DOCTOR OF PHILOSOPHY

An Investigation into the Potential Role of a Virtual Learning Environment for Visually Impaired Adults

Lynch, Paul

Award date: 2008

Awarding institution: Queen's University Belfast

Terms of use
All those accessing thesis content in Queen’s University Belfast Research Portal are subject to the following terms and conditions of use:

• Copyright is subject to the Copyright, Designs and Patent Act 1988, or as modified by any successor legislation.
• Copyright and moral rights for thesis content are retained by the author and/or other copyright owners.
• A copy of a thesis may be downloaded for personal non-commercial research/study without the need for permission or charge.
• Distribution or reproduction of thesis content in any format is not permitted without the permission of the copyright holder.
• When citing this work, full bibliographic details should be supplied, including the author, title, awarding institution and date of thesis.

Take down policy
A thesis can be removed from the Research Portal if there has been a breach of copyright, or a similarly robust reason.
If you believe this document breaches copyright, or there is sufficient cause to take down, please contact us, citing details. Email: openaccess@qub.ac.uk

Supplementary materials
Where possible, we endeavour to provide supplementary materials to theses. This may include video, audio and other types of files. We endeavour to capture all content and upload as part of the Pure record for each thesis.
Note, it may not be possible in all instances to convert analogue formats to usable digital formats for some supplementary materials. We exercise best efforts on our behalf and, in such instances, encourage the individual to consult the physical thesis for further information.
AN INVESTIGATION INTO THE POTENTIAL ROLE OF A VIRTUAL LEARNING ENVIRONMENT FOR VISUALLY IMPAIRED ADULTS

by

Paul Lynch B Ed (Hons.) Maitrise, MSc

A dissertation submitted as part of the requirement for the Degree of Doctor of Philosophy In the School of Education, Queen's University Belfast

September 2008
ABSTRACT

New advances in technology suggest that we have the capacity to include visually impaired adults in the e-learning domain, but recent evidence reveals there are still a number of practical issues that need to be dealt with, principally in terms of providing training to students on how to use new technology and then apply it to e-learning. One of the biggest challenges for those working in the field of accessibility and e-learning is to find technical solutions that will enable visually impaired people to access learning on an equitable basis with their sighted peers.

This research investigates the potential role of inclusive learning environments in promoting effective learning for visually impaired adults. In seeking to do this it explores some of the main advances in the development of e-learning and assistive technology, identifying how these can provide new learning opportunities for this group of learners. It also utilises a research strategy that derives from a commitment to principles associated with the emancipatory movement in disability studies research.

This strategy is integrated within a framework of mixed methods to find out whether new technology can be used explicitly to develop learning environments and how, in turn, this symbiotic relationship affects the experience of learners and impacts on learning outcomes.

Findings from the study reveal that inclusive learning environments have a positive impact on how visually impaired learners perceive themselves as members of the digital age. Other findings suggest that visually impaired learners are seeking more complex ways of learning with the support of new forms of technology. The implications of these findings are discussed in relation to current and future developments in accessible e-learning, and in relation to the potential benefits and limitations of working with principles of inclusive research associated with the emancipatory paradigm in disability studies.
Chapter One - Introduction

1.0 The digital divide
1.1 The scale and impact of the digital divide, with reference to disabled people
1.2 Government response to the digital divide
1.3 The 'challenge'
1.4 Research aims
1.5 Context for the research
1.5.1 Epistemological position
1.6 Definitions of visual impairment
1.7 Outline of the thesis

Chapter Two - Literature Review

2.0 Introduction
2.1 The role of vision
2.1.1 The role of touch and the environment
2.1.2 The auditory environment
2.1.3 Integration of information from different sensory modalities
2.1.4 The acquisition of cognitive skills
2.2 Visual impairment in adulthood
2.2.1 Blindness and personal testimonies
2.2.2 Educational attainment and onset of visual impairment
2.3 Learning theory and visual impairment
2.3.1 Social constructivism and scaffolding
2.3.2 Development of psychological tools for the blind
2.3.3 Developing critical thinking and higher-order thinking
2.4 Introduction to e-learning
2.4.1 Development of e-learning platforms
2.4.2 Design issues for e-learning
2.5 Situated learning in communities of practice
2.5.1 Communities of enquiry
2.5.2 Text-based communication
2.6 Blended e-learning
4.2.2 Stakeholders' workshop
4.2.3 Interviews
4.2.4 Designing and piloting the interview schedules
4.2.5 Round-table discussions
4.2.6 Organisation of roundtable discussions
4.3 Procedures for data collection
4.3.1 Data analysis
4.4 Ethical issues and consent

Chapter Five – Results from Stages One and Two

5.0 Introduction
5.1 Overview of sample group and design of questionnaire
5.2 Presentation of data from the questionnaire
5.2.1 Computer use
5.2.2 Screen-reading software
5.2.3 Training and qualifications
5.2.4 Individual learning preferences
5.2.5 Other technology
5.2.6 Special interest group
5.2.7 Summary
5.3 Consultation with stakeholders
5.3.1 Discussion of overall findings from the questionnaire
5.3.2 Meeting the training requirements of visually impaired learners
5.3.3 Exploring learning materials
5.4 Next steps
5.5 Introduction to stage two
5.5.1 Defining a role for the disabled peer researcher
5.5.2 Discussion of key findings from stage one
5.6 Identifying a set of principles for research
5.6.1 Exploring opportunities to run a pilot study

Chapter Six – Presentation of Findings from Stage Three

6.0 Introduction
6.1 First testing of ACE
6.1.1 Participants' background data ................................................................. 164
6.2 Round-table discussions ............................................................................ 177
6.3 Identification of main themes from the first round-table discussion .......... 178
   6.3.1 Accessing and navigating the virtual learning environment ............... 178
   6.3.2 Use of online tools .............................................................................. 181
   6.3.3 Complexities of accessing e-learning courses for visually impaired
         learners. 183
   6.3.4 Presentation of key issues identified during first testing period .......... 185
6.4 Summary of key issues .............................................................................. 187
6.5 Redevelopment of VLE based on participants' initial experiences .......... 188
Section Two ........................................................................................................ 189
6.6 Results from second round-table discussion ............................................ 190
6.7 Summary .................................................................................................... 196
6.8 Final interviews with participants and resulting themes ......................... 197
   6.8.1 Levels of participants' technical knowledge and access to the VLE ...... 198
   6.8.2 Impact of e-learning courses on participants' learning characteristics ... 200
   6.8.3 Applying learning strategies to support e-learning .............................. 207
   6.8.4 Information-age skills for the visually impaired ................................. 210
   6.8.5 Inclusive design of e-learning courses increases confidence and
         independence .............................................................................................. 211
6.9 Visually impaired people reflect on their experiences as co-researchers..... 215
6.10 Summary .................................................................................................... 219
   6.10.1 Pedagogical issues affecting e-learning content and delivery .......... 219
   6.10.2 Adapting the environment to meet individual and social needs ......... 220
   6.10.3 Impact of the VLE and e-learning materials on learning outcomes .... 221
Chapter Seven – Discussion of Findings ............................................................ 223
7.0 Introduction ................................................................................................. 223
7.1 Part One: E-learning and blended learning for visually impaired community 224
   7.1.1 Inclusive design increases accessibility to VLEs ............................... 224
   7.1.2 Accessing training on the use of assistive technology ...................... 226
   7.1.3 Using new mobile technologies to increase learning opportunities .... 227
   7.1.4 Meeting the technical needs of the visually impaired to 'e-learn' ....... 230
LIST OF TABLES AND FIGURES

Table 1. How often do you use a computer? (Question 1). Base: Whole sample (N=32) ......................................................116
Table 2. Where do you use a computer? (Question 2).................................................................................................116
Table 3. What stops or prevents the respondent to use a computer (more often)? (Question 3) ..................................................118
Table 4. What do you use computers for? (Question 4)...............................................................................................119
Table 5. What screen-reading software do you use, if any? (Question 5).................................................................120
Table 6. Why do you use this software? (Question 6)...............................................................................................122
Table 7. Would you prefer different screen-reading/ magnifying software from the one you are currently using? (Question 7) ...................................................................................123
Table 8. Who provided the training? (Question 8) Base: 18..........................................................................................125
Table 9. Do you know of any computer course in your town that leads to a formal qualification? (Question 12) ......................................................................................................................................126
Table 10. Can you say which skills or tasks you would like to be able to use the computer for? List of priority skills (maximum 3 skills) (Question 13) ..............................................................................128
Table 11. How do you think you best learn? (Question 14).........................................................................................130
Table 12. Do you use any other types of technology? (Question 16)..............................................................................132
Table 13. What aspect of VICS do you most enjoy? (Question 17) Base: (n=20).........................................................133
Table 14. Details of tasks conducted by co-researchers as part of a review of ACE ... 156
Table 15. Description of tests, results and recommendations .......................................................................................157
Table 16. Extract taken from module 3 (word-processing)......................................................................................158
Table 17. Reported details about the participants (eye condition, age, professional status and location) Base: N=10 ..................................................................................................................................167
Table 18. Participants technical experience and aspirations before testing the VLE ... 173
Table 19. List of courses participants chose to follow .....................................................................................................174
Table 20. How do you think you best learn?. Base: N=10 .............................................................................................176
Table 21. A comparison of learning characteristics before and after engagement in the e-learning courses ..................................................................................................................................................206
ACKNOWLEDGEMENTS

I wish to express my gratitude to a number of people who helped through the research process.

I would like to thank my supervisor Professor Anthony Gallagher for his useful advice.

A very special thank you to Professor Ann Lewis who has helped me so much over the final months of writing this thesis.

A special thanks to my dear friends Gino Lerario, Christopher Robertson and Kevin Hynds who supported me during the final stages of the research.

Many thanks to Stuart Lawler who has taught much me about assistive technology and has shared his personal experiences of being blind.

I wish to say thank you to Dr. Bryn Holmes who motivated me to conduct this research.

Lastly, a special thanks to Emma and Nicky who so kindly gave up so much time to participate in the research.
1.0 The digital divide

People with blindness or other forms of disability are not able to take full advantage [of learning opportunities] due to the inaccessibility in the technology itself. If the problem of inaccessibility is not solved, the discrepancy, known as the digital divide, will become bigger as information technology advances (Peter White, BBC Correspondent).

New technology is rapidly changing the way we access and share knowledge. Many of us are able to take advantage of new ways of learning using the Internet and other mobile devices. Many visually impaired people are often unable to take advantage of new learning opportunities because of inaccessible technology. It is therefore the responsibility of all who are engaged in the planning and delivery of large learning initiatives to maximise levels of accessibility and e-literacy for all their citizens as a matter of right.

The emergence of the knowledge of information society, building on the pervasive influence of modern information and communication technology, is bringing about a fundamental reshaping of the global economy. ICT is facilitating a rapid globalisation of economic activity. Innovation, which fuels new job creation and economic growth, is quickly becoming the key factor in global competitiveness (ISC, 2002).

Levels of engagement of ICT in Ireland have grown significantly in recent years. Recent statistics from the Information Society Commission (2005) reveal that over four-fifths of household PCs were connected to the Internet in 2004, up from one-quarter in 1998. Ireland now has 46 PCs and 38 Internet connections per hundred households (ISC, 2005). ICT engagement is broadly consistent within EU averages, with the exception of broadband connectivity where there were only 6 broadband connections per hundred households which was one-fifth the average level in competitor countries e.g. UK (ISC, 2005). Ireland still has some catching up in
extending broadband connectivity across the whole of the country. There are currently no available statistics specifying how many disabled people have access to computers or have Internet connections.

1.1 The scale and impact of the digital divide, with reference to disabled people

There is a recurrent reference in the media to the social and economic 'digital divide' and how marginalised groups are being left behind in the race to become technologically literate (EU, 2005). Contributing factors include lack of affordability, access, accessibility, skills and motivation for the estimated 30 to 40 percent of Europeans not benefiting from the information society with significant differences in access between rural and urban areas (EU, 2006). A key challenge is for governments to help disabled communities to participate more equally in today's 'information society.'

1.2 Government response to the digital divide

Governments consider the Internet to be at the core of e-learning and have been investing heavily in transforming the public sector to establish 'a technology-based learning society' (Selwyn, et al. 2006, p.9). If there is an increasing use of technology, and if this is resulting in an increasing digital divide, then the key issue is to embed it within social inclusion and disability agendas. There is a need to consider the excluding possibilities of technical developments but, more importantly, to pro-actively consider how these developments can foster more inclusive practices in the information building society. Ideally this might even open up new possibilities to technical developments if the new technology is used to liberate people from environments which have excluded them from full participation. This seems feasible given the nascent state of technical development and the fluidity and flexibility of how it moves forward into seamless and less rigid dimensions. However, and in line with discourses around inclusive thinking, it will be argued that these progressive outcomes can only be achieved if the process of development is one of co-creation,
that is, the key groups are themselves a fundamental part of the process of development.

The Irish Government recognises that technology is central to a modern, progressive and successful society, bringing greater employment prospects, boosting productivity, enhancing knowledge and alternative work practices, and providing new ways of communication (Cradock, 2004). Despite this recognition, there is currently no Irish law that specifically covers the accessibility of ICT-based products and services for disabled people. The Equal Status Act (2000) and Employment Equality Act (1998) come closest, but both lack effective compulsion.

The Disability Act (2005) appears to go further, but is unclear in its meaning and commitment to changing the lives of many disabled people. Irish organisations representing disabled persons' interests are becoming increasingly more agitated by the lack of policy that addresses the inequalities in accessing information and learning with the support of ICT. Organisations such as The National Council for the Blind, Ireland (NCBI), the main blind charity in Ireland, in the wake of unclear policy, has decided to set a series of initiatives to help bridge the digital gap for visually impaired people by helping them to procure new technology, receive training programmes on how to use the technology and avail of reliable technical assistance. Unfortunately, limited funding means that many visually impaired people do not receive the equipment and training they need to become independent technology users particularly in rural areas of Ireland.

The Information Society Commission of Ireland (2005) states, that without effective public policy intervention, the uptake of ICT is likely to have the effect of exacerbating existing social divisions. The Dublin Employment Pact (2003) state that 'the key individual-level variables that influence computer awareness, confidence and competence are having a third-level education, being in a low or high social class category, household income and the number of friends and neighbours who are able to provide help and advice in relation to computers and Internet' (Haase and Pratschke, 2003). In spite of the Irish and other EU Governments' commitment to equal access to ICT and the knowledge information society, there are still over 90
million EU citizens who cannot benefit from ICT in full, or are effectively cut off from them because of age or disability (Reding, 2004).

1.3 The ‘challenge’

There is little doubt that the visually impaired community can greatly benefit from the Internet by accessing essential information and services that can change the quality of their life. An increase in the use of the Internet means disabled groups can access information about their rights and affiliate with organisations that promote important issues and policies that concern them. Other benefits include the opportunity to compete on more equal terms by providing a more equal learning and working environment, and the potential for the visually impaired to use technology at home or in the community. Unfortunately, these benefits are not reflected in current employment and training policy. The Central Statistic Office in Ireland reported a decrease in the employment rate for people with a disability from 40% in 2002 to 37% in 2004 despite overall employment growth of 6% over the same period. The Quarterly National Household Survey taken in 2002 and 2004, found that almost one in five disabled people (18%) were self-employed, the majority (75%) of these being businesses with no other employees. Most of those employed (70%) were located in part-time and low paid jobs (NDA, 2006).

The Irish Government (NDA, 2006) reported that the most popular training courses involved computers and that the participants who were most likely to enrol for these courses were male, disabled and aged 20–29 years. Furthermore, most of this training was provided at ‘segregated training centres’ with only 25% of those completing training progressing to some form of employment; in contrast, the comparable figure for those from employer-based training rose to 38%.

New innovations in the design of assistive technology (AT) are helping to reduce barriers to the Internet. This in turn allows the visually impaired to become more independent learners and communicators. There are some key benchmarks provided by international initiatives such as the Web Accessibility Initiative (WAI) which have led to the establishment of standards aimed at ensuring that all electronic environments and content are useable by all. These have also increased public
awareness to the difficulties that the visually impaired community faces in terms of accessing the same information at the same time. Special interest groups (e.g. Visually Impaired Computer Society in Ireland) promoting 'universal design' struggle against reactive approaches to accessibility and the lack of consultation designers have with them when introducing new projects into the public domain.

There is evidence which challenges much current practice as being limited and inadequate (EU, 2006): computer interfaces such as VLEs cannot claim to be adhering to universal design by simply carrying out a few usability tests with visually impaired users. Rather, an approach based on inclusive principles would imply that the process requires continuous collaboration with targeted user groups throughout the process. Thus, at a learning level, web designers and pedagogues will be faced with the challenge of making virtual learning environments (VLEs) maximally accessible to the visually impaired, but this can only be achieved through careful planning and testing. Most importantly, the development of these environments can be achieved through an inclusive process of co-creation supported by inclusive approaches of research and discourse (Walmsley, 2006; Duckett and Pratt, 2007).

The Internet has changed the pattern of employment as greater emphasis is placed on ever higher levels of qualifications and the possession of vocational skills to expanding sectors (e.g. financial and IT service industries) (Selwyn, et al. 2002). Any initiative which would contribute to a boost in the level of vocational training for people with visual impairment in the short and medium term could equip them with the skills that move them away from the stereotypical employment posts e.g. switchboard operator, to new opportunities that help them to build their skills for future learning and career prospects. The development of electronic commerce and teleworking could increase the employment prospects of visually impaired living in rural areas taking up home-based employment. This could be enhanced by working internationally using different time zones e.g. typing medical records for a pharmaceutical company in the USA and sending them to the company for start of business. The consequences of an inclusive process of co-creation of effective virtual learning environments, in other words, does have the potential for significant, concrete benefits for a community that is often excluded from mainstream economic, and hence social, life.
Such is the rate of change and development within educational technology fields that there are always people seeking new ways to deliver curriculum and assessment materials. E-learning provides one route to helping a growing market of learners' access the materials so that learning can occur anytime. More particularly, learning platforms that encourage the least mobile to e-learn may provide a key way of reducing the barrier to learning, it has the potential to vitiate the problems associated with distance, time and restricted mobility.

1.4 Research aims

This research is based on an initial belief that visually impaired people can engage in e-learning provided they have appropriate training to support their learning needs. One way to help ensure that visually impaired people are able to fully participate in e-learning is to involve them in the conceptualisation, planning and testing of potential inclusive learning environments.

The aim of this research is to investigate the potential role of inclusive learning environments in fostering effective learning for visually impaired people. The context of the research explores some of the main advances in the development of e-learning and assistive technology in providing new learning opportunities for the visually impaired.

More specifically it examines the potential benefits of VLEs for people with visual impairment and explores how these benefits can be realised through an inclusive process. This involves particular approaches to e-learning at social, practical, pedagogical and technical levels. It also aims to explore some of the main advances in the use of networked knowledge through the Internet and e-learning and, more specifically, a consideration of how they can provide new learning opportunities for the visually impaired. It also invites the visually impaired community to agree on a set of principles that could be adopted to test whether it is conceptually possible to achieve an inclusive learning environment.
Having developed my ideas through a critique of the relevant literature and discussions with key stakeholders about what inclusive practice might look like, there was an opportunity to examine a live project which was seeking to implement an inclusive strategy. This consisted of determining (a) the extent to which it met the standards identified, and (b) whether there was robust evidence of positive outcomes, and (c) the extent to which any positive outcomes were linked to the espoused underlying principles. The project was set up to address the particular electronic learning needs of a specific population in Ireland. It was felt that they could benefit from a regional programme of innovative actions to develop an 'information society' in the service of regional development of pilot electronic communities.

1.5 Context for the research

This research developed from an interest in the potential for developing an inclusive technology, or an inclusive approach to technological development. This is partly attributed to my experience as a teacher working in the field of special education and assistive technology in Ireland for over ten years as well as subsequent research work. As a result, I have been increasingly drawn to ethnographic approaches involving disabled children, parents and other professionals. Over these years, I have observed how children with moderate and more severe learning difficulties have benefited from new technology to communicate more effectively and participate in learning in mainstream settings. I have therefore developed a strong preference for methodologies that similarly encourage and respect the voices of those who have been marginalised, particularly on issues that affect their rights to quality education. There were, therefore, two elements in my motivation to pursue new research in this field. The first was borne out of my interest in assistive technology and its particular value for disabled children, young people and adults. The second stemmed from an interest in, and commitment to, research methodologies that strive to take account of the issues that concern visually impaired persons.
1.5.1 Epistemological position

My strong interest in assistive technology and learning has led to several opportunities for me to enter into discussions with visually impaired people about issues around access to technology and learning. One of the most striking messages coming out of these informal discussions was the low level of involvement of visually impaired people in consultations about issues that affected them (e.g. accessibility to the Internet). This was at a time when there was much debate around the drafting of the two prominent Disability Acts in the Republic of Ireland: the Disability Act 2005 and the Educating People with Special Educational Needs (EPSEN) Act, 2004. Both acts had been criticised for not considering the views and opinions of all disabled groups in the country. The Disability Act 2005 was particularly criticised for not involving disabled people’s organisations during the initial consultation period, resulting in their despondency and alienation.

New research approaches should take heed from previous experiences that have resulted in the marginalisation of disabled people and move towards ways of involving the voices of the disabled and other often under-represented groups. It is important to remember that the people we are researching are ‘experts’ in their own right. Disabled people are, in a sense, ‘experts’ on their disability and on issues that affect them. Research that raises doubt about the authority of their ‘expertise’ could find itself in conflict with the very issues it is trying to access, that of the views and opinions of the group it is researching. It is my belief that visually impaired people should be invited to take a participatory role in the research process. This research will explore inclusive disability models that support the inclusion of visually impaired people in the research process.

1.6 Definitions of visual impairment

Visual impairment is an umbrella term which is applied to a wide range of visual loss in children and adults. The most common way of defining visual loss relates to clinical measurements of visual acuity and visual field. Visual acuity can be defined as ‘the
ability to discriminate high contact fine detail at a distance; the power of the eye to distinguish form; the sharpness and clarity of vision' (Mason, 1997, p.53). Visual field relates to 'what a person can see from all parts of the eye when looking straight ahead' (p.53). Visual field is measured in degrees, thus a narrowing of the visual field can constitute visual impairment itself.

In the UK and Ireland, clinical measurements of visual acuity are most often concerned with measurements of distance vision based on a person's ability to read letters, numbers or pictures arranged in rows of decreasing size on a 'Snellen Chart' or using the 'LogMAR' (logarithmic minimal angle resolution) acuity test. Each row can be recognised by a person with normal vision at a specific distance of 60, 36, 24, 12, 9 or 6 metres. Subjects are placed six metres from the chart and if they can recognise the items as far down as the six metre row from that position then their vision is recorded as 6/6 or 'normal'. If subjects can only read to the 18 metre row, they are said to have an acuity of 6/18, while those who can read only the top (60 metre) row have an acuity of 6/60. Subjects who cannot read the top row at 6 metres may be moved closer until they can see the chart or test. If they can only see the chart or test at 3 metres, then their vision is recorded as 3/60.

The World Health Organisation's classification (2001) of visual impairment is based on clinical assessments of visual acuity and field:

- **Normal vision**: 6/6 to 6/18
- **Low vision**: less than 6/18 but more than or equal to 3/60
- **Blind**: less than 3/60

Children with visual impairment who rely mainly on tactile methods (e.g. objects) to develop skills in literacy will most commonly come under the WHO classification of 'blind' and are sometimes referred to as 'registered' or 'legally blind'.

The reliability of clinical assessments of visual acuity is often questioned by ophthalmologists and educators because they depend on the child's ability to cooperate and communicate what they can or cannot see to the assessor. Precise
assessments of visual acuity are therefore particularly difficult to achieve in young children with additional learning disabilities.

1.7 Outline of the thesis

The conceptual context of the research will be explored by examining the main concepts and theories around visual impairment and the impact it has on learning. It also raises issues around accessibility and how barriers to technology can be overcome and explores the difficulties around building flexible, inclusive and supportive learning environments that promote the kinds of learning endorsed by social constructivist theories. It will then expose some of the main discourses around disability research and social inclusion with a focus on exploring a framework for conducting research with visually impaired people. The methodology and procedures are then described from which a three-stage enquiry process is delivered and analysed. The implications of the findings will be explored and conclusions and recommendations for future research and practice will be drawn.
Chapter Two – Literature Review

2.0 Introduction

The aim of this research is to investigate the potential role of inclusive learning environments in fostering effective learning for visually impaired people. The context of the research explores some of the main advances in the development of e-learning and assistive technology in providing new learning opportunities for visually impaired people. The review also explores the conceptual possibility of exploiting new technological developments that promote an inclusive e-learning environment for visually impaired adults. It also considers the practical issues involved in trying to construct an inclusive process of developing virtual learning environments and whether they can enhance the learning opportunities for visually impaired students.

The review is organised into ten sections (gathered into three broader areas) which are presented in turn:

The visually impaired person
1. The role of vision
2. Visual impairment in adulthood
3. Learning theory and visual impairment

Learning and learning media
4. Introduction to e-learning
5. Situated learning in communities of practice
6. Blended e-learning
7. Virtual Learning Environments (VLEs)

Visually impaired people’s access to learning
8. Accessible technology for visually impaired people
9. Introduction to Assistive Technology
10. Developing technology solutions to enhance the learning of visually impaired people.
The review begins with three sections in relation to 'the visually impaired person'. Firstly key concepts and theories of vision are explored. This leads to a discussion of how children who have no vision acquire conceptual development and language through different auditory, tactile and environmental stimuli. This includes ways that visually impaired children develop strategies to process non-visual information through other senses. This section focuses on the development of children, as much of our development in the early years affects our adult lives. It therefore naturally leads into a second section exploring visual impairment in adulthood through personal testimonies. The third section considers some of the principle learning theories connected with social constructivism and how they can be applied to learning and teaching contexts for visually impaired children. This includes some preliminary investigations into ways in which adults, (drawing principally on the work of Vygotsky, 1978; 1993) can support or 'scaffold' visually impaired children's learning. This will lead to a brief review of some of the expected learning outcomes from cooperative learning and the development of higher-order skills.

The review then presents four sections in relation to 'learning and learning media'. It first explores the constantly evolving domain of what is broadly called 'e-learning'. This is discussed in greater depth throughout the section on 'situated learning in communities of practice', 'blended e-learning' and finally 'Virtual Learning Environments (VLEs)'. This provides a backdrop to the final sections that investigate issues around accessibility and how to overcome the technical barriers that result from poor design and lack of consultation with end-users.

Finally then, the review presents four sections in relation to 'visually impaired people's access to learning'. These sections review firstly the philosophies and broad approaches and arguments in relation to accessible technology and disability generally, and visual impairment in particular. The next section then focuses upon some of the technical solutions through an exploration of the assistive technology which helps to bridge the gap between mainstream computer interfaces and the visually impaired community. The final review section identifies examples of where assistive technology has been used to help visually impaired learners access the Internet and e-learning for studying purposes.
The chapter conclusion revisits the emerging research questions that grew partly out of the literature as well as the framework for disability research which is discussed in the following chapter.

2.1 The role of vision

'Vision' undoubtedly plays an important role in receiving information about the physical environment. Hardman, Drew, and Egan (1996) consider the visual process to be a way of gaining information beyond the range of other senses while also helping to integrate the information acquired primarily through hearing, touch, smell and taste. Vision enables us to construct a coherent sense of the physical world and our place in it, without struggling to remember (Webster and Roe, 1998). Webster and Roe (1998) state that research evidence accumulated over the past twenty years shows that vision plays an extremely important role in shaping early adult-child interactions, as well as providing information through which the world can be organised and categorised and through which a child can develop language.

Several theories of child development assume that information is processed primarily through the visual modality and that, in the absence of such information, certain developments will not take place. Other theories posit the doctrine of the vicarious (substitution) of the sensory organs which is built into a mechanism of compensation sometimes referred to as the 'sixth sense'. Experiential psychology has helped to resolve the dispute of how other senses are affected by the 'defective senses'. Vygotsky (1993) argues that the world of nature enters to a greater degree through the eyes than through the ears and 'the world is organised more as a visual phenomenon than an acoustic one' (p.104). In spite of this statement, Vygotsky believes that the education of a blind child 'must in actuality be organised on the same terms as education of any child capable of normal development' (p.108). I will be exploring Vygotsky's theory in relation to his work on children's use of psychological tools and their impact on memory and learning in section 2.3.2.
The next sections explore the ways that visually impaired children develop a sense of their environment through touch, sound and tactile modalities.

2.1.1 The role of touch and the environment

Webster and Roe (1998) state that vision is implicated in all areas of children's development as 'a co-ordinating and integrating sense' (p.68). Children who can see do not have to touch objects to be aware of their existence and therefore can begin to learn much earlier (before they are mobile). Some objects are too big to be understood by touch (buildings), some are too small or too fragile (soap bubbles). Webster and Roe conclude that 'representations of objects or space achieved through sensory modalities other than vision may be less detailed, accurate, precise or continuous and make greater demands on recall' (p.70).

Although touch is a very important source of information about the environment for visually impaired children, there are limitations to 'tactile perception' (Warren, 1994, p158). Touch requires children to search objects and move to locations to discover objects' characteristics. Warren states that representations of objects through touch require small fragments of information, acquired serially, to be put together to form a whole image (p.69). By adding together impressions gained from touch, taste, smell and sound, children are able to develop 'sensory pictures' (Miller, 1992) that can be developed. McLinden and McCall (2002) argue that schools assessing the individual needs of 'blind' students tend to place a stronger emphasis on tactile and auditory learning and will require specialised equipment to enable students to access the curriculum. Many of the children's curricular needs are likely to include aspects of socio-linguistic interaction and conceptual development, mobility and personal independence, use of Information and Communication Technology (ICT), and braille. There is some consensus among experts in the field that the onset of blindness, whether at birth or after birth through illness or accident, influences the way a child learns (Preisler, 1997; Fogel, 1997). Fogel (1997) believes that, even if all the senses are functioning, they cannot be considered as equivalent. It is not possible to gain exactly the same information from a different sense as they all have 'experiential features that are different from each other' (p.86). We can try and 'almost' obtain a
similar experience of an object through touch but not with the same in-depth knowledge. Fogel (1997) elaborates this argument further by saying, ‘touch is a sequential sensory system, whereas vision is a simultaneous and continuous sensory system’ (p.87).

Depth is seen, whole objects are seen, multiple shapes are seen, one shape can be seen to include another shape. Vision has a continuous flow that includes colour and depth, closeness and distance, and a quality of immediacy that the other senses do not have (p.87).

A vital aspect of young children’s learning is potentially under the control of parents, carers and professionals. Warren (1994) argues that ‘a stimulating learning environment facilitates the acquisition of cognitive abilities’ (p.94). He says that evidence from a number of studies comparing children from different school settings, shows that it is not the school itself that is important but the variables that tend to accompany the child’s educational situation. He provides some examples of these variables such as the nature of the school curriculum, the child’s participation in it, the use of time at home and the expectations held for the child’s cognitive growth and educational progress. He concludes that while factors such as early visual experience and residual visual function are not amenable to change, other variables under our potential influence have an equally great impact on the course of acquisition of conceptual development.

2.1.2 The auditory environment

Sounds are a valuable source of information for all individuals with visual impairment, enabling them to understand what is happening and to orientate to the surroundings. Webster and Roe (1998) say that the ability to attend to sound stimuli, ignore competing sound and distraction, and make sense of events involves a complex hierarchy of skills that depend on experience and training. They consider the classroom environment and how teaching professionals can design spaces that are easily understood and to provide discrete, identifiable sounds which are helpful for
2.1.3 Integration of information from different sensory modalities

There is extensive literature on sighted children regarding issues of inter-modality, particularly when information is received from two or more sensory modalities (Jordan, 2001). Visually impaired children who do not have vision are able to draw on inferences from the perception of spatial structure (Warren, 1994). O'Connor and Hermelin (1972) argue that blind children do not naturally encode spatially distributed auditory information in terms of its spatial distribution. In terms of information-processing strategies applied to spatial and other tasks, Millar (1982) argues that there is nothing inherently different in the information-processing capabilities of blind children, but rather that preferred strategies develop as a result of the typical ways that children gain their primary information. This may lead blind children to neglect external cues which in turn will mean they will learn less and know less about directional connections between external cues. This, then 'strengthens the preference for strategies derived from the remaining modalities' (1982, p.119). Warren says that the blind child may have external spatial-referential strategies available but tend not to use them because the primary source of spatial information (touch) tends to elicit internally referenced strategies.

2.1.4 The acquisition of cognitive skills

It is generally agreed that our immediate contact with the physical and social environment comes through our senses. However, we are not restricted to the information available at any one moment. We have the ability to remember events from prior experiences, and learn about situations by expressing them. Warren (1994) argues that language is primarily a means of social communication and a cognitive skill, and can serve to guide children through a complex set of operations and help to keep them on task. He also argues that language can serve to arrange concepts in relation to one another and to mediate reasoning. What is important is to consider whether there are specific effects of blindness on language learning, and, if so, what
are they? Landau (1997) considers this correlation and states that no studies have reported that the blind child has difficulty learning the syntactic structure of his or her native language. She argues that as far as is known, 'the growth of syntax in blind children occurs roughly on time and develops normally in terms of using nouns and verbs, their morphology and syntactic frames' (Landau and Gleitman, 1985, p.13).

Landau (1997) also argues that blind children do not appear to have difficulty learning the syntax of their native language, nor speaking in sentences that have meaning. She says that this indicates one of two things about the role of visual experience in the acquisition of language. She suggests that interpretations of heard sentences are not critical in the construction of syntax. This seems doubtful, as language comprises 'the mappings between form and meaning, and blind children, like sighted children, produce new combinations of words that have unique meanings' (p.15). She supposes that if meanings are not based on visual experience, then the critical experience for learning a language is not embodied in the experience of seeing.

This is not to claim that 'a blind language learner is in all ways equivalent to the sighted' (Locke, 1997, p.26). Locke raises this problem when children experience delays in their language development. He says that sighted children can draw on vision as a compensatory possibility that can be exploited naturally by the child. However, if the child is blind, the compensatory possibilities are diminished. These conclusions are based on small studies carried out between ten and twenty years ago, but are helpful in providing some background information about the different complexities involved in learning concept development and language when children are blind. Additionally, it provides some useful insights into how visually impaired children develop strategies to process spatial and echoic information, occasionally through the use of echolalia and from their environment through the use of tactile perception and sound including human voices (Locke, 1997).

More recent research into how blind children learn braille revealed signs of superior memory performance (Pring, 2008). She found that children's 'sound based' approach to learning helped to explain their relative facility with developing literacy, but it was not easy to understand why their short-term memory seemed so good. Pring noticed many 'memory-related' situations where blind children (and adults) outperformed those with sight (p.162). There does not seem to be any definitive
explanations as to why such memory advantages should occur. However, Pring speculates that relatively greater resources are allocated to auditory processing for those without vision, and 'this greater attention to effort is likely to lead to better retention of the material' (p.162). She puts forward the view that the increased attention to such material may be to store it for longer-term retrieval in a 'verbatim form' – a memory strategy that might be far less common among sighted people.

Recent studies of individuals with congenitally profound visual impairment show processing of speech is faster than in sighted people (Roder, et al. 2000) and there is also a better discrimination of speech in the context of a noisy room compared to sighted people (Muchnik, et al. 1991). Pring (2008) explains that verbal learning depends on short-term working memory which 'deals with the storing of sequential information ready to be further analysed by semantic and conceptual knowledge into our long-term memory' (p.162). Finally, Pring stresses the point that 'accurate recall is not the same thing as greater intellectual knowledge – it is a different kind of knowledge' (p.163). She says there is uncertainty about how to best capitalise on the memory advantages in a variety of settings for children and adults, but perhaps this capacity could be generalised to instances where accurate recall is helpful e.g. using a computer.

The psycho-social development of visually impaired children and how they acquire language and the ability to read through touch e.g. using braille or haptics (i.e. technology which interfaces the user via the sense of touch by applying forces, vibrations and/or motions to the user) has become an important area for educationalists and psychologists in understanding how children develop literacy through touch.

If we make some tentative assumptions that visually impaired children (without additional disabilities) are able to acquire cognitive skills through the encoding of auditory information and the application of information-processing strategies to different tasks such as spatial awareness through touch and sound, we can start to think about how issues of inter-modality could be addressed by using ICT.
If critical learning experiences of concept development and language are not embodied through vision, but through other modalities (touch and sound) then educationalists need to consider ways of maximising access to learning through multiple modalities including the use of multi-media. It is therefore useful to contemplate how these modalities can be constructed using different modes of technology and new teaching strategies. These will be considered later when we discuss virtual learning environments and e-learning.

