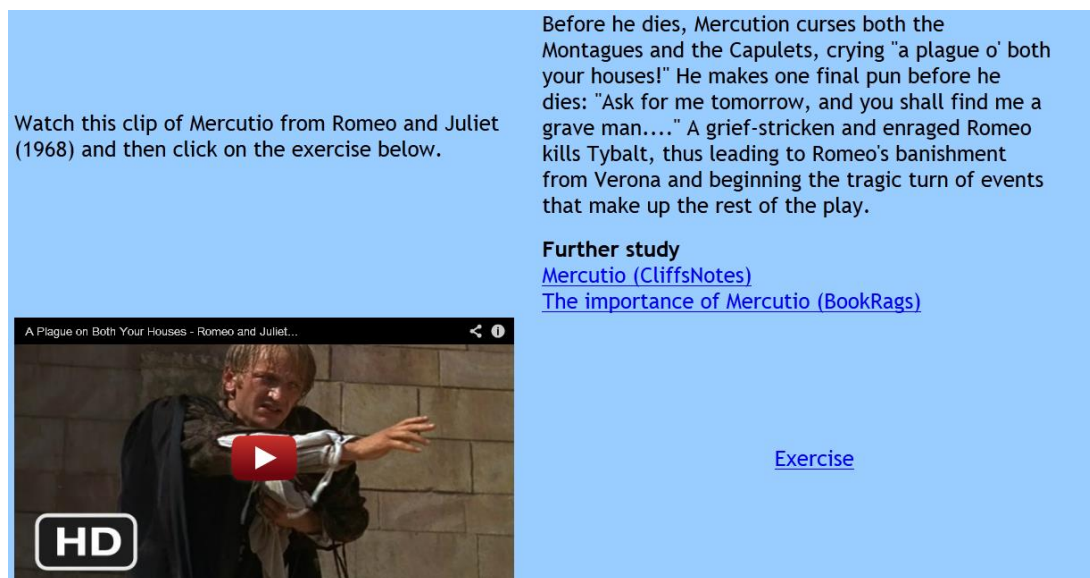
The Romeo and Juliet lesson focuses on the character Mercutio. Students watch a video clip of the character from the film (Castellani 1954). There is also a very short text that uses phrases from previous Junior Certificate exam papers. Once the student has watched the video and / or read the text of this lesson they can click through to the exercise (Screenshot 7.13).

Screenshot 7.11 can be compared with Screenshot 7.12 which was designed for students of persona type D. Students in this group are expected to use these tools for revision as they are high-achieving students in a mainstream class already. It is important to note that the colours, images, videos all look the same and everyone receives the same dyslexic-friendly layout.

This is designed this way so that it would not be obvious that some students are working on different materials. This was done to promote an inclusive classroom environment. When you look more closely at Screenshot 7.12 you can see that extra links are present for further exercises. The video is also longer in this version.

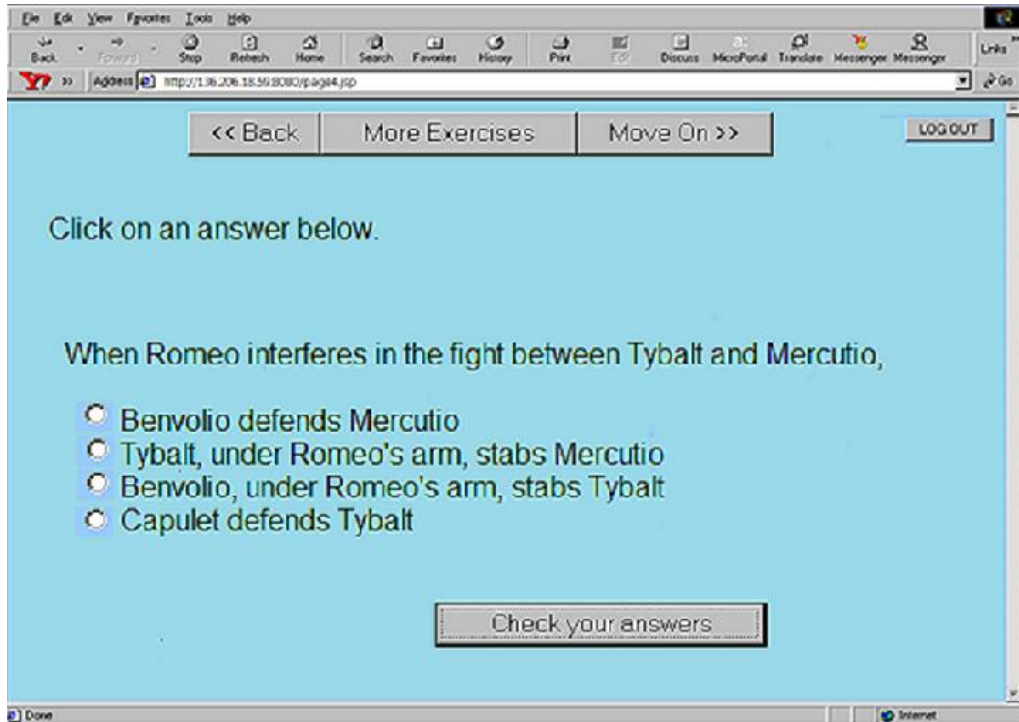


Screenshot 7.11 Romeo and Juliet Lesson for Persona B

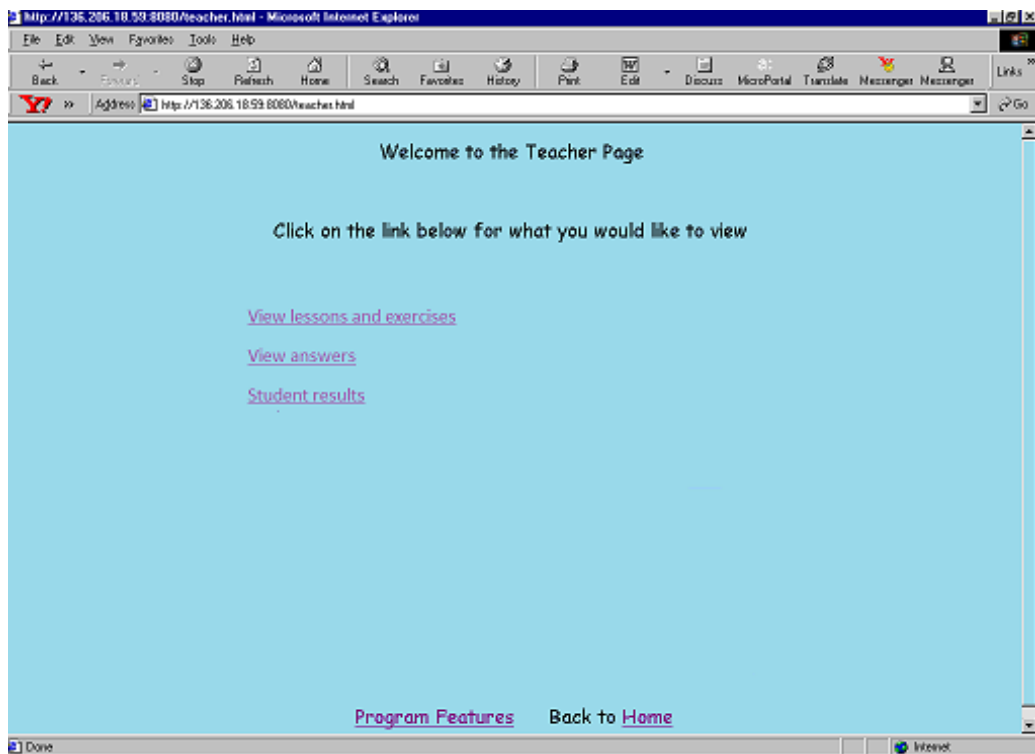


Screenshot 7.12 Romeo and Juliet Lesson for Persona D

When a teacher is logged in, they can view the teacher page where they can view lessons and exercises, answers and student results (Screenshot 7.14)

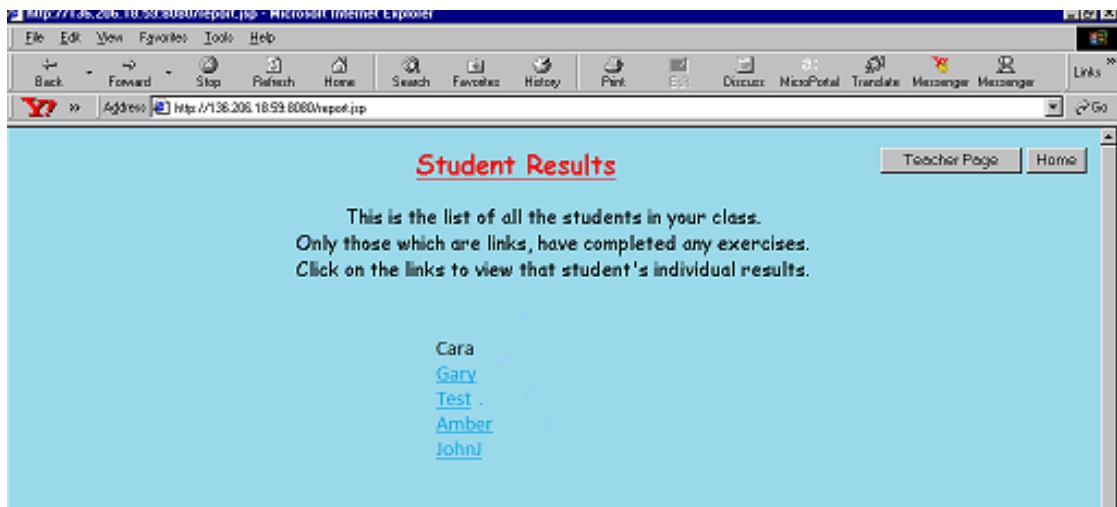


Screenshot 7.13 Romeo and Juliet Exercise



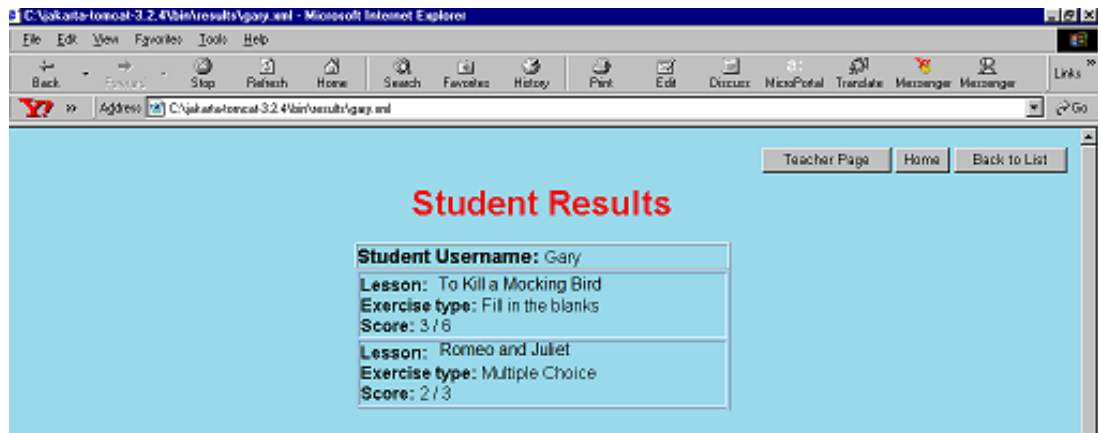
Screenshot 7.14: Teacher Page

The teacher can view which students completed exercises and can click on their name to generate a report (Screenshot 7.15).



Screenshot 7.15: Student Results Page

The teacher can also view the results for a particular student (Screenshot 7.16).



Screenshot 7.16: Individual Student Results Page

The development of the system was revisited throughout the Implementation Phase to make necessary changes when design issues arose or if there were any technical issues. The students and teachers were encouraged to give feedback to improve the system.

7.4 Testing

Full system testing for Clicker and Hot Potatoes was not carried out as they are independent pieces of software which have been extensively tested. Two teachers tested out the Hot Potatoes and Logged Exercises prior to the students in the schools. Testing for the Logged Exercises involved testing the back-end from outside of DCU to make sure it would work. An earlier version of the back-end of the Logged Exercises had been used in my fourth year project on developing CALL for beginner's French and German so the basic functionality was already tested (Greene & Keogh 2002).

7.5 Main Findings

This chapter describes the development of each of the CA(L)L materials to cater to the needs of diverse student groups in the classroom including those with dyslexia and students with learning difficulties in this research project:

- Clicker Exercises
- Hot Potatoes Exercises
- Logged Exercises

The Front-End and Back-End development was set out for each CA(L)L tool. Examples of the development diagrams and screenshots from the tools are provided.

CHAPTER 8: Implementation of Curriculum-focused CA(L)L Materials

8.1 Introduction

This chapter describes how the Clicker and Online materials described in Chapter 7 were actually used in the target environment. The Implementation Phase of the ADDIE model refers only to the deployment of the developed software. Section 8.2 briefly recaps the participant numbers for each stage of the project. The teachers and students participating in this project were given training during the project and this is described in Section 8.3. The implementation and related timeline for the two schools are given in Sections 8.4 and 8.5. Section 8.6 summarises the implementation results. Section 8.7 outlines the observation goals and Section 8.8 summarised the focus groups. Section 8.9 discusses common issues that arose during the implementation in the schools. The main findings from this chapter are summarised in Section 8.10.

8.2 Participant Engagement in the Project Phases over the Project Lifetime

A large number of teachers and students in both Schools A and B were willing to take part in the original ICT questionnaires described in Chapter 4. Table 8.1 shows the number of participants in the ICT questionnaire.

Participant type	School A	School B	Total
Mainstream teachers	27	18	45
Learning support & resource teachers	7	6	13
Mainstream students	163	261	424
Learning support & resource students	18	25	43

Table 8.1: ICT Questionnaire participants

As a follow on in 2006, teachers were then asked to take part in a 3 month trial of one type of ICT reported in Chapter 5. Table 8.2 shows the number of teachers and students who completed questionnaires on the ICT integration.

Participant type	School A	School B	Total
Mainstream teachers	23	13	36
Learning support / resource teachers	7	5	12
Mainstream students	231	132	363
Students receiving learning support	23	18	41

Table 8.2: Integration of ICT study

Teachers and students were then invited to take part in focus groups to discuss the ICT integration and design guidelines for creating materials for diverse students. Table 8.3 shows the total number of teachers (and their main teaching subject) and students (selected by teachers) who took part in focus groups after the ICT integration project.

Participant type	School A	School B	Total
English teachers	1	1	2
History teachers	1	1	2
Geography teachers	1	0	1
Learning support / resource	1	1	2
Mainstream students	3	2	5
Students in learning support	3	2	5

Table 8.3: Focus group participants

Table 8.4 shows the number of teachers and students who agreed to take part in the 3 month deployment of the curriculum-focused Clicker and Online materials (2007). The numbers decreased from the initial ICT integration due to time constraints. As the

focus was on creating materials for the Junior Certificate subjects of English, History and Geography, for the final integration phase some teachers did not continue as it was not their subject area.

Participant type	School A	School B	Total
English teachers	2	2	4
History teachers	2	2	4
Geography teachers	1	0	1
Learning support / resource	7	5	12
Mainstream students	64	67	131
Students in learning support	17	24	41

Table 8.4: Participants in deployment of curriculum-focused ICT tools project

8.3 Training

Hubbard & Romeo (2012) identify two types of CALL training: technical training and pedagogical training. Technical training teaches the users how to use the computer and pedagogical training indicates what the students are learning while using the system. In Hubbard's analysis of CALL research he showed that many projects do not include training for users and of those projects that did use it, the majority imparted technical training (22%). Very few (6%) of the projects reviewed by Hubbard gave additional training during the deployment. In this thesis, the need for training was identified early on as there was a diverse group of teachers and students (Chapter 2, Section 2.9). There are technophobic teachers in schools who are intimidated by integrating ICT. Hubbard & Levy (2007) and Rickard et al. (2006) point out that teacher training is very important at undergraduate level and for existing teachers.

Training was required for the integration of ICTs phase described in Chapter 5. The teachers were split into three groups to use three different types of ICT: general-

purpose ICTs such as word processors and Microsoft PowerPoint, special needs-focused tools and online curriculum-focused materials (e.g. Skoool.ie). The teacher groups who were going to use the special needs focused tools and the online materials were shown how to use the tools and websites.

For the deployment of the Clicker exercises and the online materials (Hot Potatoes and Logged Exercises) developed within this research, the teachers who took part in the focus groups (Table 8.3) did not need much training as they were involved in the development process. The remaining teachers were shown how to set up Clicker and how to create exercises using the Design guidelines. The teachers were also shown how to download and use Hot Potatoes with the design guidelines and how to use the Logged Exercises and view student results.

The students were given information about the learning outcomes for each exercise type. Students and teachers were also given guidance throughout the deployment.

8.4 Implementation in School A

Recall that School A is classed as a disadvantaged school and had over 800 female students.

February 2007 – April 2007

A small number of teachers agreed to take part in focus groups (Table 8.3) and continue on to deployment of the curriculum-focused materials project for a further 3 months (Table 8.5). Teachers and students were given sample Clicker and Online materials and shown how to set up each program. They were also shown how to use the logged exercises and given training which included understanding the learning outcomes for each exercise type.

Participant type	School A
English teachers	2
History teachers	2
Geography teachers	1
Learning support / resource teachers	7
Mainstream students	64
Students in learning support	17

Table 8.5: Participants in deployment of curriculum-focused ICT tools project in School A

8.5 Implementation in School B

Recall that School B is a mainstream school and had over 400 male and female students.

February 2007 – April 2007

A small number of teachers (Table 8.3) agreed to take part in focus groups and continue on to the deployment of the curriculum-focused materials project for a further 3 months (Table 8.6) Teachers and students were given sample Clicker and Online materials and shown how to set up each program. They were also shown how to use the Logged Exercises and given training which included understanding the targeted learning outcomes for each exercise type.

Participant type	School B
English teachers	2
History teachers	2
Learning support / resource teachers	5
Mainstream students	67
Students in learning support	24

Table 8.6: Participants in deployment of curriculum-focused ICT tools project in School B

8.6 Implementation Results

As School A was quite a large school they had two dedicated computer laboratories. A number of classrooms had a stand-alone computer for the teacher to use. Unfortunately, teachers moved around the school throughout the day so they were not guaranteed a computer throughout the day.

The learning support and resource teachers who took part in the study were not all working in learning support solely and some of them taught mainstream classes also. There were three dedicated rooms for learning support sessions for small groups of students or one-on-one sessions.

School B was a smaller school however proportionally more teachers took part in the study. They had one computer lab and few classrooms had a standalone computer. Most classes had the option to book the lab once a week so it was decided this time would be used for the integration of ICTs part of the project.