2.2 Visual impairment in adulthood

Many of the examples in the previous sections refer to children's development and visual impairment. It is useful to consider how adults who developed blindness in their adult lives adopted different strategies to cope with the loss of sight. Studies suggest (Dulin, 2008; Hollins, 1985) that recently blind people are able to hold visual images for several years before visual elements progressively change along with the loss of sight. These visual elements are progressively replaced by a representation based on haptic experiences. These findings seem to correlate to some of the personal testaments of adults who developed blindness in their later lives and how it has impacted on their ability to recall visual information.

The past twenty years has seen an increase in the number of personal testaments from people who developed blindness at different stages of their adult lives. This increase in personal narrative helps us to acquire a better idea of how people are able to create mental images even though they developed blindness ten or twenty years earlier. Some of the better-known testimonies include those by Hull (1992), Magee (1998) and Torey (1999), each one a moving account of how they developed coping skills and new mental capacities thought to be impossible. Researchers in the field of blindness could consider using the qualitative approaches such as self-studies to learn more about the impact of sight loss on adults. These are subjective and therefore are limited in their generalisation, but listening to personal accounts could help seed theories and frameworks that could ameliorate the impact of deteriorating eye conditions such as Retinitis Pigmentosa or Aged Macular Degeneration.
2.2.1 Blindness and personal testimonies

Hull recounts how he coped with going blind in his forties. His personal tale is interpreted by Oliver Sacks (2003). Sacks submitted a full article to the New Yorker, later published in the Sunday Telegraph in 2003 where he talks about his interest in the effects of ‘sensory deficit and deprivation’ and about the neurological effects sensory deprivation has on the brain. He was profoundly affected by an extraordinary book entitled ‘Touching the Rock: An Experience of Blindness’ (Hull, 1992). This journal, dictated over a three-year period soon after Hull became blind at the age of 48, recounts how he experienced a gradual attenuation of visual imagery and memory and finally a virtual extinction of them. Hull calls this a state of ‘deep blindness – an authentic and autonomous world, a place of its own’ (p.45). For Sacks (2003) there is a struggle between what he calls ‘simple visual imagery’ – the ability to see a design of a screw or an engine – and the higher and more intimate powers of the imagination – ‘where there is a continual struggle for concepts, form and meaning, a calling upon all powers of the self’ (p.11). He considers imagination to be the ‘vision’ that creates or constructs our individual worlds. For Hull, blindness becomes ‘a dark, paradoxical gift’ which is not just a ‘compensation’ but ‘a whole new order, a new mode of human being’ (p.54).

In ‘The Crucible of Consciousness’, Torey (1999), an Australian psychologist with a visual impairment, explains how he uses his brain to see. Torey ‘switched from a visual to an auditory mode of adjustment’ and developed what he calls an ‘inner eye’. When it became clear that he would have to live his life as a blind man, Torey was advised to rebuild his representation of the world on the basis of hearing and touch and to ‘forget about sight and visualising altogether’. Torey maintained a scientific attitude to his images by every means available. He created an internal ability ‘to imagine, to visualise,’ arriving at a solution to the brain-mind problem by characterising the brain ‘as a perceptual juggling act of interacting routines’ (p.49). If we consider the whole psychological system of perception, cognition and emotion, we are likely to see very different kinds of ‘normal development’ in the blind compared to those in the sighted. If blindness is not an impairment, but rather an entrée into a
different culture, then we need to consider what it is like for a person with a visual impairment to suffer the superiority of the *sighted culture*.

Over the centuries, famous blind philosophers such as Diderot, Homer and Virgil have informed us about blindness. In *Memoirs of the Blind*, Derrida (1993) discusses the concept of seeing beyond the superficial, referring to writers and poets such as Milton, Borges and James Joyce. Derrida talks about Milton becoming blind early in his career and how he 'would have received blindness as a blessing, a prize, a reward, a divine 'requital' (p.7) For three centuries, philosophers have held that knowledge derives from experience. If so, it may be possible that despite, or because of, a lack of visual perception, people with visual impairment know the world in ways that differ from the rest of us.

Curious about this possibility, Magee (1998) began to correspond with Martin Milligan, former dean of the philosophy department at the University of Leeds, and himself blind nearly since birth. In the collection of letters, entitled *On Blindness: Letters between Bryan Magee and Martin Milligan*, Milligan discusses the notion of 'sight' and hypothesises about it being absent in all humans. Through sometimes heated discussions and rebuttals, Milligan asserts that people blind from birth do not 'live in a world of darkness,' that they don't even have a sense of what darkness is, nor would many of them want their sight restored. Diderot, Descartes and Virgil discussed the question of what it is like to be blind and its direct comparison with the sense of vision. Magee (1998), referring to a *Letter on the Blind* by Diderot, asserts our curiosity about sight given to those who were born blind:
...a greater gainer [would be found] by questioning a sensible blind man. We should learn the state of things in him, and could compare them with the state of things within ourselves; and perhaps we might from this comparison come at the solution of the difficulties which made the theory of vision and of the senses so intricate and so uncertain (p.121).

British psychologist, Fogel (1997), has referred to his struggle with losing sight as 'liberating simultaneity and spontaneity' (p.96), something that he has never fully trusted. He says that by being blind he 'might learn to see beyond the superficial, given so glibly by vision' (p.96). He does, however, acknowledge the difficulty he will have forfeiting the 'privilege of appreciating the beauty of the visual world'. This will entail giving up a certain amount of self-sufficiency considered to be more of an expectation in today's society. Fogel is philosophical about his future, which he hopes will provide him with a world where he can return to his childhood.

These different personal testimonies give some 'insight' into the complexities around coming to terms with vision loss and blindness. Fogel and Torey's perspectives are particularly intriguing as they consider blindness to be at a superior level than being sighted i.e. an entrée into a different culture. The state of blindness could give a sense of relief and liberation to those who have struggled with visual problems most of their lives. On a philosophical level, the experience of blindness allows a person to experience the world completely differently from the rest of humanity, creating almost a 'savant' status. This highest level could be the attainment of one's full potential as a human being. If we compare the fifth of Maslow's hierarchy of needs (self-actualisation), a blind person has reached what he calls 'self-actualisation' which is one of 'truth, 'justice', 'wisdom' and 'meaning'. Maslow (1954) believes that unlike lower level needs, this need is never fully satisfied; as one grows psychologically there are always new opportunities to continue to grow. He argues that only a small percentage of the population reaches the level of self-actualisation. Perhaps the blind fall into this small percentage.
2.2.2 Educational attainment and onset of visual impairment

Taking a more empirical view on educational achievement and onset of visual impairment, Douglas, et al. (2006) have found that in terms of educational achievement, onset of visual impairment at an early age was associated with higher educational achievement. They do not have an explanation for this result, but suppose this could reflect the positive impact of early intervention strategies on educational access. They also posit that it may also be associated with other difficulties including the emotional impact of developing a visual impairment. Furthermore, for participants whose onset of visual impairment was after school age, 13% had since been involved in formal education. The majority (74%) had attended adult education classes and 5% had attended ordinary colleges of further education. Interestingly, the majority of participants (68%) who were of working age (18-29) said they wanted to continue in formal education or had intentions of pursuing formal education or training. In total 80% of all visually impaired people did not wish to follow any further formal education. These findings tentatively provide some useful data about levels of education when considering the onset of visual impairment in Great Britain. It is difficult to determine whether there would be similar findings in Ireland in terms of education levels and onset of blindness, but the high level of visually impaired people not wishing to follow any further education could be a cause for concern for the Irish government, particularly after implementing the Employment Equality Act (1998) and more recently the Disability Act (2004).

The next section considers some of the theories around the new modes of learning and the wider concept of the visually impaired learner that have evolved in recent times.

2.3 Learning theory and visual impairment

Socio-constructivist approaches are said to have implications for understanding processes of learning and teaching visually impaired children (Webster and Roe, 1998). They focus on the processes by which children’s thinking and development
are involved in different forms of joint problem-solving or enquiry. What is important is that the skills and procedures of thinking are generic to all situations or exclusive to one group of children in contrast to another. This section explores the theory around social constructivism, primarily discussing the work of Vygotsky and other cognitive constructivist perspectives (Piaget, 1971; Warren, 1994; Jonassen, 1996; Webster and Roe, 1998). It also provides a backdrop for later consideration of theories associated with e-learning and could be helpful when trying to understand the complexities of introducing e-learning to visually impaired people.

The cognitive constructivist perspective has its basis in Piaget's (1971) notion of learners constructing their understanding of the world through interactions between their previous understanding and their new experiences of the world. He argued that learning can occur through assimilation, which suggests that a learner will have a richer understanding of a concept when they have experienced a broad range of examples and draw these into their understanding of that concept. The notion of accommodation suggests that learners' conceptual structures will be expanded, modified and made more sophisticated when they encounter unexpected experiences that reveal the inadequacy of their existing thinking (Seddon and Postlethwaite, 2007). The main implication of applying Piaget's method is around the idea that the child is a solitary thinker struggling to put together a personal account of the logical properties of the physical world, through self-directed exploration (Webster and Roe, 1997).

Furthermore, a child without vision may be unaware of many of the interesting things around them and may not reach out to grasp objects in exploratory play (Warren, 1994). Warren argues that as the result of visual information, there are likely to be delays in a wide range of understandings about the physical world: object permanence (when objects continue to exist even when the sensory evidence has disappeared); causality (the effects of a given action on objects); and space (how the physical spaces are structured and occupied by objects, including the relationships between objects).

What is probably more important is how Piagetian theoretical accounts have led to new interpretations of how children think and interact with the social world through
experimentation and socialisation. This shift in perspective has drawn on the work of theorists such as Vygotsky (1994) and other social constructivists (Kolb, 1984; Rogoff, 1991). These theorists have been useful in analysing the nature of adults' scaffolding of children's thinking and enquiry.

2.3.1 Social constructivism and scaffolding

The socio-constructivist approach to learning (Bruner, 1986; Rogoff, 1991) dismisses the view that in order to learn more about how children think and learn, we need to focus on individuals and their solitary problem-solving. They argue that children do not grow up in isolation and that their development is driven from within the individual (Webster and Roe, 1998). Social constructivism also argues that children's thinking and learning is tied to specific contexts of social practice and that learning is based on the mastery of these. They argue that researchers should investigate the interactions between the visually impaired child and the adult to achieve specific goals using tactile tools. Constructivists consider this learning within a framework of language-centred activities that enable the child to think and experiment and problem-solve. One of the most important ideas in social constructivism is that of 'scaffolding'. This is where the adult sets up environments and activities that allow for co-operation, negotiation and guided participation. Through social interaction with adults or mentors, children are exposed to practices and models of how others problem-solve and manage their thinking (Warren, 1994).

Scaffolding is a way of understanding the supportive environment that is created for children's learning. Another dimension of this approach is to help children to represent tasks in terms they understand, clarifying and affirming elements, reducing the complexity of the steps involved to create manageable tasks (Bruner, 1986; Kolb, 1984). Reducing the task into manageable steps helps to ensure the child's experience is successful, but also draws attention to key points of information, reminding the child about the problem to solve and giving prompts, suggestions and possible shortcuts. The scaffolding approach is more difficult to use with visually impaired children because of the potential reduction of opportunities for exploration, collaborative play or risk-taking, possibly as a result of over-protection or lack of
individual stimulus. Some research shows that limited language interaction and cognitive development strategies offered by adults could impact negatively on a blind child's development (Andersen et al. 1993). Difficulties arise when visually impaired children do not respond in the expected way, particularly when a child has underdeveloped language skills or lacks the semantic specificity to understand the social context adequately. Adults' inappropriate use of language could also reduce a blind child from grasping the concept or situation, especially when it is too visual or too abstract to understand.

2.3.2 Development of psychological tools for the blind

Vygotsky (1993) has been one of the most influential of all social constructivists. His theoretical approaches have been quoted and sometimes misquoted, partly, as a result of poor translation or interpretation (Tudge and Scrimsher, 2003) for more than sixty years. His perspectives on the education of disabled children underwent significant changes over his lifetime (Tudge and Scrimsher, 2003). Vygotsky produced an incredible amount of work but it is his work on the area of defektology and blindness that is of most interest in this discussion. He initially believed that speech (or possibly language) could serve as a replacement that would allow blind children to compensate for their impairment. This viewpoint changed under the influence of Adlerian psychology (van der Veer and Valsiner, 1994). This consisted of finding ways to develop 'super-compensation' or a supporting 'superstructure' that would allow alternative means 'not simply to replace the lack of sight but to bring about a restructuring of mind to reach these goals (Tudge and Scrimsher, 2003, p.210). Vygotsky (1993) also raised the limitations of traditional sensory-motor training, claiming that pure biological compensation (e.g. superior hearing in the blind) was an exception rather than the rule, while the domain of higher psychological activities has no limits: 'Training sharpness of hearing in a blind person has natural limitations; compensation through the mightiness of the mind (e.g. imagination, reasoning, memorisation) has virtually no limits' (p.212). He later argued that deaf and blind children had not been enabled to experience the 'cultural development of normally developing children' (p.211) and his response was for the mainstreaming of these children with their 'normal' peers.
Vygotsky (1993) discusses more specifically the child entering life blind and believes it necessary not to deal with blindness itself. Efficient compensation for the loss or weakness of natural functions can be achieved through what he calls ‘the development of higher psychological functions’ (p.81). While there may be an impairment of the natural processes of vision, audition and psycho-motor skills, remaining intact are the objects of rehabilitation, the cultural processes of abstract reasoning, logical memory and voluntary attention. The development of innovative signs to accommodate a visually impaired person’s unique way of acculturation is through the continued research and development into special psychological tools. Vygotsky considered these tools as primarily taking the form of braille for the blind. He talked about ‘different symbolic systems’ that correspond to one and the same content of education – meaning is more important than sign (p.54). Wertsch and Tulviste (1992) argue that Vygotsky’s position in terms of psychological tools and how they are used in the cultural world of higher mental processes has helped to increase our understanding of how sensory impaired children learn. Vygotsky believed that participation in a world of cultural tools does not facilitate processes that would have developed regardless, but transforms mental functioning (Wertsch and Tulviste, 1992). Vygotsky (1993) considers our involvement in the socio-cultural world to be what makes children human, by ensuring that they develop higher mental processes.

Vygotsky’s work has left a hallmark on how education is constructed and delivered in classrooms and through the construction and delivery of other learning environments (through e-learning domain). It is important to point out that the core of Vygotsky’s theory lies in the sense that children, and ultimately adults, must be actively involved in teaching or learning relationships with more competent others who both learn from children and draw them into a bigger relationship in their cultural world. Vygotsky in his later years considered it incorrect to think that a blind person belongs to a special category of persons, if this categorisation is based solely on the psychological appearance of the individual. Rodney (2003) argues that ‘blindness is not a disorder but a normal condition for the child’ (p.23). He says that the child’s experience of blindness depends on the realisation or impact of the disability in the environment. Rodney (2003) argues that Vygotsky predicted that in the future we would be ashamed to use the term ‘impaired child’. He says that socialisation and cultural
inclusion override the physical impairment and, in a sense, make the term 'defect' incomprehensible. This argument about the categorisation of 'impairment' and its relationship to 'disability' and social inclusion is discussed in more detail in chapter three when I explore the implications of using medical and social models of disability in describing the two terms.

The next sections discuss other key areas associated with constructivist learning and its aim to develop critical thinking and the application of higher-order thinking (Resnick, 1987) through the use of cognitive tools (Salomon, 1993, Perkins, 1993), and the introduction of communal constructivist theory proposed by Holmes and Gardner (2006).

2.3.3 Developing critical thinking and higher-order thinking

The development of critical thinking is closely linked with the process of enquiry which involves the processes of reflection and discourse (Garrison and Archer, 2000). Garrison and Anderson (2003) associate critical thinking with 'cognitive presence'. They describe this 'as the extent to which learners are able to construct and confirm meaning through sustained reflection and discourses in a 'critical community of enquiry' (p.28). In essence, cognitive presence is a condition of higher-order thinking and learning. This model has been adapted from Dewey's (1933) reflective thinking model which has practical value in that it deepens the meaning of our experiences and is a core educational aim. Garrison and Anderson (2003) argue that critical thinking 'both authenticates existing knowledge and generates new knowledge' (p.56). They also argue that critical thinking is synonymous with enquiry in the sense that it is not self-evident. They see an overlapping of public and private worlds helping the individual to make sense of concepts such as creative thinking, problem solving, intuition and insight (Garrison and Anderson, 2000). Pedagogues seek to understand the cognitive processes in order to allow them to design more natural and less contrived educational experiences that recognise how individuals reconstruct experience and construct meaning and not simply concentrate on assimilating facts and figures. Creating cognitive presence for visually impaired students to engage in all levels of enquiry is a challenge for pedagogues who cannot assume that these
students have had the same exposure to enquiry processes as their sighted peers. This may be achieved through careful construction of the phases students are expected to follow using discourse and reflection at each phase until they have achieved higher-order learning outcomes.

Jonassen (1996) takes a practical perspective of critical thinking as 'the dynamic reorganisation of knowledge in meaningful and usable ways' (p.29). He says that it consists of three general skills: evaluating, analysing and connecting:

- **Evaluating** involves making judgments about something by measuring it against a standard. It involves recognising and using criteria in different instances. Recognising criteria is important when it is unstated; otherwise, the learner is required to use a publicly available set of standards. It is important that learners be able to determine which criteria are appropriate.

- **Analysing** involves separating a whole entity into its meaningful parts and understanding the interrelationships among those parts.

- **Connecting** involves determining or imposing relationships between the wholes that are being analysed. Connecting compares and contrasts things or ideas, looks for cause and effect relationships and links the elements together.

Jonassen (1996) argues that the most effective ways of ensuring individuals can achieve all three skills is through cooperative learning. This is more than just sharing the same space or assignment but in order for cooperation to be successful, it should include these four elements: interdependence; face-to-face interaction; individual accountability and interpersonal skills. He concludes that collaboration is a method of learning that students use, especially when teachers insist on conveying their own interpretations of the world. He says that 'cooperation works because responsibility is spread out and because other group members support the performance of the group' (p.35). It would be useful to explore how these three skills could increase the learning performance of visually impaired learners when enquiry processes and experiential learning are different to sighted learners. There is, however, a danger that teachers' interpretations of the world could reduce the effectiveness of the learning experiences of the students if they are unable to 'strengthen the preference for strategies derived from their remaining modalities' (Millar, 1982). Teachers could consider ways of
maximising opportunities for visually impaired learners to reorganise knowledge in meaningful ways and increase their critical thinking skills.

Stahl (2005) discusses the nature of group perspective and how this affects group meaning and individual interpretation. He argues that shared meaning can only be inferred from ‘retrospection and from interpretation of people’s speech and behaviour, whereas socially shared meaning can be observed in the visibly displayed discourse that takes place in group interactions, including non-verbal communication and artefacts’ (p.80). He believes that a group meaning is constructed by the interactions of the group’s individual members, not by the individual members on their own. What is interesting to note in Stahl’s argument is that knowledge is interactively achieved in ‘discourse’ and may not be attributable as originating from an individual.

The use of discourse to interactively achieve new knowledge through group exchanges is considered in a slightly different perspective by Salomon and Perkins (1998) who compare the shared learning as a sort of ‘distributed cognition’. They see this process as a team whose collective performance improves as a result of its members’ individual learning, ‘a variant on the whole being greater than the sum of the parts’ (Holmes and Gardner, 2006, p.84). Salomon and Perkins distinguish between learning with others (the individual learns with and for the team) and learning for others (or learning as a result of the process). The former addresses the goal of a participative, collective learning while the latter is an individualised, acquisition of learning. This model of learning could be helpful for visually impaired learners who wish to develop new skills that other visually impaired people possess. Lynch et al. (2005) suggest that visually impaired people are encouraged to draw on their learning experiences and to create a more balanced relationship between themselves and non-visually impaired people. This framework links closely with the emancipatory disability framework which actively encourages disabled people to discuss their experiences, narratives and stories in ways that empower them (Hunt, 1981; Oliver, 1992). Communal constructivist principles of creating new knowledge for and with others could be associated with the emancipatory model to the extent that visually impaired learners are willing to contribute their experiences and communal knowledge in a permanent form for the benefit of existing and future learners (Holmes and Gardner, 2006).
This model is investigated later when I explore the area of e-learning and virtual learning environments for the visually impaired community.

Summary

The previous sections reviewed some of the theories connected to social constructivism and how this approach builds on socially constructed meaning. While it may appear that some learning is an individual accomplishment (Piaget), in fact, even 'alone', the individual relies on and is influenced by socio-cultural tools, signs and symbols to make sense and produce learning outcomes. The social constructivist theories are potentially useful when exploring ways of introducing e-learning principles to the visually impaired.

The next section introduces the concept of e-learning and some of the collaborative approaches that support this type of learning.

2.4 Introduction to e-learning

There are many definitions of e-learning, but the UK Government organisation – Joint Information Systems Committee (JISC) defines e-learning as 'learning facilitated and supported through the use of information and communications technology' (2007). It can cover a spectrum of activities from the use of technology to support learning as part of a 'blended' approach (a combination of traditional and e-learning approaches), to learning that is delivered entirely online. Whatever the technology, however, learning is the vital element (JISC, 2008).

E-Learning extends traditional ways of teaching students, offering both learners and teachers the opportunity to experience learning through virtual environments that do not just hold information but promote further exploration and application of information and knowledge (Holmes and Gardner, 2006). Perhaps e-learning's best asset is three-fold: it provides learners with as much choice as possible in the most economical way and at a pace chosen by the learner.

- 39 -
Garrison and Anderson (2003) say that creating an e-learning experience involves 'a serious commitment to understanding the very different features of this medium and the ways it can be used most advantageously to impart learning' (p3). With the power of the Internet, the teaching and learning transaction is exposed to incredible amounts of information. The exposure is a tremendously powerful attraction to teachers and learners; however, its engagement may not always be effective nor efficient (Garrison and Anderson, 2003). They also argue that the goal of quality e-learning is to blend diversity and cohesiveness into a dynamic and intellectually challenging 'learning ecology'.

The disadvantages of e-learning, of course, lie in its lack of face-to-face immediacy; it reduces the amount of physical presence in the classroom and depends more on people corresponding and collaborating through time and space. On one level this could disadvantage visually impaired learners who prefer face-to-face learning. The uploading of lecture material could increase learner dependence on the Internet and possibly lead to a reduction in thinking and enquiry skills. One of the difficulties tutors have when designing and implementing an e-learning environment is to make sure there are appropriate levels of 'social presence' (Anderson and Garrison, 2003), which support the content and the reinforcement of the educational goals, and produce the intended higher-order learning outcomes of all visually impaired learners. Some university departments are able to integrate e-learning into their programmes without any real shift in staff attitude, while other departments are more cautious about e-Learning and question its benefits.

Due to computer technologies, we now have much greater access to information than we can manage. We therefore need to draw on what Garrison and Anderson (2003) call the 'transformative power and capacity' (p.3) of e-learning. They argue that e-learning needs to be more than a medium to conveniently access content if it is to have a significant place in education. Institutions of higher education gradually recognise the relevance of e-learning in delivering third level degree programmes. Most universities have designed e-learning strategies, which are slowly being adopted in various schools and departments at different levels. Decisions still need to be made on how these strategies should be implemented across university faculties and colleges.
The rise of the "information age" and networked knowledge means that anyone can access information at any time. Students can 'attend' online lectures during and outside of the university term. The e-learning environment provides space for students to access various forms of electronic materials including lecture notes, power point presentations and readings. Thus, the most prominent skill demanded through e-learning is self-directed learning, the management of learning both technically and cognitively. This could be helpful to visually impaired students who are unable to travel to learning institutions on a regular basis.

Self-directed learning, coupled with critical thinking skills, provides the theoretical mechanism for designing and implementing meaningful educational practice. Teachers and lecturers have to learn to cope with the complexities of new technologies. In order to do this, they require a set of guiding principles intended to create a supportive 'critical community of enquiry' which, according to Garrison and Anderson (2003), is the core e-learning framework.

Despite the acknowledged benefits of e-learning, it does not mean that we turn our back on traditional educational values and practices. E-learning has the capacity to enrich the traditional arenas for learning such as the lecture theatre or the tutor's office. As the demands change, we expect individual learners to become more independent thinkers, and at the same time become interdependent and collaborative learners. At its best, e-learning encourages personal reflection and public discourse within a community of learners, a fusion of individual (subjective) and shared (objective) worlds.

There are different types of e-learning environments, which range from providing information to engaging learners in complex interactive activities. There are varied advanced features in use by e-learners including podcasts, video, graphics and live broadcasts. Some of these modalities are discussed in later sections 2.6 – 2.6.2.
2.4.1 Development of e-learning platforms

E-learning platforms or managed learning systems (MLS), for example Blackboard and WebCT, are essentially structures that deliver courses online. Most incorporate course management features, such as digital enrolment; dissemination features, such as the facility to download notes and upload student assignments; communication components, such as email and discussion boards; and some type of student assessment aids, including tracking the time the student has spent on the site and the facility to deliver and correct online tests. Learners can access materials, interact, collaborate on and submit assignments, and can have their progress monitored all within one environment.

Blackboard and WebCT are the leading e-learning platforms in third level online course delivery in the UK and Ireland. They offer robust environments that are easy to navigate. Initially teachers may enjoy e-learning platforms for the ease of moving their lectures online, but in the long run e-learning platforms might prove to be restrictive environments. E-learning platforms can be prohibitively expensive for all but the large institutions which are able to extend the possibilities of online learning across their faculties and schools. Open source initiatives in course management software, such as PostNuke, are promoting low cost or free alternatives where specific features can be fitted together (such as calendar and/or discussion board) into a custom built environment. Although they are less tested and less robust than the large-scale commercial alternatives (e.g. WebCT) open source initiatives offer more freedom for experimentation.

2.4.2 Design issues for e-learning

Successful learning environments are characterised by a number of features relating to how learners engage with their learning and how this is supported by a tutor (Holmes and Gardner, 2006). An e-learning environment is essentially no different except that there is a triangularity of the learner-computer-tutor interaction, where the 'computer' link is a simple way of denoting the technical complexity of an e-learning
environment. Holmes and Gardner (2006) have identified a number of features that have significant importance for designers of e-learning. Some of these features are highlighted below:

- **Developing higher-order skills** – helping learners to search for information; analyse and synthesise new meanings from it; use it to solve problems; generalise from specific cases, hypothesise and test.

- **Developing the capacity for self-assessment** – helping learners to become autonomous by being able to seek out the necessary information and knowledge without help and have the capacity to guide learners to undertake evaluation of their own progress and planning their next steps.

- **Fostering motivation** – providing a range of incentives such as rewards, offering well-developed interactional features (interactive materials), offering meaningful feedback in terms of what is going right and links to tutors or other learners who can offer more direct feedback.

- **Scaffolding ‘next steps’** – tutors can guide learners through a framework of tasks that become progressively more complex and directed to the ultimate learning goal, or can be ad hoc when the watchful tutor decides that it is necessary to assist the learners to reach the next steps in their learning progress.

- **Supporting different learning styles** – e-learning environments are capable of considerable customisation and just as conventional learning materials and approaches must be amenable to a diversity of learners including those with disabilities, e-learning design should address the flexibility needed for a wide range of learning styles and needs.

- **Incorporating learner activity** – e-learning environments should help to broaden learners’ engagement through a demand for creative responses or the completion of tasks requiring the searching for and analysing of information. Interaction with peers and tutors in a social learning context online should ensure a degree of higher-order skills activity, including the sharing of ideas and formulation of questions.

- **Creating an authentic learning environment** – e-learning environments can benefit from the use of multimedia, animation and advanced communication
facilities, e-learning can place the learner in a simulated 'virtual' environment approximating to the 'real' thing, or can engage them through interactive technologies e.g. Internet voice-conferencing.

- **Creating a social learning environment** – an environment that supports online interaction through synchronous communication (message boards, audio communication) and asynchronous communication (email, discussion forums).

- **Creating links in learning activities** – e-learning should provide a large range of resources that can be used to extend learning activities. This can be achieved by uploading documents, teaching notes and links to other useful resources on the Internet.

All nine of these features theoretically play an important role in the successful design and delivery of an e-learning environment. One feature, 'Creating an authentic learning environment,' could be challenging for web designers and e-learning pedagogues who have had little experience of developing a universally accessible VLE. Visually impaired people could miss out on the potential benefits multimedia can offer the community. The introduction of 'multimedia, animation and advanced communication facilities' could increase the learning experiences of visually impaired people provided the new modalities are thoroughly tested with visually-impaired user groups. (See sections 2.6, 2.9.3 and 2.10.1 for more detail about how potential challenges of using multimedia in e-learning can be overcome through careful planning and usability testing). These features could be tested using an emancipatory disability approach which would involve visually impaired people helping to decide which features could be tested for accessibility.

Designers and e-learning pedagogues are faced with the difficulty of providing appropriate levels of support to sustain high levels of student involvement and to ensure that all learners are able to access the learning materials (or learning objects) at the same time. This would be a challenge for tutors who are planning e-learning for all learners, including disabled students. Providing flexible learning environments that ensure the right balance of tutor help, independent learning and the incorporating of learner activity is a significant challenge for e-learning design and content teams. Another challenge is for e-learning designers to find ways of supporting communities
of learners who have different learning needs, a core element of an educational experience when higher-order learning is the desired learning outcome. The role of social participation is now explored through 'situated learning' and 'communities of practice'.

2.5 Situated learning in communities of practice

Situated learning influences different contexts for social engagement in communities. Lave and Wegner (1991) situate learning in certain forms of 'social participation' (p.14). These social forms of engagement for learning are, to Lave and Wenger, as important as the cognitive processes and conceptual structures involved. They put forward the view that an individual does not acquire a discrete body of abstract knowledge that he reappllies in later contexts. Instead, he will acquire the skill to perform by actually engaging in the process under conditions they call 'legitimate peripheral participation'. This is defined as providing 'a way to speak about the relations between newcomers and old-timers and about the activities, identities, artefacts, and communities of knowledge and practice' (p.29). They define understanding and learning in terms that are relative to active contexts and not to self-contained structures.

Within the situated learning context the quality of learning is not affected by the difference or level of engagement. Lave and Wegner argue that there is not necessarily an 'illegitimate peripheral participant' in the same way as there is not such simple a thing as 'central participation' in a community of practice. They accept that peripheral participants, located in the social world, change their locations and perspectives at different times. The important aspect of their argument is that the partial participation of newcomers does not mean someone is disconnected from the practice or interest. They see the peripheral participation as a way of gaining access to sources for understanding through growing involvement.

Legitimate peripheral participation refers both to the development of knowledgeably skilled identities in practice and to the reproduction and transformation of communities of practice (p.55).
This raises questions about the 'socio-cultural organisation' of space (e.g. electronic communities) and the circulation of knowledge skill questions about how new learners are allowed to access ongoing activities and build new relationships within the group. All levels of participation should be valued by the learning community, including the visually impaired. The changing roles of some of the participants will provide the community with new structures and identities. Apparently for Lave and Wegner learning is never simply a process of transfer or assimilation: learning, transformation, and engaging are regenerative practices that will help sustain a future. This is similar to the communal constructivist view that learning and new knowledge creation is continuous and should be deposited for the benefit of new learners. Whether you take an observational role to a more participatory one, both require a way of absorbing or being absorbed in the 'culture of practice' (p.95). Lave (1993) later concluded that 'developing an identity as a member of a community and becoming knowledgeably skilful are part of the same process, with the former motivating, shaping and giving meaning to the latter, which it subsumes' (p.65).

Apprentices or novices are essential to the creation and sustainability of knowledge. They provide 'old-timers' with the impetus to record and share this knowledge in ways that can be fully understood by all members. Knowledge is acquired, according to Lave and Wenger, through 'centripetal participation' which is based in the community of practice where questions of learning must be addressed within the 'developmental cycles of that community'. They therefore see technology of practice as an arena for people to discuss problems of access to understanding. Furthermore, understanding the technology of practice is more than just successful use of the tools of learning; it enables connection with the past history of the practice of the community and direct participation in its cultural life. Lastly, one of the purposes of legitimate peripheral participation is not to learn from talk but to learn to talk. There is a reciprocal relation between those who are newcomers and the old-timers. Certain conflicts or disagreements in practice mean that new learners move towards full participation in the community ensuring that it does not stay static.
2.5.1 Communities of enquiry

One of the critical aims of an e-learning environment is the development and nurturing of those members who are participating in the different learning and communication activities. Demands of an evolving knowledge society create expectations for individuals to be independent thinkers and, at the same time, interdependent, and collaborative learners. Garrison and Anderson (2003) argue that the creation of knowledge in an educational context is a personally reflective and collaborative process made possible by 'a community of learners'. They say that it is within such a community of learners that the potential of e-learning will be fully achieved. This community encourages 'cognitive independence and social interdependence simultaneously' (p.23). They say that it is the juxtaposition of both aspects that ignite a true educational experience that has personal value and socially redeeming outcomes. Garrison and Anderson express concern that designers and e-learning pedagogues should motivate learners and facilitate meaningful and worthwhile learning activities and outcomes. They argue that the affordability and ubiquity of e-learning, as well as its capability to support a community of learners, is disrupting the dominant technology in higher education – the lecture. They also say it is the lack of a clear model of technologically mediated learning (e-learning) consistent with the values and ideals of higher education that limits the wider adoption of computer mediated communication (CMC) such as computer conferencing and e-learning. They conclude that e-learning has all the potential to not compromise the values of higher education, but create the idealised community of enquiry, if properly used.

2.5.2 Text-based communication

While e-learning is a powerful communication tool, serious questions should be raised concerning the extent and degree to which text-based communication changes the 'flow and structure' of higher order learning and teaching (Wells, 1999), as compared with the more familiar environment of speech-based communication. Text-based communication may be considered to be the most appropriate form of communication for visually impaired learners. More thought is required in terms of
how the text is presented and to what extent the text encourages the critical thinking and reflection skills that teachers wish learners to engage with when online. Pedagogues may consider text as the only suitable mode of delivery for the visually impaired community, excluding the introduction of other modalities such as audio and other potentially adaptable multi-media options. It would be pertinent for pedagogues to discuss what new modalities of learning could be used and how they could be accessed by visually impaired students. Again, this consultation could be guided using an emancipatory framework where visually impaired students could be invited to share their learning experiences and talk about their expectations of an e-learning course. This issue is discussed in more detail in the section on blended e-learning and mobile e-technologies and in the final discussion in chapter seven. Serious questions should be raised when e-learning courses are predominantly text-based with little opportunity for interactive learning promoted through discussion and reflection.

Garrison and Anderson (2003) support the use of text-based communication, but this needs to have other learning activities ‘wrapped around’ (Littlejohn and Pegler, 2007) to increase the right balance of independent learning with group collaboration promoted by ‘blended learning’.

2.6 Blended e-learning

The term ‘blended learning’ or ‘blended e-learning’, introduced by Holmes and Gardner (2006) is based on the recognition that there will inevitably be a mix of e-learning pedagogies and traditional pedagogies. Littlejohn and Pegler (2007) state that ‘the combination of conventional teaching approaches and e-learning elements within a single course or programme is commonly referred to as ‘blended learning’ (p.29). They make a distinction between blended learning and blended e-learning by referring to the proportion of e-learning content on the course – being a strong blend (almost exclusively e-learning) or a weak blend (virtually none).

It is possible to think of these blends in terms of ‘media blend’ or ‘activity blend’ (Littlejohn and Pegler, 2007). This could consist of a media blend of audio and video
(e.g. webcast) and print resources or readings with face-to-face lectures and tutorials. Littlejohn and Pegler (2007) explain that the 'activity blend' focuses on what we do and where. For example, is a discussion going to happen online or offline? How can the activities be sequenced and supported so that they work well? These are key questions that pedagogues need to consider when planning a blended online course. Within education in general there is growing awareness of the potential and implications of blended e-learning, not just among the techno-enthusiasts but across the majority of teaching and support staff.

While the term 'blended' implies a seamless integration or intermingling of e-learning and conventional teaching approaches and environments, Littlejohn and Pegler (2007) state that this is not what is usually offered in colleges and universities. They see the practice of blended learning more as the introduction of e-learning alongside, or a substitute for, specific elements within an otherwise conventionally taught course. Sometimes these courses are more 'lumpy' than seamless with the 'joins between the newer e-learning and older-established material being apparent to students' (p.30).