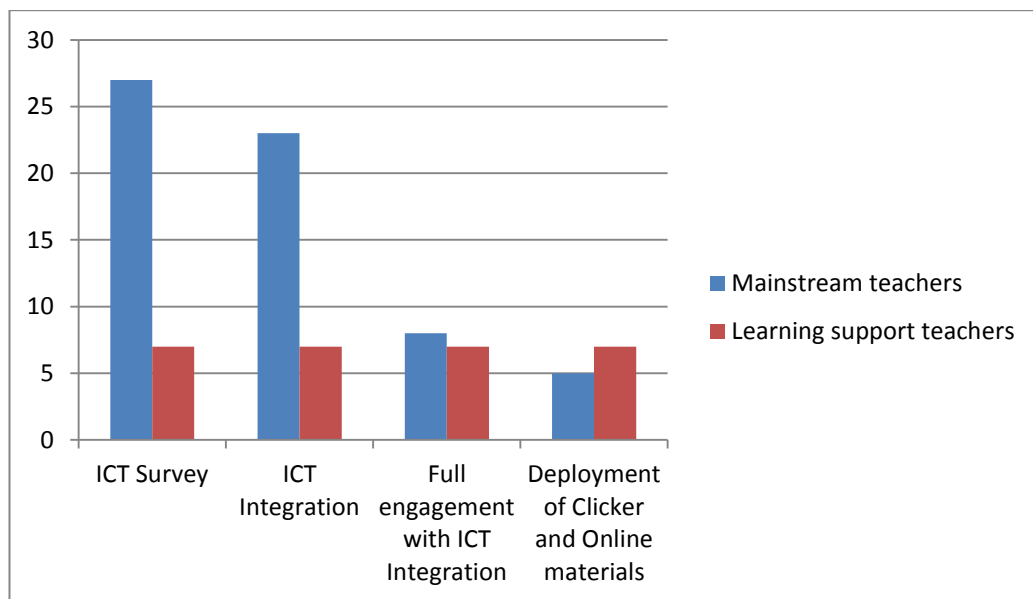


Figure 8.1: Teacher numbers throughout the project in School A

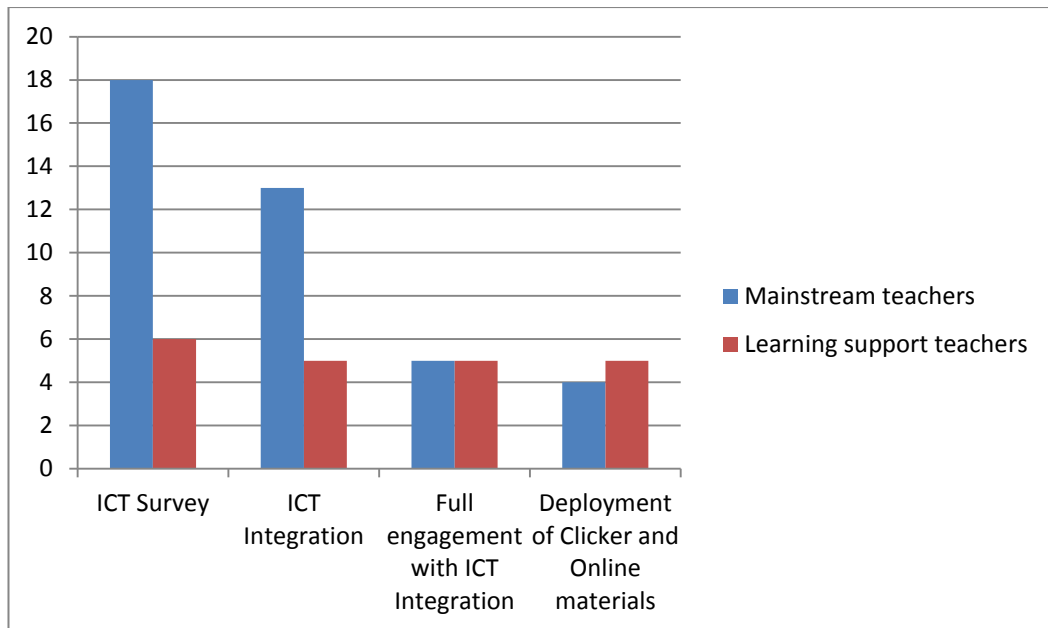


Figure 8.2: Teacher numbers throughout the project in School B

Figure 8.1 shows that all learning support and resource teachers in School A continued into the integration of ICT project. One learning support teacher left the project from School B (Figure 8.2). This shows that the learning support teachers in School A and B were very motivated to continue their engagement with the project.

Five mainstream teachers from School A and four from School B took part in the deployment phase of the curriculum-focused Clicker and online materials developed within this research. The seven learning support teachers from School A and five from School B continued with the project. Access to the labs was not possible on a daily basis for this project. Teachers in both schools used the materials approximately once a week. The online materials could also be used at home by the students and teachers.

8.7 Observation

Both schools were happy for me to be involved in observation work. This meant that I would attend a proportion of their classes to observe teachers working with each type of curriculum-focused resource. Most important was to observe all four persona types with the Clicker, Hot Potatoes and Logged Exercise. In practise, this meant me going into a classroom or lab once a week to observe:

- teacher use of the software
- student use of the software
- technical issues
- impact of the technology and teaching style and content
- impact of the technology on learning style
- impact on student relationships

Notes were taken during these observation sessions on how the teachers used the software in practise and how the students interacted with the materials. It was important for me to note whether the students noticed that other students were working on slightly altered materials e.g. the various levels of exercises available for different persona types. Table 8.7 shows a summary of four of the observation sessions in classrooms / labs with computer access (one for each resource) with the number of participants. All four resources were observed in the two schools.

The observation of the Clicker, Hot Potatoes and Logged Exercises in the mainstream classrooms and labs showed that students had no major technical difficulties after the first week. Teachers in the mainstream were generally comfortable allowing the students to work on the materials after an introductory period at the start of the class. The teachers checked on each student in turn throughout the class time. Another way the resources were used was the teacher put the screen up on the main projector and gave an overview of the exercise to with the class. On the students' own screens, as all various levels of materials look very similar, students were not automatically aware that their neighbour was working on something different. Looking around the classroom, it looked like every student was working on the same materials. From an observation point of view, students seemed engaged in the materials, and most importantly, the teaching content.

The observation in the smaller learning support sessions showed that teachers worked closer with the students on the materials as could be expected. These observation sessions took place in the learning support classrooms which both had two computers. However, in the second half of the three-month observation period, students worked on the materials on their own much more frequently. As the materials were catered to the needs of the student receiving them, the students were gaining confidence working on their own.

Observation 1 School A				
Type	No.	Duration	Notes	Observation
Inclusive class	27	40 mins	Using Clicker	No problem using tools. Class working well on materials. No divide noticeable.
Observation 2 School A				
Type	No.	Duration	Notes	Observation
Learning support	3	40 mins	Using Hot Potatoes	Students using materials to direct their own learning.
Observation 3 School B				
Type	No.	Duration	Notes	Observation
Learning support	4	40 mins	Using Logged Exercises	Students completing exercises ok.
Observation 4 School B				
Type	No.	Duration	Notes	Observation
Inclusive class	24	40 mins	Using Logged Exercises	No divide noticed in classroom. All students working on materials with no focus on the material content / level.

Table 8.7: Observation during the Curriculum-Focused Integration

There were enough materials to keep all students engaged during the sessions. Students had the option to do further exercises on a topic if they were finished ahead of others. This allowed the classes to run smoothly. Figure 8.3 shows the contact with the schools during the curriculum-focused tools integration.

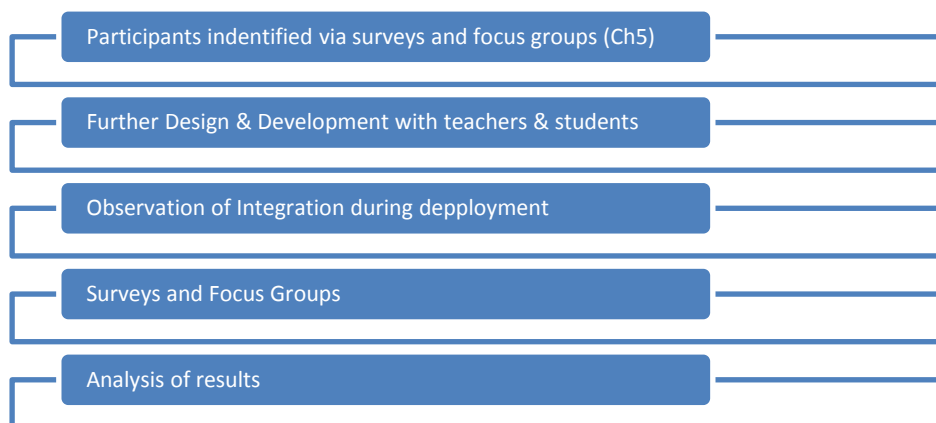


Figure 8.3: Contact with Schools for Curriculum-Focused Tools Integration

8.8 Focus Groups

All teachers and students who took part in the focus groups at the end of the initial ICT integration (Chapter 5) also took part in the focus groups at the end of the curriculum-focused integration (Table 8.8 to Table 8.11). The teacher focus groups were two classes (an hour and 20 minutes) and the student focus group was one class session. Hand-written notes were kept on the sessions.

Teacher Focus Group (School A)				
Subject	No.	Duration	Notes	Important comments
English	1	80 mins	Teachers very positive about integration experience especially LS	Further training was needed.
History	1			Sample exercises v. useful.
Geography	1			Students worked seamlessly
Learning Support	1			Enjoyed creating own materials.

Table 8.8: Teacher Focus Group School A after the Curriculum-Focused Integration

Teacher Focus Group (School B)				
Subject	No.	Duration	Notes	Important comments
English	1	80 mins	LS teachers said time creating materials worthwhile	Computer crashing was an issue.
History	1			Students enjoyed design process.
Learning support	1			Materials were age-appropriate.

Table 8.9: Teacher Focus Group School B after the Curriculum-Focused Integration

Student Focus Group (School A)				
Type	No.	Duration	Notes	Important comments.
Mainstream	3	40 mins	Students were positive about Logged tool.	Enjoyed designing materials.
Learning support	3			Enjoyed the multimedia and interaction.

Table 8.10: Student Focus Group School A after the Curriculum-Focused Integration

Student Focus Group (School B)				
Type	No.	Duration	Notes	Important comments
Mainstream	2	40 mins	Students motivated to use ICT.	Will continue to use materials.
Learning support	2			Felt confident using the tools.

Table 8.11: Student Focus Group School B after the Curriculum-Focused Integration

8.9 Common Issues

A common issue in both schools was access to labs. While some classrooms had one computer in them for the teacher to use, teachers did not always have access to those classrooms. After a few weeks, these problems settled a little because teachers scheduled the class plans with ICT for the days they could get a lab rather than a classroom. As a result, this restricted how much ICT integration, and therefore normalisation, was achieved. The first two weeks my presence in the classes was used more as technical support rather than observation. Technical issues arose when so many students logged onto the “Logged Exercises” at the same time which were quickly resolved by slightly staggering logins.

Students needed further training, or guidance, in those two weeks to be fully comfortable with the various CA(L)L tools developed. After those two weeks of initial teething problems I was able to transition into a more observational role.

Common Issue	Found in other studies?
Access to lab time	Sepehr & Harris (1995) had similar difficulties with access to computers in their study with primary school teachers
More technical support needed	Felix (2005) and Colpaert (2007) state that technical support should be given throughout if needed.
Further training needed	Hubbard (2005) emphasises the importance of thorough training so I felt it was ok to give more at this point.
School timetable	Sivin-Kechala (1998) had similar issues in their review of ICT research studies in schools.

Table 8.12 Common Issues

A significant issue that arose was the school timetable. Sometimes classes were cancelled due to teacher absence, student absence (in the case of smaller learning support sessions) or school trips. It was very important for me to be flexible to the school timetable and last-minute changes. Table 8.12 summarises the common issues and whether they were found in international studies.

8.10 Main Findings

This chapter describes how the Clicker and Online materials were actually used in the target environment. Section 8.2 briefly recapped the participant numbers for each stage of the project. The teachers and students participating in this project were given training during the project and this is described in Section 8.3. The implementation and related timeline for the two schools was given in Sections 8.4 and 8.5. Section 8.6 summarised the implementation results. Section 8.7 outlined the observation goals and Section 8.8 summarised the focus groups. Section 8.9 discussed common issues that arose during the implementation in the schools.

The participants from the focus groups created the Design Guidelines and helped with the design and content for the sample CA(L)L Clicker exercises and Online materials. All learning support and resource teachers in School A continued into the integration of ICT project. One learning support teacher left the project from School B (Figure 8.2). This shows that the learning support teachers in School A and B were very motivated to continue their engagement with the project.

The main implementation issues that arose were due to access to computers. This issue was resolved when a consistent timetable to lab use was established however it had the effect that the materials were not used as frequently as envisaged. Due to teacher absence or computer unavailability, I learnt to be very flexible with my schools visits. As the students and teachers needed some extra guidance with the materials from me, this affected the schedule of observation by two weeks. The observation showed that this extra time proved really important as the students were then at a point of being confident with and fully aware of the functionality. Teachers also left the students to work through the materials while checking every so often and working with students who had questions or wanted further guidance.

CHAPTER 9: Evaluation and Results

9.1 Introduction

The main aim of this research project is to investigate whether curriculum-focused CA(L)L materials can be successfully integrated into the post-primary school curriculum to cater for the needs of diverse students, including students with a learning difficulty such as dyslexia. The project also investigated further important questions such as whether a CALL methodology can be applied to a CA(L)L project, what ICTs are being used by teachers and students, why is there a lack of curriculum-focused materials for students with learning difficulties and how useful are the materials developed within this project. The final question was whether teachers can create and successfully integrate their own CA(L)L materials into the inclusive classroom.

Three CA(L)L materials (Clicker Exercises, Online Hot Potatoes Exercises and Online Logged Exercises) were designed (Chapter 6), developed (Chapter 7) and implemented (Chapter 8) in two schools in Ireland. The materials present content and exercises for three subjects at Junior Certificate level: History, Geography and English. This chapter presents the evaluation of the CA(L)L materials.

Section 9.2 discusses the evaluation background with Section 9.3 explaining the various evaluation metrics. Section 9.4 provides an overview of the evaluation of curriculum-focused materials. Section 9.5 presents the evaluation framework. Sections 9.6 and 9.7 give the details of each resource. Section 9.8 presents an evaluation of the Logged Exercises as a piece of software and Section 9.9 summarises the main findings for the overall project in relation to the original research questions.

9.2 Evaluation Background

CALL evaluation metrics are applied to the CA(L)L research project described in this thesis because they focus on the learner fit and meaning focus. In recent years, there has been increasing focus on evaluation in CALL such as in Felix (2005) and Hubbard

(2005). Felix reviews evaluation in CALL and provides suggestions and examples of projects that have carried out good evaluations. Hubbard reviews what types of evaluation are carried out and reports that both subjective and objective evaluations are used. The issue of quantitative and qualitative evaluation in CALL and the need for, and the value of both are outlined below. In order for CALL research to be of value, it is essential that evaluations are carried out. However, it is equally important that evaluation is considered at the start of a project and not just as an afterthought. Levy (1999) states that evaluation should be considered at the design stage. Chapter 6 provided a brief outline of the design of the Clicker Exercises and the Online Materials and evaluation taken into consideration at this point. This chapter reports on qualitative evaluations on the materials developed from various viewpoints, as well as a project-wide evaluation.

Goodfellow (1999) lists different types of data that are relevant to evaluation, including quantitative performance data, qualitative performance data and learner insights. While it would be desirable to have all three types of data, often the reality is that it is not possible to obtain them all. Felix (2005) outlines the pressing need for good effectiveness research. She discusses the fact that this type of research is relatively scarce. Felix refers to shortcomings reported by Chapelle and Jamieson (1991) and states that they are still relevant today. Researchers do not control for extraneous variables and therefore they cannot show cause and effect. Subjects are not randomly selected and the measuring instruments are questionable. Also, researchers do not control for the 'reactive effect', where the attitudes and feelings of students, teachers and organisations impinge on the outcome. However, it should be acknowledged that it is very difficult in real-world deployment contexts to create good control groups. One way of overcoming these shortcomings is to focus on the process of learning rather than on the outcomes alone.

Other common problems include misleading titles of research reports, providing a poor description of the research design, a failure to investigate previous research, poor choice of variables to be investigated and over-ambitious reporting of results. Researchers should state procedures, materials, technologies, tests and statistical analysis used. Felix (2005) cites Nutta et al., (2002) as a good example of CALL effectiveness design and reporting. Researchers should discuss limitations and

potential threats to their findings (Chapelle and Jamieson, 1991). Felix outlines various research categories, variables and research designs that can be used. Research categories include the number of participants, the research design used, technology, setting and language skill. Variables include conversation, grammar, learning styles, listening and time. Research design considers the use of pre- and post-tests, the use of a control group and the selection of random subjects, all of which are not always possible in a real-life setting. Felix states that there should be a match between the design, the research question, the context, the time-frame available, the variables, the statistical analysis capacity and the ability to control for confounding elements. Various collection measures should be used. Hubbard (2005) identifies some CALL research weaknesses. He cites the small number of subjects as one potential shortcoming, however notes that the numbers involved are commensurate with research from similar areas.

Quantitative and Qualitative Evaluation

Quantitative and qualitative evaluations are both important components of evaluation of ICTs. Quantitative provides the numbers while qualitative can often provide deeper insight into what happens when a learner uses the materials or artefacts. In recent years there has been a re-awakening with CALL researchers of the value of quantitative research (e.g. Jamieson and Chapelle, 2004). It can be difficult to change such deeply ingrained cultural stances, however, both modes of evaluation provide useful information and, where possible, both modes should be used. This project focuses on qualitative evaluation. While the teachers had access to a certain amount of quantitative data when they viewed student logs, these logs just show how many questions students got right in each exercise. This does not really answer the question of whether this type of exercise is appropriate or whether the teachers could create appropriate resources themselves.

Formative and Summative Evaluation

Formative and summative evaluations can be used in research projects. Formative evaluation takes place in parallel with software development i.e. the users evaluate the software and their feedback is taken into account during software design and development. Summative evaluation on the other hand, takes place after the software

has been developed. Formative evaluation often occurs when prototypes are used, whereas summative evaluation is more common when an ADDIE approach is adopted. In the context of this project, formative evaluation was used during the design phase (Chapter 6) when sample materials were being created, while summative evaluation was used once the materials were fully developed.

9.3 Evaluation Metrics

Evaluating CA(L)L

Evaluation of the effectiveness of the use of ICTs and CA(L)L for learning is a fundamental concern at present, particularly as there is a remarkable absence of reliable data on the use and effects of ICT. Government supported initiatives in Finland and Sweden are to the forefront in this regard (Freeman 2001), while to date most of the studies of the Irish Schools Information Technology 2000 Project (IT 2000) have been quantitative rather than qualitative in nature. This shows that a qualitative evaluation of how students and teachers are using ICTs in every day scenarios is needed.

This section provides a brief overview of Chapelle's (1991), ICT4LT and Colpaert's CALL evaluation criteria. Combined, the criteria are quite comprehensive and were used to evaluate the Clicker Exercises and the Online materials and the results are presented in the relevant sections below. Chapelle (1991) identifies evaluation principles as well as judgemental and empirical evaluation for CALL tasks. She states that evaluation of CALL should take into account the deployment context and that both judgemental and empirical analysis should be carried out. She says that the learning potential should be the main evaluation criterion. A summary of these principles and their implications are shown in Table 9.1. Chapelle outlines three levels of analysis for CALL evaluation: CALL software (judgemental), teacher-planned activities (judgemental) and learner performance (empirical) (see Table 9.2). As these evaluation criteria are aimed at CALL and language acquisition, the metrics have been amended for first language content for the CA(L)L project described in this thesis.

Principle	Implication
Evaluation of CALL is a situation-specific argument.	CALL developers need to be familiar with criteria for evaluation which should be applied relative to a particular context.
CALL should be evaluated through two perspectives: judgemental analysis of software and planned tasks, and empirical analysis of learners' performance.	Methodologies for both types of analyses are needed.
Criteria should be applied in view of the purpose of the task.	CALL tasks should have a clearly articulated purpose.
Learning potential should be the central criterion in evaluation of CALL.	Learning should be the main aspect of the purpose of CALL tasks.

Table 9.1: Chapelle's (1991) Principles and the Implications for CALL Evaluation

Level	Object of evaluation	Example question	Method of evaluation
1	CALL software	Does the software provide learners the opportunity for interactional modifications to negotiate meaning?	Judgemental
2	Teacher-planned CALL activities	Does the CALL activity designed by the teacher provide learners the opportunity to modify interaction for negotiation of meaning?	Judgemental
3	Learners' performance during CALL activities	Do learners actually interact and negotiate meaning while they are working in a chat room?	Empirical

Table 9.2 Chapelle's (1991) Levels of Analysis for CALL Evaluation

Chapelle specifies six criteria for evaluation: language learning potential (modified to learning potential for project purposes), learner fit, meaning focus, authenticity, positive impact and practicality. An explanation of each of these terms is given in Table 9.3. She provides example questions for both judgemental and empirical evaluations and these are shown in Table 9.4 and Table 9.5 respectively. The questions have been adapted to apply to all content (e.g. English language content on the English, History and Geography curricula) rather than just foreign language learning content.

Criteria	Explanation
Learning potential	The degree of opportunity present for beneficial focus on content.
Learner fit	The amount of opportunity for engagement with content under appropriate conditions given learner characteristics.
Meaning focus	The extent to which learners' attention is directed toward the meaning of the materials.
Authenticity	The degree of correspondence between the CALL activity and activities of interest to learners out of the classroom.
Positive impact	The positive effects of the CALL activity on those who participate in it.
Practicality	The adequacy of resources to support the use of the CALL activity.

Table 9.3: Chapelle's (1991) Criteria for Evaluation CALL Task Appropriateness

Qualities	Questions
Learning potential	Do task conditions present sufficient opportunity for beneficial focus on content?
Learner fit	<p>Is the difficulty level of the targeted material appropriate for the learners to increase their ability in a particular subject?</p> <p>Is the task appropriate for learners with the characteristics of the intended learners?</p>
Meaning focus	Is learners' attention directed primarily toward the meaning of the content?
Authenticity	<p>Is there a strong correspondence between the CALL task and content of interest to learners outside the classroom?</p> <p>Will learners be able to see the connection between the CALL task and tasks outside the classroom?</p>
Impact	<p>Will learners learn more about the subject and about strategies for learning through the use of the task?</p> <p>Will instructors observe sound pedagogical practices by using the task?</p> <p>Will both learners and teachers have a positive learning experience with technology through the use of the task?</p>
Practicality	Are hardware, software, and personnel resources sufficient to allow the CALL task to succeed?

Table 9.4: Chapelle's (1991) Questions for Judgemental Analysis of CALL Task Appropriateness

Qualities	Questions
Learning potential	What evidence suggests that the learner has acquired the skills that were focused on during the CALL task?
Learner fit	What evidence suggests that the content is at an appropriate level of difficulty for the learners? What evidence suggests that the task is appropriate to learners' individual characteristics (e.g. age, learning style)
Meaning focus	What evidence suggests that learners' construction of meaning aids learning process?
Authenticity	What evidence suggests the learners' performance in the CALL task corresponds to what one would expect to see outside the CALL task? What evidence suggests the learners see the connection between the CALL task and tasks outside the classroom?
Impact	What evidence suggests that learners learn more about the target subject and about strategies for learning through the use of the task? What evidence suggests that instructors engage in sound pedagogical practices by using the task? What evidence suggests that learners and teachers had a positive experience with technology through the use of the task?
Practicality	What evidence suggests that hardware, software, and personnel resources prove sufficient to allow the CALL task to succeed?

Table 9.5: Chapelle's (1991) Questions for Empirical Analysis of CALL Task Appropriateness

ICT4LT Evaluation

The ICT4LT web site provides a CALL software evaluation checklist. It covers some of the areas considered by Chapelle, however places slightly more emphasis on the

software side. For example, it explicitly considers sound, pictures and video. The ICT4LT evaluation criteria are shown in Table 9.6.

Question
Is the level of content that the program offers clearly indicated?
Is the user interface easy to understand? For example, are there ambiguous icons that cause confusion?
Is it easy to navigate through the program? Is it clear what point the learner has reached?
What kind of feedback is the learner offered if he/she gets something wrong? Is the feedback intrinsic or extrinsic?
If the learner gets something right without understanding why, can he/she seek an explanation?
Can the learner seek help?
Does the program branch to remedial routines?
Can the learner easily quit something that is beyond his/her ability?
Does the learner have to mentally process the content that he/she sees and hears? Or does the program offer a range of point-and-click activities that can be worked through with the minimum of understanding?
If the program includes pictures, are they (a) relevant, (b) an aid to understanding?
If the program includes sound recordings, are they of an adequate standard? Are they (a) relevant, (b) an aid to understanding? Is there a good mix of male and female voices and regional variations?
Can the learner record his/her own voice? Can the learner hear the playback clearly? Does the program make use of Automatic Speech Recognition (ASR)? Is it effective?
If the program includes video sequences, are they of an adequate standard? Are they (a) relevant, (b) an aid to understanding?
Does the program include scoring? Does the scoring system make sense? Does it encourage the learner?

Table 9.6: ICT4LT (2005) CALL Software Evaluation Criteria

Colpaert's Usefulness Criteria

Colpaert's usefulness criteria were initially discussed in Chapter 6 on Design. His criteria are usability, usage, user satisfaction and didactic efficiency. Table 9.7 shows a summary of these criteria.

Criteria	Summary
Usability	Is it usable by the target audience?
Usage	Does actual use correspond with intended use?
User satisfaction	Will the user continue to use the program and is s/he as satisfied as possible?
Didactic efficiency	Does it increase the efficiency and effectiveness of the teaching and learning process? (e.g. Chappelle's (1991) criteria)

Table 9.7 Colpaert's (2004) Usefulness Criteria

9.4 Evaluation of Curriculum-focused Materials

Evaluation for the curriculum-focused materials had to be carried out at several levels. The resources produced (Clicker Exercises, Hot Potato Exercises and Logged Exercises) had to be evaluated for their suitability for teachers and students. Chappelle's criteria (1991), the ICT4LT questions (2005) and Colpaert's usefulness criteria (2004) were used for this purpose. Their evaluation criteria consider the pedagogical aspects of the resources as well as the software from a CALL point of view. Sections 9.6 and 9.7 cover the evaluation of the Clicker Exercises and the Online Materials (Hot Potatoes Exercises and Logged Exercises). As this project designed and developed Logged Exercises for diverse students, including those with dyslexia, this was the first time an evaluation of the logged materials as a piece of software was carried out (Section 9.8). This meant evaluating the software using standard software engineering criteria such as maintainability and usability. The third level of evaluation was the overall project evaluation with regard to the original project goals and research questions. This evaluation is described in Section 9.9.

Evaluation was carried out by the teachers, the students and the developer where appropriate. Subjective evaluations were provided by the teachers via questionnaires and focus groups. Focus group questions can be found in Appendix D. The learners also provided subjective evaluation via questionnaires and informal focus groups. MacWhinney (1995) has warned against the possibility of the ‘smile coefficient’ when working with first-time CALL users. This is when they tend to view CALL very positively, in the first flush of excitement and novelty when using something different. He suggests that more mature CALL users would probably not experience the same ‘euphoria’ with the same product and would provide more critical feedback. The students had already been using and evaluating ICT in the earlier deployment (Chapter 5), so they were more likely to give an honest appraisal.

The questionnaires given to the students were drawn up following Fowler’s (1995) guidelines. Fowler explains how to word and format questions that will evoke the kind of answers for which they are designed and how to evaluate survey questions empirically. Objective evaluation, where appropriate, was carried out by analysing data produced by the students. The student and teacher questionnaires can be found in Appendices A, B and C.

Another issue to be aware of in comparative evaluation is the Hawthorne effect (1949). This occurs when users of a particular process / treatment do better on tests or have improved learning outcomes because they get a boost from the fact that they have been selected to participate in the study. In terms of this project, the students were aware that they were part of a project as they carried out a series of questionnaires and some were involved in focus groups. However, their usage was framed in the context of evaluating the resources to see if they were useful, not whether or not they did better than other students. From a teacher point of view the resources were being evaluated in the context of whether they were easy to adapt and if the content was appropriate for their students.

When considering authenticity, Chapelle (1991) asks if there is a strong connection between the CALL task and the task outside the classroom. In the case of this project, authenticity is viewed as a reflection of what tasks the students normally perform with the subjects (e.g. tasks that they would normally perform in class and studying at home).

Evaluation Methodology

Following the initial ICT Deployment phase (Chapter 5), teachers and students took part in focus groups (Table 9.8) to evaluate the tools.

Participant type	School A	School B	Total
English teachers	1	1	2
History teachers	1	1	2
Geography teachers	1	0	1
Learning support / resource teachers	1	1	2
Mainstream students	3	2	5
Students in learning support	3	2	5

Table 9.8: Focus group participants (reproduced from Table 8.4)

The participants in these focus groups developed design guidelines for curriculum-focused CA(L)L materials to cater to the needs of diverse student groups, including those with dyslexia.

Table 9.9 shows the number of teachers and students who agreed to take part in the 3 month deployment of the curriculum-focused Clicker and Online materials.

Participant type	School A	School B	Total
English teachers	2	2	4
History teachers	2	2	4
Geography teachers	1	0	1
Learning support / resource teachers	7	5	12
Mainstream students	64	67	131
Students in learning support	17	24	41

Table 9.9: Participants in deployment of curriculum-focused ICT tools project (reproduced from Table 8.5)

In the Design Phase of the project (reported in Chapter 6), consideration was given to evaluation and in particular, how to carry out empirical evaluations. The ideal situation of having a control group was recognised where each group would use one of the three pieces of software (Clicker, Hot Potatoes and Logged Exercises) however this was not possible in the actual implementation. As there were so few teachers involved and much student cross-over between the teachers (e.g. most students took all three subjects English, History and Geography) it was not possible to have certain students use only one type of material consistently. Each of the CA(L)L types were made available to the teachers through the sample exercises and the logged materials. The teachers' preference for a particular resource would play a role in indicating which tool they found the most useful. Teachers and students took part in questionnaires and informal focus groups after the implementation.

9.5 Evaluation Framework

As outlined, a number of evaluation metrics are used to evaluate the curriculum-focused materials:

- Chapelle's Judgemental Criteria
- Chapelle's Empirical Criteria
- The ICT4LT software checklist
- Colpaert's usefulness criteria
- Bradin's CALL Software Evaluation Criteria
- Software Engineering Design Principles

Figure 9.1 shows which evaluation metrics are applied to each type of curriculum-focused material developed.

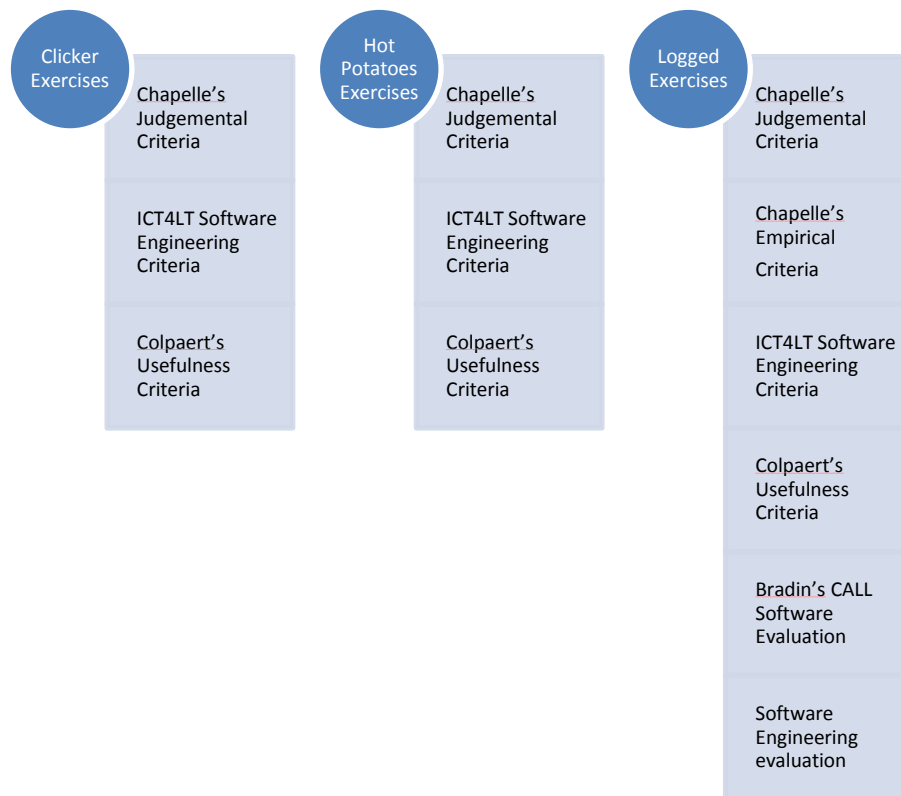


Figure 9.1 Evaluation Framework

- Chapelle's Judgemental Criteria

Chapelle's (1991) Judgemental Evaluation Criteria evaluation was chosen because it helps to investigate the appropriateness of a CA(L)L tool. In Chapter 6, I mentioned that these criteria were taken into account during the design phase. With these criteria in mind you can design a tool that will be useful. For example, in regard to evaluating the Clicker exercises, what is the learning potential of an exercise on the junior certificate novel? Will the student get a thorough understanding of the novel or just a certain plot point? Is the material age- and content- appropriate? Will they actually learn about the topic while using this tool? Is the learners' attention going to be directed at the content (as opposed bells and whistles or just spending time on the computer?). Is there a strong link to CA(L)L lesson on the novel and the work the teacher covers in class in novel? Chapelle puts forward a blended learning approach where the two types of lesson should be interchangeable. Will the learners gain strategies for learning that will help them with other novels? Is the infrastructure appropriate to allow this CA(L)L tool to run as expected?

- Chapelle's Empirical Criteria

Chapelle's Empirical Evaluation Criteria was chosen as an evaluation metric for the Logged Exercises because it evaluates the evidence that the learner has acquired skills that were focused on in the CA(L)L. This metric was only appropriate for the Logged Exercises because teachers could access student logs with information on log in times and exercises completed. To evaluate an exercise on medieval Ireland, these criteria look at what evidence is there to show that the content was appropriate to the learners? What evidence is there that the tasks was appropriate to the students' learning style and computer experience? Is there evidence that the students working on the medieval Ireland exercise by themselves aided the learning process? What evidence is there that the medieval Ireland exercises was similar to what would be done in class without a computer? Do the students themselves see this connection? What evidence is there that the teacher engaged in sound pedagogical practices by using the task? Did the students and teachers have a positive experience with the Logged Exercises? Was the hardware and software sufficient for the CA(L)L task?

- The ICT4LT software checklist

The ICT4LT software checklist was used for all evaluations because it evaluates the software from a learner experience point of view. For example, in evaluating a Hot Potatoes exercise on volcanoes it would ask is the level of the content that the program offers clearly indicated? Is there any confusion which persona type this is aimed at for example? Is the user interface and navigation appropriate to dyslexic students? Is there feedback given to the learner on their answers in the volcano exercise? Are there explanations on answers? Can the learner seek help or easily quit a section? Does the (dyslexic) learner have to mentally process the content or does the program help with a range of point-and-click exercise? Does the volcano exercise contain multimedia content and is there automatic marking of the volcano exercise?

- Colpaert's usefulness criteria

Colpaert's usefulness criteria were used in all evaluations because this was the overall goal of the thesis; to find out if the materials developed were useful to the students and teachers. For example in evaluating a Clicker exercise on poetry, it asks is the tool

usable by dyslexic students? Can it actually be used to learn about poetry? Will the teacher continue to use the Clicker exercises after the study ends? Does it increase the efficiency and effectiveness of the teaching and learning process?

- Bradin’s CALL Software Evaluation Criteria

Bradin’s CALL Software Evaluation Criteria (Table 9.21) was chosen to evaluate the Logged Exercises because they look at feasibility of running software in schools, the quality of the content, how easy, or not, the tool is to use and what logs are kept.

- Software Engineering Design Principles & Attributes

The Software Engineering Design Principles were used to evaluate the Logged Exercises (Table 9.22). These principles are useful for checking modularity of the software, the design process, whether the content can be changed to broaden scope and whether the teachers and students could use the exercises themselves. Table 9.10 summarises the reasons for choosing the evaluation metrics.

Evaluation Metric	Reason for Choosing
Chapelle’s Judgemental Criteria	To investigate the appropriateness of a potential CA(L)L tool.
Chapelle’s Empirical Criteria	To evaluate the evidence that the learner has acquired skills that were focused on.
The ICT4LT software checklist	Evaluates the software from a learner experience point of view.
Colpaert’s usefulness criteria	Evaluates whether the tool can actually be used to learn about the content contains.
Bradin’s CALL Software Evaluation Criteria	Evaluates whether logs were kept, the feasibility & consistency of the tool.
Software Engineering Design Principles & Attributes	Evaluates whether the software could be used for other content types.

Table 9.10: Why the Evaluation Metrics were Chosen

9.6 Evaluation of Clicker Exercises

Chapelle's Judgemental Evaluation Criteria

Drawing on the findings from questionnaires and the feedback from the teachers and students in the focus groups, Chapelle's judgemental evaluation criteria can be applied as shown in Table 9.11.

The Clicker Exercises are not drill exercises and they are focused on the curriculum that both mainstream and students with learning difficulties use every day. With regard to Authenticity, 80% of mainstream teachers, and 50% of learning support teachers, reported that these CA(L)L Clicker materials had a strong correspondence with learners' classroom tasks. When I investigated the reason for this in the focus groups after the CA(L)L Clicker integration, learning support teachers said using the materials was different to the usual classroom tasks however it was not a bad thing. They were happy to use a tool that focused on curriculum instead of the usual content-free tools.

With regard to Impact, a key finding was that learning support teachers were more motivated to create their own CA(L)L Clicker exercises than mainstream teachers. Mainstream teachers reported that while they found both the sample Clicker Exercises developed by the researcher and the materials created by themselves useful, there were significant time constraints involved. In the focus groups, learning support teachers reported that they were very happy and motivated to create their own materials. On average, learning support teachers created more materials for their students.

Both mainstream students and students with learning difficulties reported that they were able to use the CA(L)L Clicker Exercises without any major problems. 90% of learning support students and 80% of mainstream students had a positive experience with the software. When I queried these results with students in focus groups, mainstream students re-affirmed that they enjoyed the multi-modality and they could use the materials for revision.

The learning support students and teachers both reported that the system was easy to use and the content was both age- and language-appropriate. Both mainstream and learning support students mainly used Clicker to create synopses of a curriculum unit

they covered in class. For example, in a classroom activity in a geography class that was carried out in a computer lab, the teacher used PowerPoint to explain ‘the course of a river’. The teacher had created a learning grid of words and pictures associated with this topic. The students then used Clicker to embed these pictures in their text to create their own mind map or text/picture synopsis.

The key finding is that some students created large essays in this project while other students created small mind-maps based on mainly pictures. This result shows that the students who have different learning styles can use the CA(L)L Clicker exercises in different ways to suit them.

Chapelle’s Empirical Evaluation Criteria

I have not included Chapelle’s empirical analysis of the CA(L)L Clicker materials here as no empirical evaluation was carried out on the Clicker Exercises. The exercises were stored in student folders on their local computer so the usage could not be ascertained.

Qualities	Judgemental Evaluation
Learning potential	Students could create comprehension texts using the sample learning grids or the grids their teacher has created on a particular topic. The grids were made up of key vocabulary students needed to be familiar with in each topic.
Learner fit	100% of all teachers stated the level of difficulty is appropriate for the learner as the content was developed by their teachers. Each teacher decided which exercises were made available to particular groups of students and 80% of mainstream teachers liked that they had the options to do this. One criticism was it created more work for the teachers.
Meaning focus	Meaning focus is required to understand the lesson. The Clicker Exercises are not drill-and-kill exercises and they are curriculum-focused.
Authenticity	Viewing authenticity in a modified form, results showed that there is a strong correspondence between the CA(L)L task and the learners' classroom tasks according to 80% of the mainstream teachers and 50% of learning support teachers.
Impact	51% of mainstream students and 61% of students in learning support enjoyed using Clicker and 100% of learning support teachers felt they were worthwhile. 80% of mainstream teachers and 100% learning support teachers reported that they were happy to create new Clicker Exercises themselves based on the samples given to them. The feedback from all students (85%) and teachers (90%) indicated that they had a positive experience with the software.
Practicality	The students were able to use the CA(L)L Clicker lessons without any major problems.

Table 9.11 Chapelle's (1991) Judgemental Evaluation Criteria Applied to the Clicker Exercises

ICT4LT (2005) Software Evaluation Criteria for the CA(L)L Clicker Exercises

A summary of the ICT4LT evaluation criteria applied to the CA(L)L Clicker Exercises is shown in Table 9.12. The mainstream teachers and learning support teachers and students were involved in the design of the design guidelines and the

sample exercises. They also created their own Clicker Exercises with their own content. As result both groups reported the content level was appropriate.