Littlejohn and Pegler (2007) propose a more elegant 'solution' as consisting of a wrapping approach which means taking a conventional teaching approach and wrapping it around e-learning resources or vice versa. They suggest that blending a 'wraparound' will work best when attention has been given to how the resources relate to, and complement, each other. The proportion of online to offline and the type of offline activity favoured should be informed by the pedagogical and the operational preferences of the institution and the pedagogical course developers. If we are considering the learning needs of visually impaired learners, pedagogues will need to decide which activities in the course are accessible and best accomplished through e-learning, and what level of assessment these parts should carry, where in the course e-learning will occur and how it will be introduced to the learners. On the operational side, designers will need to consider how to best resource and support new approaches as they blend with established teaching and to consider the technical issues that may arise from introducing certain types of multimedia to visually impaired learners.
One of the main challenges for colleges and universities is to plan blended activities in flexible ways that enable visually impaired learners to choose their most comfortable mode of learning. This often does not simply mean providing a principally offline course for those learners who cannot access online materials and a parallel course for those who can access all the blended activities. It may also require more creative ways of constructing courses (and learning objects) which enable all learners to access the maximum amount of information and shared learning practices through the delivery of accessible multi-media blends (e.g. providing a spoken commentary for videos). Other types of learning devices could be used to support learning and communication for all learners. Visually impaired learners will need to develop techniques and use tools (assistive technology) to access e-learning. The interfacing of assistive technology and e-learning is discussed in section 2.10 in this chapter.

Designing courses in small, reusable chunks can help e-learning content providers to personalise the learning experience. Learners can be offered a menu of topics to select from or, alternatively, they could choose a personal navigation route through a course on the basis of prior experience, diagnostic tests or their performance and preferences as they follow the course. Allowing choice and selection should improve the potential of courses to address learner diversity and impairment. If students are offered a choice of learning resources in a variety of formats (e.g. video, text, audio), they can choose which format is the most suitable one for them. A student who does not have broadband may choose to do an offline or face-to-face activity.

'Personalisation' in education offers many potential advantages to the visually impaired learners enabling them to choose their preferred modes of learning and devices. This could lead to the creation of personal learning environments (PLEs) which allow students to use their own mobile devices such as a mobile phone or an MP3 player to access the learning objects. New generation mobile phones and MP3 players are becoming more widely adopted for downloading music and talks that could potentially be exploited further by e-learning website designers and pedagogues. Furthermore, this approach responds to learners who may struggle with certain types of technology preferring to use technology that they are confident using. These ideas are still in their infant stage but they are potential solutions to delivering e-learning courses in more personalised ways for visually impaired learners.
2.6.1 Deciding on an e-learning blend

It is tempting to think that by adding on e-learning as an extra, designers and pedagogues are managing risk, creating an effective blend while at the same time allowing learners to fall back on conventional face-to-face sessions if this does not work. Kirkwood and Price (2005) argue that where the use of new media is optional or incidental, learners will typically not value material presented in that way as much as material that is clearly core or assessed. They say this creates a vicious circle whereby lack of experience and confidence in using e-learning feeds into approaches to blending that are undervalued by students and unused by many, contributing to the overall lack of positive experience and confidence. This could have an impact on practical skills in using the e-tools (synchronous and asynchronous discussion boards), but also an absence of important skills that develop the learners' ability to use search engines (software that helps to locate web pages based on a search of keywords). This could be particularly problematic for visually impaired learners who may have had little or no training on how to use the Internet and do not have the confidence to take learning risks.

Laurillard (2001) emphasises the need for educational activity designs using different media to support interactivity and be communicative (enabling reflection on learning in progress), as well as the requirement to be adaptive (subject to the necessary modification while teaching is in progress) and narrative (articulating the conception of teachers to students and vice versa). Laurillard (2001) argues that media strengths differ, and it is important to obtain the right blend so that learning can be enabled and enriched. When designing learning for visually impaired learners it is useful to review the different options available through media to offer a format that would not exclude them from participating in any of the activities. Different learning formats, such as text, should not lead to an inferior learning experience for visually impaired learners. As a result of the rapidly changing face of blended e-learning, it is now possible to use web-based applications that allow streaming of audio within a web-page. This is a significant move towards more seamless blending experiences whereby multimedia can be used within a single course or even inside a single learning activity.
These innovations have huge potential for visually impaired learners who may have to use more than one learning interface to access different online learning materials.

Today, learners can access audio or video, print, online games and simulations that were previously available as separate print handouts or audio/video options. This can solve several of the operational difficulties that formerly restricted the use of multimedia. In theory the integration of multi-media sounds potentially groundbreaking for learners who are able to access these modalities without having to use assistive technology (e.g. a piece of computer software that reads information off the screen). The blending of various forms of multi-media could also be problematic for learners who do not have sufficiently powerful computers at home to download the required ‘plug-ins’ to enable the streaming of audio or video. These e-tools could result in ‘locking-out’ those who are least likely to have access to the most up-to-date technology i.e. the visually impaired community.

2.6.2 Mobile technologies

Another significant development in the blending of online media is the increase in access to portable and mobile technologies (e.g. MP3 players, personal digital assistants, mobile phones). These technologies offer greater opportunities to visually impaired learners by allowing access to multimedia resources in a variety of locations where such access would otherwise be impossible. Many adult learners now carry devices such as mobile phones and PDAs that have as much capability as computers. These technologies also have the potential of widening the gap between the ‘haves’ and ‘have-nots’ in terms of purchasing power. There are, still, potential benefits for the visually impaired community to use mobile technologies, particularly for those who do not have regular access to computers. Littlejohn and Pegler (2007) say there is a major concern about expecting students to use their own mobile technologies in that there are still numbers of students who do not have access to such devices. There remains a ‘digital divide’ in terms of those who have mobile devices and the capability to use them in different ways. The introduction of any new type of technology would need to be accompanied by training and appropriate infrastructure, particularly in rural parts of a country where mobile phone signals are
weak or Internet broadband is unavailable or too expensive.

Technologies are also being developed that allow users to interact with physical resources located at a distance, such as access to virtual hands-on laboratory experiments. Advances in programming languages such as JAVA increase the ease with which such virtual environments are constructed and manipulated. Increases in the storage and searching capacity of databases also support new ways of student assessment, such as the use of digital portfolios.

Wireless technologies open up opportunities to access educational opportunities regardless of location. Holmes and Gardner (2006) say that they move us towards 'ubiquitous' computing. This lends itself to possibilities for more spontaneous use of electronic tools (e.g. mobile phones, MP3 players and PDAs), as they are near to hand and can be used wherever the student is located. This is particularly useful for visually impaired students who may live in rural areas and are unable to travel to college or university on a regular basis. These technologies provide easier and more convenient access to both 'everyday' and 'institutional' software tools. Wireless spaces are being set up in more places around cities and towns in the UK and Ireland. One American café chain (Starbucks) provides free wireless access in most cities and in Tokyo it is possible to use the Internet on the subway. Access to wireless networks is still limited, however, in rural areas in Ireland.

Technology is making it easier for learners to reshape digital content to suit their differing styles. Such efforts at 'putting material into the learner's hands' have implications for pedagogy. Research on the impact of laptops and wireless applications in education shows that students have a greater feeling of ownership of the materials and process, according to a study conducted by O'Callaghan (2001). Technology is now being developed that will better manage content databases, to select and deliver tailored materials, and to support customisation (O'Callaghan, 2001). The promise of individually tailoring a course to a visually impaired student's needs is exciting but needs to be balanced with discussions on copyright and digital rights management (DRM).

Clearly, from the outset, there is a need to design for universal access, an area
discussed at a later stage of this chapter (see section 2.8.3). Several standards bodies, including the Dublin Core Institute of Electrical and Electronics Engineers (IEEE) and the World Wide Web Consortium (W3C), have ensured interoperability in technology designed for the Web. Accessibility would be promoted by producing guidelines for web developers, involving the greatest number of agencies, and by making it legally binding to adhere to W3C standards and best practices. These issues are discussed later in this chapter.

Summary

Blended e-learning opens up a number of opportunities for visually impaired people in terms of the flexible ‘blends’ that can be used. It offers a number of possibilities for e-learning course designers to develop new opportunities to combine traditional teaching approaches with emerging media blends in one location. The benefits for the visually impaired are huge but there are other technological challenges that still need to be explored, principally, how information systems such as virtual learning environments (VLEs) can facilitate blended e-learning.

2.7 Virtual Learning Environments (VLEs)

Virtual learning environments (VLEs), according to McGill and Hobbs (2007), ‘process, store and disseminate educational material and support communication associated with teaching and learning’ (p.191). They argue that despite the ubiquity of VLEs in education today, much of the evidence to support their use is anecdotal or limited generalisation. In particular, there has been very little research on the use of VLEs by instructors and how they can influence student learning (Alavi and Leidner, 2001). McGill and Hobbs argue that VLEs are designed to support students in their learning, and instructors in their teaching. They explain that while these two tasks are closely linked they differ in important ways, and may receive different types and levels of support from VLEs. For example, student use of a VLE is primarily as an end-user: students access and interact with the VLE. However, instructors may play a dual role: one, as end-user in the development role, establishing a course within a VLE and then the second to interact with it as a user.
Studies such as Piccoli et al. (2001) and Chou and Liu (2005) have compared classes taught using VLEs with traditional classes and considered outcomes such as satisfaction, self-efficacy and academic performance. Piccoli et al. (2001) found no significant differences in performances between students enrolled in the two environments, and participants in the VLE group reported being less satisfied with the learning process. For Chou and Liu’s (2005) study, students in the VLE environment achieved better learning performance and higher levels of satisfaction. These conflicting findings show how difficult it is to determine whether VLEs actually do increase academic performance. In another study, Hayashi et al. (2004) investigated the role of computer self-efficacy in the e-learning context and found that it did not influence students’ perceptions of the usefulness of VLEs or their satisfaction. Interestingly further studies show that much depends on the levels of technical ability and confidence in knowing how to use the technology. Newton (2001) found that a lack of training on how to use a VLE was identified as a barrier to use.

Results from these studies show that students' levels of satisfaction vary from using one VLE and e-learning to another. It is therefore difficult to draw any firm conclusions on learning performance, levels of satisfaction and interaction with a VLE. The issue related to technical knowledge, however, is of significant interest as it shows that e-learning course providers cannot assume that all students will have the required technical training and confidence to participate effectively in a VLE. These findings also have implications for learners with visual impairment who may require considerably more training on how to use a VLE with the support of assistive technology. Additionally, there is an important issue regarding access and how visually impaired computer users are able to access, log onto and navigate VLEs which may not have been designed according to specific accessibility and usability guidelines set by international agencies as the W3C. These implications are discussed in the next sections.

2.8 Accessible technology for visually impaired people

The importance of e-learning for communities of learners who experience access difficulties cannot be over-estimated as it offers a major pathway of learning
opportunities for those who cannot avail themselves of the education provision most people would see as standard. For the estimated 1 million people in the European Union, there are a number of ways in which e-learning environments can be made accessible. These include designing the online materials and their delivery specifically for blind and low vision users through the use of assistive technology (see section 2.10).

2.8.1 Developing inclusive practices for visually impaired people

This section explores the difficulties that visually impaired people experience when using new technology and how inaccessible environments, such as VLEs, are created as a result of insufficient collaboration with the visually impaired community. It also discusses the importance of inclusive design in building technological environments for disabled communities and discusses some of the examples of good practice.

Perspectives in universal design are said to be challenging mainstream design in relation to the way that disabled people are excluded from the considerations of the designer in the design process generally (Keates, et al. 2001). Protagonists of these approaches stress the importance of implementing a structured approach to user-aware design through the involvement of the user in the design process (Keates, et al. 2001). Bennett (2002) argues that the power relations associated with different positions adopted in relation to design participation are not given sufficient attention within theoretical models of an inclusive design process. She argues that the model of 'user participation' has varying interpretations, in some cases it does not denote a transfer of responsibility, but indicates a change of procedure within an unchanged balance of power. This position falls in line with the 'emancipatory' paradigm of research which advocates that the researcher should place these skills at the disposal of disabled people to use in whatever way they choose (Oliver, 1990). This position could be considered to be a rather extreme challenge to the traditional models of design.
The application of a discourse embedded in opposing the oppression and discrimination of disabled people, and to their exclusion from key decisions affecting the quality of their lives (Barton, 2005) to a different technological agenda requires careful consideration and testing. Perhaps it is more realistic for the experts in the field to consider demystifying or unpacking the conceptual and technical difficulties that shroud the design of user interfaces so that disabled people are able to make better sense of what methods and outcomes are available. Barton (2005) argues that such a partisan approach could carry certain risks and difficulties, including dangers of 'incorporation and the neutralisation of a radical analysis and the conservative nature of academic research' (p.321). He also argues that there is a struggle in building a culture which encourages vigilance, dialogue, openness and self-criticism by designers. It may not be possible to take all recommendations made by disabled groups into consideration. This may be due to practical reasons where in some cases, adaptations could lead to loss of a specific functionality e.g. graphics or for economic reasons where making the changes would lead to prohibitive costs (Emiliani, et al. 2005).

The next section discusses the discourses around universal design for disabled users and legislation that promotes appropriate use of good design for all.

2.8.2 Universal design

One of the most significant problems for disabled people relates to the various physical obstacles and barriers in the built environment (Imrie, 2004). Recent disability legislation in the UK, with the Disability Discrimination Act (2005) and in Ireland, with the Disability Act (2005) have set new regulations on how to increase the levels of accessibility to buildings and public transport. We now have buses equipped with hydraulic lifts that can accommodate wheelchairs and even children's buggies. Commercial companies and public bodies are expected to take reasonable measures to ensure wheelchairs can enter buildings and move between floors. The lack of consideration for disabled people's ease of access to public places is considered by some to be 'tantamount to an infringement of disabled people's liberties' (Imrie, 2004, p.279). With strong lobbying from disabled groups, commercial and public buildings
are beginning to see how placing accessible ramps and other accessibility features on their premises can enable disabled people to move unhindered around a shop, gallery or restaurant.

One of the key challenges for designers, architects and policy makers is to provide a suitable policy environment with a dovetailing of statutory measures which have a commitment to involving disability movements and the voices of the disabled in the construction, review and amendment of inclusive policy (Roulstone, 1998; Shakespeare, 2002; Barnes, 1997).

Another perspective is Universal Design for Learning (UDL) which is an approach that addresses and redresses the primary barrier to making expert learners of all students: inflexible, one-size-fits-all curricula that raise unintentional barriers to learning. The Center for Applied Special Technology (CAST) devised a set of guidelines to help meet the challenge of diversity by suggesting flexible instructional materials, techniques and strategies that empower educationalists to meet these varied needs. A universally designed curriculum is designed from the outset to meet the needs of the greatest number of users, making costly, time-consuming and after-the-fact changes to a curriculum unnecessary. Universal Design for Learning refers to a process by which a curriculum (i.e. goals, methods, materials and assessments) is intentionally and systematically designed from the beginning to address individual differences. With curricula that are universally designed, much of the difficulties of subsequent 'retrofitting' and adaptation can be reduced or eliminated, and a better learning environment for all students can be implemented.

A different definition is applied to 'Universal design' (UD) which is a standard by which products, environments and communications are useable by all people, regardless of ability, to the greatest extent possible without the need for further adaptation or redesign (Imrie, 2004). UD requirements ignored at the start of a project are often more expensive or impossible to incorporate later. Emiliiani and Stephanidis (2005) argue that traditional approaches to computer accessibility have enabled users who are disabled to access interactive applications originally designed and developed for non-disabled users by adding assistive technology, i.e. introducing posteriori adaptations or reactive approaches. By the time a particular access
problem has been addressed, technology has advanced to a point where the same or a similar problem occurs again. This is typically experienced by blind users who have had to adapt to changes in new generation technology e.g. DOS or Windows Operating Systems. This level of product adaptation is considered to be the least favoured because of the high costs associated with almost deconstructing what is originally built. Emiliani and Stephanidis (2005) argue for a more proactive 'environment-level adaptation' that extends the scope of accessibility to cover potentially all applications running under the same environment (e.g. Microsoft Windows). They also recommend providing appropriate hardware technology to make that environment alternatively accessible. It is likely that some built-in possibilities offered by a wide range of integrated devices will satisfy the requirements of visually impaired people who will also benefit from a wider availability of voice input and output. This in turn could facilitate the design of accessible solutions and reduce the need for assistive technology (Mynatt, et al. 1994). It is important when ensuring universal access to new technologies and the Internet to investigate how human functions will be engaged in the emerging forms of interaction and an individual's perceptual and cognitive space (e.g. emotion, information processing and memory). These are important when considering the concept of learning through the use of electronic platforms on the Internet (Evans and Douglas, 2008). The main challenge in this respect is to identify and avoid forms of interaction and learning that lead to negative consequences, such as confusion, cognitive overload and frustration (Emiliani and Stephanidis, 2005).

Universal design plays an important part in increasing the accessibility of VLEs so that as many audiences can access learning materials and are able to participate in all the complementary activities that are also offered in the environment. Designers cannot claim to have met the conditions of universal design by simply carrying out a few usability tests with visually impaired students. Universal design offers enormous benefits for disabled people provided the process is carefully planned. Before the universal design movement, architects rarely addressed the mobility and communication needs of disabled people, leaving us with buildings inaccessible to many. Legislation mandating universal access led to extensive retrofitting, such as installations of ramps, elevators, talking signs and other access devices. But retrofitting is expensive, often aesthetically disastrous, and usually inadequate in
many ways. Bitterman and Hess (2008) argue that the principles of good design call on designers to create good designs that consider the abilities of all people. Simply put, they say that 'universal design shifts the responsibility of functional usability from users to designers' (p.32). This bottom up approach could help break a traditional mode where the designer or architect takes the initiative to design or redesign technology before consulting the user.

Why some companies successfully practise universal design while others do not was the focus of a three-year study in the USA by Vanderheiden and Tobias (1998). They found that around 80% of the 26 companies studied, considered that the cost of UD was prohibitive in the areas of design, manufacturing, testing and product support. Furthermore they identified two factors that affected a company’s choice to adopt universal design. The first, the threat of government regulation, dissipated when the regulation was not enforced. The second depended upon whether universal design would yield high profits, such as was experienced with Oxo’s line of kitchen tools. Interestingly, the decision to apply UD to one product line would tend not to generalise to other product lines within the same company.

Universal design should, in principle, extend our desire to include all people. It is no longer acceptable for retailers, public services or public buildings to ignore the advantages of universal design. Universal design should not be seen as an add-on or something temporary but should be built into the overall design of products and services.

**2.8.3 Universal access**

The information society is expected to evolve in the direction of the proliferation of computer systems that integrate a range of networked interactive devices embedded into a physical context which is either indoor or outdoor. Emiliani and Stephanidis (2005) believe that these systems will provide hosting for a broad range of computer-mediated human activities and access to a multitude of services and applications. They see a vision where 'ambient intelligence' places an emphasis on user-friendly, more efficient services to support human interactions. They also say that people are
surrounded by intelligent intuitive interfaces that are embedded in all kinds of objects and an environment that is capable of recognising and responding to the presence of different individuals in a seamless, unobtrusive and often invisible way. This utopian view of technology is exciting for humanity, particularly for vulnerable, disabled people who could greatly benefit from such radical changes to how they interact in society. Emiliani and Stephanidis (2005) consider personal devices (e.g. voice recognition and synthesis, pen-based pointing devices, vibration alerting and touch screens) which have built-in multi-modal interaction functions to be the way ahead in terms of offering disabled people more independence and self-sufficiency. What is even more important is the shift away from assistive technology to facilitating the design within devices that everyone can use. This shift may still be in the distant future for some people, but designers are beginning to wake up to the needs of disabled people and are seeking solutions that are proactively informed by universal access perspectives, appropriate design and suitable development approaches.

2.8.4 International legislation on increasing accessibility

As the development, design and use of the Internet becomes more of an integral part of society, standards bodies are emerging and promoting interoperability and, increasingly, accessibility. In 1999, the European Commission launched its eEurope 2002 which is an ‘information society’ for all e-learning and lifelong learning initiatives. The action plan set out to increase equality access as well as promote computer literacy.

The European Commission, through a series of agreements including the Lisbon European Council of March 2000, reinforces the importance of creating a competitive 'knowledge-based economy, with sustainable economic development, more jobs and greater social cohesion' (EC, 2006). One of the objectives of the programme is to increase the participation of people with special needs and disadvantaged groups, regardless of their social-economic background. ICT encourages bilateral and multilateral partnerships that promote ‘quality in education and training systems’ (article 5, 2006). One key area of interest is the transfer of innovation projects that previously focused on one target group or sector to a wider number of target groups
including the disabled. For example, priority 4 (skills development of adults in the labour market) in the Leonardo da Vinci programme encourages projects that support close links with working life, both in initial and continuing vocational education and training (VET) and increased opportunities to learn at work through developing digital competencies (EC, 2006). The EC promotes the use of new technologies e.g. podcasts, wikis, virtual social sites, as well as tools such as mobile phones that are easy to use, are affordable and widespread, particularly among groups at 'risk of exclusion' (2006).

A number of other international initiatives have taken place over the last ten years which have led to changes in how electronic information is presented to the public. One of the most far-reaching initiatives is the Web Accessibility Initiative (WAI) which was set up to encourage universal principles of design, specifically when designing Internet websites for public use. Two international policy initiatives helped to pave the way for more recent legislation in the UK and Ireland – the amended Rehabilitation Act in the USA and the W3C Web Accessibility Initiative (WAI).

One of the first initiatives on improving accessibility was spearheaded by the USA in 1998 with the amended 'Rehabilitation Act.' This piece of legislation, better known as 'Section 508', requires Federal agencies to make their electronic and information technology accessible to disabled people and to eliminate barriers in information technology, to make available new opportunities for people with disabilities.

Nielsen (2001), a leading American expert on usability, believes that 'a more constructive approach would be to start thinking of users with disabilities as a big group of potential customers' (p.56) and work to make it easier for them to conduct business with all.

....this is just an extension of the general usability ideology, which aims to make customers feel that 'their' needs are the drivers of the design. Anybody who wants to sell to senior citizens needs to prioritize accessibility, but even in younger age groups, there are about 10% of users with some kind of impairment (Section 508, USA Government Dept).
The World Wide Web Consortium (W3C) is committed to promoting a high degree of usability on the web for people with disabilities. The push towards a more inclusive mind-set in terms of good design is a major focus of the W3C through its Web Accessibility Initiative (WAI) Guidelines. WAI, in coordination with organisations around the world, pursues accessibility of the Web through five primary areas of work: technology, guidelines, tools, education and outreach, and research and development. WAI enables representatives from different constituencies:

- to work together at the design stage of key Web technologies; and
- to develop accessibility solutions by consensus under W3C Process.

The Web Content Accessibility Guidelines (WCAG) Version 1.0 are divided into three main priorities. Following priority 1, the highest level of accessibility, will make it possible for all disabled groups to use the site. For some groups, including the visually impaired, this is the basic requirement to enable them to access the information. By following priorities 2 and 3, public bodies and companies will remove significant barriers for one or more groups, though strict adherence to the guidelines may cause some problems of access to one group and not to another. The WCAG sets out a series of checkpoints for web designers to refer to with a rationale for each priority.

Priority 3.6 Supplement text with graphic or auditory presentations where they will facilitate comprehension

A wide variety of techniques can be used to provide supporting information, including animations, icons, graphs, video, recorded speech, synthesised speech, sound effects or sound alerts. Note: It is important to provide equivalents for any supporting information you provide to ensure that it is available to the widest possible audience. For example, the information communicated through a graph should also be available in text format as well (NDA, W3C WAI Guidelines, 2006).
Results from a recent study carried out by the UK Disability Rights Commission (DRC, 2004) on *The Web: Access and Inclusion for Disabled People* shows that only 19% of government and public sites complied with the most basic web accessibility initiative category. Furthermore, only 6% of the top 100 UK company websites met the minimum accessible standards in 2001. By November 2003 this had increased to 10%. It is estimated that the number of disabled people in the UK that have problems with inaccessible Websites is between 1.3 and 3.2 million, with an estimated annual spending power of £10-20 billion. The now defunct DRC set forward a series of recommendations to the government.

A similar study was conducted by the Research Institute for Networks and Communications Engineering (RINCE) at Dublin City University in 2002. This centre investigated how well 159 Irish websites conformed to the W3C web accessibility guidelines. Results from the audit show that at least 94% failed to meet the minimum WAI level A standard (the lowest) and at least 90% failed to meet minimal conformance with other generic technical standards for web interoperability. In their report, the team highlight some of the most obvious barriers they discovered including defective HTML coding, inaccessible online forms and ambiguous or meaningless hypertext and links in inappropriate language (e.g. ‘click here’ or ‘more’). This high percentage of failure may have fallen as a result of the introduction of the Disability Act in 2005. New research should review the accessibility status of Irish websites in 2008 to see how far new legislation has impacted on practice.

In Ireland, through its statutory monitoring role, the National Disability Authority (NDA) plays a vital part in providing an independent voice on the impact of the National Disability Strategy. It also gave important additional statutory functions under the Disability Act 2005. These include:

- Preparation of draft Codes of Practice in relation to accessible public buildings and services under Part 3 of the Disability Act.

- Monitoring compliance with the statutory employment target for the public sector under Part 5 of the Disability Act and recommending actions to be taken by public bodies to promote and achieve compliance.
Establishment of a Centre for Excellence in Universal Design.

The new Centre for Excellence in Universal Design, set up by the National Disability Authority (NDA) in January 2007, is dedicated to the principle of universal access, enabling people in Ireland to participate in a society that takes account of human difference to interact with their environment to the best of their ability. The Centre acts as an information source for public bodies and private companies to consult when moving towards providing the contents of information electronically. There is now significant legislation in Ireland on ICT accessibility (The Disability Act, 2005; The Employment Equality Act, 1998; and The Equal Status Act 2000) that should raise both private and public companies' levels of awareness to the implications of employing disabled people and how their needs can be best met using a repertoire of technology solutions.

Where a public body communicates in electronic form with one or more persons, the head of the body shall ensure that as far as practicable, the contents of the communication are accessible to persons with a visual impairment to whom adaptive technology is available (Section 28, The Disability Act, 2005).

This Centre for Excellence in Universal Design has been set up within the NDA and is considered to be an integral part of the National Disability Strategy. This significant financial investment by the Irish Government puts Ireland among one of the first countries to take universal design seriously. Among one of its many roles is to extract clauses and sections from Irish legislation related to ICT and accessibility and present them in digestible chunks in order for a non-technically minded person to understand their obligations. One of the most difficult roles for the centre is to produce web accessibility guidelines in a format that is easy for web-designers to follow. A checklist was designed to support assessment tasks carried out by people in the roles of Planning and Procurement and Testing, Assessment and Quality Assurance. The WAI guidelines and universal design are important landmarks on the social inclusion and disability agendas in that they mutually advance our knowledge and practice of inclusive technology.

- 65 -
Legislation tends to be the driving force for those who try to change the way technology is designed so that it becomes more inclusive from design to final product (Section 508, Rehabilitation Act, 1998). Roulstone (1998) states that the involvement of the disabled tends to be represented by 'experts' in the field of new technology and disability. These tend to be disabled academics, computer designers and rehabilitation workers. This is not the same as full inclusion but could be considered as a step towards the inclusion of non-technology experts who are disabled. Research paradigms, such as emancipatory research, that encourage non-experts to take a greater part in discussions around technology and disability could help to redress the academic-practitioner imbalance.

Summary

This section has explored some of the issues associated with the development of inclusive learning practices when introducing e-learning to the visually impaired community. The promotion of e-learning requires careful planning and discussions with those who will be using the learning environment. Certain conditions need to be in place before a VLE can be considered as completely accessible to visually impaired learners. The introduction of new web accessibility guidelines and government policy are encouraging designers to be more inclusive when planning and building new websites. Research that involves visually impaired users can play a vital role in ensuring the responsibility of functional usability shifts from users to designers, thus, leading to a more bottom up approach to universal design.

In spite of the current initiatives on improving accessibility, visually impaired people still experience major difficulties accessing information on the Internet. It is therefore necessary to seek alternative solutions that can help address the 'digital divide'. I will explore how assistive technology helps to bridge the gap and reduce the technical barriers that prevent access to information over the superhighway.
2.9 Solutions to access using assistive technology

As new learning opportunities are available on the Internet, learners with visual impairment need to be taken into account. The training needs of people who learn using additional technology and different senses can be overlooked when colleges and universities provide online training for their students. Very often those responsible for designing e-learning environments and content may not have an understanding of what is required to make it possible for visually impaired students to access learning. Visually impaired learners (blind and low vision) have a range of needs when it comes to accessing e-learning materials. Students with low vision are able to read large print with the help of screen-magnification software, while others may have eye conditions that produce 'tunnel vision' and may be unable to read a single line or word at a time. Those who experience photosensitivity from the glare of the screen may need to wear tinted glasses to be able to read off the screen.

Some visually impaired people may have developed blindness in their later life and could need help with understanding some of the implications of using screen-reader software. Some may find it difficult to accommodate new ways of accessing the written text with earlier visual techniques, and, as a result, will require help with assimilating non-visual text with their pre-knowledge. Others who were born blind or developed blindness at an early age may have problems with understanding visual language in a text, which, again, may need some explanation.

The advent of new more sophisticated mainstream technology, such as the Internet, has not necessarily led to increased access for the visually impaired community, but, in some ways has caused greater problems. The increased use of multi-media and other high quality graphical displays on the Internet may be problematic for visually impaired learners to use. The increasing use of visualisation on VLEs could cause more problems for those who cannot appreciate or sometimes not want to know about the aesthetics of a website, i.e. the blind.

The following sections explore some of the ways that visually impaired people can
access and share information using assistive technology.

2.9.1 Assistive technology

Assistive technology (AT) refers to mechanical, electronic or computerised tools for enhancing the functioning of people who have a physical impairment or disability (Scherer, 1993). There have been considerable technological developments in AT for people who are blind or who have low vision. Many people who are blind have learned to read through touch, principally through braille. They can now have access to electronic braille note takers. For example, a *Braille 'n' Speak*, which is a portable note taker, can act like a computer, containing a similar keyboard to the Perkins brailer, with seven black buttons (six dots plus a space key) making it easier for someone to transition from the classic brailer to a technological equivalent brailer. A more sophisticated piece of AT which involves knowledge of braille is the electronic refreshable braille display. This is a keyboard that displays between 20 and 80 characters of text in one line. The braille letters are formed by sets of pins being raised and lowered electronically. These displays are refreshable, meaning that they allow the information displayed to change as the user moves the display window around the screen (Leventhal, 1996).

Most visually impaired computer users in the UK and Ireland employ screen-reading software packages available on the market, such as the screen-reader ‘Job Access With Speech’ (JAWS) or Supernova screen-reader. Dolphin, a UK manufacturer of screen-reading software, has recently launched a screen-reader on a USB or pen-drive which can be inserted into any PC that has a sound card. This is particularly useful for secondary and third level students who wish to access the Internet at different locations e.g. at computer labs, Internet cafes, at home and other locations. All these screen-readers speak the text helping the learner to navigate through menus, dialog boxes and edit fields and other functions. The computer is normally controlled by a standard keyboard using key combinations called keyboard shortcuts, instead of a mouse. The shortcut keystrokes are generic and can be used to execute any action using Windows Operating System or Microsoft Office. The screen-reader, JAWS, has additional key strokes or shortcut keys that enable users to perform...
certain tasks e.g. the enter key allows text to be entered into an edit field commonly found on online forms.

New technologies give computers a voice or allow the user's voice to be recognised by the computer. Voice eXtensible Mark-up Language (VXML) gives WebPages the option of built-in speech or, in the case of Dragon and Naturally Speaking, allows interfaces that support voice input through automatic speech recognition. Torres, et al. (2002) discusses the number of different possibilities for developing voice online as part of their project called VISUAL (Voice for Information Society Universal Access and Learning). They argue that VXML should be considered Web navigation's third dimension to make websites more natural and attractive for people with visual impairment.

The quality of screen-reader voices has improved considerably over the past ten years as a result of increased investment in developing less synthetic and more 'human' type voices. The classic Stephen Hawkins voice has been the standard screen reader voice used for JAWS and earlier screen-readers, including the Kurtzweil, for more than twenty years. New advances in speech output software have resulted in users being able to choose from a more sophisticated menu of accents and gender. These earlier synthetic voices were phonetic and so letters would be lost creating problems of comprehension (Gerber, 2003). The Dolphin software company in the UK has been successful in producing a range of high quality human voices that are easier to listen to and are more affordable than many other screen-readers. Experienced users of the software can set the voice at fast speeds, allowing for quicker access to information from the central processing unit (CPU). This is advantageous for those who can surf quickly through webpages and find the precise information (Gerber, 2003).

There are other technologies relevant to the visually impaired user such as Kurtzweil's advancements in screen magnification and Duxbury's software that transcribes text into braille, which can then be printed out onto a braille press. Some operating systems have built-in accessibility features. The Mac OS X Tiger includes a voice-over interface, magnification options and keyboard control. Tiger also reads out loud the contents of files and reports on screen activity. By assigning unique voices to
different types of information users can quickly distinguish information sources. Voices can also be tailored by adjusting its pitch, speech rate and volume. The progress in tailoring speech software to suit individual preferences could have a strong impact on the way people who are blind access information by increasing their capacity to retain more information at faster rates. There is currently little research to prove whether the tailoring of synthetic voices increases the rate at which visually impaired users access and retain information.

2.9.2 Usability

Usability measures the quality of a user's experience when interacting with a product or system — whether a website, a software application, mobile technology or any user-operated device. It is important to realise that usability is not a single, one-dimensional property of a user interface. Usability is a combination of factors including:

- **Ease of learning** – How fast can a user, who has never seen the interface before, learn it sufficiently well to accomplish basic tasks?
- **Efficiency of use** – Once an experienced user has learned to use the system, how fast can he or she accomplish tasks?
- **Memorability** – If a user has used the system before, can he or she remember enough to use it effectively the next time? Does the user have to relearn with every attempt at a task?
- **Error frequency and severity** – How often do users make errors while using the system, how serious are these errors, and how do users recover from these errors?
- **Subjective satisfaction** – How much does the user like using the system? [http://www.usability.gov/basics/whatusa.html]

According to Nielsen (2001), 'studies of user behaviour on the Web find a low tolerance for difficult designs or slow sites.' He argues that people do not want to wait
and they don't want to learn how to use a home page.

There's no such thing as a training class or a manual for a Web site. People have to be able to grasp the functioning of the site immediately after scanning the home page — for a few seconds at most (Nielsen, 2001).

Usability engineering techniques exist that broadly extend the skill range of potential users, and accessibility techniques for physical capabilities (Keates and Clarkson, 2002). However, approaches for combining utility, usability and accessibility methods are rare (Nielsen, 1993). Nielsen argues that usability needs to be designed directly into the system therefore allowing accessibility to the whole population.

There are now websites that provide useful information to companies and organisations on how to plan usability activities that can be integrated into a website's design. Usability.gov is an American government website which provides a step-by-step approach for planning usability activities that can be integrated into a website's design. This organisation takes a company or organisation through the process from start to finish, provides a rationale for carrying out these steps, and details the benefits for both the site user and the company or organisation.

2.9.3 Accessing multimedia

One of the key problems discussed earlier in this chapter (see sections 2.4.2 and 2.6.2) is making multimedia accessible to visually impaired people. Today, publishers of trade books, textbooks and periodicals are developing electronic books that can be accessed, downloaded and displayed using browser plug-ins, stand-alone software and hardware devices. Many e-book formats offer features such as audio playback, built-in dictionaries, easy-to-read type, highlighting, note-taking, book marking, text searches and direct Internet connections. Most e-book titles can be read on a desktop or laptop running Windows or Macintosh OS, and an increasing number can be read on portable devices such as palm pilots, Tablet PCs or Pocket PCs. The US Government has spearheaded a project called 'Beyond the Text' through the National Center for Accessible Media (NCAM) to enable disabled users to easily locate,
activate and utilise accessible multimedia content within various e-book formats, software and hardware. With funding from The US Department of Education [www.ed.gov], NCAM researches and produces demonstration models, recommends good practices and contributes to specifications that support the creation of accessible images, audio and multimedia. The device manufacturer Cytale is developing sophisticated rendering technology into its CyBook reader. Adobe has also recognised this potential and is developing a technology called CoolType, which will allow for better rendering of text in PDF format.

Similar Government sponsored projects could revolutionise the way electronic books are published in the UK and other EU countries increasing the internationalisation of books, periodicals and textbooks for studying and work purposes. The increased availability of e-books should lead to richer learning experiences for visually impaired people participating in e-learning and blended e-learning activities.