Criteria	Clicker Exercises
Content level indicated	Yes (100%) as teachers and students were involved in the design of the content. Teachers decided which exercises students could access.
User Interface	Clicker has a basic user interface which is usable by teachers and students.
Program navigation	Easy for the student to navigate according to 80% of the mainstream students and 60% of the learning support students. Students could decide the order in which they completed exercises.
Feedback	Feedback was provided by the teacher as this tool was used in class.
Explanations	Short explanation of task provided.
Learner help	Short help text on each task provided.
Remedial routines	No (better provided by the teacher in class)
Easy to quit	Yes
Mental processing	There was only one type of exercise e.g. students using the grids with words and pictures to create sentences.
Pictures	Yes. Pictures are easy to add. Pictures representing a concept can be used in sentences also.
Sound	Yes – Clicker allows you to hear the word before you select it.
Learner voice	No – however is a possibility.
Video	No video, however pictures could be added.
Scoring	No scoring.

Table 9.12 ICT4LT (2005) Software Evaluation Criteria for the CA(L)L Clicker Exercises

Both mainstream and learning support students reported that the curriculum units were suitable for them. Clicker's user interface is straight-forward. Students only received the exercises appropriate to them in their local folder depending on their persona type. 80% of the mainstream students and 60% of the learning support students said the program navigation was clear. When I investigated this result in the focus groups, one learning support student felt that they needed their teacher to use the system. Feedback was provided by the teacher as this tool was used in class in a blended learning environment. A short explanation of each task is provided for each CA(L)L Clicker Exercise. Pictures are easy to add to Clicker grids. Pictures representing a concept can be used in sentences also. An important feature of this tool for dyslexic students is that students could hear the word pronounced before selecting it. Learning support teachers reported that this was an important attribute for their students.

Colpaert's (2004) Usefulness Criteria Applied to the CA(L)L Clicker Exercises

Colpaert's usefulness criteria focus on usability, usage, user satisfaction and didactic efficiency (Table 9.13). The Clicker Exercises were designed for use by mainstream and learning support teachers and the students. This combination was able to use the software as provided, meeting the usability criteria. The software was used as intended, meeting the usage criteria. Teachers could edit and create their own materials or use curriculum units of their own. Students created comprehension texts using the sample learning grids or the grids their teacher had created on a particular topic. The learning grids include text and pictures. The program continued to be used after the project and, while there is room for improvement, it meets the user needs and user satisfaction conditions. The question of didactic efficiency has been addressed by using Chapelle's evaluation criteria (see Table 9.11).

Criteria	Summary
Usability	Teachers can edit the materials. 80% of mainstream and 100% of learning support teachers were happy to do this.
Usage	Teachers can create grids on any curriculum topic. Students can create comprehension texts using the sample learning grids or the grids their teacher has created on a particular topic. The learning grids include text and pictures.
User satisfaction	Teachers were happy to create their own materials because they knew the content level would therefore be appropriate. Teachers did acknowledge that creating resources was time consuming (50% of mainstream teachers).
Didactic efficiency	The Clicker Exercises help students to create essays with key words that their teachers have chosen. This is important for students of all abilities as they are becoming familiar with the key points associated with a curriculum topic.

Table 9.13 Colpaert's (2004) Usefulness Criteria Applied to the CA(L)L Clicker Exercises

9.7 Evaluation of Online Exercises

The evaluation of the online exercises includes the Hot Potatoes Exercises and the Logged Exercises.

9.7.1 Evaluation of Hot Potatoes Exercises

Chapelle's Judgemental Evaluation Criteria Applied to the CA(L)L Hot Potatoes Exercises

An important difference between the Clicker and Hot Potatoes exercises is that the CA(L)L Hot Potatoes Exercises could be used at home. Drawing on the findings from

questionnaires and the feedback from the teachers and students in focus groups, Chapelle's judgemental evaluation criteria are summarised in Table 9.14. Students used the CA(L)L Hot Potatoes exercises on average once a week. An example from an English class was students watched a short video on different types of media e.g. newspaper, advertising, and then they completed a multiple choice exercise. This exercise used questions and vocabulary from previous exam papers so that all students, especially those with a literacy difficulty, could familiarise themselves with those terms. This finding indicates that that the material caters to diverse students in an inclusive setting.

Students reported that the level of difficulty was appropriate for the learner (90% for mainstream and 90% for learning support) as the content was developed by their teachers.

Again, the CA(L)L Hot Potatoes Exercises were allocated to individual student folders on the local school server. Each teacher decided which exercises were made available to particular groups of students based on their persona. Teachers could adapt the Hot Potatoes exercises to include whatever curriculum materials they wanted along with notes on the learning outcomes if they so wished. Both mainstream and learning support teachers said there is a strong correspondence between the CA(L)L task and the learners' classroom tasks.

The learning support students liked Hot Potatoes because the design (70%) and content (90%) were appropriate to them. 70% of mainstream teachers and 90% of learning support teachers felt the time adapting the Hot Potatoes Exercises with the design guidelines was worthwhile. During the focus groups, the feedback from the students and teachers indicated that they had a positive experience with the software. The students were able to use the CA(L)L Hot Potatoes exercises, however instances of lack of access to labs (60%) and internet connection problems (42%) were reported.

Judgemental Empirical Evaluation Criteria Applied to the CA(L)L Hot Potato Exercises

I have not included Chapelle's empirical analysis criteria here as no empirical evaluation was carried out of the Hot Potatoes Exercises. The exercises were stored in

student folders on their internet server so the usage could not be ascertained. Students could access the Hot Potatoes Exercises from home however this could not be tracked.

Qualities	Judgemental Evaluation
Learning potential	Students were using the exercises on average once a week and at home once a week. Students could revise a curriculum unit and answer an exercise on the unit e.g. watching a short video followed by a multiple choice exercise.
Learner fit	Students reported that the level of difficulty was appropriate (90% for mainstream and 90% for learning support) for the learner as the content was developed by their teachers. Each teacher decided which exercises were made available to particular groups of students.
Meaning focus	Teachers could adapt the Hot Potatoes exercises to include whatever curriculum materials they wanted along with notes on the learning outcomes
Authenticity	Viewing authenticity in a modified form, there is a strong correspondence between the CA(L)L task and the learners' classroom tasks.
Impact	The students liked Hot Potatoes because the design (70%) and content (90%) were appropriate to them. The teacher felt the time adapting the Hot Potatoes Exercises with the design guidelines was worthwhile (80%). The feedback from the students and teacher indicated that they had a positive experience
Practicality	The students were able to use the CA(L)L lessons however instances of lack of access to labs (60%) and internet connection (42%) were reported.

Table 9.14 Chapelle's (1991) Judgemental Evaluation Criteria Applied to the CA(L)L Hot Potato Exercises

ICT4LT (2005) Software Evaluation Criteria for the CA(L)L Hot Potatoes Exercises

A summary of the ICT4LT evaluation criteria applied to the CA(L)L Hot Potatoes Exercises is shown in Table 9.15.

The language level of the CA(L) Hot Potatoes exercise was reported to be appropriate. The Hot Potatoes interface is a bland grey colour. The design guidelines were applied

to create the sample materials. Teachers were shown how to do this themselves successfully (e.g. Screenshot 6.3).

Criteria	Clicker Exercises
Language level indicated	Yes, as teachers were involved in the design of the content. Teachers decided which exercises students could see. Content was based on exam paper questions so that students would become accustomed to that style of questioning and the recurring vocabulary needed.
User Interface	The Hot Potatoes interface is a bland grey colour. The design guidelines were applied to create the sample materials. Teachers were shown how to do this themselves successfully (e.g. Screenshot 6.3). The guidelines include design for dyslexic students.
Program navigation	Easy for the student to navigate online or offline. Students could decide the order in which they completed exercises.
Feedback	Hot potatoes feedback was provided which lets students know how many answers they got right.
Explanations	Short explanation of task provided.
Learner help	Short help text on each task provided.
Remedial routines	Yes
Easy to quit	Yes
Mental processing	Mixture of exercise types
Pictures	Yes
Sound	Yes
Learner voice	No
Video	Yes
Scoring	Yes, hot potatoes scoring

Table 9.15 ICT4LT (2005) Software Evaluation Criteria for the CA(L)L Hot Potatoes Exercises

The guidelines include design for dyslexic students such using light pastel backgrounds and Trebuchet font. The exercises were easy for the students to navigate online or offline. Students could decide the order in which they completed exercises. Hot Potatoes feedback was provided which lets students know how many answers they got right. Each of the exercises gave a short explanation of the task provided. Hot Potatoes allowed for a range of exercise types for students who liked to learn in different ways.

Colpaert's (2004) Usefulness Criteria Applied to the CA(L)L Hot Potatoes Exercises

Colpaert's usefulness criteria focus on usability, usage, user satisfaction and didactic efficiency (Table 9.16). The teachers and students in the focus groups (described in Chapter 5) contributed to the design of the Hot Potatoes Exercises. The software was used as intended, meeting the usage criteria. Teachers were happy to create their own materials because they knew the content level would therefore be appropriate. Mainstream teachers did acknowledge that creating resources was time consuming. They enjoyed applying the design guidelines that they helped to create age-appropriate and content-appropriate materials. A key finding here is that the learning support teachers did not comment on the extra workload included. The question of didactic efficiency has been addressed by using Chapelle's evaluation criteria (see Table 9.14).

Criteria	Summary
Usability	Teachers can edit the materials easily while applying the design guidelines.
Usage	Students can study a curriculum unit and then answer an associated exercise. Students receive basic feedback on their scores.
User satisfaction	Teachers were happy to create their own materials because they knew the content level would therefore be appropriate. Teachers did acknowledge that creating resources was time consuming. They enjoyed applying the design guidelines that they helped to create age-appropriate and content-appropriate materials.
Didactic efficiency	The Hot Potatoes Exercises allow students to work with their teacher on a topic in school or at home as a revision exercise. As the ICT surveys pointed to the fact that students are using computers for their homework it was important to have a tool they could use at home.

Table 9.16 Colpaert's (2004) Usefulness Criteria Applied to the CA(L)L Hot Potatoes Exercises

9.7.2 Evaluation of Logged Exercises

Chapelle's Judgemental Evaluation Criteria Applied to the CA(L)L Logged Exercises

Drawing on the findings from questionnaires and the feedback from the teachers and students in focus groups, Chapelle's judgemental evaluation criteria can be summarised as shown in Table 9.17.

The CA(L)L Logged Exercises presents each student with a page of the exercises allocated to them. Another feature, the Teacher Page, allowed teachers to view how many exercises the students completed, how many exercises they got correct and view any answers submitted by the students.

Results showed that 100% of students logged in at least once to the system. On average both mainstream and learning support students logged in once a week. An

example of using the CA(L)L Logged Exercises from a History class was students watched a slide show of pictures (with a very small amount of text) around the Renaissance period. The slide show was embedded into the Logged Exercises. Pictures included the trajectory of Renaissance art and architecture. Students could then type notes and answer multiple choice questions.

According to 100% of the learning support students and 80% of the mainstream students the level of difficulty is appropriate for the learner as the content was developed by their teachers. This indicates the materials are suitable to diverse students in an inclusive environment. When I queried this result in the focus groups, mainstream students said that they needed more exercises than were provided. It was not necessarily the language level being too easy, rather that they got through the exercises quite quickly. Each teacher decided which exercises were made available to particular groups of students. The system presented these exercises to the student.

The Logged Exercises content could not be edited by the teacher, unfortunately. Each exercise focuses on one concept and the learning outcome is clear.

Both mainstream and learning support teachers reported that, again, there was a strong correspondence between the CA(L)L task and the learners' classroom task as the CA(L)L resources were focused on the curriculum.

100% of learning support students liked the CA(L)L Logged Exercises because they received more detailed feedback on some of the exercise types. Students could also enter short answers which teachers could review later. 60% of mainstream teachers and 58.3% of learning support teachers found that they would have liked to create their own materials to add to those already there. The students were able to use the CA(L)L lessons, however again the same issues of lack of access to labs and internet connection problems occurred. 90% of learning support students and 70% of mainstream students indicated they were more motivated to use ICT tools after using the CA(L)L tools.

As noted, School A is a DEIS (disadvantaged school). Proportionately more students in School B took part in the study. No differences in how students accessed the CA(L)L materials or their experience with them was evident.

Qualities	Judgemental Evaluation
Learning potential	Results showed that 100% of students logged in at least once. On average students logged in once a week. Students could revise a curriculum unit at home and answer an exercise on the unit e.g. watching a short video followed by a multiple choice exercise.
Learner fit	According to 100% of the learning support students and 80% of the mainstream students the level of difficulty is appropriate for the learner as the content was developed by their teachers. Each teacher decided which exercises were made available to particular groups of students. The system presented these exercises to the student.
Meaning focus	The Logged Exercises content could not be edited by the teacher unfortunately. Each exercise focuses on one concept and the learning outcome is clear.
Authenticity	Viewing authenticity in a modified form, there is a strong correspondence between the CA(L)L task and the learners' classroom tasks.
Impact	100% of learning support students liked the Logged Exercises because they received more detailed feedback on some of the exercise types. They could also enter paragraphs answers which teachers could review later. The students were involved in the design of the exercises. 60% of mainstream teachers and 58.3% of learning support teachers found that they would have liked to create their own materials to add to those already there. This was a significant drawback of the Logged Exercises.
Practicality	The students were able to use the CA(L)L lessons, however again the same issues of lack of access to labs and the internet connection occurred.

Table 9.17: Chapelle's (1991) Judgemental Evaluation Criteria Applied to the CA(L)L Logged Exercises

Chapelle's (1991) Empirical Evaluation Criteria (1991) Applied to the CA(L)L Logged Exercises

Some empirical data was collected on the usage of the Logged Exercises. The data included who had logged into the system. This data showed that all of the students used the system at least once during the evaluation period. Student logs were kept indicating how many exercises students answered correctly. This was not the main focus of the project however it was useful to the mainstream teachers (100%) and learning support teachers (33.3%). Chapelle's empirical analysis criteria are summarised in Table 9.18.

Qualities	Empirical Evaluation
Learning potential	No empirical evaluation was carried out.
Learner fit	The only evidence to suggest that the lessons were appropriate for the learners is that they were able to use the system without difficulty.
Meaning focus	No data collected.
Authenticity	The information from the teacher indicated that the CA(L)L Logged Exercises could be used seamlessly in the classroom without much "fuss".
Impact	Student logs were kept indicating how many exercises students got right. This was not the main focus of the project however it was useful to the mainstream teachers (100%) and learning support teachers (33.3%).
Practicality	The students were able to use the system on a regular basis over several weeks without any problems.

Table 9.18: Chapelle's (1991) Empirical Evaluation Criteria (1991) Applied to the CA(L)L Logged Exercises

ICT4LT (2005) Software Evaluation Criteria for the CA(L)L Logged Exercises

A summary of the ICT4LT evaluation criteria applied to the Logged Exercises is shown in Table 9.19. Both the mainstream and learning support students and teachers reported that the language level was appropriate to them. Content was based on exam paper questions so that students would become accustomed to that style of questioning and the recurring vocabulary needed.

The design guidelines were applied to create the user interface. The guidelines include design for dyslexic students. 80% of mainstream students and 100% of learning support students said they liked the interface. All students reported that the Logged Exercises website was easy to navigate online. In the focus groups, a mainstream student reported that the interface could be improved to have a clearer navigation structure within the site.

The system provided feedback which lets students know how many answers they got right and whether they were almost right. Both mainstream and learning support students reported they liked getting this instant feedback. It also allows for more extensive answer paragraphs and questions to be submitted directly to their teacher.

Criteria	Clicker Exercises
Language level indicated	Yes 100%, as teachers were involved in the design of the content. Teachers decided which exercises students could see. Content was based on exam paper questions so that students would become accustomed to that style of questioning and the recurring vocabulary needed.
User Interface	The design guidelines were applied to create the user interface. The guidelines include design for dyslexic students. 80% of mainstream students and 100% of learning support students said they liked the interface.
Program navigation	Easy for the student to navigate online (100%). Students were presented with a short list of the exercises for them.
Feedback	The system provided feedback which lets students know how many answers they got right and whether they were almost right. It also allows for larger answers and questions to be emailed directly to their teacher.
Explanations	Short explanation of task provided.
Learner help	Short help text on each task provided.
Remedial routines	Yes
Easy to quit	Yes
Mental processing	Mixture of exercise types
Pictures	Yes
Sound	Yes
Learner voice	No, however is possible
Video	Yes
Scoring	Yes, though this feature can be turned off.

Table 9.19 ICT4LT (2005) Software Evaluation Criteria for the CA(L)L Logged Exercises

Colpaert's (2004) Usefulness Criteria Applied to the CA(L)L Logged Exercises

Colpaert's usefulness criteria focus on usability, usage, user satisfaction and didactic efficiency (Table 9.20). Unfortunately teachers cannot edit the Logged Exercises materials. In the focus groups, mainstream teachers commented that they did not have time to edit them anyway and liked that the curriculum units were prepared for them.

Criteria	Summary
Usability	Unfortunately teachers cannot edit the materials. However some did not have time to edit them anyway and liked that the curriculum resources were prepared for them.
Usage	Students can study a curriculum unit and then answer an associated exercise. Students receive feedback on their work however this can be turned off if the student is working with their teacher on the materials for example.
User satisfaction	Both teachers and students were very happy with the Logged Exercises due to their age-appropriateness, content-appropriateness and their satisfaction with being involved in the design of the project.
Didactic efficiency	The Logged Exercises allow students to work with their teacher on a topic in school or at home as a revision exercise. As the ICT surveys pointed to the fact that students are using computers for their homework it was important to have a tool they could use at home.

Table 9.20 Colpaert's (2004) Usefulness Criteria Applied to the CA(L)L Logged Exercises

The Logged Exercises were designed for online use. Students can study a curriculum unit and then answer an associated exercise. Students receive feedback on their work however this can be turned off if the student is working with their teacher on the materials for example. The question of didactic efficiency has been addressed by using Chapelle's evaluation criteria (see Table 9.17).

9.8 Evaluation of Logged Exercises as a Piece of Software

As the Logged Exercises, as well as the under-lying engine, were developed for this project (as opposed to the adaptation of the Clicker and Hot Potatoes Exercises), they should additionally be evaluated in terms of their use as a piece of software. This section evaluates the Logged Exercises in terms of CA(L)L software and from a software engineering point of view.

Bradin's CALL Software Evaluation Criteria

Bradin (1999) provides a checklist for CALL software evaluation. It is intended mainly for potential purchasers of CALL software however is also useful in the context of this project. It first considers the feasibility of the software (e.g. will it run on your computer). It then asks the potential purchaser to consider the quality of the software in terms of content, format and operation. A summary of her criteria and an evaluation of the Logged Exercises using these criteria are shown in Table 9.21. The Logged Exercises meet most of the criteria, with room for improvement in some areas (e.g. use of motivational devices and feedback).

Checklist for Software Evaluation	Logged Materials Evaluation
Step 1: Feasibility	
Will the software run on your computer?	Yes
What platform (computer type) does the software require?	Basic PC with Microsoft standard software installed. The program is stored remotely using a java platform.
Will the software run on your network?	Not in the implementation phase of this project, however this would be possible.
Can the software be made available to many students?	Yes
Does the software require Internet access?	Yes
Can you afford the software?	Yes (free)
Step 2: Quality	
Content	
What is the goal of the software? Is it consistent with yours and that of our students?	Provide curriculum-materials depending on students' needs. The program adapts to whoever has logged in.
Is the level appropriate?	The goal was to answer this question. Results point to teachers finding the content appropriate.
Is the content accurate?	Yes, as teachers were involved in the creation of content.
Is the material culturally appropriate?	Yes
Does the software accommodate the students' learning styles and preferences?	To a certain extent, yes. Exercises deemed appropriate by their teacher are presented to the student.

Is the software interesting?	Relatively interesting for the students.
How flexible is the software?	The software is flexible for a developer however not for a teacher unfortunately.
Format	
Is the interface consistent?	Yes
Is the screen display effective?	Yes, dyslexia styles are adhered to.
In drill software, are the motivational devices effective?	Students are given immediate feedback on their results
Operation	
Is the software easy to use? Are the tasks and directions clear?	Yes, the students were able to use the software without any operational problems
Does the software allow text and graphics to be printed?	Yes, it is a web interface.
How much control are the learners allowed?	Students can choose the order they do exercises in only.
How interactive is the software?	Students have to watch videos and fill in the blanks.
Is the quality and degree of feedback adequate?	Feedback is limited however it was important that their teacher discussed the exercises with students.
What kinds of records does the software keep?	Exercise data and student records.