2.9.4 Global Positioning Systems (GPS)

Technological advances, governmental deregulation and commercial competition have resulted in portable user-friendly devices. By combining GPS and computer technology it is now possible to navigate (to a certain extent) human designed and natural environments. The advent of wireless technology such as Bluetooth, the decreased size of hardware and increasing connectivity capabilities of personal digital assistants (PDAs) make it possible to construct lightweight and practical interfaces. The Sonic Arts Research Centre (SARC) at Queen’s University Belfast, is developing algorithms for location detection. Known as ‘Enabled’ these algorithms are based on Wireless local area network LAN, Bluetooth and global positioning systems (GPS), will determine the outdoor or indoor location of a visually impaired user (Kuber, et al. 2005).

Scheidegger (2007) from the US Center for Assistive Technology suggests that GPS devices should be used as an adjunct to the more traditional orientation and mobility aids like guide dogs and canes. He goes onto say that ‘this technology can provide
users who encounter sensory loss with valuable information about the environment' (p.56). There is a need for portable braille readers and *haptic* devices that offer feedback vibration connected to PDAs. Unfortunately, weak satellite signals, lack of accuracy, complex and vulnerable technological set-ups, and user acceptability issues could cause problems to successful implementation of these new technologies.

A recent study conducted by Gustafson-Pearce et al. (2007) investigated the use of GPS for visually impaired pedestrians. They found that pedestrians need to be able to hear ambient sounds, such as the approach of a vehicle or other pedestrians, when outside walking. Many of the aids available for visually impaired pedestrians use haptic perception (e.g. the cane, tactile maps) therefore, making tactile interfaces an effective method of gathering information. They say that the majority of aids currently in use employ the active tactile method, which requires the user to engage in information gathering/processing in order to disseminate information. They invented a different interface in the form of a harness that is worn under the outer layer of clothing but over lightweight underwear, and provides passive feedback, which did not require the user to engage in information gathering/processing; the messages are given and the user responds. The testing of the harness produced mixed results with some visually impaired subjects reporting a strange uncomfortable feeling from it whereas others reported that it felt 'intuitive' and that with a longer period of use they would become 'very comfortable' with using the interface.

While all these cutting edge projects can be seen as breaking through the technological barrier, researchers are increasingly aware of the need to involve disabled users in testing new devices. Nielsen (2001) states, 'usability goes beyond the level of individual users interacting with screens. It's also a question of how easy or cumbersome it is for the entire organization to use a system (p.53).’ In other words, we need to think more about usability in terms of collective groups, to see how individual groups, for example deaf-blind users (visually and hearing impaired users), collectively access a new system interface or device.
2.9.5 Assistive technology and training

Many types of assistive technology are quite complex to use and often require individual, face-to-face, instruction on how to use it. In education contexts, teachers sometimes avoid introducing more technically challenging types of technology to visually impaired students even if they are more appropriate (Corn and Wall, 2002). In their study of the use of technology and multi-media presentations by teachers of students with visual impairment they found that the teachers were more at ease with general technology rather than the assistive technology. Craven and Brophy (2003) in their study of the use of library interfaces by people who are blind or have low vision found that people using the latest versions of assistive technology were offered navigational shortcuts to speed up the search and browsing process, but not everyone had access to the latest technologies. They also found that those with more experience with the assistive technology were often more successful with the task. Abner and Lahn (2002) found in their study of teachers working with learners with visual impairment that the teachers did not, in general, feel competent to teach assistive technology. Douglas (2001) also points out that new technologies are often complex and that teachers must have high levels of competence to exploit their potential.

Summary

This short exploration of the vast domain of assistive technology and the small selection of vignettes help us to better understand the complexities involved in designing and testing different options. One of the biggest issues involved in providing assistive technology is training for both the user and the teacher or tutor. Some of the evidence from testing screen-readers shows that good knowledge of how to use them can enhance the learning opportunities for the visually impaired.

The final section explores how assistive technology can be applied to computer and Internet interfaces to access learning.
2.10 Developing technology solutions to enhance the learning of visually impaired people

Advances in the design and use of assistive technology should make 'the information age' accessible to all learners, including those with very specific needs. However, there is still a considerable way to go in terms of moving from a prototype stage to making it more widely available to the public. Research into this domain requires large amounts of funding from large state and scientific organisations as well as excellent research partnerships at national and international levels. Recent developments have led to an increase in interest in making assistive technology more available to visually impaired people in developing countries such as India and parts of Africa. For example, the RNIB and Dolphin, an assistive technology company, have recently spearheaded an initiative to manufacture large quantities of screen-reading software on USB pens as part of an international campaign called 'TechShare' in 2007. This initiative has already attracted attention from other assistive technology suppliers of screen-reader software companies who see the value of making their software available to larger audiences across the African continent and Indian sub-continent. This, in turn, helps to drive down the cost of the software which has always been a reason why many people, even in Europe, cannot afford to purchase the software.

There is a general sense that recent technical developments, through faster broadband and greater flexibility in learning approaches, will impact positively on visually impaired communities. Levels of engagement differ between members of visually impaired communities and between people who have low vision or blindness. One of the key questions to explore is to what extent there is a level playing field between e-learners who are blind, those with low vision and those who are sighted. This question is discussed in the next sections of this chapter.

2.10.1 Seeking solutions to e-learning access

Pedagogues and web designers have had to overcome challenges to make VLEs maximally accessible to the visually impaired, through careful planning and usability
testing. It is important to discuss conceptual frameworks that increase not only the level of access to a VLB and e-learning for the visually impaired but also increase their levels of learning. One of the most important considerations to take into account is the amount of time a visually impaired person needs to carry out similar tasks compared to their sighted peers. Evans and Sutherland (2003) discovered, in a comparative study between blind and sighted computer users, that those who used a screen-reader spent up to three times longer on tasks in the VLE than did sighted users. They explored this finding further in a more substantial study which incorporated a theoretical framework that was based on navigation in hypertext and on cognitive load theory (Cooper, 1990; Paas, et al. 2003). Cooper (1990) defines cognitive load theory as 'the level of energy required to process a given amount of information' (p.108). They explain that as the amount of information to be processed increases, so too does the cognitive load.

Many studies outside the field of visual impairment show that multimedia presentation of learning content can lead to enhanced learning experience and better performance (Mayer, 2003; Garrison and Anderson, 2003). Multimedia environments occur when communications are presented in more than one form i.e. in a verbal and a visual format (Mayer, et al. 1999). Mayer et al. (1999) put forward a cognitive theory of multimedia learning where visual and verbal materials are processed in different processing systems and that a human is only able to process information in each channel at one time. They also argue that meaningful learning occurs when learners mentally select relevant information and build coherent connections. The third point is based on constructivist learning which occurs when learners are able to 'build referential connections between corresponding aspects of the visual and verbal representations held in the working memory at the same time' (Mayer, et al. 1999, p.639). By varying cognitive load on working memory through varied animation and narration, learners have opportunities to build the referential connections needed for constructivist learning.

Earlier research conducted by Mayer (1997) has produced evidence for a contingency effect in which students perform better on retention and transfer when they view the animation concurrently with the corresponding narration than when they view the animation before or after the narration. McAteer and Shaw (1995) also found
that e-learning is more effective when more senses are engaged; that is, when both the cortical and visual senses are engaged, deeper and more meaningful learning can take place. Multimedia environments that minimised working memory load allowed learners to select relevant information and build integrated mental models that allowed transfer. These results may not be specific to e-learning, or blended e-learning, but they are significant in that they raise an issue about how people who are blind learn using multimedia. If learners who are blind are engaging with different modalities that are designed to maximise learning using text and images, they are even more at a disadvantage if they are accessing only the textual element. Craven and Brophy (2003) in a study, previously discussed in the earlier section on ‘Assistive technology and Training,’ found that visually impaired learners have to spend more time searching for information than do sighted people. They found that the time can be reduced considerably if simple design features are included. They also observed that screen readers forced the users to navigate pages in a serial way that was not always appropriate for the design of the page. Gerber (2003) identifies two approaches that visually impaired people use to navigate the Internet – ‘scrolling’ and ‘searching’. The ‘scrolling’ approach entails listening to the pages in their entirety or scrolling through the pages by links using arrow keys or other strategies. The ‘searching’ approach entails mining for the information you need. Gerber found variations in use based on the level of expertise of computer technology, the type of assistive technology used and the age group and gender. More experienced users explained that searching with targets in mind is better than browsing.

Morley et al. (1999) conducted a study among nine blind users of a hypermedia system that made use of non-visual interface, non-speech and three in-put devices. They found that apart from the design issues, the users enjoyed the chance to explore in a non-linear manner and 'were excited by the multi-media presentation, which gave them access to a wider variety of information than ever before' (p.25). More research could help us to understand how best to design e-learning materials in order to maximise visually impaired students' learning outcomes and enjoyment.

In a more recent study, Evans and Douglas (2008) measured the experiences of 10 male participants who were blind and 10 male participants (all aged between 16 and 27) who were sighted while working through an online learning task. All participants
were competent users of computers, the Internet, e-mail and chat rooms. The information in the tasks was presented in the form of text, audio and graphics in a linear format covering 24 pages or screens. The learning objects were primarily designed for sighted persons, but were adapted to be used by persons who are blind in that everything was accessible through direct screen-reader software. Participants were asked to work through the learning material which took approximately 10-35 minutes. The learning materials contained questions around the 'mental effort' required to understand the materials and navigate through them. The participants who were blind were also asked a similar question about accessibility.

Overall, the participants who were blind took twice as long to complete the learning task as the sighted participants. They took an average of 8% of their time accessing materials with their screen-reader. Both groups spent more time engaged in 'doing' than other tasks, though the participants who were blind spent 40% of their time listening and reading and spent a further 35% of their time answering questions compared with their sighted peers who took 21%. The participants who were blind on average said that accessing the materials took mental effort using the screen-reading software and the sighted participants did not have this additional task. Two participants who were blind thought that the learning materials were user friendly and easy to use. Five of the participants who were blind specifically commented that the materials were accessible and usable. Lastly the sighted group had a higher average score than did the blind group.

Despite the small sample in the study, it provides some useful data about e-learning and the contrasting performances of blind and sighted students. One of the most significant results is the amount of time students who are blind used accessing the screen reading software to access the learning object. Evans and Douglas see this as a 'cognitive load' in time of on average 8%. This percentage could be reduced further if the students had used the shortcut keys that were added to the learning materials. This is an important finding as the inclusion of keystrokes to help blind users navigate around an e-learning environment could reduce the amount of time used on accessing the learning object with the screen-reader, leaving more time for other activities e.g. 'doing'. As discussed in an earlier section on universal design, the following of good design principles, such as the WAI should reduce any high level
barriers that could prevent a screen-reader from accessing information on a VLE.

Finally, Phipps and Kelly (2006) put forward a holistic approach to the design of e-learning and argue that simply following the WAI guidelines may not be sufficient. In their approach to accessible e-learning, there is a need to provide accessible learning experiences and not necessarily an accessible e-learning experience. This approach has parallels with the concept of 'blended e-learning'. They propose addressing the usability of e-learning resources, the pedagogic aims of the e-learning resources, infrastructural and resources issues which are appropriate to the framework. There is a need to place the learner at the centre of the development process by focusing on the broad learning outcomes and recognising that inaccessible e-learning resources may be used provided that disabled learners are still able to demonstrate the required learning outcomes in a way that does not disadvantage them or their non-disabled peers.
2.11 Summary and ensuing research questions

This review has captured some of the main concepts and theories around visual impairment and the impact it has on learning. It has raised some of the difficulties that using new technology present for website designers and e-learning content managers. The review has identified some ‘gaps’ in our knowledge in terms of how much we actually know about the learning outcomes of e-learning for the visually impaired. Advances in technology seem to suggest that we have the capacity to include visually impaired adults in the e-learning domain, but new evidence seems to suggest that there are still a number of practical issues that need to be dealt with, principally in terms of training students and teachers how to use assistive technology and then apply it to more mainstream interfaces (e.g. the Internet and e-learning).

The review also raised issues around accessibility and how barriers to technology can be overcome. It also explored the difficulties around building flexible, inclusive and supportive learning environments that promote the kinds of learning posited by social constructivism (by developing critical thinking and the use of higher-order skills). There are great potential benefits for the visually impaired community if appropriate steps are taken to construct an e-learning environment that considers their individual technical and learning needs; however, there are few cases where these needs have been taken forward and been incorporated into new e-learning structures. Assistive technology still plays a critical role in helping visually impaired users access learning, but it does not necessarily hold the answer to total access. This may only happen when VLEs and supporting e-learning content can offer a choice of seamless integration of blended tools and learning activities that can easily be accessed without having to use assistive technology. This may still be a dream for some but it could change the way disabled people learn using technology.

One of the biggest challenges for web designers and pedagogues is to ensure that visually impaired people are involved in the construction and testing of new learning environments. Inclusive principles of design also mean including the visually impaired using research approaches that value their opinions. The resulting research questions (below) derive from this review and have been constructed to find out more
about how we can build on the current technological developments to promote inclusive learning for visually impaired adults. The literature review has identified some areas that could be further explored, particularly in terms of developing greater access to e-learning through the promotion of virtual learning environments. We need to consult with the visually impaired community to agree on a set of principles that can be adopted to see if it is conceptually possible to achieve an inclusive virtual learning environment. Finally, we need to explore the most appropriate way of achieving these principles. Chapter three explores a potential framework for disability that could facilitate this process.

The following research questions are at the heart of this thesis and follow from the research aim to investigate the potential role of virtual learning environments in fostering effective learning for visually impaired people. The context of the research explores some of the main advances in the development of e-learning and assistive technology in providing new learning opportunities for the visually impaired.

1. What principles should be used to provide a framework for the development of a technology-based inclusive learning environment with particular reference to adults with visual impairment?

2. Is it possible to derive a set of principles through an inclusive strategy?

3. Can these principles be used to develop and test an inclusive learning environment, including a VLE and an appropriate pedagogy for e-learning?
Chapter Three – A Framework for Researching Disability

3.0 Introduction

This chapter sets out to identify a suitable methodology to address the research questions given at the end of the previous chapter. These questions have highlighted gaps in our understanding of how developments in new technology can promote more inclusive ways of learning for visually impaired people.

As a result of my experience as a teacher working in the field of special education in Ireland as well as subsequent research work over ten years, I have been increasingly drawn to ethnographic approaches involving disabled children, parents and other professionals. I have had the privilege of participating in a range of small school-based research projects that have used participatory research models drawing on methods such as photography, music and art (e.g. Dublin Inner-City School and The Photography Gallery Project, 2002). These methods and their associated methodologies encouraged children to take the lead in creating a number of visual and musical outputs that celebrated learning diversity and difference.

As a result of these projects I have developed a strong preference for methodologies that similarly encourage and respect the voices of those who have been marginalised, particularly on issues that affect their rights to quality education. It is with this particular stance that I intend to continue my research within the field of ethnography.

As part of this process to identify a suitable framework for this research, I expose some of the main discourses around disability research and social inclusion with a focus on exploring a framework for conducting research with visually impaired people. This framework is partly based on the lead researcher's epistemological standpoint of being committed to research that declares itself to be supportive of shifting the locus of control to a position that acknowledges the importance of participation and co-ownership of disabled people (see chapter one, section 1.5.1).
The review will identify and discuss some of the current practices of increasing the levels of participation in research. This implies researching paradigms that shift the level of ownership from the non-disabled researcher to a more balanced relationship where the disabled person has more control over what research issues should be prioritised and how research should be constructed and delivered.

A useful emancipatory research paradigm is proposed out of the discussion around disability research. It is proposed that a resulting framework should establish procedures through which discourses can be developed into methods that challenge the imbalance of power between the research ‘subjects’ and the researchers. This imbalance of power is challenged by ways of conducting research through a coalition of researchers, most of whom are visually impaired. Duckett and Pratt (2007) carried out a review of social science literature and were unable to find examples of research informed by empowering and emancipatory paradigms involving visually impaired people. They argue that such research is ‘at best unrecognised and at worst considerably under-developed’. This contrasts quite remarkably with research involving disabled people more generally, where the social model and the use of empowering and emancipatory research designs are growing (Duckett and Pratt, 2001). This paradigm will be discussed in relation to carrying out research into inclusive learning environments, more specifically, how it can help to develop research on the implications associated with using assistive technology for e-learning and the barriers caused by inadequate consideration for inclusive design for the visually impaired community.

3.1 A short review of disability models

This section discusses two of the most prominent models of disability (medical model and social model) and their impact on the discourse around social inclusion, discussed in section 3.3. It is unnecessary, at this stage, to review the history of disability but instead more useful to discuss how shifts in thinking have led to wider interpretations of existing theories of disability (Corker and Shakespeare, 2002).
The rise of disability theory grew from disabled people and their organisations that developed their own critique of the conventional approaches to disability (Barnes and Mercer, 2003). The politicisation of disability by disabled activists in the 1960s and 1970s led to a shift in how disability was perceived by earlier sociologists (e.g. Goffman, 1968; Scambler and Hopkins, 1986) who chronicled almost every aspect of disabled people's lives mainly through the mechanisms of social control of doctor-patient interactions. Many of these studies were rooted in 'conventional wisdom' (Barnes, 2006), namely, that the accredited impairment, whether physical, sensory or learning, is the primary cause of 'disability' and therefore the problems (economic, political and cultural) encountered by people labelled as 'disabled'.

What is interesting about the debate between the definition of 'impairment' and 'disability' is the interpretation attached to whether we are discussing it in relation to the medical definition e.g. cognitive, sensory or in socio-political terms as 'the outcome of an oppressive relationship between people with impairments and the rest of society' (Finkelstein, 1980, p.47) or through a social model which redirects the line of causation from the 'individual pathology' to an interpretation of the outcomes of social barriers and power relations that impact on the disabled (Finkelstein, 1980; Oliver, 1996). This two lens approach through which we formulate our views of social exclusion and disability i.e. focusing on the impairment or on the social barrier, can cause friction among the medical profession and disability movement.

The 'social model of disability' coined by Mike Oliver in 1983, referred to 'nothing more or less fundamental' than a shift from an emphasis on individual impairment 'towards the ways in which physical, cultural and social environments exclude or disadvantage people labelled disabled' (Barnes, 2006, p.348). Oliver drew on a number of influences, including personal experience and the writings of disabled people such as Finkelstein (1980) and Hunt (1966). This was considered to be a radical departure from conventional wisdom in discussions of disability and impairment and has been interpreted and misinterpreted by social science researchers. International organisations such as the World Health Organisation (WHO, 2001) have changed the incorporated aspects of the social model into its most recent 'International Classification of Functioning, Disability and Health; transitioning from the definition of 'impairment, disability and handicap'' to "impairment and
participation'. It is a matter of debate whether WHO development work has evolved through its own engagement with discourses about impairment and disability or whether it has been more directly influenced by the social model associated with Oliver (1983).

Corker and Shakespeare (2002) take a postmodernist stance of how disability should be interpreted today. They consider existing theories of disability, which are sometimes radical and other times mainstream, as no longer adequate. They argue that both the medical model and the social model seek to explain disability universally leading to 'meta-historical narratives that exclude important dimensions of disabled people's lives and of their knowledge' (Corker and Shakespeare, 2002, p.15). They are strongly opposed to squeezing the global experiences of disabled people within one unitary model or a set of ideas. It is important to remember that the social model of disability is particularly associated with a United Kingdom perspective on disability. This perspective has been influential internationally, and continues to be, but other theoretical accounts of disability and its social dimensions have been developed in North America, some of which are not driven by the social model of disability exclusively, or at all (Siebers, 2004; Davidson, 2008). Siebers and Davidson propose a post-modern concept to talk about disability considering the different ways in which disabilities impact on individuals and groups over their lifetime. They propose a 'new theoretical toolbox' which has a number of conceptual tools at the researcher's disposal to interpret what is happening at a particular time of a disabled person's life. They consider the importance of visiting different theoretical approaches such as through a post-structuralist intervention which is concerned with ways of thinking about how meanings are established, and then are organised through difference in a dynamic play of presence and absence. This could also be interpreted through a Derridean perspective which would argue that 'normativism' needs disability for its own definition: 'a person without an impairment can define herself as 'normal' only in opposition to that which she is not – a person with an impairment' (Corker and Shakespeare, 2002, p.7).

Further interpretations can be made from other overlapping theories of Marxism, queer studies, 'race' studies, to name a few. These theories, often opposing at times or even in tension, avoid the stamping of the individual and try to be more dynamic in
their explanation of the changing relations of political domination, social exclusion, religious bigotry or cultural differences of the body. Finally, Corker and Shakespeare (2003) argue for disability studies to engage more with the outside world by integrating postmodernist approaches that link to empirical investigation. They state that there should be ongoing involvement of disabled people and with the policy issues facing the disability community at local, regional and international levels. Corker and Shakespeare highlight the complexities that now exist when we try to decide on which approach(es) to use when trying to map out the disability terrain, as it is fraught with critics who challenge researchers' wisdom against a backdrop of modernist and postmodernist theories. We can observe the complexities of disability if we compare its unfixed status with other social dimensions where equality dimensions normally apply. For example, a person's gender status is reasonably straightforward to define and does not generally change for the majority of the population; however, a person's socio-economic status can change and there are categories that help us to identify which group a person falls into. It is more difficult to identify disability status where there are a range of conditions, some of them transient, all of which carry different implications. For example, a child who has severe low vision at an early age could develop further loss of vision as a result of having a deteriorating eye condition or disease such as Retinitis Pigmentosa (RP) which will eventually lead to the child developing complete blindness in later years. The 'visual impairment' will have a greater impact on the child's life when she is an adult.

The term 'social model' is still widely used today in spite of the criticisms levied around it for being too restrictive as a model (Corker and Shakespeare, 2003) and has been adopted by disabled persons groups outside the UK. New conceptual interpretations of the model have led to a new term of 'social interpretation' proposed by Vic Finkelstein (2001), which looks at the historical-materialist version of the social interpretation of disability. This 'interpretation' does not consider 'disabled people' as the subject matter but more the 'disablement' i.e. the social oppression of people with impairments, as the subject matter. The model is influential at three levels:

1. through research and teaching (e.g. Imrie and Edwards (2007) being felt to be obliged to filter the data through a social model of disability to satisfy the
institutional sponsor. This was despite the children's testimonies and experiences suggesting that they did not feel oppressed or disadvantaged by the environment;

2. policy (e.g. disability rights, legislation in the UK); and

3. non-government organisations and advocacy organisations that espouse a commitment to the social model of disability.

This consideration of some of the main concepts around the models of disability will help to inform my epistemological position to inform the research process and will help to explore the development of disability research and the identification of a research framework that could be employed for the next stages of the research.

3.1.1 Disability research in Ireland

It is useful at this point to have a brief look at how disability research has developed in Ireland and the increasing acceptance of the social model as the principle research framework there. The National Disability Authority (NDA) is committed to a social model of disability and the empowerment of disabled people (NDA, 2000). It has shown strong allegiance to Oliver (1990) and his interpretation of emancipatory research (see section 3.3 for more discussion about the nature of emancipatory research). A prominent Irish disability researcher, Kitchin (2000), has looked beyond the social model and emancipatory principles into what he considers to be more practical models of research. He has promoted a participatory model called Participatory Action Research (PAR) which, he claims, is based on changing the social relations of research by creating an equal partnership between a researcher and people with disabilities. The NDA has developed a series of publications for researchers wishing to conduct research into disability in Ireland (Guidelines for Including People with Disabilities in Research in 2002 and Ask Me: Guidelines for Effective Consultation with People with Disabilities in 2004). These guidelines help academic researchers to explore new ways of including disabled people in participatory research.
The NDA supports research that employs other researchers with disabilities to work on projects (2002). They view the employment of disabled researchers similar to those of the research target population as valuable in terms of 'utilising disabled people's experience and expertise to inform the content of the research ensuring that researchers employed can demonstrate an awareness of fundamental issues around disabling barriers' (NDA, 2000, p.32). The Authority provides some practical guidelines on travel and transport, provision of equipment and meeting the cost of personal assistants. These guidelines proved to be useful when I set up the research with two organisations representing the visually impaired: the National Council of the Blind, Ireland (NCBI) and the visually Impaired Computer Society (VICS).

Over the past ten years, Irish Universities have taken the lead in disability research by setting up equality studies and disability departments (e.g. University College Dublin, Trinity College Dublin) and have focused on research around women and disability through the work of the Equality Studies Centre at UCD.

3.2 Disability research

Research is a social act which involves interactions and relationships with a range of individuals and groups which entail ethical, procedural and political issues (Barton, 2005). Criticism has been placed on social scientific researchers from a range of sources (Hargreaves, 1996; O'Reilly and Barot, 1997) for wasting limited financial resources, writing politically biased materials and having a lack of relevance to schooling and the economic well-being of society. Disabled scholars and organisations of disabled people are arguing for criteria of utility that are explicitly concerned with issues of social justice, equity and citizenship and therefore address political dimensions to social research.

There is a strong argument that research involving disabled people should seek ways of empowering those who agree to participate in studies (Barnes, 2006; Walmsley, 2006). Oliver (1997) asserts a value for research that is transformative, relevant to the disabled and significant in the lives of disabled people. How we define what is or is not relevant research could depend on whether the research priorities of the
research funding body are similar to the issues concerning disabled people. Some 'significant' research in the past has had disastrous consequences on the lives of disabled people where certain groups of disabled people have been institutionalised (e.g. Goffman's work on physically disabled and 'disfigured' and people with mental illness in American institutions). Oliver is therefore seeking a fundamental shift in the ways in which we think about research; these include the purpose, process and outcomes of these activities. This shift is what Oliver terms an 'emancipatory' form of research activity. Barnes (2006) defines this as 'the empowerment of disabled people through the transformation of the material and social relations of research production' (Barnes, 2006, p.349).

Other interpretations of emancipatory research or emancipatory method (Duckett and Pratt, 2001; Walmsley, 2001; Kitchin, 2000) assume that disabled people are the experts on disability and that their leadership and involvement in the research process is necessary for any research about them. Ultimately, the research agendas must be driven by the concerns defined by disabled people. The challenge is how to elicit these agendas, and how to do so in ways that are authentic and credible (Lewis, et al. 2008) linked to an understanding that there may be a spectrum of engagement with a commitment to an emancipatory framework for research. The British Council of Disabled People (BCODP) has taken measures to ensure emancipatory disability research actually produces data from research rather than simply being a political statement that is used by disabled people to criticise research where disabled people have not been involved. For instance, the BCODP, which consists of mainly disabled people, carried out some research on discrimination in Europe in 1991 which played an important role in achieving anti-discrimination legislation in the UK (1996 Community Care Direct Payments Act).

3.2.1 Inclusion of voices

An interest in seeking to understand the lived experience of disabled people in particular contexts has encouraged the introduction of oral and life-history approaches and story-telling as an alternative methods to undertaking research (Barton, 2005). This type of research can be very persuasive but has the danger of
being decontextualised or over-romanticised with regard to research practice. This form of research is time-consuming and produces only a small number of case studies at one time. This approach also questions the role of researchers and how they present the final presentation of the life-stories as the 'real' and 'truthful' stories (Goodley, 1996). Oral and life-history approaches and story-telling do not necessarily provide the 'research subjects' with the opportunity to decide how the research is carried out even in the case of Goodley and Moore (2002), when those being researched have learning difficulties and cannot decide for themselves.

Prevailing conditions continue to dictate that academic researchers find their careers obstructed if they attach greater precedence to research publications valued by disabled people (Oliver, 2006). This could potentially be problematic if those involved in the research are unhappy about how the final research is disseminated or even 'watered-down' to fit research journals. Journals that value the disabled person's voice through prose, narratives or personal life-stories (e.g. Disability and Society) may be better placed to accommodate the views and opinions of disabled researchers. It is still important for disability research to be published in publications that will have impact at a number of levels including policy makers, academia and at a level where disabled people are most likely to have access to information e.g. through organisations that represent their views.

Partly as a result of the disability rights movement, there is also a growing movement towards research that encourages the inclusion of those voices who are being researched (Baker, et al. 2004; Clough and Nutbrown, 2002; Walmsley, 2006). Gerber (2006) argues that the voice of the disabled has become so powerful that 'intellectual and ideological forces' (p.245) are seeking to give their voices centrality in shaping the discussion of disability. Research of this nature presupposes that the voices of its subjects have historically been excluded and oppressed through a variety of offensive 'mechanisms of silencing, suppressing and censoring' (Hooks, 1989, p.16). This type of research is demanding and can be quite time-consuming as it may involve 'self-reflection' and 'criticism' (Barton, 2005). The main challenge is over the extent to which participants find the experience of the research process to be enabling (Clough and Barton, 1995). Implications may arise from research that does not completely represent the voices or views of disabled people, particularly when
there are doubts about the capacity of people with severe learning disability being able to express their intentions to participate (Walmsley, 2006).

This calls into question the power relations between the researcher and the researched and this essentially humanist (Barone, 1990) approach to solidarity and empathy is not always enough for some researchers or readers who may consider the end result as an emancipatory act rather than 'the production of valid knowledge in itself' (Mies, 1983; Harding, 1987). Hammersley (1988) takes this argument further by encouraging us to question the assumptions that exist among research practitioners that remain unchallenged. He believes the emancipatory model is constrained by the limited range of topics that are judged to be important i.e. those directly related to the task of emancipation. This critical perspective of emancipatory research should not deter researchers from pursuing the topics that concern disabled people. What is more critical to this discussion is whether the agendas of topics proposed by disabled groups and individuals affect the way the data are collected, analysed and reported. Social scientists involved in the research, including me, have an academic duty to ensure the research design and chosen tools collect reliable data that can be scrutinised and judged as valid and reliable. It is critical that the research design has the flexibility to allow for multiple perspectives but still stay within the conventions of how social research should be conducted. The design should have enough flexibility for amendments if there are any unanticipated changes of plan and this is one of the virtues of qualitative research.

Social research is never truly objective and distant in the way research is claimed to be in the natural sciences, particularly with regard to the nature of issues that are being exploited and the assumptions that are accepted or challenged. In this respect, the research 'subjects' may help to shape the priorities of the research agenda or be allowed to ensure that their perspectives are adequately represented, but there is a real problem if the analysis and reports are altered to suit the specific agenda. This could arise when disabled people's groups extract research results from a study to promote their own agenda or campaign at a specific time or in the case where researcher interests are over-dominant.
This discussion now turns to inclusive research followed by a short review of research projects involving disabled people using the different approaches.

### 3.3 Inclusive research

Inclusive research is an umbrella term which is often used to refer to ‘participatory’ or ‘emancipatory’ approaches. Ostensibly, emancipatory research (Barnes and Mercer, 1997; Oliver, 1992; Zarb, 1992), which is almost exclusively associated with the Disability Movement, encourages the use of methods such as dialogue and reflexivity to obtain the experiences of disabled people. Participatory research is rooted in a long standing effort to ‘co-opt and understand the under-dog in a whole variety of settings’ (Walmsley, 2006, p.334). The dividing line between participatory research and emancipatory research can become quite blurred, but Zarb (1992) clearly states that ‘participatory research may be a prerequisite to emancipatory research in that researchers can learn from disabled people and vice versa’ (Zarb, 1992, p128). Lewis et al. (2008) see the importance of involving disabled people in research that takes different forms, ‘some more participatory and emancipatory than others, but such collaborative research seems likely to increase’ (p.82). Zarb also suggests that further important differences lie in who controls the research, who defines the role of the researcher, who holds the research accountable and how it is disseminated. Participatory research encourages a partnership with disabled people, particularly at data collection stages compared with emancipatory research which gives disabled people control of all aspects from formulation of questions to dissemination. Zarb argues that the accountability of the research in a participatory model is with the funder and for emancipatory research this tends to be disabled people and their organisations. This rather puritanical binary separation could lead to misinterpretations about which type of methodology is more representative of disabled people’s agendas or the funders’ own interests.

For the purpose of this research I will use the term emancipatory research as it is closer to the aims of this enquiry process and the following empirical study. This is based on an intrinsic commitment to the research design that recognises and affirms the experience of visually impaired people.
It is now important to compare and contrast ethnographic methods with emancipatory approaches. Emancipatory research, in this enquiry, seeks to address the imbalance of power between the researcher and the research 'subjects', in this case, by encouraging disabled people to consider their own role in the research process, whenever possible. This issue will be investigated further when we discuss the development of a three step study in chapters four, five and six. Creating a more balanced relationship between the researcher and a 'disabled group' can not necessarily be achieved unless all the participants have a full understanding of what is involved in the study and have a grasp of what expectations are placed on them (Finkelstein, 2001). Unlike other research approaches, the researcher moves from being the expert interpreter of the world to being 'the servant of disabled people, putting his or her skills at their disposal' (Walmsley, 2006, p.334). Although the disabled people's movement claims emancipatory research as its own, it does owe a great deal to the ideals of Freire (1970) who sees the road to 'emancipation' through a struggle of power between those who are oppressed as a result of power blocs and monopolies (economic, technological and political). Although he is not talking about research, he argues that dialogue is the core element in an emancipatory strategy that liberates rather than imprisons us in manipulative or antagonistic relationships.

Discourses around social inclusion have generated new alliances and partnerships between governments and disabled groups in the UK. These have become increasingly central to New Labour political ideology and politics (Long and Bramham, 2006). The Social Exclusion Unit (SEU) of the Cabinet Office considers exclusion in key service areas from health to housing via education, employment and crime prevention. These represent areas of major concern for disabled groups, including the visually impaired, particularly in relation to the lack of participation, integration and access to power many experience (Room, 1995). Long and Bramham (2006) argue that the social engineering of projects that fit the current debate are in danger of losing sight of who they are supposed to benefit. Just because a project is delivered in a disadvantaged area does not necessarily mean that the presumed benefits accrue to the socially excluded. Furthermore, a call for inclusion may not always result in research that is participatory, empowering or emancipatory. Duckett and Pratt (2007) are concerned with the risks of involving visually impaired people in
research to validate dominant disabling ideological frameworks. Bauman (2000) warns that ‘personal narratives are mere rehearsals of public rhetoric designed by the public media to represent subjective truths’ (Bauman, 2000, p.86). Hearing a small number of participants’ opinion that visually impaired people are unemployable cannot validate that opinion but can provide some personal life-stories that help us to better understand the challenges they face.

Emancipatory research can facilitate partnerships which make the research process more inclusive, not just by promoting a dedicated space ‘trapped in a cycle of sentimental biography or individual anecdotes’ (Finkelstein, 1980, p.67), but by encouraging the disabled participants to become involved in the decision-making processes from the conceptualisation of research issue right through to the writing and dissemination of the results (Lewis, et al. 2008; Porter, et al. 2005). In practical terms this could have dramatic consequences, particularly if the research questions, the data gathering methods, forms of analysis or all of these are controlled by one group, or if there is little or no dialogue between those carrying out the research and those controlling the agenda. As new research approaches are being tested to bring the voices of the disabled and other often under-represented groups, it is important to remember that the people we are bringing into the research process are the ‘experts’ in their own right. Disabled people are, in a sense, ‘experts’ on their disability and on issues that affect them. Research that places doubt about the authority of their ‘expertise’ could find itself in conflict with very issues it is trying to access; that of the views and opinions of the group it is researching.

Emancipatory research, through its aim to achieve cultural exchanges, allows the researchers to analyse their interpretations of the world with participants’ assumptions and interpretations. It is therefore important that researchers explain the roles they adopt and to reflexively analyse their role in actually producing research findings (Davis, 2006). Oakly (1994) sees this as a constant reflexive process in which reworking and re-understanding of observations and experiences lead to a story which represents the interaction between the culture of the researchers and the cultures of those being researched. Baker et al. (2004) argue that systematic reflexivity is a requirement of emancipatory research as ‘it is only through the constant analysis of one’s theoretical and methodological presuppositions that one
can retain an awareness of the importance of other people's definitions and understandings of theirs' (p.183). They also argue that reflexivity can facilitate change if it is guided by principles of democratic engagement and a commitment to change.

Gollop (1989) identifies three fundamentals on which emancipatory research must be based – reciprocity, gain and empowerment. In effect this means that 'researchers have to learn how to put their knowledge and skills at the disposal of the research subjects' (Oliver, 1990, p.111). In this way a new research agenda will be developed and research relationships, as expressed in traditional social research methods, are more likely to be the focus of considerable debate.

These three fundamentals can be built in by encouraging self-reflection and a deeper understanding of the research by the research 'subjects' (Lather, 1987). These fundamentals are important but are very difficult to achieve in research which requires enormous contributions from disabled groups e.g. people with learning disabilities. While reciprocity is a worthwhile aim, claims to have achieved it (Oakley, 1981) have been called into question when researchers never reveal as much about themselves as they expect to be revealed (Freire, 1970). A major issue is how experienced researchers put their knowledge and skills at the disposal of the research subjects for them to use in whatever ways they choose.