Table 9.21 Bradin's (1999) CALL Software Evaluation Criteria

Software Engineering Evaluation

Software Engineering design principles include modularity, anticipation, generality and incrementality. Modularity refers to the degree of independence of different parts

of a system. Anticipation of change is where a system takes into account that it will change over time and allows for this. Generality means that a system is not hard-coded to deal with a particular local case, however rather is built to cover more general cases. Incrementality implies that parts of the system can be available and usable before the system as a whole is ready. An evaluation of the Logged Exercises based on these principles is shown in Table 9.22.

Principle	Use
Modularity	Separate modules for exercise content, correction and display.
Anticipation of Change	The design process took the current resource limitations into account, however also allowed for future improvements.
Generality	The content can be changed to any subject material (by the developer, not the teacher).
Incrementality	Teachers and students could use the early exercises as more were developed based on their formative evaluation.

Table 9.22 Software Engineering Design Principles – Logged Exercises Evaluation

Well-engineered software is easy to maintain, dependable, efficient and usable. Maintainability refers to the ability to make changes to the system relatively easily. Dependability refers to how stable and reliable the system is when it is being used. Efficiency considers how well the system uses the resources available, while usability refers to how usable the system is for the users (akin to Colpaert’s usefulness criteria). The logged software has acceptable maintainability. The code files are relatively small. It was still possible to edit this successfully as shown in the fact that the back-end was used in a previous project on CALL for beginners’ learning German and French in primary school. The system is dependable in the sense that there were no major operation problems reported during its use by the students. The content was reliable as the teachers were involved and content was also taken from exam papers. One of the aims of the project was to try to reuse existing resources where possible. It

was thought that reusing resources would be more efficient than developing new resources from scratch which is in agreement with Ward (2007). While resource reuse may not always be practical or more efficient, the resources reused in this project (Back-end of Logged Exercises, Clicker and Hot Potatoes) were extremely useful. The usability question has been addressed in previous sections, which reported that the system was indeed usable by the target users. A summary of the Software Engineering Design Attributes evaluation is shown in Table 9.23.

Attribute	Logged Exercises
Maintainability	Back-end used in CALL for primary school project previously
Dependability	No major problems reported during use
Efficiency	Reuses existing resources where possible
Usability	Target users could use without any serious problems

Table 9.23 Software Engineering Design Attributes – Logged Exercises Evaluation

9.8.1 Summarising the Evaluation Framework

The evaluation framework consisted of the following metrics:

- Chapelle’s Judgemental Criteria
- Chapelle’s Empirical Criteria
- The ICT4LT software checklist
- Colpaert’s usefulness criteria
- Bradin’s CALL Software Evaluation Criteria
- Software Engineering Design Principles

There is some overlap in what these metrics evaluate however these overlaps have strengthened the evaluation process by reinforcing the key findings of teacher and student satisfaction and the usefulness of the tools developed. The metrics complement each other by checking all aspects of the implementation of the curriculum focused materials. I have learnt that there are so many aspects that have to be evaluated fully in a deployment project of this scale. This framework helped me to

cover all angles of the evaluation and check them from a user, CA(L)L and software engineering point of view.

9.9 Main Findings from the Overall Project

This section gives the results for the overall project in relation to the original research questions. The aims of this project and the research goals were presented in Chapter 1. The research sub-questions posed, and finally the overall research question, are answered in this section. Each of the sub questions will be answered with the final question being the overall research question.

9.9.1 Answering the Research Questions

Can a Computer Assisted Language Learning (CALL) research methodology be successfully applied to “first language content” rather than second language?

The research project demonstrates that Colpaert’s CALL RBRO Model can be successfully applied to a project which is not traditionally CALL. While CALL methodologies are normally aimed at second language acquisition, it was an interesting research question to investigate whether a CALL methodology could be applied to a project where the main focus was on helping students with dyslexia overcome difficulties with their first language.

A CALL methodology was successfully followed in this project because the project is firmly focused on how various students access the curriculum. While many students have no problem with a text-based curriculum, some, in particular students with literacy and learning difficulties, prefer to access content in other ways. While the use of CALL techniques is aimed at the needs of dyslexic learners, it was important not to create materials that were inappropriate to mainstream students. The CA(L)L materials aim to cater to wide range of abilities.

Integrative CALL principles that specifically helped in the design and development of the CA(L)L materials for first language content and diverse students (including those with dyslexia) in this project include:

- Student/learner-focus
- Meaningful purpose
- Sufficient level of stimulation (cognitively and affectively)
- Multiple modalities (to support various learning styles and strategies)
- High level of interaction (student-computer and teacher-student)

The Integrative CALL Principles are used to frame the discussion of the results. Results from the evaluation of the curriculum-focused CA(L)L materials (first half of Chapter 9) indicated that both mainstream and learning support teachers students reported that the CA(L)L materials were useful, age- and content-appropriate (Student/learner focus, high level of interaction). While some mainstream teachers reported that it took extra time to develop their own Clicker and Hot Potatoes CA(L)L materials, learning support teachers were motivated and involved in creating a thorough suite of curriculum units using the CA(L)L tools provided by this research (meaningful purpose / multiple modalities).

In this project, a blended learning approach was taken. A CALL methodology was successfully applied to this project because CALL is driven by both pedagogy and research. The materials were designed to be used in the classroom with the teachers and at home. I was present at the schools regularly to carry out observations and also to help if teachers had any problems developing materials. Students worked on the materials and were kept engaged during the sessions (high level of interaction, sufficient level of stimulation). Results (first half of Chapter 9) show that both mainstream and learning support students used the materials in class with their teachers. More mainstream students than learning support students reported using the materials at home. This is understandable as learning support teachers reported their preference to use the materials in class with the students rather than setting homework.

Colpaert's CALL RBRO Model was useful for this project because it is a learner-centric model (student/learner focus). The Analysis Phase and GLDT grid include a full needs analysis of the school environment, the needs of students and the current systems available prior to design and development. This concept is very important for this research project because the CA(L)L materials need to be able to be adapted for the different needs of the various student groups in an inclusive classroom. Results

from the Evaluation of the CA(L)L materials showed that mainstream students went through the materials very quickly and extra more challenging materials need to be developed. This is an issue that arose due to time constraints on the initial set of sample CA(L)L materials developed and the time it took for teachers to create their own CA(L)L materials.

CALL evaluation metrics which are learner-focused contributed to the successful use of a CALL methodology (student/learner focus). Chapelle's (1991) evaluation metrics state that learning potential should be the main evaluation criterion. She also includes learner fit and meaning focus which are important for this project. The ICT4LT (2005) evaluation metrics focus on feedback to the learner and the level of content (high level of interaction). Both Felix (2005) and Hubbard (2005) emphasise that it is very important to report what training is provided for teachers and students. Colpaert's evaluation criteria focus on whether the learner uses the materials as intended and is satisfied with them. Results from the Evaluation (first half of Chapter 9) show that the learning potential of the exercises is significant because the materials are based on the curriculum and exam paper texts. Teachers reported that the curriculum-focused CA(L)L tools were very useful compared to content-free tools. The learning support teachers were very happy with the materials due to the fact that they found it difficult to access ICT curriculum materials (student/learner focus) previously (Chapters 4 and 5).

What ICTs are being used by teachers and students and how are they using them?

Three types of ICT were identified from the questionnaires described in Chapter 4 (Use of ICT in Two Post-Primary Schools in Ireland):

- General-purpose ICTs (e.g. Word Processors)
- Focused-special needs ICTs (e.g. Read and Write Gold)
- Online curriculum-focused websites (e.g. Teachnet)

The results from Chapter 4 show that teachers are under-utilising available ICTs. One reason for this is that the tools available do not suit the needs of dyslexic students.

Some of the tools are content-independent so for them there is no meaningful purpose as the tools do not focus on a particular curriculum. While an average of 80% mainstream and students with learning difficulties reported using word processors and search engines at home to do their homework, only 3% of students said they use them regularly in school. This is due to the text-based and written-work focus in schools. It is difficult for teachers to include ICT when the infrastructure in Irish schools is not suitable for full integration of ICT. The results from the questionnaires show that teachers had difficulties with access to computers and internet connectivity. Teachers were more likely to use ICTs to prepare work for the classroom (e.g. printing materials from the internet) rather than have students use the ICT themselves in the classroom in a blended learning environment. These results make sense in the context of the Investing Effectively in ICT 2008-13 Report (DES 2008) which stated that the lack of consistent funding for computer labs and resources hinders the uptake and integration of ICT in Irish Education.

Furthermore, Chapter 4 indicated a lack of age- and content-appropriate tools for students with a learning difficulty such as dyslexia. This shows a lack of a high level of interaction. Results from Chapter 4 demonstrated that learning support teachers could not find appropriate curriculum-focused ICT resources for their students' needs. Learning support teachers reported that they relied on subject-independent tool-technology and primary school ICT programs, rather than curriculum-focused materials.

Chapter 5 (Initial Deployment of ICT Materials in Two Post-Primary Schools) investigated how teachers used the ICTs identified in the initial ICT questionnaires (Chapter 4). Both mainstream and learning support teachers reported that they could not find curriculum resources to suit the needs of students in their classroom who had a learning difficulty such as dyslexia on the curriculum-focused websites. This result demonstrates that the websites did not focus on students in learning support. The reasons given were that not many resources on the websites were tagged as special needs appropriate and much of the content and presentation style of the mainstream materials was too difficult for these particular students. This mis-match with dyslexic students show that the materials did not have enough stimulation, interaction, multiple and modalities and learner focus on dyslexic learners.

Further results from Chapter 5 outline that schools have difficulty accessing focused special needs tool such as Dragon Naturally Speaking (2006). All of those tools are available on loan from the Department of Education and Skills Education Centres. However, in reality they are difficult to get for a significant amount of time as many schools are looking for them.

Can teachers create appropriate CA(L)L materials?

Results from the Evaluation of CA(L)L Clicker, Hot Potatoes and Logged Exercises show that teachers can successfully create their own useful materials which indicates that the materials have meaningful purpose and can be used to learn about the topic. The teachers and students involved in the initial integration of ICTs study (Chapter 5) took part in focus groups to develop design guidelines for the curriculum-focused CA(L)L materials which ensured a focus on the student / learner.

Chapter 6 (Design of Curriculum-Focused CA(L)L Materials) described how these design guidelines were used to design and develop the CA(L)L Materials. I developed a sample database of the three types which I gave to the teachers:

- CA(L)L Clicker Exercises
- Online CA(L)L Hot Potatoes Exercises
- Online CA(L)L Logged Exercises

Results from the Implementation Phase (Chapter 8) showed 80% of mainstream and 100% of learning support teachers were happy to create new Clicker Exercises and apply the design guidelines to the Hot Potatoes Exercises. Students reported that they liked the materials developed by their teachers with Hot Potatoes because the design (70%) and content (90%) were both appropriate to them. This relates to the integrative CALL principles of being sure to use multiple modalities and a high level of interaction. The teachers felt the time adapting the Hot Potatoes Exercises with the design guidelines was worthwhile (80%). The feedback from the learning support students indicated that they had a positive experience (80%) with the materials developed by their teachers. Students reported that the level of difficulty was appropriate (90% for mainstream and 90% for learning support) for the learner as the

content was developed by their teachers. Teachers indicated that the students could use the materials to learn about the topic involved. This shows that the tools had meaningful purpose and were not a distraction from learning.

Why is there a lack of age-appropriate curriculum-focused materials for students with learning difficulties?

Chapter 3 (Literature Review) showed how post-primary school students with learning and literacy difficulties in Ireland have access to less support than they did at primary school. The amount of ICT resources developed for this age group also appears to drop.

Chapter 3 presents an analysis of Online Curriculum Focused Websites (Scoilnet, TeachNet and Skool) carried out in 2010. These websites use the tag “Special Needs Resource” to indicate which materials are appropriate for that group. From my analysis of the resources, it seemed like some of materials were actually appropriate for dyslexic students however they were not tagged “Special Needs Resource”. These online curriculum websites rely on teachers to submit their teaching resources. Results from the questionnaires reported in Chapter 4 and 5 show that no learning support teachers from the schools had contributed materials. If this result is somewhat representative of the general situation across Ireland, it could be one reason there are so few materials. Teachers should be encouraged to share any materials they develop for their classes.

How useful (or not) are the materials developed within this project?

Chapter 9 (Evaluation and Results) presented the evaluation of the curriculum-focused CA(L)L materials developed within this research. Both mainstream and learning support teachers found the materials useful because they could use them offline when they had internet connection problems. Teachers liked the fact that they could allocate exercises to particular students which allowed for personalised student / learner focus. Students liked that they were involved from the beginning and enjoyed using the Clicker grids to create essays on key topics. This showed that the materials have

meaningful purpose and students used the tools to learn topics that could be done in a traditional classroom environment.

The evaluation of the Hot Potatoes Exercises in Chapter 9 showed that teachers were again happy to be involved in the design of the materials and the content. Teachers liked the fact that they could allocate exercises to particular students based on whether they had particular language issues to overcome or based on their learning style. Students liked that the exercises were age- and content- appropriate. Both sets of students reported that they used the CA(L)L Hot Potatoes Exercises at home once a week because they were online. These results showed that the materials had a sufficient level of stimulation, a high level of interaction and multiple modalities to cater to the learning needs of the diverse students.

The evaluation of the Logged Exercises in Chapter 9 showed that teachers found the student logs very useful to see what exercises students were using (meaningful purpose). Teachers liked the fact they could allocate exercises to their students automatically which had a high level of interaction. Once a student logged in, they received a list of exercises appropriate to them which focused the exercise on the student / learner. Students liked that the exercises were online and they could do them at home as well as the fact that the materials used a mix of modalities such as pictures, videos and slide shows. Teachers liked that they could see how many exercises students had completed, their answers and any view any answers the students typed in. One drawback was that the teachers would have liked the option to edit the materials themselves like with the Clicker Exercises and the Hot Potatoes Exercises.

Can curriculum-focused CA(L)L materials be integrated successfully into the post-primary school Junior Certificate curriculum to cater to the needs of diverse students?

Chapter 8 (Implementation of Curriculum-Focused CA(L)L Materials) described the CA(L)L integration in the two schools.

Results from the Clicker evaluation showed that 80% of mainstream and learning support students and 80% of teachers indicated that they had a positive experience with the software. The mainstream and learning support students liked the Hot Potatoes Exercises because the design and content were appropriate to them which

shows the materials' focus on the individual student / learner. The teachers felt the time adapting the Hot Potatoes Exercises with the design guidelines was worthwhile (80%). The feedback from the students and teachers indicated that they had a positive experience (80%) with the software. 100% of learning support students liked the Logged Exercises because they received more detailed feedback on some of the exercise types (meaningful purpose). They could also enter paragraph answers which teachers could review later. The students were involved in the design of the exercises. 90% of learning support students and 70% of mainstream students indicated they were more motivated to use ICT after using the CA(L)L tools (Dörnyei 1998). 60% of mainstream teachers and 59% of learning support teachers found that they would have liked to create their own materials to add to the Logged Exercises already there.

It was also interesting to find out if the materials, which are designed to cater to the needs of diverse student personas, detracted from the learning experience of mainstream students. Results from the focus groups showed that mainstream students covered the materials very quickly. This shows again that the materials had meaningful purpose and students actually covered the curriculum content. Both mainstream teachers and students reported that this group needed more exercises for a class period to give the other students time to finish. This was due to the small sample set of exercises originally developed by the researcher and the time constraints on the teachers developing materials.

An important finding is that the CA(L)L materials benefited the inclusive classroom. Due to the private nature of CA(L)L, students did not know exactly what exercises other students were working on. The mainstream teachers reported that every student logged into the same CA(L)L system. During the observation it was clear that there was no stigma attached to particular resources as everyone had the same dyslexia-friendly interface. The only difference was that each student received the materials developed by their teacher for their particular needs privately.

Table 9.24 summarises the results in regards to the Integrative CALL principles.

Integrative CALL Principle	Results from Evaluation (with Evaluation metric used)
Student/learner-focus	Teachers and students deemed the materials to be content and age-appropriate. Materials were personalised to persona types outlined by the teachers (Chapelle).
Meaningful purpose	Teachers and students found the materials useful for learning the content (Colpaert) and fit for purpose (Chapelle).
Sufficient level of stimulation	During observation sessions, students were engaged with the lessons and exercises.
Multiple modalities	The exercises have a range of pictures, videos, slideshows and text to cater to different teaching & learning styles.
High level of interaction	Students reported that they could interact with the lessons and exercises and this was noted in observation sessions.

Table 9.24: Results with regard to the Integrative CALL Principles

Table 9.25 now summarises the key results with regard to the evaluation framework which was used to assess each of the tools. This framework is focused on the student / learner and the usability of the materials developed during this research project.

Chapelle's Judgemental Criteria

Teachers stated the level of difficulty is appropriate for the learner.

Teachers and students reported there is a strong correspondence between the tools and a classroom task.

Teachers & students were able to use the tool as intended & reported a positive experience.

Chapelle's Empirical Criteria

For the Logged Exercises, teachers reported the appropriateness of the content.

Teachers indicated that the CA(L)L Logged Exercises could be used seamlessly in the classroom.

Student logs were kept indicating how many exercises students answered correctly.

The students were able to use the system on a regular basis over several weeks without any problems.

The ICT4LT software checklist

Teachers were involved in the design of the content.

Teachers decided which exercises students could see.

Content was based on exam paper questions.

Teachers were shown how to create their own materials using the design guidelines.

Tools were deemed easy for the student to navigate.

Students could decide the order in which they completed exercises.

Hot potatoes & Logged Exercises feedback was provided which lets students know how many answers they answered correctly.

Short explanation of task provided.

Short help text on each task provided.

Multimedia content used to cater for varying teaching & learning styles.

Colpaert's Usefulness Criteria

Teachers could edit the materials except for the Logged Exercises.

<p>Students can study a curriculum unit and then answer an associated exercise.</p> <p>Teachers and students deemed the exercises age-appropriate, content-appropriate and stated their satisfaction with being involved in the design of the project.</p> <p>The exercises can be used at school or at home.</p>
<p>Bradin’s CALL Software Evaluation Criteria</p>
<p>Logged exercises provide curriculum-materials adapted to students’ needs.</p> <p>Results point to teachers finding the content appropriate. The goal of this research was to answer this question.</p> <p>Exercises deemed appropriate by their teacher are presented to the student.</p> <p>The software is flexible for a developer but not for a teacher unfortunately.</p> <p>Dyslexia styles are adhered to.</p> <p>Students are given immediate feedback on their results.</p> <p>Students can choose the order they do exercises in only.</p> <p>Students have to watch videos and fill in the blanks.</p> <p>Feedback is limited however it was important that their teacher discussed the exercises with students.</p> <p>Exercise data and student records kept.</p>
<p>Software Engineering Design Principles</p>
<p>Separate modules for exercise content, correction and display.</p> <p>The design process took the current resource limitations into account, however also allowed for future improvements.</p> <p>The content can be changed to any subject material (by the developer, not the teacher).</p>

Table 9.25: Results with regard to the Evaluation Framework

Section 9.2 discussed the evaluation background with Section 9.3 explaining the various evaluation metrics used in the evaluation framework. Section 9.4 gave an overview of the evaluation of curriculum-focused materials describing each of the metrics in detail. Section 9.5 presented the evaluation framework. These metrics were chosen for their focus on the student / learner and the usability of the materials

developed during this research project. Sections 9.6 and 9.7 gave the evaluation results of the Clicker and Hot Potatoes resources. Section 9.8 gave an evaluation of the Logged Exercises as a piece of software. These three sections reported that the materials were integrated successfully into an inclusive classroom and that the teachers and students found them content- and age-appropriate as well as being useful. Section 9.9 gave the answers to the research questions posed in Chapter 1 based on the CALL integrative principles. These results showed the materials had meaningful purpose, which focused on the learner's needs, had sufficient stimulation via multimodalities and had a high level of interaction.

CHAPTER 10: Conclusions, Contribution and Future Work

10.1 Introduction

This chapter discusses the contribution this research has made to the field in terms of the overall aim of the research project as set out in the research questions in Chapter 1. This is achieved by presenting the initial aim of each phase of the research, delineated by chapters, and the resulting contributions from each. This chapter also presents limitations of the project, recommendations from this research and future work.