Barton (2005) states that researchers are already coming under greater pressure to examine their assumptions and methods, which in many respects, is to be expected, and is effectively leading to closer partnerships between the researcher and the researched during the research process. Barton proposes a process of open debate and mutual tolerance to ensure a more productive way forward.

Until recently, there are few examples of research informed by an emancipatory paradigm involving visually impaired people (Duckett and Pratt, 2001). Duckett and Pratt (2007) express disappointment in both the quantity and quality of the research they found that employed emancipatory and participatory research methods in the field of visual impairment in the UK. Paradoxically, the same is not true in the field of learning difficulties (Atkinson, 2004; Chappell, 2000; Ramcharan, 2005; Walmsley, 2001) or mental illness (Fossey, et al. 2002; Kruger, 2000) where there are numerous
examples of research studies based on employing emancipatory research principles. Walmsley (2001) suggests that research projects including people with learning disabilities have led to some creative, even empowering projects.

These few examples, although having contradictory impact, in terms of the critical appraisal, appear to mirror the social policy context where the right to social inclusion of disabled people is embedded in social policies. In Ireland, the National Disability Authority (NDA) has a formal purpose to ensure that the rights and entitlements of disabled people are protected. It also assists in the coordination and development of disability policy and to commission or collaborate in disability research, and to contribute to the development of statistical information relating to programmes and services for disabled people.

The Departments of Education and Health in the Republic of Ireland, through the support of the NDA in Ireland are taking a greater interest in the views of different disability groups e.g. The National Council for the Blind (NCBI), National Association of the Deaf (NAD) and special interest groups e.g. Learning Disability Special Interest Group, Disability Federation of Ireland. The Irish Government organised several consultations with the purposely formed Disability Legislation Consultation Group while debating the then Disability Bill (2004). As a result substantial amendments were made to the Bill before it could proceed to the final stages of becoming law. It may be argued that this consultation process has increased incentives to include disabled people in research (Gilbert, 2004).

3.4 Moving towards a research framework

This review has highlighted some of the discussions and criticisms around disability models and their impact on research in the disability field. It also discussed the cultural and theoretical shift research has made in order to address the imbalance of power between the researcher and the research 'subjects', by encouraging disabled people to consider their own role in the research process. This shift to a more egalitarian approach to social research is referred to as 'emancipatory disability research' which emerged partly out of the growing unrest among disability rights - 96 -
movements which were strongly concerned by the lack of consultation between the researchers and the targets of their research 'disabled people'. These serious concerns generated considerable debate in the disabled academic field which challenged the more traditional medical or individualistic models of research that had dominated disability research in the mid to late 1990's. This, once powerful earlier tradition, regarded disabled people as primarily the 'subjects' of research, until a more socially acceptable model of disability was proposed by the UK Disability Movement.

Drawing from the various discussions around the social model and inclusive research, a next step was to decide on a suitable approach that could articulate an inclusive process that encouraged the participation of visually impaired people in discussions and potential research agendas that were important to them. This coalition would be based on the premise that visually impaired people are experts on their own lives, needs and feelings and therefore should be allowed to play an active role in shaping the course of research projects (Barnes, 1992; Stone and Priestley, 1996). The most suitable framework to promote the views and perspectives of visually impaired people, based on the various strengths of the social model, is one of an emancipatory strategy that develops and informs the reciprocal relationship between the researcher and the research subjects (i.e. visually impaired people).

One of the most important ways of developing a balanced coalition is to become aware of the issues that concern the visually impaired community. This could be achieved through informal discussions with organisations that represent the views and opinions of the community. This framework would build in informal and then more formal consultations with stakeholders who were either visually impaired or provided ICT training to the visually impaired community. It would enable participants to be as frank and explicit about their own agendas and not feel that they should have to hide any of their opinions on how they thought the research should be conducted. This reciprocity would involve engaging people from the start of the research planning and design to the implementation stages (Baker, et al. 2004).

The involvement of research participants poses many challenges which become more apparent as the research unfolds. There is always the danger that the researcher and the research participants do not agree on the issues or agendas or
even on how they should be addressed. However, recognising the practical limitations posed by emancipatory research cannot be a sufficient reason for not pursuing this form of research. The reciprocity between the two groups involves the restructuring of power relations and 'should be an important move towards the democratization of research' (Baker, et al. 2004, p.182) as well as the building of research capacity within the disabled field.

One of the main tasks for an emancipatory approach to research is to establish procedures through which understandings can be developed into the methods and procedures that lead to a study that helps us better understand the issues that affect the visually impaired community. These methods and procedures need to be explored so that the research subjects can enter into dialogue about the research undertaken in their name, at any time. Baker, et al. (2004) propose the idea of a Research Coalition arrangement where power would be shared. They argue that 'no-one would have the authority to name, codify and claim scholarly understanding and ownership of someone's world without debate, negotiation and consent' (Baker, et al. 2004). Setting up a research coalition will often be the responsibility of those who exercise control over the research, but negotiations and discussions need to be in place to identify any potential barriers that need to be overcome. These barriers could arise from differences in research expertise, language usage, life experiences and attitudes to research.

3.5 Developing a framework for the research

As a commitment to emancipatory research, I wish to declare my support to the visually impaired community by helping them to develop their own research in new and empowering ways. This research should move beyond the inclusion of visually impaired people to identifying and eliminating the barriers that disadvantage visually impaired people both within this research and beyond. What is therefore proposed is a multi-methods approach using questionnaires, interviews and round-table discussions to identify, explore and discuss some of the issues that concern the visually impaired community in relation to access to technology and e-learning.
A framework will be used to address the over-arching questions in gathering specific evidence about the potential role of virtual learning environments and e-learning for visually impaired adults. This framework consists of a three-stage process that investigates some of the main issues concerning computer access and visual impairment. These are later developed into a set of inclusive principles for a pilot study. As 'experts' who have first hand knowledge of visual impairment and the issues around accessing technology and the Internet, they were invited to take a prominent role in the research process. The next three chapters present the three stages in which visually impaired people were involved in the research and how they were invited to become, firstly, a peer reference group and, secondly, a small group of co-researchers.

The framework for this process aimed to follow the inclusive principles associated with emancipatory disability research. It also reflected my epistemological position in terms of shifting the locus of control from the researcher alone to the co-producers of this research knowledge.
Chapter Four – Methods

4.0 Introduction

This chapter presents the methods adopted across the research and provides specific details of how each of them was used. Proponents of emancipatory research place a strong emphasis on the use of qualitative methods when conducting research. There is, however, a strong argument for using quantitative methods to collect essential baseline data, in this case, about computer frequency usage of a representative sample group of blind and low vision adults living in urban and rural parts of the Republic of Ireland.

Qualitative research, as a set of interpretative activities, privileges no single methodology practice over another. Nor does it have a set of methods or practices that are entirely its own (Denzin and Lincoln, 2003). Selecting the most appropriate methods in emancipatory research should be based on a commitment to securing an in-depth understanding of the views and opinions of visually impaired people. Barton (2005) argues that there is the need to ‘increasingly recognise and more thoroughly understand and practice the art of ‘listening to the voices of disabled people’ (p.325). Tools should be developed and tested to ensure that the voices of all research participants are given prominence. It is my intention to develop a research culture in which non-disabled (myself) and disabled researchers can share, support and act as critical friends to one another throughout the research process.

A three-stage process was developed around an inclusive approach where visually impaired people played a prominent role. Each of the three stages is described briefly before outlining each of the selected methods.
4.1 Description of the three stages

• Stage One

This research was based on an initial belief that visually impaired people can engage in e-learning provided they have appropriate technical expertise and training to support their needs. A first step in testing this belief was to collect some baseline data on the types of technology visually impaired people are using at home and work. It was important to have some key information about levels of computer literacy across the country. A telephone questionnaire would be useful to capture information from a sample of visually impaired people living in urban and rural parts of Ireland. These findings served as a useful platform for discussion of several issues, such as increasing computer usage for visually impaired people and developing courses and materials to meet their needs and increase their chances of being employed. A next step was for the stakeholders to collaboratively explore ways of meeting the learning needs of visually impaired students with the support of ICT. This consisted of coming up with some recommendations on how to move from an exploratory stage to one where some of the generated ideas could be tested. A key recommendation was to present the issues raised during the exploratory stage to members of the visually impaired community.

• Stage Two

This stage consisted of taking the main findings and recommendations from the stakeholders’ workshop and presenting them to a peer reference group who represented the views and perspectives of visually impaired people living and working in rural and urban parts of the country. The use of a ‘peer reference group’ of visually impaired people also represented a commitment to an emancipatory research strategy in that it encouraged visually impaired people to have some control over the social and material relations of the research process (Zarb, 1992). This was also in line with a commitment to involving visually impaired people in questioning assumptions that I may have held. The principal role of the peer reference group was to comment on the findings emerging from stage one and to offer suggestions and guidance on how these emergent findings might be tested in a research context.
A final outcome from the consultation process was to propose principles that could be adopted when developing inclusive learning environments for visually impaired adults. These principles could be developed through a sophisticated system in the form of a completely accessible Virtual Learning Environment (VLE). How such a VLE should be designed and tested would need to be discussed with educational tutors and e-learning experts who have experience of constructing and delivering high quality e-learning courses on a VLE.

- Stage Three

This stage consisted of a pilot study that tested whether it was possible to use the principles in an inclusive way to develop an inclusive learning environment and then test such an environment on a small group of visually impaired adults. Three people (two men and one woman) who were part of the peer reference group, agreed to work closely with me to test whether the agreed principles could be applied to a virtual learning environment and how a supporting pedagogy for e-learning could be developed. This study invited a small number of visually impaired adults who were already using technology to take part in a short pilot study to test some of the principles that were defined in stage two of the research process. The co-research team aimed to find out (a) the extent to which the research met the identified standards, (b) whether there was evidence of positive outcomes, and (c) the extent to which the positive outcomes were linked to the principles. This pilot study used the vehicle of a funded project that was set up to address the particular electronic learning needs of a specific population in Ireland.

4.1.1 Timeline for the three stages

The planning and delivery of all three stages of the data collection including the pilot project took almost two years (see Appendix A) with stages one and two data collection predominating during year one and stage three data collection predominating during year two. There was a short delay of one month in carrying out the second round-table discussions and interviews because of some unavoidable technical problems with the tested VLE which required solving by the project team.
The next sections present the methods adopted for the three steps.

4.2 Methods adopted for the three stages

Social researchers advocate various methods of interaction. These interactions constitute the locations where empirical materials are collected and analysed. The choice of research methods depend on the questions that are asked; these questions depend further on their context (Nelson, et al. 1992), on what is available in the context and on what the researcher can do in that setting. The tools presented in the next sections were selected to generate different types of data that would simultaneously address two issues: the larger research questions about the research process and the more specific questions related to the viability of creating a virtual learning environment for visually impaired learners.

The following tools were selected to collect data and are discussed at different stages of this chapter.

- Questionnaires (stage one)
- Stakeholders' workshop (stage one)
- Interviews (stage three)
- Round-table discussions (stage three)

4.2.1 Questionnaire

One of the first steps was to obtain some primary data about how often visually impaired people used computers and assistive technology and about why they used them. A base-line questionnaire proved to be a useful method to capture essential data on what visually impaired people knew about technology and the Internet and to learn more about how they used the two interfaces together. The questionnaire took the form of a telephone interview lasting 15-20 minutes. Details about the sample group and testing are described in chapter five.
The telephone questionnaire (see Appendix B) was constructed with the help of members of the Visually Impaired Computer Society (VICS) who identified questions and possible issues related to how visually impaired people access technology at work and home. I drafted a first list of questions for the VICS members to comment on and provide feedback. Subsequently, a small group of members provided useful suggestions on correct wording and follow-up questions. The VICS members were very helpful in providing feedback and as a gesture of my gratitude I asked them whether they would like to contribute one or two questions. The second version of the questionnaire contained an extra question for VICS members specifically asking about what aspects of the Society they enjoyed the most.

4.2.2 Stakeholders' workshop

A useful way of collecting information about current ICT practices is to speak directly to professionals involved in training visually impaired people how to use assistive technology with computers and the Internet. Workshops may not be considered to be a formal method for collecting data, but researchers can use them to draw on the expertise of specialists in a specific field at that time. A half-day workshop for 12 key stakeholders generated very useful feedback on the data generated from the baseline telephone questionnaires and provided a forum in which 'experts' could discuss their experiences with their peers.

4.2.3 Interviews

The research interview has been described as 'a two-person conversation initiated by the interviewer for the specific purpose of obtaining relevant information' (Cannel and Khan, 1968, p.271). It offers the researcher two different levels of qualitative depth depending on which form is chosen: a tightly structured or a semi-structured interview. Mann and Stewart (2000) state that, 'the choice of interview method usually depends on the research questions or on the qualitative approach which informs the overall research design' (p.75). Both forms of interview tend to start with preliminary
questions and then gradually ease into more complex, or probing, questions. The questions can be *open-ended*, encouraging the interviewee to expand on each response and also allowing the interviewer to ask more probing, follow-on questions.

Social researchers from different disciplines and traditions underscore the importance of being able to interview in one form or another, as this practice offers a very flexible and accessible method of data collection. Powney and Watts (1987) argue that the interview tool should not be used complacently and that the interviewer needs careful preparation and practice to develop 'social and recording skills and the ability to analyse and evaluate the data collected' (p.9).

Borg and Meredith (1989) conclude that, for educational purposes, the more appropriate form of interview technique is the semi-structured interview. This tool also provides an alternative channel of expression for those individuals who find other formats, such as questionnaires or telephone interviews, more intimidating. The interviewer can seek both clarification and elaboration on the answers through probing and by entering into a dialogue with the interviewee. May (2004) states that semi-structured interviews 'allow people to answer more on their own terms than the standardised interview permits' (p.123), but the interviewer needs to understand the context and content of the interview in order to keep it within the focus areas.

Ethnographic studies in general invade privacy in pervasive ways, therefore it is essential for the interviewer to be aware of the concerns a participant may have. Furthermore, it is often difficult to identify any gains for the interviewee. Therefore, when conducting interviews, it is important to agree on a place that is conducive and comfortable for the interviewee. Careful consideration also needs to be made for visually impaired people to ensure that they are comfortable with the environment and that the interview is kept to the agreed time to allow for the interviewee to travel home.

Telephone interviews may be the most obvious choice of method when dealing with large sample sizes. This was the case for an extensive piece of research carried out on the opinions and circumstances of over 1,000 visually impaired people in Great Britain as part of Network 1000 (Douglas, et al. 2007) in which telephone interviews
were used exclusively and effectively for all 1,000 visually impaired people. Furthermore, telephone interviews are useful for collecting personal details about research participants. However, telephone interviews may not be the most appropriate method for people who are shy or who do not feel comfortable about talking about certain issues over the telephone. Face-to-face interviews could be more helpful for in-depth discussions about sensitive issues. This form of interview was chosen to be the most appropriate way of contacting visually impaired people in rural parts of the country.

When devising interview schedules, the researcher should build in opportunities for self-questioning and reflexivity. This allows for wider research questions that, in this case, probe into the conceptual possibilities of promoting inclusive learning environments. Such reflexivity can also prompt more immediate field questions that, here, test the inclusive principles within an empirical piece of research. Interview schedules for participants in a study should be developed for further external interpretation and possible clarification. Having the privilege to speak directly to visually impaired people across Ireland and learn about how they have been managing with new or out-of-date technology was revealing and useful evidence of what was happening in the country at the time. This experience proved to be very helpful in developing the next stages of the research. Oliver (2006) advocates an inclusive research approach which is one that follows certain protocols to protect those who are vulnerable and isolated. He argues that interviews carried out by large UK Government organisations, such as the Office of Population Censuses and Surveys (OPCS), have alienated disabled people from the research because of the lack of consultation when designing questionnaires and interview schedules. Oliver (2006) argues that Disabled Persons Organisations report that they are often not consulted about research in advance or about what issues should be investigated. Furthermore, they are often not invited to review or reformulate questions on postal questionnaires or interviews that could lead to possible interviewee oppression or reinforce isolation of individuals. I wished to avoid this criticism by inviting a small number of visually impaired people to co-develop the interview schedules.
4.2.4 Designing and piloting the interview schedules

In keeping with the emancipatory strategic framework the research tools were co-designed collaboratively with three visually impaired research peers. The first interview schedule (see Appendix C) consisted of questions that would capture information about the participants' visual status, their experiences of using computers and to find out more about their learning needs and what they wished to achieve from the pilot project. The data from the interviews helped to establish baseline data for comparison later in the study. The second interview schedule (sees Appendix D) consisted of questions that helped to evaluate the extent to which the virtual learning environment and the supporting pedagogy for e-learning supported the learning needs and aspirations of the visually impaired participants.

Both interview schedules were piloted on a small group of visually impaired people. The co-researchers contacted two visually impaired peers to test the questions on them and then receive useful feedback on how they felt the interviews went for them, whether the questioning techniques were appropriate and whether there was sufficient probing. All the interviews were recorded on a mini-disc recorder and were then transcribed and coded using the three steps of open coding, axial coding and selective coding (see section 4.3).

4.2.5 Round-table discussions

Round-table discussions allow research participants the opportunity to discuss the types of issues that concern them. They are helpful in accessing and 'giving voice' to people who have been marginalised and have not had opportunities to meet and talk about their concerns with their peers. Kruger (2000) argues that it is important to facilitate an environment in which disclosures are 'encouraged and nurtured' (p.26). Round-table discussions should follow agreed protocols that encourage all participants to contribute to the discussion as much as possible. It is helpful to provide the questions in advance in either braille or large print to allow each participant time to prepare for the session. This form of discussion should create what
Nutbrown (2001) calls a 'dynamic where one person allows another's words to illuminate and sometimes rephrase their own' (p.81).

4.2.6 Organisation of roundtable discussions

The co-researchers were interested in obtaining group as well as individual perspectives through a combination of informal interviews and round-table discussions. Two round-table discussions were organised during the lifetime of the pilot. The first one took place about six weeks into the second year of the project and the second took place almost eight months into the same year. They allowed all the participants to informally discuss how they were managing with the online courses in an open and informal way. These discussions featured tea and biscuits, an important social protocol for carrying out research in Ireland. The relaxed atmosphere helped the participants to speak openly about any concerns they might have held. The two co-researchers decided to participate in the discussions as participants whereas the other two facilitated both sessions which took approximately 40 minutes. All participants were sent a letter in braille outlining the areas for discussion a week before the group meeting. The main logistical problem of running the discussions was ensuring all participants were present at the same time. Some arrived late or had to leave early because of limited choice of times for certain bus routes to rural parts of the country. The constant movement of people at different times caused some disruption to the sessions, particularly for those who were able to stay for the whole meetings.

4.3 Procedures for data collection

Ethnographic data can take the form of extracts of natural language, such as long quotations from in-depth interviews, and transcripts of conversations among many other data sources. The scope of the data can be extended to furnish theoretical inferences and empirical generalisations, but this is not as easy as quantitative research (Brewer, 2000). Analysis is a continuous process and is tied closely with the actual collection of data. This is reflected in the three stage approach that was used in this study. This can be best summarised by Huberman and Miles (1998) who
define data analysis as involving three sub-processes: data reduction (selecting units of data from the total mass of data); data display (assembling the information in some format e.g. tables, quotations) and conclusion drawing (interpretation of the findings).

Part of developing a framework is to look at ways of legitimising the qualitative data methods and the ensuing analysis procedures. The methods employed were to read and re-read the data corpus and 'discover' categories, concepts and properties and their interrelationships. Glaser and Corbin (1990) say that it is important to develop the ability to perceive variables and relationships which they term as 'theoretical sensitivity'. This was affected by a number of processes including the reading of the literature and the researchers' use of techniques designed to enhance sensitivity. This process worked well at a co-researcher level because we were able to both independently and collectively identify variables and decide which ones were isolated or interrelated.

One of the ways to analyse the transcripts was to use 'open coding' which Glaser and Corbin (1990) say are concerned with identifying, naming, categorising and describing phenomena found in the text. These are labels that refer to variables such as places, information gathering and other themes. It is important to maintain an inventory of codes with their descriptions (i.e. creating a codebook), that is useful, along with pointers to text that contain them. In addition, as codes are developed, it is useful to write memos known as code notes that discuss the codes.

The second step was to use axial coding which is the process of relating codes (categories and properties) to each other, via a combination of inductive and deductive thinking. To simplify this process, rather than look for any and all kind of relations, it was more useful to fit things into a basic frame of generic relationships. The third step is selective coding, which is the process of choosing one category to be the core category, and relating all other categories to that category. This process was helpful but was sometimes difficult at a multi-level as we did not always agree on all categories. Despite this, this process was the most appropriate in my view at the time and helped us to pull together real examples from the transcripts.
4.3.1 Data analysis

The various phases of the research reflected a spiral process based on the rationale that visually impaired people should be involved in all aspects of the design and delivery of the research. Furthermore, all four researchers (three visually impaired and one sighted person) were involved in the collection of the data and their coding based on information gathered from the interviews and round-table discussions. The data were entered on to a qualitative data computer package, Nvivo, which facilitated the organisation and coding of the data. The data were interrogated to identify key phrases or statements that could be linked from one database to another. The next stage was to annotate, reflect and compare the statements with other data sources and code them. The coded records were revisited until patterns and explanations could be fully established. It also helped to identify a range of themes which formed the basis for the discussion and could be used to answer the research questions for this stage of the process and subsequently the wider questions for the whole research.

The main themes emerging from the round-table discussions were based on technical issues around accessing the VLE, the use of the online tools and their initial reactions to the e-learning courses. The first step of the process was to write short descriptions in the appropriate fields against statements or phrases that were related to the pilot study. Only the categories that discussed the empirical data related to the research questions were extracted, leaving the more descriptive data to be used for other purposes e.g. reports. These descriptions were assigned a name and then categorised using a series of ‘nodes’. Having direct access to multiple data sets from different sources (interviews and round-table discussions) helped to check and to validate the data through a process commonly known as ‘triangulation’.

The use of a peer reference group in stage two was an important aspect of this study and members were extremely pro-active in sharing their perspectives and offering guidance and support to ensure the dialogue continued through to the establishment of priorities for research. Following the fundamental principles of emancipatory research strategy (Duckett and Pratt, 2001; Walmsley, 2001; Kitchin, 2000) the three
members of the reference group were invited to co-lead the study in whatever
capacity they felt most comfortable. Two out of the three co-researchers were invited
to participate in the VLE and move closer to where the activities were taking place. As
part of this process they were able to draw on their own experiences in the research
process and to compare them with new interpretations and interactions with their
visually impaired peers.

4.4 Ethical issues and consent

The research process followed ethical protocols laid down by the National Disability
Authority Ethical Guidelines for Disability Research [http://www.nda.ie] in Ireland and
the British Educational Research Association (BERA) Revised Ethical Guidelines
(2004). Before research could take place, participants had to agree to the aims of the
research and then give their consent once they had fully read the outline of the study
in braille or in large print.

All participants were sent a letter in braille as well as a letter of invitation to participate
in the research that also served as a consent form. The letter (see Appendix E)
outlined the research aims and informed the participant of how the research would
run along side the funded project (ACE).

You are invited to participate in this exciting study which will run at the same time as
the Accessing Communities for E-Business (ACE) Project. This research will follow
your participation during the lifetime of the project (see attached research description),
however, your consent is required to use the data collected during face-to-face and
group recorded interviews, and feedback on the proposed virtual learning
environment and e-learning courses.

All participants were sent the letter before a meeting at the NCBI headquarters in
Dublin. The meeting was organised to inform the participants about the research,
answer questions and ask for their consent to work with them.
It was made clear that all information shared would be treated confidentially; should the nature of the research change, each would be duly notified. It was made clear that by agreeing to be named the participant indicated a willingness to enter a dialogue that could be shared with people outside the research. As stated in a previous section, a small number of the participants agreed to their names being published in this study and in further publications.

A discussion of how the fact that the research was for a research degree might have impacted on the chosen approach that was being adopted is located in a section on 'the limitations of adopting an emancipatory approach' (chapter seven, section 7.3.5).
Chapter Five – Results from Stages One and Two

5.0 Introduction

This chapter presents the findings from stages one and two of the enquiry process. The first part provides an overview of the sample group chosen for the base survey, a presentation of the data gathered from the telephone questionnaires and a synthesis of the main findings. The second part consists of a description of how the principle findings from the base survey were shared at a workshop attended by different stakeholders. The purpose of this workshop was to invite them to discuss and reflect on these findings with a view to recommending a next step forward.

5.1 Overview of sample group and design of questionnaire

The first stage consisted of gathering some baseline data about current computer practices of visually impaired people in different parts of Ireland. Having previously contacted the NCBI, I learnt that this organisation held a database of people who had received a computer and software from them. I was allowed access to the database as long as I kept respondents' details on a secure database and was prepared to share some of the results with the charity. I was prepared to do both.

The NCBI holds information on visually impaired people who have received a computer and software, and who use assistive technology (screen-reader or screen-magnifier) to access their computer. This provided the population base for the survey. A total of 40 people (20 male and 20 female), registered blind, between the ages of 18 and 65 (working age) were selected from different regions of the country with approximately a third of the sample in Dublin (n=14) and two-thirds in rural parts of Ireland (n=26). Out of 40 phone calls made, 32 were successful. Questionnaires were spread proportionately between the North West, South East, and South West of Ireland. The entire sample was sent details about the survey and a copy of the questionnaire in braille or large print. The NCBI was very supportive in helping me to
access a database of people's telephone numbers. This organisation was particularly interested in hearing the results as they could have an impact on their policy on providing technology and training services to registered members. Results from the questionnaire were disseminated to the charity during a stakeholders' workshop described in this chapter.

The final questionnaire consisted of 17 questions formed from a combination of closed questions and more open questions (encouraging the respondent to generate topics and issues of relevance to them. The questionnaire (see Appendix B) identified information about each participant in five main areas: 1) the frequency and type of use made of the computer; 2) enabling factors which helped support computer use; 3) constraining factors which restricted use of computers; 4) the current level of training and qualifications and 5) the types of computer skills he or she desired to gain. Questions about 'enablers' and 'barriers' would also help to determine the participant's level of technical knowledge.

An experienced researcher familiar with the field of special educational needs, who had had no direct contact with the research, was asked to independently rate a selection of transcripts to validate the coding categories. The independent rater (IR) randomly selected nine transcripts (30%) for questions which generated qualitative (non-numeric) data (questions 3, 6, 13 and 14) from the 32 completed questionnaires. She independently worked through four of the 'open' question responses and generated stage one categories for all these questions. The IR and the researcher then met to discuss the different coded categories for all four questions and calculated an inter-rater reliability score for each of them. The procedures and the results of these questions are discussed below.
5.2 Presentation of data from the questionnaire

The results are presented in a series of tables grouped under a theme with a base sample size. All the percentages have been rounded to the nearest whole number and as result may not always add to 100%. The tables provide data about respondents' computer habits as well as the screen-readers used to access the computer. The data also includes their qualifications and available training opportunities. The last sections discuss the ways in which the respondents preferred to learn as well as other technological equipment or devices they used in addition to the computer.

5.2.1 Computer use

From Table 1 we can see that a high proportion of the sample (47%) used computers on a daily basis with only a small number (n=2) who did not use them at all. More than a quarter (29%) used them at least once a week to several times a week. Table 2 shows that the sample used computers slightly more at home (88%) than at work (63%) with over a half saying they used computers both at home and work (57%). This shows that nearly all the respondents have access to computers all the time but more use them at home than at work. These findings suggest that a high proportion of home users are not using computers on a regular basis.
Table 1. How often do you use a computer? (Question 1). Base: Whole sample (N=32)

<table>
<thead>
<tr>
<th>Frequency</th>
<th>%</th>
<th>Total sample (n)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Every day</td>
<td>47</td>
<td>15</td>
</tr>
<tr>
<td>Several times a week</td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td>At least once a week</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>At least once every two weeks</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>At least once a month</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Don't use/never use</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>100</td>
<td>32</td>
</tr>
</tbody>
</table>

Table 2. Where do you use a computer? (Question 2)

<table>
<thead>
<tr>
<th>Location</th>
<th>%</th>
<th>Total sample (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>88</td>
<td>28</td>
</tr>
<tr>
<td>Work</td>
<td>63</td>
<td>20</td>
</tr>
<tr>
<td>At work and at home</td>
<td>57</td>
<td>18</td>
</tr>
<tr>
<td>Other: local library, university</td>
<td>7</td>
<td>2</td>
</tr>
</tbody>
</table>

*Two answers were given for one of the respondents (home and university)*

The IR and researcher independently worked through the responses to question 3 (What stops or prevents the respondent to use a computer more often?) for the sample 9 transcripts and generated stage one coding categories (n=9). We discussed the categories and found they were similar and finalised the coding categories. These were applied by the researcher and the IR independently for the 9 transcripts and found to have inter-rater reliability of 100% agreement. Finally, the researcher applied the same coding categories to the remaining transcripts and these are reflected in the
results in Table 3. In addition, the researcher also clustered the 9 coding categories into two broader themes (individual and social issues) to aid interpretation.

When asked ‘what stops or prevents you from using a computer (more often)?’ a variety of social, economic and individual factors emerged (see Table 3). Lack of time and other commitments were identified by over half of the respondents (63%). Many reported that other commitments such as work, travelling and family engagements as constraints to using computers more often. Lack of confidence was identified by almost half of the sample group (47%). Visual impairment was identified as a barrier by approximately one third of the sample population (35%). Lastly, six respondents said that they were not particularly motivated to use computers more mainly because of the technical problems that kept arising from using the software and the lack of general technical support to repair broken PCs.

The Network 1000 Survey in Great Britain (Douglas, et al. 2006) found similar results in frequency use of computers with the highest proportion (38%) saying they used a computer everyday. An interesting finding from their study shows that almost half of the sample group lacked confidence in using computers. This is a concerning issue that would need to be researched further as it could have repercussions on how visually impaired people used computers for learning or work purposes. The problem arising from using software could also cause particular problems for the visually impaired, particularly if the software in question is a screen-reader.

Table 3 also points to wider social issues, which are mainly linked to problems with accessing equipment and being able to afford screen-reading software. This finding is unsurprising as specialised software tends to be very expensive. Respondents considered accessibility of equipment (e.g. specialist equipment and installation) and the use of Internet connections as an important factor to reducing their use of computers. The general availability of equipment (both generic and specialist) and software (e.g. screen-readers) was considered to be a barrier by a quarter of the sample (25%). The cost of equipment was also an important factor (13%); however, most respondents said that they received a free computer and installed software from the Health Board. Their main problem was not being able to afford replacement software or a new PC after three or more years.
The Network 1000 survey (Douglas, et al. 2006) results showed that a higher proportion of respondents (30%) said that problems related to their vision prevented them from using the computer more often. Similar social issues arose including the availability and accessibility of equipment and issues related to training courses. However, the issue around access to equipment seemed to be more of a problem in Ireland (50%) than in Great Britain (21%).

Table 3. What stops or prevents the respondent to use a computer (more often)? (Question 3)

<table>
<thead>
<tr>
<th></th>
<th>%</th>
<th>Total sample (n=25)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Individual issues</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time &amp; other commitments (e.g. family or personal problems)</td>
<td>63</td>
<td>20</td>
</tr>
<tr>
<td>Lack of confidence</td>
<td>47</td>
<td>15</td>
</tr>
<tr>
<td>Related to visual impairment</td>
<td>35</td>
<td>11</td>
</tr>
<tr>
<td>Lack of motivation as a result of lack of knowledge</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td><strong>Social issues</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accessibility of equipment &amp; Internet</td>
<td>50</td>
<td>16</td>
</tr>
<tr>
<td>Availability of equipment &amp; software</td>
<td>25</td>
<td>8</td>
</tr>
<tr>
<td>Cost of equipment &amp; software</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>Issues related to training courses (e.g. lack of training initiatives)</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>Uncertain</td>
<td>16</td>
<td>5</td>
</tr>
</tbody>
</table>

When respondents were asked about more specific use of computers, in Table 4, they cited a range of uses including word processing, e-mailing, surfing the Internet and filling out spreadsheets. Unsurprisingly, 80% of respondents said that they use computers to type word documents. Approximately three-quarters said that they used computers to send and receive e-mails (71%) and to surf the Internet (73%). A small number (n=3) said they used computers to play games, to upload and edit digital
photographs, and to create desk-top publishing for a magazine. Comparing these results with the Network 1000 Survey, a similar proportion of people said that they used computers for word-processing and sending e-mails. Interestingly, UK respondents (75%) said that they used computers to surf the Internet. These findings tentatively show that visually impaired people are using computers to do similar activities in both the UK and Ireland.

Table 4. What do you use computers for? (Question 4)

<table>
<thead>
<tr>
<th>Activity</th>
<th>%</th>
<th>Total sample (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word processing</td>
<td>80</td>
<td>25</td>
</tr>
<tr>
<td>Sending and receiving e-mails</td>
<td>71</td>
<td>22</td>
</tr>
<tr>
<td>Surfing the World Wide Web/Internet</td>
<td>73</td>
<td>23</td>
</tr>
<tr>
<td>Filling out spreadsheets</td>
<td>22</td>
<td>7</td>
</tr>
<tr>
<td>Database work</td>
<td>13</td>
<td>4</td>
</tr>
<tr>
<td>Anything else — including playing games, digital photography, desk-top publishing</td>
<td>9</td>
<td>3</td>
</tr>
</tbody>
</table>

5.2.2 Screen-reading software

The next few questions sought more information about the types of software programs visually impaired people were using, why they were using them and whether they would prefer to use a different software program.
The respondents were asked to name the screen-reading software they were using at the time. As we can see in Table 5, all 32 used either a screen-reader or magnifier. The majority of the respondents (82%) said they used the screen-reader JAWS (Job Access With Speech). Only two people used older screen-readers ‘Window Eyes’ and ‘Hal’ which preceded JAWS. Approximately 13% (n=4) use a screen-magnifier which is a software program that increases the font size of text as well as icons and Internet browsers. These tend to be used by people who have partial sight.

Table 5. What screen-reading software do you use, if any? (Question 5)

<table>
<thead>
<tr>
<th>Software</th>
<th>%</th>
<th>Total sample (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>JAWS (Job Access With Speech)</td>
<td>82</td>
<td>26</td>
</tr>
<tr>
<td>Dolphin Supernova</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Window Eyes</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Hal</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Zoomtext (screen-magnifier)</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>32</td>
</tr>
</tbody>
</table>

Following the same procedure described for question 3, the IR and researcher independently worked through the responses to question 6 (Why do you use this software?) for the sample 9 transcripts and generated stage one coding categories (n=5). We discussed the categories and found they were similar and finalised the coding categories. These were applied by the researcher and the IR independently for the 9 transcripts and found to have inter-rater reliability of 100% agreement. Finally, the researcher applied the same coding categories to the remaining
transcripts and these are reflected in the results in Table 6. There was no need to cluster the categories into broader themes for this question.

In Table 6 we can see that most (78%) said the software had been recommended and installed onto their home and work computers by the National Council for the Blind, Ireland. Two said that when they started using computers there were few options and so they decided to use what was available. Only one said that they used JAWS because it was 'better with the Internet' and three said they preferred the voice quality of one particular piece of software (possibly the new Dolphin Supernova software).

Both identified similar themes for all nine respondents. It was extremely useful to find out why respondents used a particular type of software as this could have an impact on future training initiatives for the visually impaired. Interestingly, new software such as Dolphin's screen-reader, which has better choice of voice options, was being used only by a very small percentage of respondents (10%). JAWS has been on the market for longer and has a grip on the Irish market, whereas Dolphin is still new and relatively unknown by visually impaired people. It would be useful to know whether one performed better than the other when interfacing with the Internet.
Table 6. Why do you use this software? (Question 6)

<table>
<thead>
<tr>
<th>Reason</th>
<th>%</th>
<th>Total sample (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Recommended by the National Council of the Blind, Ireland</td>
<td>78</td>
<td>25</td>
</tr>
<tr>
<td>No other choice at the time e.g. pre-installed on PC</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>JAWS is better with the Internet</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>Prefer the 'voice' quality</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>No response</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>32</td>
</tr>
</tbody>
</table>

Respondents were asked whether they would prefer different screen-reading/magnifying software from the one they are currently using.