This chapter is structured as follows: Section 10.2 discusses the contribution of this research to the field. Section 10.3 points out some limitations of the project and future work. Section 10.4 presents recommendations arising from the research carried out in this thesis. Section 10.5 summarises the chapter.

10.2 Contribution

When I was a learning support teacher (2002), I found that students with literacy and learning difficulties such as dyslexia were struggling to keep up with the curriculum work in their mainstream classroom. I re-worked curriculum materials that the mainstream teachers were covering and presented the students with versions of the material with a more appropriate language level. With my background in CALL, I was able to make a contribution to the learning resources for this small group of students. I developed Hot Potatoes exercises based on the curriculum units. This small pilot project motivated me to carry out research on a bigger scale.

Chapter 1 set out the kinds of requirements and constraints that exist in a research project involving diverse groups of students and teachers in an inclusive blended learning environment. The first requirement was that all materials should be made available for use for teachers beyond the lifetime of the project outlined in this thesis. Most of the materials were given to the schools with detailed instructions on how to create more materials. Unfortunately, the Logged Exercises proved too difficult to set up on both schools' servers for continued use so these materials are not being used by the teachers and students now. However, the Clicker Exercises and the Hot Potatoes Exercises were made available to the schools and are still being used.

Another requirement was that while the materials presented here are developed to be curriculum-specific, they had to be easily adaptable to other curricula and learning styles. Mainstream and learning support teachers showed that they could add curriculum units to the CA(L)L Clicker Exercises and the CA(L)L Hot Potatoes Exercises. For the CA(L)L Logged Exercises, any researcher or developer could use the back-end of this system and apply their own curricula to it.

Another requirement was that the curriculum-focused CA(L)L materials developed in this thesis are meant to complement the work done in class in a blended-learning environment. The Hot Potatoes and Logged Exercise CA(L)L tools can be used both in the classroom and at home by the students. Importantly, results showed that they enhanced the learning experience rather than detracted from it. All three sets of materials developed are designed to use in a blended learning environment; they are a tool to aid the teaching and learning process in the classroom rather than something that overtakes a traditional classroom environment.

The Irish education system adopts an inclusive class approach where students of diverse abilities are taught in the same classroom. Any ICT materials developed within this project had to cater to the needs of mainstream students as well as students with learning difficulties such as dyslexia. Teachers and students from all of these groups provided feedback to create the CA(L)L materials so that can be used by the whole classroom together in an inclusive manner. Results from the evaluation of the CA(L)L materials showed that both mainstream and learning support students found the materials useful, age- and content-appropriate. Students in these inclusive classrooms worked privately on their CA(L)L materials with the teacher available for feedback. Students did not know which exercises were presented to the person next to them. Therefore, there was no stigma attached to different materials and the dyslexic, learning support and mainstream students used the materials successfully.

A limitation of this project is that both schools had difficulties with access to computers. During both the initial evaluations of available ICT and the evaluations of CA(L)L materials developed within this research, availability of ICT tools, access to computer labs, crashing websites and internet connectivity were significant problems. While the CA(L)L materials developed within this research were viewed favourably and were integrated as much as possible, it might not be possible for all schools to do

the same. As mentioned previously, the Investing Effectively in ICT 2008-13 Report (DES 2008) stated that the lack of consistent funding for computer labs and resources hinders the uptake and integration of ICT in Irish Education.

A major constraint was the number of participants. It proved difficult to get a fully representative and statistically significant number of teachers and students involved in the project. While the numbers are small, the findings contribute to a field where there still are relatively little research results.

An important constraint was that no exam results could be used within this research. Therefore, qualitative, rather than quantitative, evaluation was employed (Converse & Presser 1986 & Temkin 2009). This research project did not contribute findings on whether students performed better in their exams as a result of them engaging in the CA(L)L materials. The research contributes findings on the usefulness of the CA(L)L Clicker, Hot Potatoes and Logged Exercises (Chapter 9) in the targeted application scenario.

Chapter 2 (Research Methodology) introduced Colpaert's CALL RBRO Design Model (2004). Chapter 2 also set out my reasons for using a CALL Model for "first language content" rather than learning a second language. Results from the overall project (Chapter 9) showed that a CALL model can be used successfully for first language content. Colpaert's version of the ADDIE model and in particular Colpaert's Analysis Phase guides the researcher to focus on the needs of the each stakeholder group involved in the project in a structured way, e.g. students in learning support, mainstream students and teachers. It also ensures that all findings from the Analysis Phase are represented in the Design Phase of CA(L)L materials. The subdivision of the Design Phase into conceptualisation, specification and prototyping is useful in dealing with this potentially complex phase.

Chapter 3 contributed a comprehensive literature review on Special Education in Ireland, Dyslexia, CALL and CAL, online curriculum-focused websites and related research and government ICT policy. This shows the diverse level of ability in inclusive Irish mainstream classrooms. Chapter 3 also outlined the cuts that have taken place in learning support and resource teaching hours over the last few years (NCSE 2012).

Chapter 4 (Use of ICT in Two Selected Post-Primary Schools) and the initial ICT questionnaire investigate which ICTs were being used in classrooms and at home by teachers and students to support the Junior Certificate / Leaving Certificate curriculum. These results, together with the questionnaires and focus group results from Chapter 5 (Initial Deployment of ICT in Two Selected Post-Primary Schools) show that teachers are under-utilising available ICTs. Teachers were more likely to use ICTs to prepare work for the classroom (e.g. printing) rather than have students use the ICT themselves. Learning support teachers reported that they relied on subject-independent tool-technology and primary school programs. While mainstream students and teachers use the online curriculum focused websites, learning support teachers did not find appropriate resources for their students on them. A key finding here was that some of the curriculum units on these sites were suitable for learning support students however were not tagged as such.

The teachers who took part in the Initial ICT deployment in Chapter 5 received the lists of curriculum units that were amenable to integrating ICT materials and the sample exercises using the various ICTs in the study. A contribution to the research field are the Design Guidelines that students and teachers created for curriculum-focused CA(L)L materials to cater to the needs of diverse students including those with learning difficulties and dyslexia in an inclusive environment.

Chapter 6 (Design of Curriculum-Focused CA(L)L Materials for Diverse Students) described Colpaert's Design Stage and contributed results for Colpaert's Design Decisions for a CA(L)L research project in an inclusive environment.

While the aim of the design was to create a technology-independent design for each of three resources, this was not possible. The Logged Exercises are designed to be technology-independent but the Clicker and Hot Potatoes exercises are ready-made tools.

During the design phase teachers were given training on how to use the CA(L)L materials and how to apply the design guidelines to create new appropriate content materials. Results show that teachers were happy to create their own materials because they knew the content would be appropriate. At the same time, they also found the Logged Exercises useful because it was a ready-to-go system. Each teacher indicated

to the researcher which exercises were appropriate to which students. When the students logged in, only appropriate resources were allocated to them. Teachers liked the design that allowed them to view the student logs after they finished the exercises. Mainstream and learning support teachers who participated in this project built up a database of CA(L)L curriculum exercises.

Chapter 7 described the development of the Clicker and Online Exercises in terms of the front-end and the back-end. The technology chosen to develop the Logged exercises was described. Java, jsp and xml were chosen as they allowed the exercises to be displayed online and were useful for creating a database of answers as well as student logs. This chapter contributes configuration diagrams and detailed information on how the development was achieved including testing. Screen shots of all three resources were also provided as well as information for teachers on how to download, install and adapt Hot Potatoes and Clicker.

Chapter 8 described the implementation across the project in Schools A and B. The key implementation finding was that the number of participants (teachers and students) dropped out throughout the project. The reason given was time constraints.

Training was provided for teachers prior to the deployment of the curriculum-focused materials (Hubbard & Romeo 2012). The Clicker, Hot Potatoes and Logged materials were available to all students as there was a lot of cross-over between students taking the three subjects (English, History and Geography) so it was not possible to limit students to one type of resource only. The implementation results showed that students in both schools used the materials once a week at most and some weeks they could not use them. Problems they encountered include other school activities impacting on the time needed and lack of access to labs. Results show that the learning support teachers, or teachers who had a number of students with learning difficulties in their classroom, engaged more with the deployment. The reasons given for this were that they were motivated to continue with a project that was working for their students and they were motivated to create a database of curriculum materials for their students.

Chapter 9 (Evaluation and Results) described the evaluation metrics used in the project. The project was qualitatively evaluated using questionnaires and focus

groups. Chappelle (1991), ICT4LT (2005) and Colpaert's (2004) evaluation criteria were used to evaluate these results.

Chapter 9 then provides results for the overall project, specifically the final deployment phase for the curriculum-focused materials (Clicker Exercises, Hot Potatoes Exercises and Logged Exercises).

The Hawthorne effect (1949) did not seem to be a significant aspect in the evaluation of this project as the usage evaluates the usefulness of each resource to the students and teachers rather than if they are doing better than the student next to them. The same applies for the smile co-efficient (MacWhinney 1995) as students involved in this project already had experience using and evaluating other ICTs (Chapter 4 and 5).

The evaluation of the Clicker Exercises showed that teachers were happy to be involved in the design of the materials and the content. Teachers liked the fact that they could allocate exercises to particular students. Students liked that they were involved from the beginning and enjoyed using the grids to create essays on key topics.

The evaluation of the Hot Potatoes Exercises showed that teachers were again happy to be involved in the design of the materials and the content. Teachers liked the fact that they could allocate exercises to particular students. Students liked that the exercises were online and they could do them at home.

The evaluation of the Logged Exercises showed that teachers found the materials useful, especially the student logs. Teachers would have liked the option to edit the materials themselves. Teachers liked the fact that the allocation to students was done automatically. Students liked that the exercises were online and they could do them at home.

The software evaluation of the Logged Exercises showed that it met nearly all the feasibility measures and the content, format and operation measures. As the software was quite difficult to set up on a local school server, the schools could not easily continue to use this resource after the project. This, however, is something that could be amended in future implementations. The software also fully met the software engineering design attributes.

This research project shows that ICT materials can be integrated into the inclusive classroom successfully, except perhaps Dragon Naturally Speaking (see Chapter 5). I believe that this particular resource was not needed to enhance an inclusive classroom. There was a lot of training needed on the resource which mainstream students really did not need to be using. This project also showed that CA(L)L can be integrated into an inclusive classroom successfully however there are some practical difficulties to be overcome such as logistical issues (time-tabling and access to labs). CA(L)L integration also depends on teacher involvement and whether they are motivated to engage ICT and whether they have time. An institutional driver such as the Department of Education and Skills or the National Centre for Technology is needed to address these logistical issues so that ICT can be integrated fully into the curriculum.

This research project shows that a CALL methodology can be used successfully to create and integrate curriculum-focused CA(L)L tools into an inclusive classroom environment to cater to the needs of diverse students. Colpaert's RBRO Design Model (2004) CALL methodology was successfully followed in this project because the project is firmly focused on how diverse students access the content of curricula. Colpaert's model focuses on learner-centric design, and how to create useful tools appropriate to the diverse needs of the students.

The integration of CA(L)L materials showed that teachers are motivated to create their own CA(L)L materials. Both mainstream and learning support teachers used the design guidelines to create their own materials for curriculum units. Results showed, that while it was time-consuming, both sets of teachers had a positive experience creating their own materials. Both learning and mainstream students reported that the materials developed were age- and content- appropriate.

From my observation in the classrooms and labs I noted that integration of the CA(L)L materials into the inclusive classroom helped to improve the flow of the inclusive classroom. Both groups of students in inclusive classrooms worked privately on their CA(L)L materials with the teachers attending everyone. Both groups of students opened the same CA(L)L resource. Students were not aware of which exercises their peers received. There was no obvious difference apparent to students

using the systems or stigma attached to using ‘different’ resources for learning support.

The main contribution from this work is the CA(L)L materials developed for the inclusive classroom. One of the schools confirmed they are still using the materials developed within this project. This shows that the materials are useful. Teachers have been able to use the training and sample sets they received as a part of this project, as well as the design guidelines they created, to continue to make curriculum-focused materials for a range of subjects for their students.

10.3 Limitations of the Project and Future Work

There were a number of limitations in this research project. The early part of the project involving the ICT questionnaires and the initial ICT deployment was too broad in scope. Teachers from many different subjects were involved in this deployment. It was impossible to create sample examples for all three types of ICT (General ICT, Special Needs Focused Tools and Online Curriculum-Focused Websites) covering all of these subjects as well as provide support in terms of training.

Due to the work load and also time constraints on the teacher side, the number of teachers and students participating in the project decreased. Another reason the number declined was because I decided to focus on developing samples for the History, Geography and English curricula for the Junior Certificate so the Leaving Cert teachers did not continue to participate in the project. For future work in this area, I would also only involve teachers from specific subject areas from the very beginning. There are important infrastructure problems and time constraints that stop ICT from being integrated and normalised in the classroom.

A control group was used in the first deployment (Chapter 5 where teachers and their corresponding students were split into three groups for the study according to ICT types) however in the middle of the deployment I realised this was a mistake. I felt some teachers were not using their class-time as effectively as they could have, giving focused-special needs tools to all students in their classroom rather than just the group that needed it. No control group was used in the final implementation phase because there was a large cross- over of students taking each of the three subjects.

If I was doing a similar project again in the future work I would aim to set up a control group where this cross-over would not happen so the results can be compared against each other. However in practice, this would be quite difficult due to the logistics of the post-primary school timetable.

Most importantly, technology has moved on since the implementation phase of this research project in 2007. This is now the internet generation with smart phones, Facebook and tablet computers. Students have the opportunity to use social networking for learning e.g. Edmodo.com (2010) where teachers can upload content and set homework for students. Students can also upload homework to the site. This is a fantastic resource available now to dyslexic students. The announcement that the new Junior Certificate is moving towards a continuous assessment model is good news for dyslexic students. In 2009, the Irish government launched a 150 million euro plan for 'smart schools'. The three year plan ending in 2012, provided a teaching laptop, software and digital projector as part of the plan (DES 2009). This has made a positive impact on the road towards ICT normalisation in the classroom with more classrooms having a computer. This means that students and teachers can use ICT as a part of their normal teaching and learning.

While some of the technology has moved on, many of the findings have not. One of the main findings from the research reported in this thesis is that teachers not only are motivated to, but can, create curriculum-focused CA(L)L materials to suit the diverse student group in their classroom including dyslexic students. The Investing Effectively in Information and Communications Technology in Schools, 2008-2013 (DES 2008) strategy has identified that there is a gap in curriculum-focused materials and has set out to ensure that there is an adequate supply of innovative, high quality and Irish curriculum-related digital teaching and learning material available to teachers and students at all levels. However, and unfortunately, this report does not set out guidelines on ensuring that these materials are accessible and appropriate to students with learning difficulties including dyslexia and this needs to be addressed.

Another finding that stands out is that students are motivated to be involved in the design of their own curriculum materials through the questionnaires and focus groups. This is an important finding for ICT and special education policy advisors because the students found the CA(L)L materials that they helped to design were useful.

While a shift in technology and the daily use of technology has taken place, the ICT policy in Ireland is struggling to keep up. Further investment is badly needed and was set out in the Investing Effectively in Information and Communications Technology in Schools, 2008-2013 (DES 2008) strategy. With the cuts in education, not all of this money has come through to schools and the infrastructure and digital materials available are lagging behind what is available to students at home.

10.4 Recommendations Arising from this Research

- Online Curriculum Website Providers

There is a need for more curriculum focused materials that cater to students with learning difficulties such as dyslexia. Some of the materials available on the sites were not tagged as appropriate however they actually were used successfully by teachers. A recommendation to online curriculum website providers is to review the materials and tag those that are appropriate to students with learning and literacy difficulties. Another option would be to have a means by which learning support teachers could tag the materials themselves. Another recommendation is that teachers who create materials for the sites could be asked to incorporate dyslexia friendly colours and fonts and incorporate design guidelines in their materials.

- Schools

It is hard for schools to promote ICT in the classroom when in the majority of classrooms the infrastructure is not in place. Technology has moved on however teaching and learning infrastructure has been slow to move with it. Access to computers and broadband needs to be made a priority. There are teachers in schools who are intimidated by integrating ICT. Hubbard & Levy (2007) and Rickard et al. (2006) point out that an emphasis should be put on teacher training at undergraduate level and for existing teachers.

- Teachers

Teachers should create their own learning resources and share them with their colleagues and through sites like TeachNet and ScoilNet. It is possible to use tools like Clicker and Hot Potatoes to create materials to suit the needs of all students including those with dyslexia. Sites like edmodo (2010) may suit dyslexic students because they can submit homework online using word processors and multimedia. However, dyslexic students still have to sit exams and any exemptions they are entitled to are still recorded on their Junior Certificate and Leaving Certificates.

- Recommendations to ICT Policy Makers

Irish classrooms have not kept up with the changing technology. The new world of global technology ends at the school door. The provision for developing curriculum-focused digital resources was set out in Investing Effectively in ICT 2008-13 (DES 2008). In the light of the Croke Park Agreement (DPER 2010), teachers have a lot less time to prepare materials. Funding for digital curriculum-focused materials and infrastructure should be prioritised.

10.5 Summary

This research project showed that once a dyslexic student moves from primary school to post-primary school, they receive less special needs support. There is also less ICT resources available for post-primary learning support students with many learning support teachers using primary school programs (Chapter 4). Curriculum materials developed for the needs of dyslexic students can help to amend some of the gap in resources. Teachers and students were involved in the design of materials through taking part in focus groups which developed the design guidelines that the materials are based on. Teacher and student training was very important so that they would feel comfortable with the materials. As a result of this training, teachers were able to create their own materials based on the guidelines. This shows that teachers are more than willing to integrate ICT if they are given the resources and support. This approach promotes a blended learning environment where the teachers may use a lesson plan with the CA(L)L tools or without. The materials are designed as a tool to aid the teaching and learning in a classroom rather than being an actual teaching tutor itself.

This approach may help the normalisation of ICT in the Irish classroom because the computer is seen as simply another tool like the projector or board.

Observation showed that the materials developed were integrated successfully into an inclusive environment so that students were working together in one classroom on different exercise types. A CALL Methodology can be used successfully for a CA(L)L deployment for dyslexic students in second level in Ireland because it was learner-centred.

Finally, the exercises developed within this research were made available to the teachers and are still being used by one of the schools today which shows their usefulness and successful integration.

BIBLIOGRAPHY

Akkoyunlu, B. & Soyulu, M.Y. (2006). *A Study on Students' Views About Blended Learning Environment*. Hacettepe University, Faculty of Education, Department of Computer Education and Instructional Technology, Ankara, Turkey.

ASTI (2010) Statement on OECD (2010) *Education at a Glance: OECD Indications Report*.

AIB Bank (2006) *Allied Irish Banks* Available at: <http://www.aib.ie> [Accessed November 2012]

Baddeley A., Ellis N., Miles T., Lewis V. (1982) *Developmental and acquired dyslexia: a comparison*. *Cognition*. 1982 Mar;11(2):185-99. PMID: 7198959

Bakker, D. (1992). *Neuropsychological Classification and Treatment of Dyslexia*. *Journal of Learning Disabilities*, 25(2), 1-2-109.

Bax, S. (2003) *CALL - past, present and future*, *System* 31, 1: 13-28.

BBC Learning Website (2010) *BBC Learning Website*. Available from: <http://www.bbc.co.uk/learning/> [Accessed November 2012]

Bebo (2006) *Bebo Social Networking Site*. Available at: <http://www.bebo.com> [Accessed November 2012]

Blin, F. (1999) *CALL and the Development of Learner autonomy*. In R. Debski and M. Levy (eds.), *WorldCALL: Global Perspectives on Computer-Assisted Language Learning*, Lisse: Swets and Zeitlinger, pp. 133-147.

Blin F. and Levy M. (2003) *Workshop organisers and convenors, IRCHSS funded International Workshop on Research in CALL, 03-SEP-03 University of Limerick*

Boder, E. (1973) *Developmental Dyslexia: A Diagnostic Approach based on three atypical reading-spelling patterns*. *Developmental Medicine and Child Neurology*, 15, 663-687.