Table 7 shows some interesting answers in terms of how assistive technology has advanced over the past five years. At the time, many respondents (over half) were aware of quality technology available to visually impaired people. Over a quarter said they would like to change their current software for one that had 'a less robotic voice'. Many older screen-readers, including JAWS, have only a small number of built-in synthesised robotic voices to choose from. A small proportion (10%) preferred to keep the same software but wanted to upgrade to the more recent versions. One said he would like to try a new screen-reader available on a USB drive (Dolphin pen). He cited a number of advantages to using this new software including the ability to use it on any machine and the good range of high quality 'human' voices (male and female). Lastly, over 50% of respondents did not have an answer, which could be partly interpreted as having little knowledge of what other software is available.
Table 7. Would you prefer different screen-reading/magnifying software from the one you are currently using? (Question 7)

<table>
<thead>
<tr>
<th>Response</th>
<th>%</th>
<th>Total sample (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prefer a less robotic sounding voice of screen-reader</td>
<td>28</td>
<td>9</td>
</tr>
<tr>
<td>Need to upgrade existing version to a more superior version (JAWS)</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>There is nothing better on the market at the moment</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Like to try the new Dolphin USB screen-reader currently being tested</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>No response</td>
<td>53</td>
<td>17</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td>32</td>
</tr>
</tbody>
</table>

The results from this section of the questionnaire provided some useful data about frequency levels of using computers at work and home, as well as the sort of issues that prevented people from using a computer more often. Some of the social issues result from lack of training and access to technology, which could be linked to the low levels of confidence that many respondents are experiencing. The issue of training is discussed in the next section.
5.2.3 Training and qualifications

This section deals with issues related to the training required for using assistive technology, computer software and the Internet. It also discusses the types of courses that lead to formal qualifications.

Over half of the respondents (57%) said they had received training on how to use a computer. Over a quarter (28%) said they had received no training. Sixteen percent (n=5) did not respond to the question.

The 18 respondents who said they had received training were then asked specifically about the actual courses they followed. Over a half (n=12) had received training on computer basics (e.g. how to use Windows Operating System, open and save a document, etc.) Eight said they had received a course in touch typing and on how to use shortcut keys. A high proportion (n=14) said they had received specific training on how to use JAWS software with Word. (This course is run at the NCBI central and regional offices). A total of five said they had received training on how to surf the Internet.

The same respondents were then asked to identify the providers of the training. We can see in Table 8 that the majority of those responding (n=8) had received training from the NCBI, whereas five members had received help or training from a family member or friend. Two were receiving visits from a volunteer as part of a new voluntary program set up by the NCBI; this involved linking 'sighted' members of the community who have good knowledge of computers with visually impaired adults at their home. Three said they received training at work as part of 'in-house' training and not specifically related to assistive technology.
When asked if the training met their expectations, 11 out of 18 said that it did meet their expectations. Three said they were unsure or did not know. Those who said the training did not meet their expectations (n=4) were asked to qualify their responses. Two respondents who received 'in-house' company training said the trainers did not know how to use the screen-reading software. Another person receiving 'in-house' training said he was unable to ‘keep up’ with his sighted peers. One was unable to attend a specific course on how to touch-type because of low enrolment numbers and subsequent cancellation of the course.

The second part of this section of the questionnaire sought information about the level of formal training (up to certificate level) that the sample group had received. A quarter (n=8) said they had taken a test or a number of tests that led to a formal certificate in ICT. Three-quarters had not taken any formal test of certificate (n=24).

A total of five said they had taken one or two European Computer Driving Licence (ECDL) modules out of a total of seven. Two said they had successfully completed three or more modules but had not completed the complete ECDL. One male
respondent was taking final exams as part of a three-year Bachelor Course in Computer Studies.

Table 9. Do you know of any computer course in your town that leads to a formal qualification? (Question 12)

<table>
<thead>
<tr>
<th></th>
<th>%</th>
<th></th>
<th>Total sample (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>15</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>No</td>
<td>60</td>
<td></td>
<td>19</td>
</tr>
<tr>
<td>No response</td>
<td>25</td>
<td></td>
<td>8</td>
</tr>
<tr>
<td>Total</td>
<td>100</td>
<td></td>
<td>32</td>
</tr>
</tbody>
</table>

Some respondents were aware of training courses in their locale, so we asked them to describe the contents. As we can see from Table 9, a total of five respondents said they knew about training in their town. Two, both living in South West Ireland (Tralee), knew about an introductory course on how to use JAWS that had been advertised through the local NCBI office. Another respondent knew about a three-day introductory course on ‘How to use Windows,’ which was organised at the computer centre in Donegal Town. The two other respondents received information from their local job centres about computer training courses: an introductory course on Microsoft Office – Excel and another on learning how to surf the Internet.

All respondents were then asked to give a maximum of three skills they wished to prioritise and develop over the next year.

Following the same procedure described for questions 3 and 6, the IR and researcher independently worked through the responses to question 13 (Can you say which skills or tasks you would like to be able to use the computer for?) for the sample 9 transcripts and generated stage one coding categories (n=8). We discussed the categories and found they were similar and finalised the coding categories. These
were applied by the researcher and the IR independently for the 9 transcripts and found to have inter-rater reliability of 100% agreement. Finally, the researcher applied the same coding categories to the remaining transcripts and these are reflected in the results in Table 10. There was no need to cluster the categories into broader themes for this question.

Table 10 shows a high proportion of the prioritised skills linked to use of e-mail and the Internet. Nearly fifty percent (44%) said they would like to be able to go online to search for information about holidays and flights and be able to book them without having to ask someone else to do it. Almost a quarter (22%) said they would like to be able to send e-mail to friends and relatives. Eleven (35%) raised more specific skills related to using the Internet. These included using a search engine (n=3), being able to take an online course at home (n=3) and, more specifically, to be able to develop a website to promote their own business or publication (n=3). A smaller proportion were interested in learning to use ‘Word’ (n=6) or how to manage a PC (n=3).
Table 10. Can you say which skills or tasks you would like to be able to use the computer for? List of priority skills (maximum 3 skills) (Question 13)

<table>
<thead>
<tr>
<th></th>
<th>%</th>
<th>Total sample (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>To be able to book flights, holidays online independently</td>
<td>44</td>
<td>14</td>
</tr>
<tr>
<td>How to use e-mail</td>
<td>22</td>
<td>7</td>
</tr>
<tr>
<td>Typing word documents</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>Learn more about managing a PC</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>To be able to use a search engine</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>To be able to do a course at home online</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>To be able to develop a website e.g. to promote a farm business</td>
<td>10</td>
<td>3</td>
</tr>
<tr>
<td>To be able to access and read current information on disability issues on the WWW</td>
<td>6</td>
<td>2</td>
</tr>
</tbody>
</table>

The general lack of training courses leading to formal qualifications could have repercussions for visually impaired adults when they seek employment. Many large Irish companies require job candidates to have experience of using word processing software and spreadsheets (e.g. the ECDL). For visually impaired adults, the main barrier to acquiring these skills is the lack of local training courses in towns – other than Dublin. This issue is discussed in section three of this chapter when stakeholders are invited to comment and reflect on these findings.
5.2.4 Individual learning preferences

The next question (number 14) sought information about the learning preferences of visually impaired people - about how the respondents thought they best learned. Since the respondents were not restricted to a single answer, it was necessary to code all the responses. Following similar procedures to questions 3, 6, 13 and 14, the IR and the researcher independently worked through the responses to this question, generating stage one coding categories (n=11). We discussed the categories and found they were similar and finalised the coding categories. These were applied by the researcher and the IR independently for the 9 transcripts and found to have inter-rater reliability of 100% agreement. Finally, the researcher applied the same coding categories to the remaining transcripts and these are reflected in the results in Table 11. In addition, the researcher also clustered the 11 coding categories into three broader themes (learning for assessments through 'structured' methods; 'self-directed' learning and more 'group/ collaborative' learning) to aid interpretation (again this is reflected in the presentation of the results). There was a supplementary category 'unsure' or 'don't know'.

The results presented in Table 11 show as many as 20 respondents (63%) had a preference for more structured methods to learning. Twelve said that they learned or crammed information for a test or an exam and seven said they had a preference for learning in a classroom or similar learning environment. A significantly smaller number of the respondents (25%) had a preference for learning by taking notes (n=2) or acquiring new skills and then practising them in different situations (n=3). Three respondents described how they liked to organise their time effectively. The smallest percentage of respondents (16%) said they had a preference for more 'collaborative' type of learning activities that consist of group learning and problem solving or abstract thinking activities. Seven said they were unsure or did not know, however, two of these also described a preference for learning information for a test or an exam and the other five respondents may not have understood the question.

The varied responses raise some important issues about how visually impaired adults think they best learn. This question is also pursued at stage three when it is asked again to a small group of individuals who agree to participate in a pilot study. When
the participants' responses at the start of the study were compared with responses after the study, a small shift was made away from the more traditional learning approaches to more socially collaborative ways of learning. These results are discussed in chapter six.

Table 11. How do you think you best learn? (Question 14)

<table>
<thead>
<tr>
<th>Learning Style</th>
<th>%</th>
<th>Total sample (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Structured learning</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Repeat the same task/skill over again until it is memorised</td>
<td>19</td>
<td>6</td>
</tr>
<tr>
<td>Immersed in a classroom or similar learning environment</td>
<td>22</td>
<td>7</td>
</tr>
<tr>
<td>Learn or cram information for a test or exam</td>
<td>38</td>
<td>12</td>
</tr>
<tr>
<td>Listening to the teacher</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td>63</td>
<td>20</td>
</tr>
<tr>
<td><strong>Self-directed learning</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Note-taking and highlighting texts</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Acquire new skills and then practising them in different situations</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Organise time effectively</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Interested in the subject</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td>25</td>
<td>8</td>
</tr>
<tr>
<td><strong>Group/collaborative learning</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Group learning – talking about the task with others</td>
<td>9</td>
<td>3</td>
</tr>
<tr>
<td>Through problem solving activities and abstract thinking</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td><strong>Sub-total</strong></td>
<td>16</td>
<td>5</td>
</tr>
<tr>
<td>Unsure or Don't know</td>
<td>22</td>
<td>7</td>
</tr>
<tr>
<td><strong>Participants interviewed</strong></td>
<td>100%</td>
<td>32</td>
</tr>
</tbody>
</table>
The respondents were asked about any experiences they had of learning using the Internet. Only three respondents (10%) had taken an online learning course. One male respondent was using Blackboard, a well-known e-learning platform to access lecture notes and assignments. The second respondent took an online braille course run by a school for the blind in the USA and a third was following an online language course in Ancient Greek as part of a PhD in Medieval History.

It is difficult to draw any firm conclusions from question 14 but it gives some indication of how the respondents think they prefer to learn. This could be partly determined by the way they are used to learning that suggests that they are used to more traditional or didactic approaches. Pring (2008) suggests that blind people showed signs of superior memory performance (see section 2.1.4) and speculates that relatively greater resources are allocated to auditory processing and therefore ‘...greater attention to effort is likely to lead to better retention of the material’ (p.162). It may be interesting to pursue this finding as it could help trainers to plan new training courses that draw on the visually impaired students' strengths. This theme is discussed again in the next two chapters.

5.2.5 Other technology

One of the two final questions sought information about other types of technology used by the sample group. Table 12. shows that a fifth said they listened to music on MP3 players and a half used a mobile phone. Only half (n=17) cited the mobile telephone as a technology in spite of the fact that all 32 possessed a mobile phone. Four people said they used digital cameras independently. Twelve people did not respond to the question or said they did not use any other piece of technology. The independent rater and researcher agreed on similar themes when coding the subsample.
Table 12. Do you use any other types of technology? (Question 16)

<table>
<thead>
<tr>
<th></th>
<th>Total sample (n=32)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mobile phones</td>
<td>17</td>
</tr>
<tr>
<td>MP3 Players</td>
<td>6</td>
</tr>
<tr>
<td>Talking books on CD</td>
<td>5</td>
</tr>
<tr>
<td>Digital camera</td>
<td>4</td>
</tr>
<tr>
<td>Braille note takers</td>
<td>3</td>
</tr>
<tr>
<td>Mini-disc recorder</td>
<td>3</td>
</tr>
<tr>
<td>No response</td>
<td>12</td>
</tr>
</tbody>
</table>

5.2.6 Special interest group

A final question was targeted at those who were members of the special interest group VICS (the Visually Impaired Computer Society) to determine the sorts of activities they enjoyed the most. Twenty of the sample group were paid members of VICS. Table 13 shows that the two aspects or activities most valued by the members were the regular meetings the Society organised in Dublin and Cork and the e-mail list which focused on technical issues around using assistive technology, computers and the Internet. Ten said they enjoyed the annual general meeting which provided them with opportunities to learn more about the changing world of assistive technology and to meet friends face-to-face.
Table 13. What aspect of VICS do you most enjoy? (Question 17) Base: (n=20)

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Total sample (n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>E-mail help list (talk to other people who have experienced similar problems)</td>
<td>14</td>
</tr>
<tr>
<td>Regular meetings (every three months)</td>
<td>12</td>
</tr>
<tr>
<td>Annual General Meeting</td>
<td>10</td>
</tr>
<tr>
<td>Making new friends</td>
<td>8</td>
</tr>
<tr>
<td>It keeps me up-to-date with new technology</td>
<td>6</td>
</tr>
<tr>
<td>Don't know</td>
<td>2</td>
</tr>
</tbody>
</table>

Total interviewed (n=20) 52

The responses to question 16 proved particularly interesting because they showed that visually impaired adults used the sorts of mobile technologies that can interface with blended e-learning courses (see section 2.6.2). These data are useful for designers and pedagogues who could consider innovative ways of increasing the levels of access to technology for the visually impaired, particularly in rural areas of Ireland.

5.2.7 Summary

The results from the questionnaire provided some useful baseline data about how visually impaired people are using computers in Ireland. The sample does not represent the views of all visually impaired people in Ireland because it was based on a systematic random sample taken from a list provided by the NCBI (see section 5.1 for more details about the sample group). Comparing some of the findings from this survey with the large-scale survey in the UK, we see some similar trends in relation to...
computer frequency use, the types of activities visually impaired people carry out when they access a computer and some similar issues related to cost and access to equipment. Both these sets of data (UK and Ireland) have highlighted some areas where there needs to be greater resource investment, particularly in ICT training, which could address the technical and social barriers that prevent visually impaired people from using computers on a more frequent basis.

These data also help to highlight some of the individual, social and economic factors that are preventing visually impaired people from using computers more at home and work.

The principal findings were extracted from the spreadsheet database and are presented under five key headings:

- **Computer use**
  - A high usage of computers among the sample group – around three-quarters of those sampled – use computers at least once a week;
  - A high percentage (88%) are using computers at home and over half (63%) using them at work;
  - Individual, social and economic issues are affecting the rate of use. The most common issue is time commitment (63%); one-third attributed lower use as a result of visual impairment; other less common issues include cost and availability of equipment (total 38%) and issues relating to training, i.e. meeting individual needs.

- **How computers are used**
  - Over 70% use computers to send e-mails and to surf the Internet; over 80% use computers to write word documents; smaller percentages use spreadsheets and fill-in databases.

- **Screen-readers**
  - JAWS screen-reader is still the most commonly used (80%); this is partly as a result of recommendations made by the NCBI;
  - Some awareness was noted of new programs available on the market, including a USB pen drive and more sophisticated speech-out software.
• Training
  ✓ Over half (57%) have received training in how to use a computer and screen-reading software;
  ✓ Most training has been provided by the NCBI, e.g. how to use JAWS;
  ✓ The other 50% have received no training;
  ✓ A small amount of discontent was noted with work-based training where visually impaired learners follow generic in-house training courses;
  ✓ 85% revealed little knowledge of local training opportunities leading to formal qualifications; 60% claimed none were available and 25% did not respond or did not know;
  ✓ 25% had taken between one and three modules of the ECDL.

• Skills Prioritisation
  ✓ About 44% wish to develop skills around using the Internet (e.g. booking flights and holidays, performing online banking) and using online resources (e.g. search engines and web site development sites).

5.3 Consultation with stakeholders

As indicated in the introductory section, the next step of information gathering featured a presentation of the principal findings from the questionnaires at a workshop attended by the different stakeholders. The purpose of this workshop was to share primary data with interested parties and to invite them to discuss and reflect on the findings with a view to recommending a next step forward. This became the first step of a process that would include the views, opinions and perspectives of those affected by the issues that emerged from the survey. This was reflected in my epistemological position stated in chapters one and three to ensure that there was a space for continuous dialogue and reflection for the rest of the research.

The participants, both sighted and visually impaired, consisted of representatives of organisations providing vocational training and technical ‘experts’ in the field of assistive technology and e-learning. They were invited to discuss ways of developing the skills and competencies valued by visually impaired people and to consider the different learning programs that could be adopted to meet their technical needs.
The workshop was organised with the support of Trinity College Dublin, which provided an accessible conference room on their premises. A total of 12 people attended the workshop: three from a further education college in Dublin; two from the NCBI; three lecturers from Trinity College Dublin; a visually impaired Masters student taking an MSc in IT and Education; two people from the Visually Impaired Computer Society and me.

The workshop was divided into four parts:

- To examine the overall findings from the questionnaire;
- To explore ways of meeting the training requirements of visually impaired students;
- To discuss the potential use of existing and new learning materials;
- To discuss ways materials can be made available to all visually impaired students.

5.3.1 Discussion of overall findings from the questionnaire

The key themes discussed in the previous section were presented to the stakeholders. The presentation consisted of data about computer use, barriers to use, training and qualifications, and prioritising skills. These findings served as a useful platform for discussion of several issues, such as increasing computer usage for visually impaired people and developing courses and materials to meet their needs with a view to increasing their chances of gaining new full-time employment. Specific discussion items were raised around screen-reader configuration and the need for additional training materials to help blind people install and set up the software at home. All agreed that basic knowledge of how to configure a screen-reader correctly before operating it could avoid potential barriers to accessing computer software, including Windows Operating Systems. For example, configurations can accidentally be changed by a user who would then encounter new problems at the next usage. These issues were considered to be quite technical and solvable once specific training courses were established. The literature shows that many types of assistive technology, particularly screen-readers, are quite complex to use and often require individual, face-to-face, instruction on how to use them (Corn and Wall, 2002).
Douglas (2001) argues that teachers need to have high levels of technical competence to learn how to use assistive technology.

The overall reaction from the group to the findings from the questionnaire was positive. Reasonable levels of satisfaction were found regarding the generally good spread of computer use across the country as well as the high level of interest in developing practical skills that could be used at work, e.g. using e-mail and creating spreadsheets. A project officer at the NCBI was struck by the growing level of interest of the more experienced respondents in developing electronic skills for business (developing their own websites or carrying out banking activities online). She said that there was a need to try and meet these changing needs through the provision of new courses that covered topics related to the Internet and electronic business.

Some concern, however, was raised among the trainers and representatives at the NCBI about the low level of initial training respondents received and how appropriate it was to their needs. Another concern was raised by the NCBI in relation to the number of courses available for people living in rural areas and the cost-effectiveness of running one- or two-week courses for small numbers of people. These preliminary findings were considered extremely useful for the NCBI which plays a large part in the supply of training of equipment and software. It was unclear, at this stage, how the charity would be able to increase its levels of support over the next five years, but this survey was able to provide some empirical evidence of what was happening across the country.

A lecturer from Trinity College Dublin (TCD) conveyed concern that few respondents were using technically advanced forms of screen-reading software. He suggested that much of this software was prohibitively expensive and could only be purchased at reduced prices by large organisations that have the power to negotiate lower prices for large number of software licences. This could reduce the chances of new, less expensive software from being used by the visually impaired community. This is an issue that the NCBI would need to take up with the leading screen-reader software companies in the UK and the USA, particularly as the NCBI is the largest customer in the country. NCBI could negotiate new price deals lowering the cost of the software on behalf of their own clients.
5.3.2 Meeting the training requirements of visually impaired learners

The next step for the stakeholders was to collaboratively explore ways of meeting the learning needs of visually impaired students. Trainers shared their experiences with the rest of the team, discussing some of the problems they encountered over the past 10 years as tutors. Two of the three trainers were visually impaired and therefore had first-hand knowledge of the issues for both learners and trainers.

One trainer stated that teaching computer skills to the visually impaired should not be considered as 'one size fits all' but should be more open-ended, where every student chooses a preferred style to tackling tasks. She suggested that students be able to choose different approaches to learning that is, ones that are easiest or the most successful for them. She urged trainers not to impose a set of instructions on their students.

A second visually impaired trainer added that there was no apparent shortage of training materials but visually impaired students required carefully written training materials that explained how to use applications such as Windows and Microsoft Office (Word or Excel) from the keyboard only. He suggested a simple document that listed all shortcut keys for each application, for example using Word or an Internet browser such as Explorer or Mozilla Firefox. He added that 'this information seems to be difficult to find on the Internet.' He also suggested that students have access to this information in both tactile (braille) and auditory formats. The recommendation to introduce short guides with shortcut keys on how to use different Internet browsers and frequently used websites (e.g. Google) could be very useful for many visually impaired computer users who have little experience of using the Internet. This recommendation links closely with findings from a study by Douglas et al. (2008) where they discovered that the inclusion of keystrokes to help blind users navigate around an e-learning environment could reduce the amount of time used on accessing the learning object with the screen-reader, leaving more time for other activities e.g. 'doing'. Also, the following of good design principles, such as the WAI
should reduce any 'high level' barriers that could prevent a screen-reader from accessing information on a VLE (see section 2.10.1).

A visually impaired Master's research student at Trinity College Dublin briefly discussed his research on the evolving learning and social needs of visually impaired adults in Ireland. He commented on a particular phenomenon that occurred before computer training was offered where visually impaired people tended to have low expectations about computers and about their abilities to learn; yet after a small amount of success with computers, their views changed drastically. First successes in sending emails, writing documents or browsing the Internet tempted new users to consider more complex tasks and new learning opportunities. He concluded that it was important that the training should be open to everyone, regardless of their initial expectation levels.

The provision of appropriate training for visually impaired computer users is a key area of concern for both the users and service providers (e.g. the NCBI). Evidence from the literature, findings from the questionnaire survey and findings from ensuing discussions with stakeholders working in the field of ICT training seem to suggest that without basic training on how to use screen-reading, visually impaired people will be unable to participate in the same activities as their sighted peers. This conclusion will be discussed further in the next chapter.

5.3.3 Exploring learning materials

The next part of the discussion moved to training materials that have already been successfully adapted to visually impaired users. The workshop participants at Trinity College Dublin and the Further College of Education have built up considerable experience in either redesigning course material (such as the European Computer Driving Licence) or teaching students how to use it.

The Trinity College lecturers recommended the ECDL as a highly usable computer learning program that is accessible to adult visually impaired learners. It was first set up with the intention to address computer literacy skills of 'all'; however, at that time,
the specific issues relating to disabled people were not considered. In September 2001, the European Commission funded a pilot project called ECDL® PD aimed at adapting the ECDL® certificate to the needs of disabled people. This project identified the issues and barriers faced by the different groups in achieving the ECDL. The Trinity College lecturing team decided to explore solutions to the barriers that were preventing disabled people from accessing the materials and to develop another version of the ECDL that could be validated by the ECDL Foundation.

As part of the exploration of learning materials, the group considered some of the issues that could prevent visually impaired students from taking the ECDL. The three higher education college trainers had detailed knowledge of the whole course and were invited to comment on whether each component was suitable for training and examining purposes. Below are three main points taken from their list of recommendations:

- Students would require thorough training in the use of the screen-reader software JAWS (Job Access With Speech) before tackling the ECDL; Trainers of students with visual impairment would require further training on how to teach JAWS;
- The ECDL syllabus was 95% accessible, but phrasing of specific questions in the test could cause some problems, e.g., 'Which of the following icons...?';
- Questions on the Internet that required students to go onto specific websites should only refer to websites that comply with the W3C WAI accessibility guidelines.

While the ECDL was considered by the majority of the stakeholders to be a viable course to use with visually impaired people, some problems were identified. This qualification meets the learning needs of some but not all learners. Those who expressed a wish to learn more about desk-top publishing or how to design a website would have to enrol on other learning courses that may not be as accessible as the ECDL. Regarding the content, the main problem was a lack of flexibility in using new material to solve every day tasks such as looking up train timetables or booking a rail ticket online. The group agreed that new course materials should be explored – those that met the evolving needs of those who are interested in developing their digital
skills, such as designing a website or learning to use multimedia tools. Evidence from the questionnaire survey suggests that visually impaired people want to be able to use the Internet in the same ways as sighted people (see Table 10), e.g. book flights, carry out online banking, online shopping Morley et al. (1999) found that the small sample (nine users) ‘were excited by the multi-media presentation, which gave them access to a wider variety of information than ever before’ (p.25).

As a final contribution to the discussion, TCD Computer Science lecturer Alexis Donnelly, a strong advocate for universal access to e-learning, identified three potential learning groups among the participants:

- Computer novices with no experience of computers;
- Computer users who are not yet proficient to ECDL level;
- And proficient users who would like to gain an ECDL certificate or a qualification in another field.

Dr. Donnelly viewed each group as not entirely distinct from the others; in fact, he held that they formed a continuum. Hence, he recommended caution regarding initial recruitment for the piloting of any courses that involved complex levels of the keyboard. Optimal candidates, according to Donnelly, would be those with keen interests in learning how to develop their own personal skills and those willing to take a leap into a completely new and exciting field. Dr. Donnelly’s perspective was helpful in deciding how materials should be designed and offered to visually impaired learners. Consultations with stakeholders should also involve ‘experts’ in universal design who can advocate for the inclusion of people in the planning and designing of inclusive technology. Alexis Donnelly’s involvement as an advisor to the discussion around universal design is an example of a bottom up approach that is favoured by universal design theorists including Bitterman and Hess (2008). They argue that the principles of good design include consideration of the abilities of all people.

Including highly recognised and respected courses was considered a critical step towards ensuring good quality training. As more visually impaired people achieve certification in ECDL and other electronic skills, prospective employers might widen job parameters for them. The project officer at the NCBI suggested that by acquiring...
these certifications visually impaired people might be encouraged to set up home-based businesses of their own, a motivating factor particularly for those living in rural areas of Ireland. Yet the only college recognised to teach the ECDL was in Dublin and no immediate plans were known to extend training to other regions of the country.

5.4 Next steps

A final task for the stakeholders was to come up with some recommendations on how to move from the exploratory stage to one where some of the generated ideas could be tested. The group recommended a consultation stage where the issues raised during the exploratory stage of the process could be presented to members of the visually impaired community. All parties agreed that the involvement of visually impaired people in the design process of a study was essential and that any exclusion of this community could lead to serious criticism by the academic and disabled communities.

A small group of visually impaired adults would be invited at least two or three times to the discussion table. This consultation group would be asked not only to comment on issues that have been presented to them but they would help to identify the sorts of issues and agendas that they felt needed to be researched. This peer reference group would also help establish a set of principles that could be used to design, monitor and evaluate a study around issues affecting the level of computer usage of visually impaired people at home and work.

The stakeholders suggested advertising this ‘role’ informally to members of the visually impaired community through the NCBI and VICS newsletters. Any interested people could directly contact me for further details about the role and the terms of reference. The stakeholders recommended that those invited to the peer reference group should have an interest in new computer technology and training. The NCBI and VICS participants recommended recruiting people with different levels of experience of using computers. They also recommended recruiting one or two people who had some knowledge of how to use assistive technology and the Internet. Lastly,
at least one member should have experience in computer training and potentially have some background knowledge of the ECDL and other computer literacy skill programs. Essentially, members of the group should have a personal interest in working as a team to explore ways of improving the level of access to new technology through inclusive approaches.

Once a small team of peers was established, the stakeholders recommended that they invest some time reviewing the main issues that emerged from the questionnaire findings and from the stakeholders' workshop before contributing their own ideas, opinions and perspectives to the discussion forum. These perspectives could then be formalised into a set of principles to be tested in a potential pilot study. In this way, the visually impaired peer group would be able to influence the research agenda by deciding on which issues need investigating. The peer reference group could act as an advisory group during the study and also evaluate the study against the suggested principles. It was also recommended that the peer reference group disseminate the final study findings to their peers and to bigger audiences across the country.

A new two-year European Union (EU) funded project (see Appendix H for details about the project) was set up at approximately the same time as this research was taking place. The aim of the study was to help increase the knowledge of electronic business concepts as well as develop rudimentary electronic skills that would increase abilities of the visually impaired to compete in the Irish workplace. The project funder (the EU, under a National Development Plan) was particularly interested in the level of impact the stakeholders' project had on a targeted population in rural parts of Ireland. The EU funded project team realised the potential for a pilot study that could run next to their project. So they invited a small team to design a study that could be shared with the Irish Government, special interest groups and charitable organisations in Ireland representing disabled people.

The next sections discuss stage two of the process which involved identifying and recruiting a peer reference group of visually impaired adults. It also outlines some of the principles that emerged from the consultations and how they could be applied to a new pilot study.
5.5 Introduction to stage two

Stage two of the enquiry process was to take the main findings and recommendations to a reference group who represented the views and perspectives of visually impaired people living and working in rural and urban parts of the country. The role of this peer reference group was to comment on the findings emerging from stage one and offer suggestions and guidance on how these emergent findings might be tested in a research context.

The use of a peer reference group of visually impaired people also represented a further commitment to an emancipatory research strategy in that it shifted the establishment of priorities for research away from the service providers and academics towards the visually impaired community who had the perspective of the 'end-user'. It provided a dialogic context, which would ideally authenticate new perspectives and ideas. This use of reciprocity is a key aspect of emancipatory research – allowing disabled people to have some control over the social and material relations of the research process (Zarb, 1992).

5.5.1 Defining a role for the disabled peer researcher

The next stage was to compose a work description for the role, drawn from the stakeholders' proposals, and to then advertise it through the NCBI and VICS newsletters. As part of the role, peers would meet two or three times over a period of six weeks to explore ways of developing research into ICT and visual impairment. The role was voluntary, but any small travelling and subsistence costs would be covered by the NCBI.

Lewis et al. (2008) in their research involving disabled people as co-researchers, saw the value of having a small number of disabled people in a reference group (two people) to 'sustain a close involvement with their work and make a contribution, regularly and in-depth' (p.80). In light of this finding, two small advertisements were placed in the NCBI newsletter and the VICS electronic information newsletter. They advertised for four or five visually impaired people who had experience in using
computers and the Internet and who were interested in meeting informally to discuss ways of building a research agenda. These advertisements led to a small number of enquiries mainly from visually impaired people living in and around Dublin.

One enquiry was made by a person living on one of the Cork Islands. He warned that he was unable to physically attend the meeting because of commitments on the island but was interested in contributing via voice-conferencing. This proposition could have been possible if all the peer group members had access to the same voice-conferencing software and were able to use it. The NCBI received only one enquiry from a female and the VICS received five enquiries from male members. The final group of five people were blind (see Appendix I for a brief profile of each participant) consisting of four male and one female all living in Dublin and surrounding counties. There were no enquiries from people with low vision. All five were experienced users of assistive technology, computers and other mobile technologies (e.g. mobile phones, MP3 players). They were also enthusiastic about the latest developments in assistive technology and the potential impact it could have on the lives of many visually impaired people.

Only one participant had experience of e-learning as an undergraduate student at a third level institution whereas the other four had some notions of distance learning but did not have the opportunity to take part in any specific e-learning activities. Michael, one of the members of the peer reference group, was the President of VICS at the time and was a strong advocate for ICT training for young people and adults with visual impairment. He co-founded VICS in 1986 with a small number of people who had similar interests in technology for the visually impaired including Ronan (a second member of the peer reference group). VICS' membership has now grown to over one hundred members across Ireland.

Both Michael and Ronan had considerable experience using assistive technology and had witnessed technical advances and failures over the past twenty years. All five participants were members of VICS and were well known in the visually impaired community. They were respected experts in assistive technology and the Internet. Each had acquired a reputation as an 'expert' in the field of training visually impaired adults, specifically on how to use screen-readers and mobile technologies. They were
often invited to talk about their experiences at workshops and to demonstrate emerging technology at awareness days for the NCBI and VICS.

At the first meeting, one person was appointed as chair and another as secretary. Minutes of the meetings were typed up and then embossed into braille and sent to all the team by post. Discussion at the meeting was supplemented by contact via e-mail between meetings. The aim of the first meeting was to agree on the group's primary task, to agree working parameters and to decide on a set of tasks to work on over three sessions. It was agreed that the main purpose of the group was to establish a number of testable principles for assistive learning. It was also important to clarify ethical procedures on matters of confidentiality, recognition and responsibility, and for the group to make 'good use of [the] established ground rules and protocols for meetings and discussions' (BERA, p.80). The group went through the following actions to achieve these goals:

1. discuss the findings and recommendations from stage one (the questionnaire and stakeholders' meeting);
2. identify unexpected or unusual findings and discuss possible reasons for these results, based on their own perspectives and experience;
3. identify key testable principles;
4. explore mechanisms through which the principles could be tested.

Actions one and two were discussed together; action three required more detailed level of discussions. Action four was to be linked to the funded study which is outlined in Appendix H.
5.5.2 Discussion of key findings from stage one

The principal findings outlined in the summary section were presented to the five members of the peer group by me (more details can be found in section 5.2.7). The members were invited to reflect on the data and to suggest possible explanations for the results. They were also asked to identify themes that they considered to be important and should be added to the summary. The group identified the four main themes for consideration:

- Issues around the chosen sample group;
- Computer use and visual impairment;
- The role of assistive technology;
- Training initiatives for visually impaired adults.

• Issues around the chosen sample group

The peer group confirmed that the overall results from the 32 returned questionnaires were quite representative of the visually impaired community in Ireland. However, the omission of retired people from the sample could have had an impact on the final results, particularly with reference to frequency of use and individual problems related to visual impairment. They considered it highly probable that a proportionately higher percentage of retired people would not use computers as regularly as those of working age. They also considered there to be lower levels of computer literacy among retired people possibly resulting in much lower usage, but this view was based on their own experience of the field and talking to people as part of their work. They recommended the inclusion of retired visually impaired people in future surveys to find out more about levels of training and access to technology.

• Computer use and visual impairment

The group agreed that the overall interest in computers among visually impaired people was high, particularly among younger people. The high percentage of usage at work (63%) suggests that people are able to use the computer and a screen-
reader to send e-mail and surf the Internet. Ronan confirmed the point that initial fear of computers can be quickly overcome if people are given specific training on simple tasks that are easy to achieve. He said it would be easier for younger people to develop the essential computer skills which would hopefully help to reduce any psychological constructs such as low levels of confidence. He added that confidence levels among the older generations of visually impaired could vary considerably depending on where they live, the amount of access they have to computers, and whether there is any available training in their community.

Issues concerning the cost and availability of equipment have always figured prominently as problems arising from poor Internet connectivity in rural areas and the high costs of using dial-up connections. Many living in rural areas may not be able to afford the cost of installing and running the Internet and are therefore further marginalised.

The group considered the high level of interest in using computers to send e-mails and surf the web as a clear sign that visually impaired people are keenly interested in participating in practical activities for work and leisure. They suggested that training should be more focused on the skills that enable them to achieve both work and leisure related activities. They still believed that many people required training on basic computer literacy but that this should be delivered in a flexible way so that learners can take a module or part of a course that meets a specific need. All five participants learned to use a computer and Microsoft Office software on their own because there were few courses available for visually impaired people ten or fifteen years ago. They also used to draw on local support mainly in the form of friends and members of their family who could help them get started. They therefore unanimously agreed that more help should be provided to those who are just starting to use computers through targeted training and technical support.

Michael wished to make a point about the level of motivation and those who simply did not want to engage with technology. Results from the questionnaire show that almost twenty percent fell into this category. He showed concern over this number of working age people who were not benefiting from the vast opportunities and services (such as online shopping and banking), which could greatly improve the quality of
their lives. He said that these people need to be made aware of the potential benefits of computer technology and the Internet through awareness days in both urban and rural regions of the country.

- **The role of assistive technology**

The group was not surprised by the high percentage of people who used JAWS screen-reading software. This result may also reflect the high number of respondents who are blind or have severe low vision and need to use a screen-reader. They agreed that JAWS has proven to be a highly reliable piece of software for over twenty years in spite of the fact that the quality of the voice has not changed much over this time period. In the recent past, few alternative software programs have proved as reliable as JAWS, but new technological breakthroughs in the software are tempting people to change screen-readers even after using the same one for a number of years.

Stuart, an experienced JAWS user, said that he had tried to use a new screen-reader a year ago but found it difficult to adapt to it even though its synthesised voice was easier on the ear. He added, ‘the cost of new software is still prohibitively expensive compared to mainstream technology on the market and this is deterring people from buying a more sophisticated version.’ Given the high number of existing JAWS users in the country, he felt that it would be more appropriate for course designers to develop learning materials based around this software program.