Bowers, P., & Wolf, M. (1993). *Theoretical Links among Naming Speed, Precise Timing Mechanisms and Orthographic Skill in Dyslexia*. *Reading and Writing: An Interdisciplinary Journal*, 5, 69-85.

Castellani (1954) *Romeo and Juliet* ITV Global Entertainment Ltd.

Chapelle, C. & J. Jamieson. (1991) *Internal and external validity issues in research on CALL effectiveness*. In P. Dunkel (Ed.), *Computer-assisted language learning and testing: Research issues and practice*. New York: Newbury House.

Chapelle, C. A. (1995). *A framework for the investigation of CALL as a context for SLA*. *CAELL Journal*, 6(3), 2-8.

Chapelle, C., Jamieson, J., & Park, Y. (1996) *Second language classroom research traditions: How Does CALL Fit?* In M. Pennington (Ed.) *The Power of Call* (p. 35). Houston: Athelstan Publications.

Chapelle, C. A. (1998). *Multimedia CALL: Lessons to be learned from research on instructed SLA*. *Language Learning & Technology*, 2 (1), 22-34.

Chapelle, C. (2001) *Computer Applications in Second Language Acquisition*. Cambridge: Cambridge University Press.

Citizens Advice (2010) *Irish Citizens Advice Website*. Available at: <http://www.citizensinformation.ie/en/> [Accessed November 2012]

Clarey, J. (2007) *The Real Story: Blended Learning* Brandon Hall Research.

Clicker (2006) Available from: <http://www.cricksoft.com/> [Accessed November 2012]

Cobb, T. & Stevens, V. (1996). *Computer assisted development of spoken language skills*. In M. Pennington (Ed.), *The Power of CALL*. Houston: Athelstan Publications.

Colpaert, J. (2004) *Design of Online Interactive Language Courseware: Conceptualization, Specification and Prototyping. Research into the impact of linguistic-didactic functionality on software architecture*. Doctoral dissertation. University of Antwerp, Belgium

Converse JM & Presser S (1986). *Survey Questions: Handcrafting the Standardized Questionnaire*. California: Sage.

Cooper (1998) *The Inmates are Running the Asylum*. Sams Publishing pp.207–10.

DPER (2010) *Public Service Agreement 2010-2014 (Croke Park Agreement)*. Department of Public Expenditure and Reform

DAI (2012) *Dyslexia Association of Ireland*. Available at: <http://www.dyslexia.ie/> [Accessed 27.10.2012]

Davies G. (2002) *ICT and Modern Foreign Languages: learning opportunities and training needs*, *International Journal of English Studies*, Monograph Issue 2, 1: *New Trends in Computer Assisted Language Learning and Teaching*, edited by Pascual Pérez Paredes & Pascual Cantos Gómez, Servicio de Publicaciones, Universidad de Murcia, Spain.

DES (1997) *Schools IT 2000: A Policy Framework for the New Millennium*. The Stationery Office, Dublin.

DES (2000) *Blueprint for the Future of ICT in Education Programme*. The Stationery Office, Dublin.

DES (2005) *Circular, Department of Education and Skills, Special Education 02/05*.

Available from:

http://www.education.ie/servlet/blobServlet/sp02_05.doc?language=EN

DES (2006) *Circular, Department of Education and Skills, Special Education circular 0036/2006*. Available from:
http://www.education.ie/servlet/blobServlet/cl0036_2006.doc

DES (2007) *ICT in Schools Programme* Accessed at: <http://www.ncte.ie> [Accessed November 2012]

DES (2008) *Circular, Department of Education and Skills, Special Education circular 0048/2008*. Available from:
http://www.education.ie/servlet/blobServlet/cl0048_2008.doc

DES (2008) *Investing Effectively in Information and Communications Technology in Schools 2008-2013* Available from:
<http://www.education.ie/en/Publications/Education-Reports/Investing-Effectively-in-Information-and-Communication-Technology-in-Schools-2008-2013.pdf> [Accessed November 2012]

DES (2009) *Smart Schools = Smart Economy*. Report of the ICT in Schools Joint Advisory Group to the Minister for Education and Science.

DES (2010a) *Special Needs* Available from: www.education.ie [Accessed November 2012]

DES (2010b) *Inclusion of Students with Special Educational Needs Post-Primary Guidelines*. Available from:
http://www.education.ie/servlet/blobServlet/des_insp_inclusion_students_sp_ed_needs_pp_guidelines_foreword.htm

Dörnyei Z. (1998) *Motivation in Second and Foreign Language Learning*. *Language Teaching Research*, 31, 117-135.

Dragon Naturally Speaking (2006) *Dragon Naturally Speaking Software*. Available from: <http://www.nuance.com/> [Accessed November 2012]

Dyslexia Research Trust (2005) *Family Studies and Genetics of Dyslexia* Available from: <http://www.dyslexic.org.uk/aboutdyslexia.htm> [Accessed November 2012]

Education Centres (2006) *Education Centres* Department of Education.

Google (2010) *Google Search Engine*. Available from: <http://www.ateci.ie/> [Accessed November 2012]

European Commission - Information Society and Media Directorate General, (2006) *Benchmarking Access and Use of ICT in European Schools 2006*. Empirica, Available at: www.eu.europa.eu

Falloon, G. (1999) *Developing Exemplary Practice: Why are Some Teachers Better at IT than Others*. *Computers in New Zealand Schools*, 11 (3), 19-23.

Fawcett, A., Nicolson, R., Morris, S. (2008) *Computer-based Spelling Remediation for Dyslexic Children*. Department of Psychology, University of Sheffield. *Journal of*

Computer Assisted Learning. 04/2008; 9(3):171 - 183. DOI:10.1111/j.1365-2729.1993.tb00103.x.

Felix, U. (2005). *Analyzing recent CALL effectiveness research: Towards a common agenda*. CALL Journal 18.1-2.

Freeman, E., Holmes, B. & Tangney, B. (2001). *ICTs for Learning An International Perspective on the Irish Initiative*. In J. Price et al. (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2001* (pp. 1269-1274). Chesapeake, VA: AACE.

Frith, U. (1985) *Beneath the Surface of Developmental Dyslexia*, in K.E. Patterson, J.C. Marshall, and M. Coltheart (eds.), *Surface Dyslexia*, Lawrence Erlbaum, 301-330

Frith, U. (1986). *A Developmental Framework for Developmental Dyslexia*. *Annals of Dyslexia*, 36; 69-81.

Galaburda AM, Kemper TL (1979). *Cytoarchitectonic abnormalities in developmental dyslexia: a case study*. *Annals of Neurology*, 6: 94–100.

Graham, C. (2005). *Blended learning system: Definition, current trends and future direction*. In: Bonk, C.J., Graham, C.R. (eds.) *Handbook of Blended Learning: Global Perspectives, Local Designs*, pp.3-21. Pfeiffer, San Francisco.

Greene, C., Keogh, K. (2002) *KatCar Language Learning Tool Third and Fourth Year Undergraduate Project*. Unpublished.

Greene, C. (2010) *Design Guidelines for Developing Curriculum-Focused ICT Materials for Diverse Students*. ICCHP 2010, Vienna University of Technology, Austria. *Computers Helping People with Special Needs 12th International Conference Proceedings*. *Lecture Notes in Computer Science Volume 6179*, 2010, pp 495-502

Greene, C. (2008) *The Impact of Information Communication Technologies (ICTs) on Diverse Students and Teachers at Second Level*. ICCHP 2008, University of Linz, Austria. *Springer Lecture Notes Volume 5105/2008 0302-9743 (Print) 1611-3349 (Online) Springer Berlin / Heidelberg* pp. 207-214

Habib, M. (2000) *The Neurological Basis of Developmental Dyslexia, An Overview and Working Hypothesis*. *Brain* 123, 2373-2399. Marseille, France.

Habib, L., Berget, G., Sandnes, F.E., Kahn, P., Sanderson, N.C., Fagernes, S., & Olcay, A., *Dyslexic students in Higher Education and virtual learning environments: an exploratory study*, *Computer Assisted Learning*.

Hart, R. (1981) *Language Study and the PLATO system*. *Studies in Language Learning*, 3, 1:1-24

Hémard, D. (1997) *'Design principles and guidelines for authoring hypermedia language learning applications.'* In *System* (25/1), pp. 9-27.

Hornsby, B. (1995) *Overcoming Dyslexia*. The Alden Press Ltd: Oxford: England.

Hubbard, Philip (1996) *Elements of CALL Methodology: Development, Evaluation, and Implementation*, in Pennington, Martha (ed.) *The Power of CALL*. Houston: Athelstan.

Hot Potatoes (2003) *Hot Potatoes*. Available from: hotpot.uvic.ca [Accessed November 2012]

Hot Potatoes (2006) *Hot Potatoes*. Available from: hotpot.uvic.ca [Accessed November 2012]

Hubbard, P. (2005). "A Review of Subject Characteristics in CALL Research." *CALL Journal* 18.5

Hubbard, P. (1996) *Elements of CALL Methodology: Development, Evaluation, and Implementation*, in Pennington, Martha (ed.) *The Power of CALL*. Houston: Athelstan.

Hubbard, P. & Levy, M. (Eds.) (2007) *Teacher Education in CALL*. Amsterdam: John Benjamins

Hubbard, P. & Romeo, K. (2012). "Diversity in CALL Learner Training. In G. Stockwell & M. Thomas (eds). *Computer-Assisted Language Learning: Diversity in Research and Practice*. Cambridge: Cambridge University Press.

Hughes, J., McAvinia, C., King, T. (2004) *What really makes students like a web site? What are the implications for designing web-based language learning sites?* ReCALL Journal / Volume16 / Issue01 / May 2004, pp 85-102

ICT4LT (2005) *Information Communication Technology for Language Teachers*. Available at: <http://www.ict4lt.org/en/index.htm> [Accessed November 2012]

IDA (2002) *Definitions of Dyslexia*. International Dyslexia Association. Available at: <http://www.interdys.org/> [Accessed November 2012]

Intel Ireland (2006) *Intel Ireland*. Available at: <http://www.intel.ie> [Accessed November 2012]

IDA (2012) *International Dyslexia Association*. Available at: <http://www.interdys.org/> [Accessed November 2012]

The Irish Times (2006) *The Irish Times Newspaper*. Available at: <http://http://www.irishtimes.com/> [Accessed November 2012]

Jamieson, J., Chapelle, C.A., & Preiss, S. (2004). *Putting principles into practice*. *ReCALL Journal*, 16(2), 396-415.

JCP (2006) *Junior Certificate Programme* Available from: <http://jcsp.slss.ie/> [Accessed November 2012]

Johnson, D., & Myklebust, H. (1967). *Learning disabilities: Educational principles and practices*. New York: Grune & Stratton.

Jones C. & Fortescue S. (1987) *Using computers in the language classroom*, Harlow: Longman.

Kenning, M.M., & Kenning, M. J. (1990). *Computers and language learning: current theory and practice*. New York: Ellis Horwood.

Korhonen, T. (2008) *Adaptive Spell Checker for Dyslexic Writers*. Lecture Notes In Computer Science; Vol. 5105. Proceedings of the 11th international conference on Computers Helping People with Special Needs. Pages: 733 – 741 ISBN:978-3-540-70539-0

Kurnian, S., Conroy, G. (2007) *Comparing Comprhension Speeds and Accuracy of Online Information in Students with and without Dyslexia*. Advances in Universal Web Design and Evaluation Journal: Research, Trends and Opportunities. DOI: 10.4018/978-1-59904-096-7.ch011

Kurzweil (2006) *Kurzweil*. Available from: <http://www.kurzweiledu.com/> [Accessed November 2012]

Levy, M. (1997) *Computer-Assisted Language Learning*. Clarendon Press: Oxford, England

Levy, M. (1999) *Design processes in CALL: Integrating theory, research and evaluation*. In Keith Cameron, editor, *Computer-Assisted Language Learning*. Swets & Zeitlinger, Lisse.

Levy, M. (2001) *Building bridges between disciplines, building bridges between research and teaching* SALIS: Dublin City University. 27th August 2001.

Liu, Y., Cornish, A., Clegg, J. (2007) *ICT and Special Educational Needs: Using Meta-synthesis for Bridging the Multifaceted Divide* Lecture Notes in Computer Science 978-3-540-72589-3 pp. 18-25.

MALTED (2000) *Multimedia Authoring for Language Tutors and Educational Development*. Available at: <http://malted.cnice.mec.es/ingles/maltedproject.htm> [Accessed November 2012]

Mayo, E. (1949). *Hawthorne and the Western Electric Company*. The Social Problems of an Industrial Civilisation. Routledge.

Montfort, G. (2004) *Dyslexia Learning Discoveries* Psychological Services. Available from: <http://home.iprimus.com.au/rboon/Dyslexia.htm> [Accessed November 2012]

Morgan, R. (1986) *Helping Children Read* London: Methuen & Co. Ltd.

MS PowerPoint (2006) Microsoft PowerPoint. Available from: <http://www.microsoft.com> [Accessed November 2012]

MS Word (2006) *Microsoft Word*. Available from: <http://www.microsoft.com> [Accessed November 2012]

Murphy, M, F. (2004) *Dyslexia: an Explanation*. 0953997456, 9780953997459 Flyleaf Press.

NCSE (2012) *SNA and Resource Teaching Hours Allocations 2012/13 Post Primary*. National Council for Special Education.

NCCA (2010) *National Council for Curriculum and Assessment* <http://www.ncca.ie/> [Accessed November 2012]

NCSE (2009) *Guidelines for Primary Schools and Special Schools in Processing Applications for Resources for Pupils with Special Educational Needs*. Available from: <http://www.ncse.ie/uploads/1/PRIMARYGuidelines2009forms.pdf> [Accessed November 2012]

NCTE (2010) *Information and Advice: Special Educational Needs and Information and Communications Technology*, National Centre for Technology in Education, Dublin City University. Available from: <http://www.ncte.ie/images/seninfoadvice.pdf> [Accessed November 2012]

NCTE (2012) *Getting started with ICT in the new school year*. Available from: http://www.ncte.ie/media/PDST_Sep2012.pdf [Accessed November 2012]

NDA (2012) *Special Education Provision for Children with Disabilities in Irish Primary Schools – the Views of Stakeholders*. National Disability Authority 2012.

NEPS (2012) *National Educational Psychology Service*. Available at: <http://www.education.ie/en/Parents/Information/Educational-Psychological-Services/> [Accessed November 2012]

Nicolson R, Fawcett A, Berry E, Jenkins I, Dean P, Brooks D. (1999) *Association of abnormal cerebellar activation with motor learning difficulties in dyslexic adults*. *Lancet Journal*; 353: 1662–7.

Nutta, J., Feyton, C., Norwood, A., Meros, J., Yoshii, M., & Ducher, J. (2002). *Exploring new frontiers: What do computers contribute to teaching foreign language in elementary school?* *Foreign Language Annals*, 35(3), 293-306.

Moebs, S. & Weibelzahl, S. (2006). *Towards a good mix in blended learning for small and medium sized enterprises – Outline of a Delphi Study*. Proceedings of the Workshop

O'Connor, KS (2005) *Does qualitative evaluation measure up?* Paper presented at the 2005 Federal Committee on Statistical Methodology (FCSM) Research Conference; November 14 - 16, 2005; Arlington, VA.

OECD (2010) *Education at a Glance: OECD Indications*. Organisation for Economic Co-Operation and Development ISBN: 9789264055988 Paris, France.

O'Brien B.A., Wolf M., Lovett M.W. (2012) *A taxometric investigation of developmental dyslexia subtypes*. *Dyslexia*. 2012 Feb;18(1):16-39. doi: 10.1002/dys.1431. Epub 2012 Jan 8.

- Ott, P. (1997) *How to detect and Manager Dyslexia*. Heineman ISBN 0 435 104195.
- Parr and Fung (2000) *A Review of the Literature on Computer-Assisted Learning, Particularly Integrated Learning Systems, and Outcomes with Respect to Literacy and Numeracy. Education Counts*. [online resource]. Available at: <http://www.educationcounts.govt.nz/publications/ict/59271> [Accessed November 2012]
- Pennington, M. (1996.) *The Power of CALL*. Houston: Athelstan. Plass, J.
- Ragin, C.C., Nagel, J., White, P. (2004). *Report of the Workshop on Scientific Foundations of Qualitative Research*. Conducted July 11-12, 2003. National Science Foundation: Arlington, Virginia.
- Read and Write Gold (2006) *Read and Write Gold*. Available from <http://www.texthelp.com/> [Accessed November 2012]
- Rickard A, Blin F, Appel C. (2006) *Training for trainers: challenges, outcomes, and principles of in-service training across the Irish education system*. *Teacher Education in CALL*, pp203-218.
- Richards, T., Dager, S., Corina, D., Serafini, S., Heide, A., Steury, K., Strauss, W., Hayes, C., Abbott, R., Craft, S., Shaw, D., Posse, S., Berninger, V. (1999) *Dyslexic Children Have Abnormal Brain Lactate Response to Reading-Related Language Tasks*. *American Journal of Neuroradiology*, 20: 1393 - 1398.
- Scoilnet (2006) *Scoilnet resources*. Available from: <http://www.scoilnet.ie> [Accessed November 2012]
- SchoolHistory (2006) *History resources*. Available from: <http://www.schoolhistory.co.uk/> [Accessed November 2012]
- Selikowitz, M. (1993).*Dyslexia & Other Learning Difficulties*. Oxford University Press:USA
- Serafini S, Steury K, Richards T, D, Abbott R, SR, Berninger V, *Comparison of fMRI and PEPSI during language processing in children*, *Magn Reson Med* 45, 217-225, 2001.
- SESS (2001) *Report of the Task Force on Dyslexia*. Special Education Support Service Publications.
- Seymour, P. & Evans, H. (1999) *Foundation Level Dyslexias: Assessment and Treatment*. *Journal of Learning Disabilities*, 32, 394-405.
- Sepehr, H. & Harris, D. (1995) *Teachers' Use of Software for Pupils with Specific Learning Difficulties*, *Journal of Computer Assisted Learning*, 11, pp. 64-71.
- Seymour, P. & Evans, H. (1999) *Foundation Level Dyslexias: Assessment and Treatment*. *Journal of Learning Disabilities*, 32, 394-405.
- Sharma, V. (1996) *There are many Types of Dyslexia*. Mind Publications.

Sidhu, M., Manzura, E. (2011) *An Effective Conceptual Multisensory Multimedia Model To Support Dyslexic Children In Learning*. International Journal of Information and Communication Technology Education (IJICTE) Volume 7, Issue 3.

Singleton, C. (2000) *Understanding Dyslexia*. Available from: <http://www.portobello.edin.sch.uk/LSSN/LSSN2.html> [Accessed November 2012]

Sivin-Kachala, J. (1998) *Report on the Effectiveness of the Technology in Schools, 1990-1997*. Software Publisher's Association.

Skinner B.F. (1954) *The science of learning and the art of teaching*. Harvard Educational Review. 24, 86-97.

Skool.ie (2006) *Skool.ie*, Available from: <http://www.skool.ie> [Accessed November 2012]

Slaughter, G. (2001) *The Phonological Model of Dyslexia*. Neurobiology and Behaviour, Web Report no.3 Available from: <http://serendip.brynmawr.edu/bb/neuro/neuro01/web3/Slaughter.html> [Accessed November 2012]

Sommerville, I. (2004) *Software Engineering*. Harlow, Essex, England, New York: Pearson/Addison Wesley. 7th Edition.

Snowling, M. (2000). *Dyslexia: 2nd edition*. Blackwell.

StudyNet (2012) *What is CAL?* University of Hertfordshire. Available from: [http://www.studynet1.herts.ac.uk/ptl/common/LTDU.nsf/Teaching+Documents/04739C2AEC9B471B8025729F00330361/\\$FILE/whatiscal.pdf](http://www.studynet1.herts.ac.uk/ptl/common/LTDU.nsf/Teaching+Documents/04739C2AEC9B471B8025729F00330361/$FILE/whatiscal.pdf) [Accessed November 2012]

Taylor, R. (1980). *The computer in the school: Tutor, tool, tutee*. New York: Teachers College Press.