Nicky disagreed with this point believing training courses should be written for either screen-reader or magnifier. This would simply involve providing a list of separate keystrokes for each piece of software. He also considered it essential for courses to be frequently updated when new screen-readers entered the market. He gave an example of the Dolphin USB pen that has greater transferability from computer to computer and more voice options (male/female, young/old). He finally made the point that all courses should have built-in tutorials on a range of screen-reading programs to insure full inclusion of people with low vision and blindness. Course participants would still require initial training on how to set up the configurations for voice type,
speed and interaction with text (e.g. speaking out letters, words or sentences at a time) as well as on how to use the appropriate keystrokes.

- Training initiatives for visually impaired adults

The peer reference group was disappointed about the overall level of training among the sample group and the poor range of opportunities for training particularly in rural areas. It felt strongly that specific training courses targeted at the visually impaired should not only be organised by the NCBI and volunteers but that they form part of mainstream training programs run by Government ICT training centres across the country. It was important for ‘experts’ involved in developing and training courses for the visually impaired to advise on how these courses should be run. Among the five, there was a strong sentiment that charitable organisations should try to reduce the number of courses they run for the visually impaired unless there was no other possibility for the government to run a specialised course. They believed that mainstreaming specific-skills courses should be part of all training centres’ course programmes. This would also help to improve the quality of training and increase the level of training staffs’ awareness of techniques to accommodate visually impaired students at the centres.

Michael raised the point that a low number of respondents had taken formal certificates or exams. He said that the only recognised college in Ireland that trained visually impaired students to take the ECDL was in Dublin. He suspected that most of the people who had taken the ECDL either lived in Dublin or near to the city. A review of the data confirmed that six out of the eight were from Dublin. He recommended that screen-reader training be given to ICT trainers at all colleges of higher education and at the new institutes of technology which have now been set up in nearly all Irish county towns and cities. Visually impaired students attending mainstream ICT classes would benefit from participating with others on a number of levels: academically, by being able to avail themselves of expert tuition and resources; technically, by enjoying the up-to-date computer facilities and socially, by participating in learning activities with their learning peers.
Both Stuart and Emma explored other routes to learning, including e-learning. Emma was struck by the proliferation of e-learning in higher education institutes, particularly at her university where e-learning was being used as part of her undergraduate degree course. She said, 'I'm trying to come to grips with using it, but I can already see the advantages of learning on such a system.' She said she was not surprised to hear that the majority of the respondents used traditional ways of learning, as this was a common way of teaching in schools until quite recently. She strongly believed that e-learning was the way forward for everyone including the visually impaired.

Although he had not experienced e-learning directly, Stuart suggested that the group explore how online courses could be offered to technically competent and potential computer users. Michael and Ronan went further by saying that visually impaired people in Ireland could greatly benefit from the e-learning revolution. The group felt that this could be a potentially exciting step for the visually impaired community and should be proposed as an idea for a possible pilot study. These ideas were supported by results from the questionnaire showing that 44% of the respondents wished to develop skills around using the Internet and using online resources.

The final part of this stage of the discussions involved summarising many of the issues that arose from the earlier discussions. The main summarised points follow:

- The lack of high quality training initiatives for visually impaired adults in rural areas are further marginalising them from the 'information society';
- There is a need for more awareness training on the benefits of engaging visually impaired people (particularly retired and elderly) with technology at home, at work and for leisure;
- Training should be more focused on the skills that enable visually impaired people to achieve their individual aims in flexible ways;
- More help should be provided to those who are just starting to use computers through targeted training and technical support on Government funded schemes;
- Manufacturers and suppliers should be persuaded to reduce the cost of essential assistive technology and equipment;
• Training courses should become part of mainstream training programs run by Government ICT training centres and technology colleges across the country;

• There is a need to explore other routes to learning, including the promotion of e-learning courses that could help to readdress the imbalance of training in rural and urban parts of the country.

5.6 Identifying a set of principles for research

The next task for the peer reference group was to develop the informal discussions summarised above in broader statements on how visually impaired people could benefit from the new opportunities that new technology can offer. One approach was to propose principles that could be adopted when developing inclusive learning environments for visually impaired adults. The group recommended that any new research should investigate ways of facilitating learners to make an important shift: from activities that simply recall factual information and rote learning to ‘deeper-level’ learning activities where students understand the significance of what they are learning as well as integrate it into their existing knowledge. They considered developing a virtual community of enquiry that would explore ways to increase learning independence and social interdependence at the same time.

These ideas could be developed through a sophisticated system in the form of a completely accessible Virtual Learning Environment (VLE). How such a VLE should be designed and tested would need to be discussed with educational tutors and e-learning experts who have experience of constructing and delivering high quality e-learning courses on a VLE.

Below is the proposed list of principles that could be considered if a pilot study was commissioned:

• To explore new ways of developing flexible training courses to meet the individual technical and learning needs of visually impaired learners;

• To develop multi-dimensional and multi-faceted electronic and digital learning materials that can be accessed using assistive technology;
• To provide high quality technical training to tutors who teach visually impaired students;
• To promote highly recognised and respected courses that are validated by a respected education body and lead to qualifications that employers recognise;
• To include visually impaired people in all aspects of designing and testing VLEs and new e-learning courses;
• To include the views and opinions of technical experts who understand and practice principles of inclusive design;
• To ensure that e-learning courses and VLEs demonstrate 'universal' inclusive design that complies with international standards in order to vitiate problems associated with restricted accessibility (e.g. visual cues), time and mobility.

A main recommendation from the group was to explore new developments in assistive technology and how they interface with computers and the Internet. This should be achieved through the process of co-creation, where visually impaired people are a fundamental part of the development and testing process.

5.6.1 Exploring opportunities to run a pilot study

One of the reference group members, Stuart, was involved in a joint proposal with two other organisations to carry out a two-year, EU funded project (Accessing Communities for E-Business, see Appendix H). This project sought to increase the levels of knowledge in electronic business for visually impaired people in Ireland. It was not being driven by any specific research, as such, as this was not a requirement for funding. This project was identified as a useful vehicle to test some of the principles outlined in the previous sections. Furthermore it could provide access to a group of participants and potentially serve to assess useful learning materials. Stuart suggested running a piece of empirical research at the same time as the funded project. A small research team consisting of members of the visually impaired community and the doctoral researcher could explore opportunities to examine the ACE project using their experience and expertise in the field against the following criteria:
(a) the extent to which the research met the identified standards;
(b) whether there is evidence of positive outcomes and
(c) the extent to which the positive outcomes are linked to the principles.

Once a proposal to carry out some empirical research had been approved by the ACE project team, an invitation could be sent to all the volunteers who had already agreed to participate in the funded project.

The next chapter discusses the research carried out by a small group of co-researchers while the project was taking place. It also discusses results from the interviews and round-table discussions.
Chapter Six – Presentation of Findings from Stage Three

6.0 Introduction

This chapter presents the findings from stage three of the enquiry process. This stage consisted of an empirical study to test whether it was possible to develop and to test an inclusive learning environment for a small group of visually impaired adults. A proposal was drafted to carry out a pilot study by the peer reference group and was sent to the ACE project team for assessment and approval. This opportunity arose out of discussions with Stuart, one of the peer reference group members. Stuart was involved in an EU funded project that was planning to construct and test a new virtual learning environment and e-earning materials on small group of visually impaired adults in Ireland.

The project team consisted of three partners, two institutions (Trinity College Dublin and the NCBI) and one private company (Inishnet Ltd.) This team was responsible for the development, testing and management of the VLE. As soon as the proposal was accepted, immediate steps were taken to set up a research team and to plan the study to run alongside the ACE project. Details about the project and how it impacted on this research are discussed throughout this chapter.

Three blind members of the peer group (two men and one woman) volunteered to work with me on this new research initiative. The advantage of this coalition was that the visually impaired researchers could draw on their experience and expertise in the field of technology and visual impairment to apply the agreed principles to a virtual learning environment and to develop supporting pedagogy for e-learning. The co-research team designed and tested the data collection tools (interview and round-table schedules). These tools were then used to determine (a) the extent to which the study met the identified standards, (b) whether there is evidence of positive outcomes and (c) the extent to which the positive outcomes are linked to the principles.
Review of ACE website

As part of the ACE project team’s commitment to meeting priority 1 of the WAI guidelines, the co-researchers were invited to review the newly constructed virtual learning environment (VLE) before the participants were asked to test it. We were all allocated usernames and passwords before reviewing the VLE and were asked to randomly review different parts of the VLE to ensure all usability and accessibility aspects had been dealt with. We agreed to develop a small number of tests that each of us could carry out and to record our results independently.

Table 14. Details of tasks conducted by co-researchers as part of a review of ACE

<table>
<thead>
<tr>
<th>Task One</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quickly navigate the ACE homepage to get a good sense of what the VLE is about.</td>
</tr>
<tr>
<td>Check all links on the home page of the VLE are working and are correctly labelled.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Task Two</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enter the webpage entitled ACE Courses and tab down the entire page to check that course modules are sub-divided into coherent components and are clearly listed.</td>
</tr>
<tr>
<td>Check that there are not more than two blank lines (white spaces) announced by JAWS between sections. (Blank lines can prove a distraction and add to the noise the user must negotiate to understand the page).</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Task Three</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check all combination boxes or drop-down menus and tick boxes are accessible and easy to use with JAWS.</td>
</tr>
</tbody>
</table>

The results from the three tasks, presented in Table 15 below, were discussed and recommendations were agreed on whenever appropriate. The test proved to be a useful exercise in terms of identifying potential pitfalls that could impede access to the VLE and e-learning courses. All accessibility issues discovered during the tests were considered to be low priority, meaning they could possibly cause minor problems for some JAWS users. Once recommendations had been discussed thoroughly they were shared with the ACE project team.
## Table 15. Description of tests, results and recommendations

<table>
<thead>
<tr>
<th>Task</th>
<th>Result</th>
<th>Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. <strong>Quickly navigate the ACE homepage to get a good sense of what the VLE is about.</strong></td>
<td>Homepage is easy to navigate. All essential information about the courses is well signposted.</td>
<td>No action required.</td>
</tr>
<tr>
<td><strong>Check all links on the homepage of the VLE are working and are correctly labelled.</strong></td>
<td>All links are clearly labelled and lead to the corresponding section on the page. The table of contents at the top of the home page are unnecessary as these sections are already on the homepage. The screen-reader will read the same content headings twice.</td>
<td>Take out the table of contents on the homepage.</td>
</tr>
<tr>
<td>2. <strong>Enter the webpage entitled ACE Courses and tab down the entire page to check that course modules are sub-divided into coherent components and are clearly listed.</strong></td>
<td>The page contains information about two courses (ECDL and e-business) with clearly marked links to all the module components. All links work.</td>
<td>No action required.</td>
</tr>
<tr>
<td><strong>Check that there are not more than two blank lines (white spaces) announced by JAWS between sections.</strong></td>
<td>Two researchers reported more than two blank lines between sections on all of the course webpages. Spaces between section headings could be reduced to avoid too much distraction from the screen-reader.</td>
<td>Check all web pages on VLE to ensure quantity of spaces between sections are minimised.</td>
</tr>
<tr>
<td>3. <strong>Check that all drop-down menus and tick boxes are accessible and easy to use with JAWS.</strong></td>
<td>No apparent problems with any of the drop-down menus. Emma reported a potential problem with the tick boxes. JAWS does not always announce if a box has been checked every time.</td>
<td>Need to run some additional tests on ticking boxes using JAWS. Explore alternatives.</td>
</tr>
</tbody>
</table>

A further recommendation was made to the project team to produce an audio tutorial on a CD that guides the participants through the main features of the VLE (e.g. the discussion forum). This tutorial would be particularly helpful for those participants who
had never experienced a VLE or e-learning before. The project team agreed to produce a ‘guided listening tutorial’ on a CD (see Appendix H for a short description of the tutorial).

The second part of the requested review involved testing the two proposed e-learning courses. These are discussed in the next two sections.

**Review of new e-learning courses on ACE**

Having carefully reviewed the two ECDL modules, we were satisfied with the quality of the learning content. The only concern we had was related to the recommended set of JAWS shortcut keys that help the learner to navigate through the instructional material. We were uncertain if the least experienced participants would be able to follow the JAWS instructions and follow the course (see Table 16).

**Table 16. Extract taken from module 3 (word-processing)**

1. Open a document and save it to disk with a new filename.

First hit the ‘Windows’ key and Jaws will respond ‘Start Menu’; now hit ‘P’ for programs and then keep tapping ‘M’ for Microsoft until you get to Microsoft Word. Now hit the ‘Enter’ key and Microsoft Word will open, giving a new document upon which you can type. However we do not want this document, so close it by hitting ‘Ctrl + W’

The ACE team developed an electronic business course that would be tested for the first time on the VLE. The course covered many aspects of electronic commerce including the structure of e-business (e.g. inventory management, product development, risk management, finance, knowledge management and human resource management) as well as external global and cultural issues. Although the course was not designed specifically for a visually impaired audience, there was little evidence of specific learning materials targeted at this audience. Having reviewed the course we agreed that it would be more useful to relate the principles of conducting business online to examples of how it could be applied to a visual impairment context.
The current course could lead to some problems in access and usability for the participants.

**Setting up co-researchers on the VLE**

It was agreed between the co-researchers and the project team that the whole research experience could be enhanced if at least two of the co-researchers could become participants on the VLE. They were set up with user names and passwords to log onto the project VLE at any time. The third co-researcher, Stuart, was already involved in the project and had access to the e-learning environment. The two co-researchers, Emma and Nicky, were set up with accounts (username and password) which automatically gave them complete access to the VLE and the learning materials.

Emma and Nicky agreed to participate in the same activities as their peers i.e. following an online course, keeping an online learning diary and contributing to asynchronous discussions. The actual e-learning project involved a total of ten participants: eight of the sample were blind and two had low vision. The sample was evenly divided among men and women (see Appendix I for details about each participant) and all had access to a computer and the Internet. All participants were informed about the dual role of the two co-researchers and were asked for their consent. One of the participants withdrew from the project after three months as a result of experiencing a series of technical problems with her computer at home.

One of the main tasks of the co-researchers was to capture the learning characteristics of all the participants at the beginning and at the end of testing the VLE and online learning courses. It would also be helpful to record any technical difficulties they experienced during the first testing period and feed them back to the project team. The reported difficulties could help to reduce any barriers that may have been overlooked.

The first section focuses on data from interviews and discussion groups that took place at the beginning of the testing of ACE (January – April 2004). It captures the participants' learning characteristics before their engagement in the e-learning
programme through an analysis of the data. The second section captures the participants' learning characteristics at the end of the project (October 2004).

**Analysis of qualitative data**

A total of four data sets were exported from the 20 interviews (10 interviews recorded at the beginning of the pilot project and 10 interviews recorded at the end of the testing period) as well as two roundtable discussions (40 minutes in duration each). All four sets of data were tape-recorded and transcribed into Word and each transcript was imported into the qualitative data analysis tool NVivo (Version 2). Each individual response to the interview questions and roundtable discussions was accompanied by details of:

- the participant's unique identity number (ID);
- their visual status;
- their home address;
- the participant's age;
- their professional status;
- their preferred reading media (e.g. print, braille, ICT).

These different details helped to develop background information and learning profiles for each participant which could be utilised for specific case studies to illustrate the differences in participants' learning characteristics before and after their engagement in the e-learning programmes (see Appendices M and N).

The data were analysed following an 'open coding' generative approach (see section 4.3) involving scrolling through the documents and highlighting text that related to identified themes, or 'new' issues or themes that had not been identified earlier in the interview schedule. Some of the coding was carried out on paper and braille in order for all the co-researchers to be able to access and discuss the different themes, through the use of an inventory of codes and descriptions entered into a codebook. The main reasons for choosing this process were to ensure the involvement of all four co-researchers, to agree on principle themes and to extract exemplar citations to
illustrate them. Thus, all phrases and statements were shared with the other researchers for their analysis and interpretation. One of the biggest challenges was to organise the data in a format that could be interpreted by people who had little or no experiences of conducting research. This process took a considerable amount of time as data had to be rendered into accessible formats for the visually impaired researchers to read (see section 7.3.5).

The first coding of the data was carried out by me. This consisted of developing different levels of coded data:

- **descriptive coding**: information about the participant and their attributes (see list of details above);
- **topic coding**: identifying what is being discussed in relation to the questions on the interview schedules and allocating topics to these passages (e.g. technical issues, learning preferences, levels of access to the Internet, etc.);
- **axial coding**: relating codes to each other to fit words and phrases into basic frames of generic relationships;
- **selective coding**: choosing core categories and relating other categories to that category (e.g. complexities of accessing e-learning courses or acquisition of information age skills to e-learn).

All four databases (two sets of interviews and two roundtable discussions) were coded separately before generating cross links and generic relationships between the datasets. It was essential to carry out coder consistency tests with the other three researchers to measure the reliability of the coding. The preferred method was to compare interview and roundtable data using a clean version of the document that was coded earlier by me and recode it with the help of the other three researchers. This process encouraged some deep interpretations during the first analysis of the data. It was crucial that all the co-researchers could use their personal experiences and their knowledge of learning how to use technology to identify categories and sub-categories that could be later classified into themes.

The main themes are discussed in sections 6.3 and 6.8 below.
The data from the interviews and round-table discussions are presented in chronological order:

First testing period of VLE (January – April 2004)
1. first set of interviews;
2. first round-table discussion.

Redevelopment of VLE based on participants’ initial experiences (May - July 2004)

Second testing after redevelopment of VLE (August – October 2004)
1. second round-table discussion;
2. second set of interviews;
3. group discussion with co-researchers.

The first set of interviews and round-table discussion are based on the results of the first testing period.

For ease of reference, the rest of this chapter is structured (in summary) as follows:

Section One

6.1 Results from first set of interviews
6.1.1 Participants' background data
6.2 Round-table discussions
6.3 Identification of main themes from the first round-table discussion
6.3.1 Accessing and navigating the virtual learning environment
6.3.2 Use of online tools
6.3.3 Complexities of accessing e-learning courses for visually impaired learners
6.3.4 Presentation of key issues identified during the first testing period
6.4 Summary of key issues
6.5 Redevelopment of VLE based on participants' initial experiences
Section Two

6.6 Results from second round-table discussion
6.7 Summary
6.8 Final interviews with participants and resulting themes
6.8.1 Levels of participants’ technical knowledge and access to the VLE
6.8.2 Impact of e-learning courses on participants’ learning characteristics
6.8.3 Applying learning strategies to support e-learning
6.8.4 Information-age skills for the visually impaired
6.8.5 Inclusive design of e-learning courses increases confidence and independence
6.9 Visually impaired people reflect on their experiences as co-researchers
6.10 Summary
6.10.1 Pedagogical issues affecting e-learning content and delivery
6.10.2 Adapting the environment to meet individual and social needs
6.10.3 Impact of the VLE and e-learning materials on learning outcomes
Section One

6.1 First testing of ACE

Results from first set of interviews

The results in this section cover a testing period of four months (see Appendix A). The following section provides some background data about the participants, their technical skills before testing the VLE and e-learning courses, and what they hope to learn as a result of participating on ACE.

6.1.1 Participants' background data

The results from the first set of interviews were analysed, providing background information about the participants in the project. This process was followed by analyses of data from the subsequent round-table discussions.

The presentation of the data is interspersed with quotations taken verbatim (where possible) from the participants' responses to the interview questions. In all cases, the written responses have been checked and confirmed as a correct reflection of the answer given at the time of the interview. The reasons for this were to validate the final syntheses of interview and round-table data and to consolidate their reflections on their experience of the virtual learning environment and e-learning course materials they were asked to test. This process was an integral part of my epistemological position to ensure that the voices of the participants were truly represented in this research and could 'tell it like it is'.

All the participants have been given pseudonyms to protect their identity; however, the three co-researchers agreed and signed a consent form giving their permission to be named on final publications, including this thesis. The decision not to name participants in this study could be criticised by advocates of disability studies who argue that anonymity insults participants and that they may want to be named or recognised more obviously in publications about the research. Moore and Barton (2006) argue that disabled people should be in a position in research to determine
and produce research according to their priorities and concerns and not have their views articulated through non-disabled people's voices. This is a delicate issue that has to be handled carefully on a case by case basis. Implicating new names could be problematic for the whole group who were informed that they would stay anonymous at the beginning of the research.

The results in Table 17 present some of the background data of the ten participants, such as gender, age, visual status and onset of visual impairment, current level of computer experience and their expectations of the study. Six participants lived in the south east (counties Dublin, Kildare and Louth), one in the midlands (Co. Cavan) and three in the South West of Ireland (County Cork). Eight stated their visual condition as blind and two as low vision. Three of the blind participants were employed as receptionist/switchboard operators for the Irish Civil Service and a fourth person had just retired as a switchboard operator. Three were pursuing full-time degrees (two undergraduate degrees and one PhD). A further participant/co-researcher had just completed a three-year degree in Communication Studies.

The eight participants recruited by the project team represented different levels of technical ability and experience of using ICT at home and work. The project team had created a list of selection criteria (see Appendix H) for recruitment. Ideally, it was seeking a reasonably homogeneous group to test the VLE and e-learning courses but, given the project parameters (people in rural communities with access to the Internet), it proved difficult for the team to recruit adults with similar visual impairment and learning trajectories or aspirations. In some respects it would be useful to record the learning experiences of adults with different levels of technical ability and learning styles. The final tested prototype could then claim to meet the complex needs of people with stable (blindness) and deteriorating eye conditions (e.g. Retinitis Pigmentosa) with built-in features that help to reduce barriers to full access and use.

The interview results demonstrated a reasonably good spread of technical knowledge among the participants, including use of the computer, screen-reading software, Windows Operating Systems and the Internet. All apart from one (Catherine) said they were regular computer users at work and home. Seven participants expressed confidence in using the computer with a screen-reader. Three reported previous use
of computers and the Internet as part of their undergraduate degree courses. One participant used the University's online website (Blackboard) to access reading materials and to deposit assessments. Two participants conveyed a lack of confidence about using the Internet, although they had acquired some skills using Microsoft Office (Word). The participants' learning characteristics and aspirations are briefly presented below when I discuss each of the participants' profiles.

The VLE was constructed for blind adults who use JAWS. However, the entire VLE was accessible to people with low vision, although this was not a focus of the project. The spectrum of ability would provide extremely useful information about how inexperienced and more experienced users could interact with a VLE. The description of the pilot group of participants compiled during the first interviews provides critical information.
<table>
<thead>
<tr>
<th>No.</th>
<th>Name</th>
<th>Current Visual status</th>
<th>Preferred reading media</th>
<th>Age</th>
<th>Professional status</th>
<th>Town or County</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sarah</td>
<td>Low-vision</td>
<td>Text</td>
<td>24</td>
<td>Law student; final year of BA course</td>
<td>Cork City</td>
</tr>
<tr>
<td>2.</td>
<td>Emma (Co-researcher)</td>
<td>Blind</td>
<td>Braille/Computer</td>
<td>26</td>
<td>Graduate third level student; BA in communication studies.</td>
<td>Co. Cavan</td>
</tr>
<tr>
<td>3.</td>
<td>David</td>
<td>Blind</td>
<td>ICT</td>
<td>26</td>
<td>Third level student; BSc in computer programming.</td>
<td>Co. Louth</td>
</tr>
<tr>
<td>4.</td>
<td>Nicky (co-researcher)</td>
<td>Blind</td>
<td>Braille</td>
<td>33</td>
<td>Civil Service; switchboard operator</td>
<td>Co. Kildare</td>
</tr>
<tr>
<td>7.</td>
<td>Betty</td>
<td>Blind</td>
<td>Braille</td>
<td>55</td>
<td>Civil Service; telephonist</td>
<td>County Dublin</td>
</tr>
<tr>
<td>8.</td>
<td>Veronica</td>
<td>Low-vision</td>
<td>Text</td>
<td>58</td>
<td>Secondary school teacher and student counsellor.</td>
<td>Dublin</td>
</tr>
<tr>
<td>10.</td>
<td>Catherine</td>
<td>Blind</td>
<td>Braille</td>
<td>60</td>
<td>Just retired from civil service.</td>
<td>County Kildare</td>
</tr>
</tbody>
</table>
The following sections provide some additional information about six of the participants.

In his mid fifties, Tim lives in County Dublin. He works at the Government's braille press as a technician in the centre of Dublin. He has been working at the press for over 15 years transcribing department newsletters and publications for visually impaired members of the government staff. Tim developed blindness in his late thirties as a result of Retinitis Pigmentosa. He had knowledge of how to use some of the shortcut keys to operate JAWS but had little experience of using the Internet. He hoped to find out more about how to operate a new brailler that had been causing problems. He wished he could repair faults without having to call for external assistance from the braille manufacturer.

David is in his twenties and lives in Dundalk, County Louth, where he was studying an undergraduate degree in computer science at a local institute of technology. His schooling years were spent as a resident at a school for the visually impaired in Dublin. He developed a keen interest in computers and other technology at school where he learned to use several types of screen-reader software, including the more dated Window-Eyes and JAWS. David said once he completes his final year he would seek a job in as a programmer in a computer company or bank in Dublin. He had already completed the ECDL but said he would like to play more of an advisory role in evaluating the proposed e-learning courses as well as the VLE.

**Paul:** How do you think participating on ACE will help you?

**David:** I'm more interested in finding out more about the technical side of developing the VLE. I may not learn much but it is something I wish to get to know more about.

In her twenties, Veronica joined an order of nuns and has since pursued a lifelong career in teaching. She started experiencing a deterioration of her sight due to glaucoma and has been experiencing gradual a loss of peripheral vision for over four years. She used the computer at least twice weekly to read, write and send e-mails to work colleagues and to her family who live in the United States. But as her vision deteriorated Veronica struggled to use the computer, even with a screen-magnifier.
She felt that learning to use a screen-reader would allow her to access the computer and e-mail more easily. She hoped to be able to ‘surf’ the Internet and to be able participate in online teacher discussion groups. She added that she was delighted to have been recruited onto the project even though she anticipated working hard to maintain the same level as her learning peers.

Ed was born in the UK and lived there for over thirty years where he taught Sociology. In his mid-thirties, he developed Retinitis Pigmentosa (RP) and now, at the age of 57, is completely blind. With the support of the RNIB in the UK, Ed became a regular braille user. However, recently, he has been experiencing a tingling sensation in the tips of his fingers, possibly as a result of recently diagnosed diabetes. He used JAWS proficiently, but using a screen-reader became immensely frustrating for him; he had problems trying to locate the information on what he called ‘an imaginary screen’ (the visual display unit). He eventually became reconciled with the computer interface as soon as he stopped trying to visualise the screen. Ed hoped the project would lead to additional e-business skills and a consequential economic boost for his small dairy business on the island.

Sarah, just 24 years of age, has a series of eye conditions that cause low vision. In her right eye, she developed glaucoma and in her left she has nystagmus (a repetitive, involuntary, oscillatory movement of the eye) and collaboma (the absence of a sector of the iris, appearing as a fissure or keyhole caused by malformation in early foetal development). She experienced continuous difficulty in accessing appropriate technology at both primary and secondary school levels. Sarah reported physical eye pain which she attributed to poor assessment of needs and of matching of technology for most of her school years. She found that even the glare of the computer screen would tire her eyes after working more than ten minutes at a time.

Paul: How is the technology you are using at home affecting the way you learn?

Sarah: With my condition, Nystagmus, I find it very hard to focus, that’s with nystagmus movement of the eyes. Therefore my hand and eye coordination isn’t that good. I’ve a magnifying glass and it’s in a round kind of ball and you run it along the page and I find using that helps me with regards to my eyes but
it creates a further problem because I have to tilt my wrist like that so I get very bad pains in my wrist.

Sarah said she spent a large proportion of her time surfing the Internet for specific information for her studies. She hoped the VLE and the e-business course would increase her ability to navigate the Internet more effectively, to allow her to be more task-focused.

Brian, a doctoral student, developed Retinitis Pigmentosa (an eye disease that affects the macula and then poor central vision) in his early twenties. While he was losing his sight, he had to grapple with quite unsophisticated assistive technology. Yet he remained highly motivated throughout this very traumatic experience. He pursued all the necessary steps to become proficient in using technology to gain new employment. Brian was in the process of completing his PhD at University College Cork when he was recruited to the project. (See Appendix J for edited transcript of interview with Brian).

**Paul:** Can you tell me about the path you took to become proficient in using new technology?

**Brian:** It was a case of ... I was badly short-sighted, and took it for granted that it was that, but I had a condition, a deterioration of the cells in the retina – Retinitis Pigmentosa. I wasn't diagnosed till I was about 20. I was attending a specialist. I had to force (him) to diagnose me – he didn't realise even though I had been seeing him since I was 4 years old. I made the wrong career choice. I was going to be a lab technician and do science at CIT. The instruments I was using I just could not manage, so I jacked it in and got a job in a shipping office for 8 years. Then I was laid off the job, even at that stage my sight was going against me even though I was using a CCTV but the speech software like JAWS wasn't developed at that stage.

**Paul:** How did you get on with this technology?

**Brian:** I was laid off soon after, but I bought some technology with some of the redundancy money I received and made myself familiar with computers...
Everything I read now is done through the computer. I scan using Kurtzweil. That would be the big use for the computer. Internet would be used for databases for study, library, and e-mail; (I) use it to look up stuff for the kids.

Brian chose to follow the e-business course for general interest and to be able to follow a course online. He also wanted to investigate how VLEs and e-learning could be promoted for students with visual impairment attending third level institutions including his current university in Cork.

Born with congenital cataracts and a hearing impairment, Betty was able to see reasonably well during her early years. By the age of fifteen, her blindness was fully established. Betty learned to touch-type at a rehabilitation college and took a telephony course at the NCBI before entering full-time employment. She stopped working to have two children and returned after ten years. While participating in the project, she worked as a telephonist for a civil service department. Betty claimed she missed out on a lot of key learning skills as a result of being placed at the wrong school when she was a child. She said she was misdiagnosed as primarily hearing impaired with low vision and was therefore sent to a school for the deaf.

**Paul:** Do you think your misplacement in a school for the deaf has affected what you can do now?

**Betty:** (With) what I would have learned in that school I still had no skills... to help me with the loss of vision. I had to start again and do a rehabilitation course. I think I had a slow start, but things were difficult at school. But now I think, let's put that in the past and think about how I can get on with computers.

In spite of a 40-year struggle with computer technology, Betty still considered it to be an important part of her life, and even more when she retires in the near future.

Finally, Catherine is in her early sixties and lives in County Louth. She was just retiring from the Civil Service where she had been working as a switchboard for over 30 years. Catherine has been blind since her early childhood and attended a girls' school for the visually impaired in Dublin when she was a child. She has little contact
with technology saying that she uses her computer at home very little. Catherine said she would have plenty of time to develop some basic technical skills during her retirement. She was interested in taking the ECDL course and the accompanying tests at a recognised centre.

The ten participants in the sample group expressed a wide range of personal aspirations captured in Table 18. The levels of skill varied considerably with a small number (Catherine and Betty) wishing to develop basic 'electronic writing skills'. Other participants (Emma, Brian and Ed) had more ambitious goals that involved learning more about the electronic business and being able to apply newly acquired knowledge to specific situations e.g. journalism, third level training. The wide range of interests and abilities could place some challenges on the project team (ACE) to support all the needs of the participants. This aspect will be discussed when reviewing their learning characteristics after following the e-learning programme.
Table 18. Participants technical experience and aspirations before testing the VLE

<table>
<thead>
<tr>
<th>Participant</th>
<th>Level of ICT experience before study</th>
<th>Screen-reader</th>
<th>Aspirations before participating on ACE</th>
</tr>
</thead>
</table>
| Sarah (low-vision)        | Good knowledge of basic ICT skills (word-processing, email) and use of screen-magnifier. | Zoomtext screen-magnifier | • Develop navigational skills on the Internet  
• ACE would develop her electronic skills. |
| Emma (Co-researcher)      | Considerable knowledge of the Internet (able to use search engines, navigate websites using JAWS) Overall – Excellent ICT skills. | JAWS          | • Gain a better understanding of how online companies work.  
• To be able to apply new knowledge to her own work as a journalist/news reporter. |
| David                    | Excellent ICT skills. Able to design websites but does not have some basic skills e.g. Word, Spreadsheets. | JAWS          | • Learn more about web accessibility and how VLEs are constructed. |
| Nicky (co-researcher)     | Some basic knowledge of ECDL course and e-mail but not confident at using the Internet. | JAWS          | • Acquire experience in e-learning.  
• Increase word programming skills for journalism. |
| Tim                      | Acquired some basic computer skills e.g. Word. Able to use the Internet and email with some help. | JAWS          | • Complete ECDL module on Information and Communication. |
| Brian                    | Good knowledge of basic ICT skills and use of JAWS screen-reader. Confident at using ICT for studies. | JAWS          | • Learn more about how VLEs and e-learning can be applied to third level institutions. |
| Betty                    | Some previous knowledge of how to use a PC and a screen-reader. Little experience at using Word or email. | JAWS          | • Develop basic electronic skills (open and save a word document). |
| Veronica (low vision)     | Rudimentary knowledge of how to use a screen-magnifier. Basic ICT skills, can touch-type write word documents. | Dolphin Supernova | • To be able to use a screen-magnifier to read and write e-mails.  
• To be able to navigate the Internet and participate in online teacher discussion forums. |
| Ed                       | Good knowledge of how to use the Internet. Confident at using e-mail and the Internet. | JAWS          | • Acquire additional e-business skills to promote his island business. |
| Catherine                | Some previous knowledge of basic ICT skills but not a confident user. | JAWS          | • Increase electronic writing skills.  
• To be able to independently use e-mail and the Internet. |
A member of the ACE team informed all the candidates that the two E-learning courses (ECDL and e-business) could not be accredited until they had been fully tested and passed by the ECDL Foundation and accepted by a Dublin-based business college. All ten participants were sent summaries of the two different courses and were requested by the ACE team to choose to follow either one or two modules on the ECDL course or the e-business course (see Table 19 for a list of courses each participant chose to follow). They were also asked if they could commit six months of their time to test ACE and keep a diary. Finally, candidates were advised that they could choose when to log-on to do part of a module as long as they tried to execute a little bit at least three times a week.

<table>
<thead>
<tr>
<th>Participant</th>
<th>Chosen Course: ECDL (module) or e-business</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sarah</td>
<td>e-business</td>
</tr>
<tr>
<td>Emma</td>
<td>e-business</td>
</tr>
<tr>
<td>Ed</td>
<td>e-business</td>
</tr>
<tr>
<td>Brian</td>
<td>e-business</td>
</tr>
<tr>
<td>Nicky</td>
<td>ECDL (Word-processing and Information and Communication)</td>
</tr>
<tr>
<td>Tim</td>
<td>ECDL (Information and Communication)</td>
</tr>
<tr>
<td>Betty</td>
<td>ECDL (Word-processing)</td>
</tr>
<tr>
<td>Veronica</td>
<td>ECDL (Word-processing)</td>
</tr>
<tr>
<td>Catherine</td>
<td>ECDL (Word-processing and Information and Communication)</td>
</tr>
<tr>
<td>David</td>
<td>Review two ECDL modules and learn more about the construction and running of ACE.</td>
</tr>
</tbody>
</table>

The next two sections discuss some of the data resulting from two discussion groups organised for all the participants.