Teachnet (2006) *Teachnet Resources*. Available from: <http://www.teachnet.ie> [Accessed November 2012]

Temkin, J. (2009) *How Focus Groups Work*. Available at: <http://communication.howstuffworks.com/how-focus-groups-work.htm> [Accessed November 2012]

Wahl, R. (1996) *The Role of Computers in teaching EFL to Dyslexic Students*. ETNI English Teachers Network. Available from: <http://www.etni.org.il/etninetnews/paper.htm> [Accessed November 2012]

Ward, M. (2007). *The Integration of Computational Linguistics Techniques in CALL for Irish in the Primary School Context*. PhD Thesis, Dublin City University.

Warschauer, M. (1996). *Computer-Mediated Collaborative Learning: Theory and Practice* (Research Note No. 17). University of Hawaii, 2nd Language Teaching & Curriculum Centre.

Warschauer, M., & Healey, D. (1998). *Computers and language learning: An overview*. *Language Teaching*, 31, 57-71.

Watts, M., Lloyd (2004) *The Use of Innovative ICT in the Active Pursuit of Literacy*, *Journal of Computer Assisted Learning*, v20 n1 p50-58

Williams, P., Jamali, H. and David Nicholas (2006) *Using ICT with people with special educational needs: What the literature tells us*. *Aslib Proceedings: New Information Perspectives*. v58. 330-345.

YouTube (2006) *Youtube: Broadcast Yourself*. Available at <http://www.youtube.com> [Accessed 28.10.2012]

APPENDICES

Appendix A: Chapter 4 Questionnaires

Chapter 4 Student ICT Questionnaire

How often do you use a computer for class work with your teacher?

- Every day 3 times a week 2 times a week
 Once a week 2 times a month Once a month Rarely

How often do you use a computer for homework on your own?

- Every day 3 times a week 2 times a week
 Once a week 2 times a month Once a month Rarely

Do you have a computer at home? Internet?

What ICTs do you use in the classroom with your teacher? Please name any software packages e.g. MS PowerPoint, Dragon Naturally Speaking

What ICTs do you use at home for homework / study?

Which of the following ICTs do you use at home and/or at school for schoolwork? Please tick boxes where appropriate. Please name any other ICTs or websites not listed.

ICT Type	School	Homework	Neither
Microsoft Word	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Microsoft PowerPoint	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Microsoft Excel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Interactive whiteboard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overhead projector	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Laptop computer / Desktop	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comprehension tool e.g. summarises text for	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vocabulary tool e.g. introduces new words	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Text Reader e.g. computer reads out the text	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Text prediction tool e.g. suggests word endings (like your predictive text on your	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Display tool e.g. tool for logging all exercises completed or homework submitted	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mind map tool e.g. helps you to create mind-maps for a particular subject to help when	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Google / search engine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Online thesaurus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wikipedia	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
http://www.teachnet.ie/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
http://www.skool.ie/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Social networking	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Chapter 4 Teacher ICT Questionnaire

Are you a mainstream teacher? / Learning support teacher? / Resource teacher? / Other?

What subjects do you teach?

Where do you get the material for your classes? Curriculum guidelines? Books? Internet?

How often do you use ICT in the classroom with students?

- | | | | |
|--------------------------------------|--|---|---------------------------------|
| <input type="checkbox"/> Every day | <input type="checkbox"/> 3 times a week | <input type="checkbox"/> 2 times a week | |
| <input type="checkbox"/> Once a week | <input type="checkbox"/> 2 times a month | <input type="checkbox"/> Once a month | <input type="checkbox"/> Rarely |

How often do you use ICT to prepare curriculum teaching materials for the classroom?

- | | | | |
|--------------------------------------|--|---|---------------------------------|
| <input type="checkbox"/> Every day | <input type="checkbox"/> 3 times a week | <input type="checkbox"/> 2 times a week | |
| <input type="checkbox"/> Once a week | <input type="checkbox"/> 2 times a month | <input type="checkbox"/> Once a month | <input type="checkbox"/> Rarely |

What ICTs do you use in the classroom with your students? Please name any software packages e.g. MS PowerPoint, Dragon Naturally Speaking

What ICTs do you use to prepare curriculum materials for the classroom? Please name any software packages e.g. MS PowerPoint, Dragon Naturally Speaking

Do you use any websites for help with content preparation?

Would you be available to take part in a focus group? (Print name)

Which of the following ICTs do you use for content preparation, during class with students or for setting homework? Please tick boxes where appropriate. Please name any other ICTs or websites not listed.

ICT Type	Content preparation	Students use during class	Setting homework	Never
Microsoft Word	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Microsoft PowerPoint	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Microsoft Excel	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Interactive whiteboard	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Overhead projector	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Laptop computer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Comprehension tool e.g. summarises text	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Vocabulary tool e.g. introduces new words and their meaning	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Text Reader e.g. computer reads out the text on screen for you	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Text prediction tool e.g. suggests word endings (like your predictive text on your	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Display tool e.g. tool for logging all exercises completed or homework	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Mind map tool e.g. helps you to create mind-maps for a particular subject	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Google / search engine	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Online thesaurus	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Wikipedia	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
http://www.teachnet.ie/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
http://www.skool.ie/	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Other:	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Would you like to sign up to take part in a three-month project to investigate the usefulness of the ICTs that are currently available to your post-primary school? (Print name)

Appendix B: Chapter 5 Questionnaires

Chapter 5 Student Questionnaire on the Initial Deployment of General ICT tools

MS Word	When did you use it?	<input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class <input type="checkbox"/> Homework	Comments:
MS Word	For what? e.g. which module was used	(More spaced provided on actual questionnaire)	Comments:
MS Word	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
MS PowerPoint	When did you use it?	<input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class <input type="checkbox"/> Homework	Comments:
MS PowerPoint	For what? e.g. which module was used		Comments:
MS PowerPoint	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:

Comments:

Chapter 5 Teacher Questionnaire on the Initial Deployment of General ICT tools

MS Word	When did you use it?	<input type="checkbox"/> Content preparation <input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class <input type="checkbox"/> Setting homework	Comments:
MS Word	For what? e.g. which module was used		Comments:
MS Word	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
MS PowerPoint	When did you use it?	<input type="checkbox"/> Content preparation <input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class <input type="checkbox"/> Setting Homework	Comments:
MS PowerPoint	For what?		Comments:
MS PowerPoint	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:

Would you be available to take part in a focus group to help develop design guidelines for curriculum-focused ICT materials for an inclusive classroom? Please write your name below.

Would you like to sign up to take part in a three-month project to integrate curriculum-focused ICT materials into your inclusive classroom? Please write your name below.

Chapter 5 Student Questionnaire on the Initial Deployment of Focused Special Needs Tools

Read and Write Gold	When did you use it?	<input type="checkbox"/> Content preparation <input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class	Comments:
Read and Write Gold	For what? e.g. which module was used	(More spaced provided on actual questionnaire)	Comments:
Read and Write Gold	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
Dragon Naturally Speaking	When did you use it?	<input type="checkbox"/> Content preparation <input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class	Comments:
Dragon Naturally Speaking	For what? e.g. which module was used	(More spaced provided on actual questionnaire)	Comments:
Dragon Naturally Speaking	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:

Comments:

Chapter 5 Teacher Questionnaire on the Initial Deployment of Focused Special Needs Tools

Read and Write Gold	When did you use it?	<input type="checkbox"/> Content preparation <input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class	Comments:
Read and Write Gold	For what? e.g. which module was used		Comments:
Read and Write Gold	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
Dragon Naturally Speaking	When did you use it?	<input type="checkbox"/> Content preparation <input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class	Comments:
Dragon Naturally Speaking	For what? e.g. which module was used		Comments:
Dragon Naturally Speaking	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:

Would you be available to take part in a focus group to help develop design guidelines for curriculum-focused ICT materials for an inclusive classroom? Please write your name below.

Would you like to sign up to take part in a three-month project to integrate curriculum-focused ICT materials into your inclusive classroom? Please write your name below.

Chapter 5 Student Questionnaire on Initial Integration of Online Curriculum Materials

TeachNet	When did you use it?	<input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class <input type="checkbox"/> Homework	Comments:
TeachNet	For what? e.g. which module was used		Comments:
TeachNet	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
TeachNet	Content	<input type="checkbox"/> Age-appropriate <input type="checkbox"/> Content level appropriate <input type="checkbox"/> Interactive	Comments:
Skool.ie	When did you use it?	<input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class <input type="checkbox"/> Homework	Comments:
Skool.ie	For what? e.g. which module was used		Comments:
Skool.ie	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
Skool.ie	Content	<input type="checkbox"/> Age-appropriate <input type="checkbox"/> Content level appropriate <input type="checkbox"/> Interactive	Comments:

Comments:

Chapter 5 Teacher Questionnaire on Initial Integration of Online Curriculum Materials

TeachNet	When did you use it?	<input type="checkbox"/> Content preparation <input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class <input type="checkbox"/> Setting Homework	Comments:
TeachNet	For what? e.g. which module was used		Comments:
TeachNet	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
TeachNet	Content	<input type="checkbox"/> Age-appropriate <input type="checkbox"/> Content level appropriate <input type="checkbox"/> Interactive	Comments:
Skool.ie	When did you use it?	<input type="checkbox"/> Content preparation <input type="checkbox"/> Teacher uses during class <input type="checkbox"/> Students use during class <input type="checkbox"/> Setting Homework	Comments:
Skool.ie	For what? e.g. which module was used		Comments:
Skool.ie	Easy to use?	<input type="checkbox"/> Yes <input type="checkbox"/> No	Comments:
Skool.ie	Content	<input type="checkbox"/> Age-appropriate <input type="checkbox"/> Content level appropriate <input type="checkbox"/> Interactive	Comments:

Would you be available to take part in a focus group to help develop design guidelines for curriculum-focused ICT materials for an inclusive classroom? Please write your name below.

Would you like to sign up to take part in a three-month project to integrate curriculum-focused ICT materials into your inclusive classroom? Please write your name below.

Appendix C: Chapter 9 Questionnaires

Integration of CA(L)L Exercises Teacher Questionnaire

Were you involved in the focus groups that helped to create the design guidelines for CA(L)L curriculum materials?

- Yes No

If so, did you like developing the design guidelines?

- Yes No

Comment: _____

CA(L)L Clicker Exercises

How often did you use Clicker with your students the classroom?

- Every day 3 times a week 2 times a week
 Once a week 2 times a month Once a month Rarely

How often did you use Clicker to prepare curriculum teaching materials for the classroom?

- Every day 3 times a week 2 times a week
 Once a week 2 times a month Once a month Rarely

How would you rate the correspondence between the tasks in the Clicker Exercises and the regular classroom tasks?

- Very similar Similar Very different
 Different

Comment: _____

Did you use the sample Clicker Exercises?

- Yes No

What did you use the Clicker Exercises for?

- Content Preparation Teacher use during class
 Student use during class Other: _____

How did you find the content level of the Sample Clicker Exercises?

- Age-Appropriate Not Age-Appropriate Content Appropriate
 Interactive Not interactive Not Content Appropriate

Did you like the design of the Sample Clicker Exercises?

- Yes No

Comment: _____

Did you create your own Clicker Exercises using the design guidelines?

- Yes No

What did you use your own Clicker Exercises for?

- Content Preparation Teacher use during class
 Student use during class Other: _____

Please give example of curriculum units you created using the design guidelines and Clicker. Please give as much detail as possible.

How do you rate the ease of creating Clicker Exercises?

- Easy Challenging Time-consuming

Comments:

How did you find the content level of your Clicker Exercises?

- Age-Appropriate Not Age-Appropriate Content Appropriate
 Interactive Not interactive Not Content
Appropriate

What did you like about Clicker?

What did you not like about Clicker?

Do you have any further comments about Clicker?

Online CA(L)L Hot Potatoes Exercises

How often did you use Hot Potatoes with your students the classroom?

- Every day 3 times a week 2 times a week
 Once a week 2 times a month Once a month Rarely

How often did you use Hot Potatoes to prepare curriculum teaching materials for the classroom?

- Every day 3 times a week 2 times a week
 Once a week 2 times a month Once a month Rarely

How would you rate the correspondence between the tasks in the Hot Potatoes Exercises and the regular classroom tasks?

- Very similar Similar Very different
 Different

Comment:

Did you use the sample Hot Potatoes Exercises?

- Yes No

What did you use the Hot Potatoes Exercises for?

- Content Preparation Teacher use during class
 Setting homework Student use during class
 Other

How did you find the content level of the Sample Hot Potatoes Exercises?

- Age-Appropriate Not Age-Appropriate Content Appropriate
 Interactive Not interactive Not Content Appropriate

Did you like the design of the Sample Hot Potatoes Exercises?

- Yes No

Comment:

Did you create your own Hot Potatoes using the design guidelines?

- Yes No

What did you use your own Hot Potatoes Exercises for?

- Content Preparation Teacher use during class
 Student use during class Other: _____

Please give example of curriculum units you created using the design guidelines and Clicker. Please give as much detail as possible.

How do you rate the ease of creating Hot Potatoes Exercises?

- Easy Challenging Time-consuming

Comments:

How did you find the content level of your Hot Potatoes Exercises?

- Age-Appropriate Not Age-Appropriate Content Appropriate
 Interactive Not interactive Not Content Appropriate

What did you like about Hot Potatoes?

What did you not like about Hot Potatoes?

Do you have any further comments about Hot Potatoes?

Online CA(L)L Logged Exercises

How often did you use the Logged Exercises with your students the classroom?

- Every day 3 times a week 2 times a week
 Once a week 2 times a month Once a month Rarely

How would you rate the correspondence between the tasks in the Logged Exercises and the regular classroom tasks?

- Very similar Similar Very different
 Different

Comment:

What did you use the Logged Exercises for?

- Content Preparation Teacher use during class
 Setting homework Student use during class
 Other:
-

How did you find the content level of the Logged Exercises?

- Age-Appropriate Not Age-Appropriate Content Appropriate
 Interactive Not interactive
 Not Content Appropriate

Did you like the design of the Logged Exercises?

- Yes No

Comment:

How do you rate the ease of using the Logged Exercises?

- Easy Challenging Time-consuming

Comments:

Did you find the 'Teacher' page useful?

Yes

No

Comment:

Did you find the 'Student' page useful?

Yes

No

Comment:

Did you find the automatic allocation of exercises to each student useful?

Yes

No

Comment:

What did you like about the Logged Exercises?

What did you not like about the Logged Exercises?

Do you have any further comments about the Logged Exercises?

Would you like to try out more CA(L)L exercises with your students?

Yes

No

Would you like to take part in a focus group to discuss these results?

Yes

No

If you would like to take part in the focus group, please write you name below:

Integration of CA(L)L Exercises Student Questionnaire

Were you involved in the focus groups that helped to create the design guidelines for CA(L)L curriculum materials?

- Yes No

If so, did you like developing the design guidelines?

- Yes No

Comment: _____

CA(L)L Clicker Exercises

How often did you use Clicker with your teacher in the classroom?

- Every day 3 times a week 2 times a week
 Once a week 2 times a month Once a month Rarely

How often did you use Clicker without your teacher?

- Every day 3 times a week 2 times a week
 Once a week 2 times a month Once a month Rarely

Did you think using Clicker with your teacher was similar, or not, to normal schoolwork?

- Very similar Similar Very different
 Different

Comment: _____

What did you use the Clicker Exercises for?

Teacher use during class

Student use during class

Other: _____

How did you find the content level of the Clicker Exercises?

Age-Appropriate

Not Age-Appropriate

Content Appropriate

Interactive

Not interactive

Not Content

Appropriate

Did you like the design of the Clicker Exercises?

Yes

No

Comment: _____

Please give example of topics you studied using Clicker with your teacher e.g. poems

What did you like about Clicker?

What did you not like about Clicker?

Do you have any further comments about Clicker?

Online CA(L)L Hot Potatoes Exercises

How often did you use Hot Potatoes with your teacher in the classroom?

- Every day 3 times a week 2 times a week
 Once a week 2 times a month Once a month Rarely

How often did you use Hot Potatoes without your teacher?

- Every day 3 times a week 2 times a week
 Once a week 2 times a month Once a month Rarely

Did you think using Hot Potatoes with your teacher was similar, or not, to normal schoolwork?

- Very similar Similar Very different
 Different

Comment:

What did you use the Hot Potatoes Exercises for?

- Teacher use during class Homework
 Student use during class

Other: _____

How did you find the content level of the Hot Potatoes Exercises?

- Age-Appropriate Not Age-Appropriate Content Appropriate
 Interactive Not interactive Not Content Appropriate

Did you like the design of the Hot Potatoes Exercises?

- Yes No

Comment: _____

Please give example of topics you studied using Hot Potatoes with your teacher e.g. poems

What did you like about Hot Potatoes?

What did you not like about Hot Potatoes?

Do you have any further comments about Hot Potatoes?

Online CA(L)L Logged Exercises

How often did you use the Logged Exercises with your teacher in the classroom?

- Every day 3 times a week 2 times a week
 Once a week 2 times a month Once a month Rarely

How often did you use the Logged Exercises without your teacher?

- Every day 3 times a week 2 times a week
 Once a week 2 times a month Once a month Rarely

Did you think using the Logged Exercises with your teacher was similar, or not, to normal schoolwork?

- Very similar Similar Very different
 Different

Comment:

What did you use the Logged Exercises for?

- Teacher use during class Homework
 Student use during class

Other: _____

How did you find the content level of the Logged Exercises?

- Age-Appropriate Not Age-Appropriate Content Appropriate
 Interactive Not interactive
 Not Content Appropriate

Did you like the design of the Logged Exercises?

- Yes No

Comment: _____

Please give example of topics you studied using the Logged Exercises with your teacher e.g. poems

What did you like about the Logged Exercises?

What did you not like about the Logged Exercises?

Do you have any further comments about the Logged Exercises?

Would you like to try out more CA(L)L exercises?

Yes

No

Would you like to take part in a focus group to discuss these results?

Yes

No

If you would like to take part in the focus group, please write your name below:

Appendix D: Focus Group Questions

Chapter 4 Focus Group Questions - Students

- How often do you use a computer for class work with your teacher?
- How often do you use a computer for homework on your own?
- Do you have a computer at home?
- What ICTs do you use in the classroom with your teacher?
- What ICTs do you use at home for homework / study?
- Would you like to use computers more in school?

Chapter 4 Focus Group Questions - Teachers

- Are you a mainstream teacher? / Learning support teacher? / Resource teacher?
- What subjects do you teach?
- Where do you get your material for your classes? How often do you use ICTs with your students?
- How often do you use ICT to prepare curriculum teaching materials for the classroom?
- What ICTs do you use in the classroom with your students?
- What ICTs do you use to prepare curriculum materials for the classroom?
- Do you use any websites for help with content preparation?
- Would you be willing to take part in a three-month project to investigate the usefulness of the ICTs that are currently available in post-primary school schools in Ireland?
- Do you use computers more outside of work than in work?
- Are there parts of the curriculum units you think are amenable to this ICT?

Chapter 5 Focus Groups - Teachers

- Which software type were you allocated?
- When did you use it most?
- What did you use it for?
- Was it easy to use?
- Was the tool age-appropriate for your students?
- Was the tool content-appropriate for your students? (Full explanation of what is meant)
- Was the tool interactive?
- Do you have comments on the tool?
- What guidelines would you recommend for someone developing curriculum-focused materials for your students?

Chapter 5 Focus Groups - Students

- What new software did you use over the last three months?
- When did you use it most?
- What did you use it for?
- Was it easy to use?
- Was the tool age-appropriate in your opinion?
- Was the content relevant to you?
- Was the tool interactive?
- Do you have comments on the tool?

Chapter 8 Focus Groups - Teachers

- Which software type were you allocated?
- When did you use it most?
- What did you use it for?
- Was it easy to use?
- Was the tool age-appropriate for your students?
- Was the tool content-appropriate for your students? (Full explanation of what is meant)
- Was the tool interactive?
- Do you have comments on the tool?

Chapter Focus Groups - Students

- What new software did you use over the last three months?
- When did you use it most?
- What did you use it for?
- Was it easy to use?
- Was the tool age-appropriate in your opinion?
- Was the content relevant to you?
- Was the tool interactive?
- Do you have comments on the tool?