At the initial interview, the participants were asked to share their previous learning experiences and to reflect on how they thought they best learned. This question would be posed again at the end of the study to determine whether learning online
made any difference to the way they organised their learning. Table 20 provides a summary of some of the initial reactions to the question. The answers ranged from memories of earlier school experiences (when they were expected to learn for assessments and exams) to more collaborative ways of learning (where they could discuss problems in small group discussions). Three in the group (Brian, Ed and Veronica) rejected more traditional ways of learning, preferring to discuss with friends what they had learned. These views will be discussed and compared with results from a second set of interview data presented later in this chapter.
Table 20. How do you think you best learn?. Base: N=10

<table>
<thead>
<tr>
<th>Participant</th>
<th>Learning approach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sarah</td>
<td>'I was often left on my own to learn because it took me longer to finish tasks. I like to take lots of breaks after reading texts and then write what I can remember'.</td>
</tr>
<tr>
<td>(3rd year law student)</td>
<td></td>
</tr>
<tr>
<td>Emma</td>
<td>'I need to have an exam or assessment to write otherwise I won't learn. I tend to cram information but don't really have a system of trying to memorise it.</td>
</tr>
<tr>
<td>(University Graduate)</td>
<td></td>
</tr>
<tr>
<td>David</td>
<td>'I find it quite easy to learn stuff I'm interested in, like computer code or script... It is more difficult to recall lists of dates but I use my mobile phone to remind me of things'.</td>
</tr>
<tr>
<td>(3rd year computer science student)</td>
<td></td>
</tr>
<tr>
<td>Nicky</td>
<td>'I struggled to learn things at school... Teachers made us learn heaps of information, which I tried to remember. I found it easier to recall stuff I had written in braille, funnily enough.'</td>
</tr>
<tr>
<td>(Switchboard telephonist)</td>
<td></td>
</tr>
<tr>
<td>Tim</td>
<td>'I don't know... I just try to remember things by repeating them... I wasn't very good at remembering long passages.'</td>
</tr>
<tr>
<td>(Braille press operator)</td>
<td></td>
</tr>
<tr>
<td>Brian</td>
<td>'I find reading for very long periods of time not very productive... Writing down ideas is very important in consolidating information and in highlighting places of weakness in my reading. I find discussion is also crucial... Ideas must be discussed and bounced off other minds.'</td>
</tr>
<tr>
<td>(PhD student)</td>
<td></td>
</tr>
<tr>
<td>Betty</td>
<td>'I find I need plenty of one-to-one tutoring to help me learn things. When I lost my sight it took me much longer to learn at school. I would try to find ways to make the lesson easier... but if it was in braille too I could memorise it more easily.'</td>
</tr>
<tr>
<td>(Switchboard operator and receptionist)</td>
<td></td>
</tr>
<tr>
<td>Veronica</td>
<td>'When I could see better, I could absorb quite substantial amounts, but it was sequential in my memory. I find it easiest when I talk things over with a colleague or a friend.'</td>
</tr>
<tr>
<td>(Secondary school teacher)</td>
<td></td>
</tr>
<tr>
<td>Ed</td>
<td>'I have always learnt better verbally than any other way... frequently in, like, discussions or whatever... I tend to lose patience when I have to trawl through loads of irrelevant stuff, especially on the computer as I'm unable to read much braille these days because of problems with touch in my fingers'.</td>
</tr>
<tr>
<td>(Goat farmer)</td>
<td></td>
</tr>
<tr>
<td>Catherine</td>
<td>'I find it hard to remember things if I'm in a hurry... I need time to just get things straight in my mind. Age is not helping me either.'</td>
</tr>
<tr>
<td>(Retired civil servant)</td>
<td></td>
</tr>
</tbody>
</table>
6.2 Round-table discussions

Each of the two roundtable discussions took approximately forty minutes and were held at the same location for comfort and convenience to public transport. There were a number of advantages of holding the discussions at the NCBI headquarters. On one level participants could feel secure and know that the charity was supporting the research. Most of the participants had visited the headquarters before and knew where it was located and could travel to it independently. The main concern in using the charity's premises was the association that some participants might make between the research and the charity (NCBI). There was a danger that participants and their families could connect the two and this could question the independence of the research. There could also have been an issue of accountability where the co-researchers may have felt answerable to the charity in some way. Fortunately, this was not the case for this research but is a critical point worth considering when aiming for researcher independence.

The first discussion group took place six weeks after the launch of the funded project and the second one during the second testing period of the VLB. Permission was sought from all the participants to record the sessions, which were transcribed for later analysis. Three key areas formed the basis for discussions: the design and accessibility of the VLE; the usefulness of the online tools; and the appropriate match of the learning materials for visually impaired learners. These themes were determined based on the short time participants spent piloting the VLE and the e-learning courses.

The nine who attended the first discussion group (seven participants and two co-researchers) were joined by two nominated advisers from the peer reference group to oversee the discussions. One participant could not attend as a result of prior commitments. After informal introductions the discussion focused on how the group was coping with the new VLE community and engaging with the e-learning courses after having tested them for over one month. They were also asked to what extent the VLE was meeting their learning needs.
6.3 Identification of main themes from the first round-table discussion

We (co-researchers) were particularly interested in data that provided evidence on whether being visually impaired had any significance to accessing the technology or learning outcomes. It was crucial that the three researchers could use their personal experiences of the impairment and their knowledge of technology to identify categories and sub-categories that could be later classified into themes. We finally agreed on three main themes:

- Accessing and navigating the virtual learning environment;
- Use of online tools;
- Complexities of accessing e-learning courses for visually impaired learners.

6.3.1 Accessing and navigating the virtual learning environment

One of the main purposes of the funded project (ACE) was to design a VLE that met the technical needs of visually impaired adults using the principles of inclusive web design (i.e. WAI guidelines). It was therefore essential that all the participants could openly discuss their relative ease or difficulty in accessing and navigating the newly designed VLE. If none of them could access the VLE in spite of the inclusive web design, then this could have serious consequences for the visually impaired community who would be excluded from other learning environments. It could also have implications for third level institutions when implementing inclusive e-learning strategies. The ACE team were particularly interested in hearing about the opinions of the participants at the early stages of the pilot. Identified technical problems could be dealt with once the first testing phase was completed.

The group regarded the level of accessibility of the VLE positively, experiencing it as a comfortable and safe environment. They generally agreed that the new VLE was easy to navigate with a screen-reader. Eight participants reported no difficulty finding the website (typing in the uniform resource locator definition (URL) or entering their
usernames and passwords, although two had experienced some problems finding the dialog box in which to enter their username and password. Tim eventually explained how he managed to log on:

I found it a bit annoying to be stumbling on the starter's block but I phoned Nicky who could help me find the right keystroke to switch the 'forms on' mode. This is the sort of thing I should already know, but I forget if I don't use it all the time.

Betty reported having similar problems with logging on but did not feel as brave as Tim to call for someone's help:

I wished I had phoned you Nicky... it would have been so much easier to do that than waste time trying to get the cursor to stay in the box.

This short extract highlights a recurring issue around the lack of training opportunities for visually impaired people who do not know how to use a screen-reader effectively.

Brian raised the aspect of navigation noting, 'how easy it was to transition from one section to another.' Nicky concurred, claiming the site to be 'miles apart' from more well-known sites. He said, 'It was a pleasure to enter and have a quick sense of where everything is'. It took Catherine longer to discover different sections of the website, but she found the tutorial CD helpful to listen to while navigating the site. Emma agreed that the VLE had 'many great features' that could be further exploited by the participants. She also hinted at ways of increasing the course's audience to 'people in the mainstream,' which in effect challenged the notion of a curriculum solely for the visually impaired.

Emma: It is great to have somewhere I can go everyday and do a course that is useful to me and to have a look at what other people have done and what other people are saying is a big step forward to just using e-mail. It would be nice to think that people in mainstream would be able to do the course too. Do we really need to have a separate VLE for visually impaired people?
In contrast, Veronica and Sarah, two participants with low vision, had quite different perspectives of the VLE. Sarah worried that the technology 'would further isolate people'. She contended that too much attention was directed at providing alternatives for the visually impaired rather than including the visually impaired into mainstream activities. Veronica agreed, considering the mode of learning to be too 'virtual' and not allowing for more face-to-face interaction. Yet Veronica confirmed that she was working on basic literacy skills and had not spent much time on exploring the VLE. She was one of the two participants receiving visits from a volunteer on a weekly basis.

Veronica: I wish the Minister of Education was listening to what we are saying. The online course isn't adequate. It needs person-to-person. That's why the home-tutoring is spot on.

Already an experienced user of the Internet, Brian enjoyed using the VLE, finding it 'comfortable and very, very accessible'. He added that he normally did not use discussion forums or chat rooms but that he had been enjoying the discussions taking place on this VLE. He felt 'comfortable with it,' adding that it was 'nice to try these things in a safe and comfortable environment and be more confident when you are on the net in other areas'.

The data indicate that all the participants have different levels of experience of using technology as well as specific learning needs. These needs were more based on an inability to use the screen-reading software to perform tasks rather than technical problems around accessing the VLE. There was also some indication that low vision participants were already feeling isolated from mainstream activities as a result of participating on a VLE which was targeted at blind users. This did not seem to be an issue for the blind participants who were enjoying the comfort of a very accessible VLE.
6.3.2 Use of online tools

The co-researchers asked the participants to discuss the online learning tools and to give their first reactions to them. More specifically, they were asked whether the tools effectively helped them to reflect on their online learning experiences. After a hush of silence, Catherine described many technical problems that made for a difficult experience. Her home computer had been crashing and she awaited its replacement. This set back not only affected her participation in the project but also that of her e-twin Betty, who expected Catherine to help her through the ECDL modules.

Catherine: I haven't really got started. I have had computer problems from day one...then I'm twinned with Betty and we have met once as you know. I succeeded in logging in and then getting into Word and doing a few things with that, but after that I haven't been able to log on again. So, I'm in difficulty and I'm really no use to Betty at all, so I need help myself.

Other participants seemed reluctant to share their thoughts until Brian described a less than enjoyable experience while writing the learning diary at the end of each unit. They nodded heads in agreement as Brian detailed his frustration:

I don't mind filling one in when I have something important to say, but it gets a bit tedious filling it out all the time.

Tom suggested that Brian complete the diary after each module when there might be more to say about the content and structure of the course.

Paradoxically, the group showed enthusiasm for the online discussion forum. Only two (Nicky and Sarah) experienced problems finding the correct room at the approximate time. They chatted together in one discussion room until they realised that all the other participants were in another room. This small problem could potentially be addressed technically if there was a way of helping visually impaired participants know which room a discussion was being held in. Any visual indicators could be transformed into auditory cues, such as a built-in ping sound or haptic feedback to help visually impaired users locate the correct discussion room.
Nicky: I posted a comment to the discussion board and heard back from Sarah but then we didn't hear from anyone else.

Sarah: I thought there was something a bit strange when I just kept hearing from Nicky and no one else (laughs).

Nicky: Could we have some sort of signal that tells us what room we need to go to? It can be quite lonely out there.

When asked about how they used the discussion board, members of the group provided varying perspectives. Both Emma and David, who were experienced visitors to chat rooms, were quite comfortable piloting the VLE. They were still disappointed by the lack of a synchronous tool for instantaneous chatting. Three of the participants seemed to be unsure about the purpose of the discussion board. For example, Tim said that he had enough to cope with without having to 'go into a chat room and talk about the weather'. After a small chuckle within the group, Sarah added, 'I feel the same... it's so artificial'. Yet Brian was enthusiastic about the discussion room:

I think it is a great space to bounce off ideas on almost any aspect of learning, even the weather. With the learning diary, you are only talking to one person, but the discussion forum gives you the chance to speak to a bigger audience. It's a shame we don't have an instant messaging tool, it is much more interactive and faster.

Evidence from these extracts show that visually impaired people did not seem to experience any specific problems with the online tools. The main criticism of the tools was directed at the 'learning diary' and the general lack of motivation to fill it on a regular basis. This tool was supposed to provide useful information about how the participants were learning. Poor usage could render this tool ineffective if participants did not consider it necessary to fill it out to help them acquire new e-learning concepts. In spite of this negative feedback, overall, the participants consider using the discussion board as an integral part of their learning online and that there should be more emphasis on developing these tools.
6.3.3 Complexities of accessing e-learning courses for visually impaired learners.

The participants were asked to comment on their use of e-learning materials and on their progress over the first six weeks of courses. To facilitate more focused discussions about the two different courses (ECDL and e-business), the group was divided accordingly. One co-researcher attended each group.

The six in the ECDL provided mixed reactions to the course, particularly when discussing the way the learning materials were planned and presented. All six complained that all the course units were too lengthy and extremely difficult to digest. Two said that regardless of the length of the units, the content was useful and of high quality. The use of a particular version of JAWS caused technical problems for three participants. The ECDL recommended keystrokes occasionally caused the Internet browser to close or move the user completely away from their task. Betty commented that it was important to have an excellent knowledge of how to use JAWS before moving onto more complex tasks. She also raised an interesting point about the course being available only online.

I can't understand why the ECDL is not available as a CD so I don't have to go onto the Internet and do it. I'm also worried about how much being online is costing me. I can do some at work during my lunch break, but it takes me a long time to find the right place on the course. I usually have to go through lots of links before I get to where I want, then I only have say twenty minutes to finish a unit.

Veronica expressed frustration with the course's specificity for JAWS, particularly when she did not use this screen-reader.

The ECDL online course has been quite a waste of time for me. All the guidance notes on keystrokes are for JAWS which is absolutely no good to me. I just have to try and work out a way with the volunteer and myself.
The other group comprised three participants who followed the business course. They focused on issues around course structure and presentation of learning materials. Each member experienced difficulties processing the technical content of the course and agreed that this was due to what was perceived to be a lack of direction on the course. Emma added that the course presentation lacked dynamism.

I would have liked more activities, like a multiple choice test after each section or a few questions that asked me to try something else. I find it really difficult to just read and read without doing anything.

Brian and Sarah felt overwhelmed by the volume of reading. Sarah related that she needed many breaks as her eyes tired quickly. While they both found the actual learning units to be interesting and helpful they concluded that the units did not constitute an e-learning course for them. They both expected the course to be more interactive comprising extra multi-media options such as case studies, short tests and revision exercises. Sarah was particularly concerned with the volume of learning materials and how she could cope with it. She was experiencing information overload to such an extent that she would mark a section as complete without having completely understood it.

Brian: There seems to be so much information out there... where do I start? I can't seem to get to grips with the materials. It would be more helpful to have built-in tasks or short tests that could help me to learn how to do something straight-forward.

Sarah: In terms of learning and remembering what I have learnt here, I just felt that the sections were far too long. There was so much in there. I was very interested in what I was reading, but I felt an overload was happening. I feel that I would learn better if it was in smaller chunks. For example, if there was a complete option after each sub-section. Because as it stands, I have had to mark it complete but I know I will have to return to it a few more times until I am satisfied that I have learnt and actually feel that I am learning.

In spite of these criticisms, all participants expressed a strong desire to continue using the online tools on the VLE and to try and explore ways of working together to
increase their knowledge of e-business. One of them, Emma, suggested that the four participants propose ways of making the course more interactive and share these proposals with the ACE team.

Finally, the whole group reconvened to discuss the next steps of the study and to record any technical problems that required immediate help from the VLE project team. These are summarised below in the next section.

Finally, there was some evidence of positive outcomes resulting from the inclusiveness of the VLE in terms of technical design but there was little evidence to say that the chosen e-learning materials were meeting the needs of the participants. These themes will be scrutinised further after reporting the second round-table discussion data.

6.3.4 Presentation of key issues identified during first testing period

All feedback was essential for an effective redevelopment of the VLE and course materials. Data from the round-table discussions show that the participants both individually and collectively expressed overall satisfaction with the technical layout of the VLE and the relative ease in navigating and transitioning from one section to another. The participants were invited to e-mail the co-researchers with any additional issues that were not discussed during the round-table discussion. All issues were recorded and listed under the three themes discussed above. They were then shared with the ACE project team during an informal group discussion. It was difficult to estimate how much time the team would require to make the recommended changes. They had allotted one month to make changes to the VLE in preparation for the second testing period (August – October 2004).

The participants identified a number of issues which were shared with the ACE team and their website developer.
Technical problems

1. A small number of participants experienced problems logging onto the VLE. This was mainly due to insufficient distribution of information concerning essential shortcut keystrokes;

2. The VLE had a strong bias towards blind users and little relevance to low vision participants (e.g. no use of multimedia, no options to change background colour and no guidance on how to use a screen-magnifier with the ECDL course).

Use of online tools

1. Participants experienced problems finding the correct chat room where discussions were taking place. One suggestion was made to introduce easy-to-understand cues to help participants find the chat room;

2. The need for an asynchronous messaging tool was identified to allow for quick exchanges within the discussion forum;

3. The small number of participants who made little use of the online diary felt unsure on how best to utilise the tool to maximise their learning.

Accessing e-learning courses for visually impaired learners

1. Both the ECDL and e-business courses required revisions to increase the level of participation with the learning objects. Suggestions included introducing short multiple choice question assessments, short written tests and revision exercises for the e-business course, as well as a couple of case studies to help illustrate key concepts;

2. More intervention was needed from the project team to help guide learners through the learning objects.

The project team agreed to consider these issues and to identify some solutions. These are discussed in section 6.5.
6.4 Summary of key issues

The group discussions revealed three themes. The first concerned accessibility issues, particularly in relation to using a screen-reader with a VLE. Participants who were able to use a screen-reader efficiently tended to have less technical issues when accessing and navigating the VLE and the e-learning materials. This meant that they were able to spend more time on actually 'carrying out' learning activities rather than using the screen-reader to 'access' them. Those who were not completely at ease using the screen-reader (such as the essential keystrokes on different interfaces) spent more time trying to navigate the website to locate the learning materials, therefore spending less time on engaging with the learning materials.

Two participants noticed that their screen-readers forced them to navigate the webpages in a serial way that was not always helpful. On occasions, participants said that they had accidentally left out exercises or key links because the screen-reader forced them to take a particular route around the webpage. Even though the learning units contain visual cues (e.g. headings, sub-headings, bullet points, line separations), screen-readers did not necessarily pick up on these cues.

A second theme related to the quality and flexibility of online collaboration tools and learning. While a majority of participants successfully used the discussion board and online learning diary, some experienced confusion and anxiety. They might have benefited from online instructions of tutors' guidance. Furthermore, the lack of a synchronous message interface within the discussion board led to a low level of interactivity between the participants and the tutors. Even those participants confident with technology wished to have more control over how they used the tools. Two participants sought greater flexibility in using the tools.

A final theme relates to how e-learning courses could be appropriately designed to match the learning needs of visually impaired learners. Even when all the participants were able to access the learning objects, they did not always understand what was being asked of them. They complained that none of them had been fully briefed about the courses in the same way that they had been briefed about the VLE. They also
raised concerns about the learning materials and the problems encountered with the learning. The problem with screen-readers (noted above) led to time wasted ‘tabbing’ up and down the webpage; many experienced this as an information ‘overload’ as they tried to make sense of what they were reading.

Tim: It was so difficult trying to work out how long each unit was and how many learning points I needed to learn. It was like reading a book without any paragraphs or breaks.

In summary, the technical design of the VLE allowed for a high level of inclusiveness— and this is evidence of a positive outcome. Unfortunately, the e-learning materials did not fully meet the needs of most of the participants. These themes will be considered at a later stage once the second round-table discussion data have been presented.

### 6.5 Redevelopment of VLE based on participants’ initial experiences

The redevelopment of the VLE and the e-learning materials was an essential part of the project and the research. This took place over a three-month period (May to July 2004). The ACE website developer agreed to carry out a number of small changes to the VLE based on the feedback from the participants. One change consisted of redesigning the participants’ homepages so that participants could access all new information about the project and updates on discussions each time they logged on. Participants would also be able to access their personal learning record on the same page. The VLE also underwent considerable ‘back-end’ changes, therefore making it easier for the non-technical participants to upload course materials and manage the discussion forums.

The project team were reluctant to add any additional functions such as a synchronous discussion chat room to the VLE in case it would collapse. The website designer voiced his concern about adding new functionalities to an existing framework.
We have tried to keep things quite simple and added sections as we went along. But if you completely rewrite [the website] you are better off just going back to the beginning.

The participants' feedback on the ECDL modules meant that they had to be completely rewritten by a qualified ICT trainer who had experience of teaching the course to visually impaired learners. This consisted of reviewing the content layout, i.e. breaking it into smaller sections with more examples and short tests to help the student grasp the key concepts and the necessary keystrokes. The reviewer could not change the course content, which was regulated by the ECDL Foundation.

The e-business course also underwent similar changes to the layout and the addition of some short written tasks at the end of each of the modules. No multimedia were introduced mainly because of lack of funding. The only additional learning feature was the uploading of three sound files onto a separate webpage on the VLE; these featured short interviews with different members of the visually impaired community in Ireland.

All the changes were completed within a month and the new VLE was uploaded onto the server for participants to access for a second and final time.

Section Two

Second testing of ACE

This section is dedicated to the second testing of ACE that took place between August and October 2004. Data collected includes a second round-table discussion and individual interviews with the participants.
6.6 Results from second round-table discussion

The second round-table discussion took place approximately four months after the first meeting at the NCBI headquarters. The reason for choosing a second round-table discussion was to encourage candid feedback from their experiences. The first round-table discussion proved to be very helpful in establishing the participants' technical weaknesses and identifying areas where the VLE and e-learning materials were not meeting their needs. A total of 8 participants (6 participants and 2 co-researchers) attended this session. One, who was unable to travel to Dublin, participated online using the free voice-conferencing tool Skype. Unlike the first round-table discussion, all the participants remained in one group for the entire session. This ensured that everyone heard all perspectives. Our main tasks entailed gathering data about participants' learning and to review their experiences over part five-week testing period. They addressed the e-learning materials and the online tools.

Unlike the first round-table, the second revealed a general sense of frustration and disappointment with the e-learning materials, despite some of the structural changes that were made to both of the courses. Some of the participants, who requested more help from the course tutors, did not receive the direct instruction they sought. There still was little evidence of a 'teaching presence' to help reinforce learning and to encourage a real sense of community. Unfortunately, the funded project had not built in this mechanism.

This crucial omission placed particular strain on all the participants who sorely needed directed learning. Particularly affected were the less technically adept participants who had precise questions about the content and the assessments. While many found the content useful and up-to-date, they again felt the presentation required further amendment for visually impaired people. The newly structured e-learning materials were still causing problems for participants who were unable to memorise the units, particularly on the e-learning course. Brian concluded that the e-learning materials did not 'giv(e) justice to the VLE.' Although delighted with the addition of an 'audio page', David described the course as generally far too textual and not sufficiently interactive to maintain a high level of interest. One participant/co-
researcher felt that the course’s poor design disadvantaged the visually impaired student when competing with sighted peers on an equal learning platform.

**Emma:** We were alone doing this course… but let’s say if we were with sighted people – they would be racing ahead of us. They would have the unit done before we found it.

**David:** I guess we need a head start when it comes to using the added technology and the Internet. It does get easier the more you use it but I’m still not going to be able to get through a course as quick as a sighted person. We need shortcut navigation keys to help us move around the site. It just takes a bit of thinking out… nothing really high tech in that.

**Sarah:** Yes, some of the course was too heavy-going at times. I just wanted to hear someone human talking to me rather than hearing the robotic voice (screen-reader) jabbering away at me.

Those participants who took the business course still felt isolated from the rest of the community and unsure about how well they were performing. Sarah claimed that she would have benefited from an experienced, permanent, online tutor in e-commerce to push her along the course.

It was good to have talks and discussions with the other people doing the course but it would be good to have someone who has actually set up a business to talk to us. I guess I was missing the human touch… sort of meeting people like we’re doing now. But then this is a pilot, isn’t it? May be there was no money to have tutors and lots of meetings.

Next, the discussion moved to the use of the online tools, such as the diary entries. The six participants who chose to follow the ECDL modules agreed that they were much more meticulous filling them out at the start of the course. However, after six weeks, the quantity of entries fell significantly. Upon final review, the diaries did indeed reflect the participants’ verbal testimonies; they revealed much description about the course but not much reflective practice.
Tim: I didn’t think I would get used to filling my diary out, but felt more obliged to do it when I knew that my friend was going to read it. I ended up writing the diary for Nicky, which seems a bit odd.

Nicky: Yes, it was good to hear your tales of woe (laughs), sorry (about) your thoughts on your learning... Though, I was pretty bad at getting back to you. What were they really for, anyway?

Veronica interjected that she was benefiting from the regular support of a volunteer tutor and that she was making her own hand-written notes about the course. She added that she used her hand-written learning diary as an aide memoir, entering notes about her learning experiences with the help of her volunteer. She joyfully announced that with help she had booked her first flight online. The experience seemed to liberate her and to boost her confidence.

This course was my inducement to getting to know something about getting onto the Internet. So, now I can access the website and the ECDL course. But without directions from the volunteer, I probably wouldn’t have been able to get to the right place on the website. I also feel more confident in using e-mail too. Sending, receiving, writing an e-mail that is something I can do. I can use the shortcuts – Control and N, Control and R.

Betty provided some insight into the barriers she had to overcome in order to access the learning materials.

I’m barely able to use the e-mail, but feel I have made some progress. I can’t say I was the best of students, as I have problems with my hearing and can’t always understand what JAWS is saying to me - and then there are problems with finding time to go onto the computer. I have two teenage children who like are always on the computer talking to their friends. It is difficult for me to get to it and it’s often when I’m too tired to do anything.

Betty and Veronica claimed that their retention of information and skills improved when they discussed them with another person. Yet Betty, who found the course material particularly challenging, said she relied more on face-to-face discussions.
Again, she felt her skill level was not sufficient enough to draw on the electronic support of peers. She felt she had 'a long way to go' before fully collaborating online. Interestingly, these two participants were able to benefit from an e-learning course that was in fact turned into predominantly face-to-face learning. This was the method they seemed to prefer, but whether it could be classified as e-learning, is open to debate. In a pure sense, it does not constitute e-learning because of the weak blend of electronic activities and face-to-face discussion. Having a visual impairment may have increased the problem of accessing the learning materials but the evidence seems to indicate that poor conceptualisation and design of the learning materials were impeding the participants’ ability to learn.

**Betty:** I honestly think I needed a sort of one-to-one person who was there, who would come in one day a week to be with me and help me when I'm having difficulty; make notes and try to remember the way to getting into the thing; do a little course on learning to use an e-learning programme - for a very beginner like I am. It would be different for someone who is used to a computer, going onto websites and things like that.

**Paul:** What advice would you give to a friend who wanted to try this e-community?

**Betty:** I think they would need experience of the keyboard and shortcuts, like link and alt. Somebody getting used to JAWS and the Internet would be a lot to get used to. A person would need 6 months to a year’s experience using computers before they go onto this website.

The participants were asked to reflect on their experiences as e-learners and technology users and how these experiences impacted on their self-perception as members of the ‘information age.’ This term is often used by governments to refer to ‘the creation, distribution, diffusion, use, integration, and manipulation of information as part of a significant economic, political, and cultural activity’ (Selwyn, et al. 2006, p.23). Nearly all of the participants said they felt a part of the so called ‘information age’ and more positive about their own image and self-perception when they used technology successfully. Sarah and Emma, the youngest respondents, felt especially part of the ‘digital era’ when they were engaged with their peers in discussions on the
VLE forum. They also enjoyed using their mobile phones to text friends and family. Brian added that he was a keen ‘texter’ and was excited about new developments in technology, such as the MP3 players, Bluetooth, and GPS. The European Commission promotes the use of these new technologies (including mobile phones) that are easy to use and that are affordable and widespread, particularly among groups at ‘risk of exclusion’ (2006). The challenge for the EC and the Irish Government is to transfer innovative projects that previously focused on one target – often ‘abled’ group or sector – to a wider number of target groups, including the visually impaired community.

Two participants, David and Emma, agreed that they enjoyed reading downloadable books and listening to music on their MP3 players. They said that they liked to discover the latest in technological changes and to hear how these affected the quality of information delivery for the visually impaired. What is exciting about this trend is the shift away from assistive technology to facilitating the design within devices that everyone can use. This creates greater inclusiveness in society and enables the visually impaired to participate in EU-promoted learning activities that increase equality access as well as promote computer literacy for all. Nicky considered himself as part of the ‘information age’ only ‘to a degree’. He said that he was not interested in the technical aspects of the technology, ‘but the fact that [he] can use it is great’.

I can’t believe how much I have struggled in the past just to use a computer or a scanner. Now there are many more openings to using technology in different ways. Even the thought of doing an e-learning course a year ago was unreal. It’s just a matter of putting your mind to it... as long as the technology doesn’t break down.

Sarah was more cautious when referring to herself as a member of the ‘information age’. She said that she wouldn’t ‘dive into technology unless (she) felt in full control of what might happen’.

I don’t sit at a computer. It isn’t fun to me to listen to a voice all day... but I do enjoy the thrill I get from some of the Internet sites.
Brian said he now viewed the 'digital age' as a 'vital lifeline'. He said he liked to be up-to-date on technology, which he referred to as a 'tool to do other things'. He particularly valued how he could study for his doctorate or look up information in one place, such as travel timetables. He perceived himself as a true member of the 'information age' because he could now plan, book, or make payments for flights without any help.

The term 'information age' has been interpreted differently by some of the participants, all of whom have their own personal goals. There is a general awareness that technology is able to now assist them to carry out tasks that were previously considered to be impossible or very complicated. This overall sense of empowerment is strongly felt among the younger participants who are already integrating mobile technologies into their daily lives. There seems to more caution among the older participants who are not ready to embrace the new generation of technologies that are accessible to visually impaired people.

Both Emma and Nicky claimed that the VLE helped them to learn about their own skills and that the Internet motivated them to do more interesting things at home. Emma said she was surprised at how much she actually knew about using technology. She then spoke about an online news magazine for young visually impaired people that she ran with Nicky. She started it the previous year with very little knowledge about making a recording, editing it and uploading it onto the Internet.

I made so many mistakes at the beginning... I couldn’t use the equipment very well and kept recording over a previous recording. I used to get so annoyed with myself at times that I would cry. I got some help from another blind friend who was able to help save the recordings on my computer. As soon I knew how to do this, I felt so relieved. I suppose it is like most things in life, we have to take chances and mistakes. The great thing about the Internet is once you know how to get round, the world is open to so many other opportunities.
6.7 Summary

The second round-table discussion generated much discussion around the quality and quantity of e-learning materials and the ineffective levels of interaction between the students and the course tutors, who were rarely online. Participants shared a strong expectation that there should be a greater sense of community. Principally, they sought three types of interaction: 1) teacher-student interaction; 2) student-student interaction with the use of synchronous and asynchronous discussions; and 3) student-content interaction (by accessing online resources).

Much has been written about the appropriate interactions between students and instructors (Dewey, 1933; Laurillard, 2001). The participants reported a small level of student-student interaction through the medium of the learning diary, where they could share some of their learning experiences with their peers, but these were sporadic and unsubstantial in volume. E-learning has been designed and has the capacity to digitalise and deliver different modes of interaction (e.g. material content) over the Internet; therefore, future web technology should focus on the capacity of the Internet to support different permutations of interaction (student-student, teacher-student and student-content). Such permutations would create the types of community of practice espoused by social constructivists (Garrison and Anderson, 2003; Holmes and Gardner, 2006) and the construction of knowledge through situated learning (Lave and Wegner, 199; Lave, 1993).

An interesting finding emerging from these data is the extent to which visually impaired learners wish to be able to access similar learning modalities as sighted or 'more abled' learners. What was once perhaps considered to be a predominantly accessibility issue is now more an issue on developing interactive solutions through the medium of e-learning. This discussion is taken forward in the next chapter where I talk about pre-requisites for learning and how these could be achieved using Maslow's hypothesised framework (1954) in illuminating how visually impaired individuals need to move from meeting their physical needs to securing the highest possible level of control over their own learning.
All the participants expressed enthusiasm about their ability to share learning experiences with peers both on- and off-line. Yet they were unable to conduct extra activities that could facilitate further collaborative learning among the community members. They also seemed to be aware of the liberating potential of e-learning and how it could provide them with greater learning opportunities in the future.

Overall, the evidence revealed positive outcomes of the VLE; firstly, the participants' ability to log on and experience a virtual environment. A further positive outcome referred to the participants' ability to talk about new technologies and see themselves as members of the digital age. Many were already using mobile technologies (e.g. mobile phones, MP3s) but they had not realised the potential these technologies could have in helping them to access different media-blends such as audio-cast activity-blends (e.g. offline – face-to-face discussions).

The main deficit of the VLE related to the actual 'learning' aspects of the website. These are picked up in the next section which also presents some of the main themes that emerged from the final set of interviews.

6.8 Final interviews with participants and resulting themes

The new data from the second set of interviews (recorded during the last six weeks of the project (September – October 2004) generated linked categories and new sub-categories; these provided more information about how the iterated VLE and e-learning courses impacted on the participants' learning. The interview questions generated a range of diverse opinions and perspectives which, when analysed, produced a number of inter-connected themes. These themes ranged from more technical aspects in developing and promoting inclusive learning environments for visually impaired adults to ways of better serving the visually impaired person in the future.

All final seven participants (excluding the co-researchers, who were interviewed separately) were interviewed at the end of the pilot study as part of a final evaluation of the VLE. The interviews elicited more information about the participants' personal experiences and their final reflections on the testing process. We continued to use the
recursive process of axial codes, combining our inductive and deductive thinking in order to identify a basic frame of generic relationships.

The following five themes are discussed in the next sections:

- Levels of participants' technical knowledge and access to the VLE;
- Impact of e-learning courses on participants' learning characteristics;
- Application of learning strategies to support e-learning;
- Information-age skills for the visually impaired;
- Inclusive design of e-learning courses as building participants' confidence and independence;

Each theme will be discussed in turn supported by extracts from interview data collected from the second and final set of interviews. Some comparisons will be made with identified categories from the round-table discussions and the first set of interviews.

6.8.1 Levels of participants' technical knowledge and access to the VLE

All the participants were asked to comment on whether the technical opportunities offered by the ACE project helped or impeded their access to the iterated purpose-built VLE. Those who already had a good working knowledge of how to use a screen-reader or magnifier participated in more learning and communication activities on the VLE than those who only had a more rudimentary knowledge. The two male participants who developed blindness in their mid-thirties were able to use a screen-reader as effectively as the two participants who had developed blindness at a very young age. Neither of the two participants who developed blindness in their adult lives (Ed and Brian) had received any training on how to use a screen-reader. They said that they had taught themselves how to use JAWS at home through the audio tutorial. David, who developed blindness at a very early age, was able to master the screen-reader in a short time as a result of having access to computers at his boarding school nearly all the time.
David: I was able to spend hours and hours on the computer at school... there wasn’t much else to do as a boarder. I quickly got to grips with using JAWS after listening to the tutorial.

However, the new technical opportunities offered by the project proved overwhelming for three of the participants, including the one who eventually dropped out. These participants found it difficult to make the technical and, to some extent, cognitive leaps from basic word processing to use of online tools, from using the basic keystrokes on Word to more complex tasks within e-learning activities.

Betty and Veronica said that they had to overcome a number of psychological barriers before they could feel confident enough to explore the VLE. They were able to enjoy help from volunteer tutors who increased their levels of confidence and technical knowledge. Betty joined the project as a novice at using a screen-reader but had managed to make considerable progress during the project lifetime. Due to her low vision, Veronica needed to develop a unique learning schedule; this need could not be met within the domain of the e-learning project. Sarah, who also had low vision, did not encounter the same problems as Veronica mainly because she was following a different course and was using a different screen-magnifier. Furthermore, Sarah was able to use her residual vision more extensively than Veronica could.

Five of the participants (four male and one female) said that the project offered them a good opportunity to use their technical knowledge and apply it to a completely new experiences. A selection of their comments is as cited below:

Ed: I wasn’t sure whether I was going to be able to succeed in logging onto the website, given my computer is old and I have a dated version of JAWS. There was even a risk of not getting Internet broadband. But strangely enough, all three happened and I could join in.

Sarah: I was quite pessimistic about the whole idea at first as I wasn’t really enjoying computers much. I still don’t like them much but at least I got the chance to try out something new.
Brian: I found the project quite refreshing and the website was a pleasant surprise. It's a shame we didn't have more things to try out that could have put our technical ability to the test!

6.8.2 Impact of e-learning courses on participants' learning characteristics

The participants were asked whether the opportunities presented by the pilot VLE promoted the types of learning activities they valued as visually impaired learners. They were asked to reflect on all the aspects of the VLE, including the learning materials and communication activities.

While still disappointed with the way learning objects were presented, the most technically experienced participants (n=3) expressed enthusiasm about the communication activities, which increased their access to visually impaired peers. They referred to the discussion board, learning diaries and the new audio-page. They were asked to explain how the communication activities helped them to 'get in touch with' their peers and how they developed their own learning patterns. The three participants, who followed the business course, said that the online community clarified the concept of e-learning and provided a safe online environment in which to build their knowledge.

Nearly half (47%) of the respondents who participated in the telephone interview (stage one) said that they lacked the confidence to use the computer more often. Possible reasons for this lack of confidence could be related to the technical difficulties they had been experiencing as well as the inadequate training they had received on how to use the technology. The VLE was successful in increasing confidence levels among the small number of participants who were concerned about security and confidentiality on the Internet.

The two female participants felt positive about the learning course only because they had received tutoring from the volunteers. Both were adamant that they would most likely have withdrawn if not for the tutors.
Betty: I don’t think I could have managed without Siobhan. She was able to give me a start on a difficult road that I have been crawling along for many years. Though the Internet and ACE were out of my league, I’m glad I still accepted the invitation. I was behind all the others but that didn’t bother me. I could just keep going at my own speed.

Veronica: I have only been able to use parts of the ECDL course for my own purposes. But I wouldn’t have been able to do it without Louise. I was lost at the discussion meetings when everyone was talking about JAWS. I wanted to learn how to do the basics by the end of the course and I can say that I have achieved this goal. The project was a doorway to picking up skills, a doorway to information, and to education.

Betty and Veronica were asked to detail what they had learned from their time on the VLE and whether they thought they could apply what they had learned to work and/or at home. Betty provided a list of the basic skills she could now perform independently, while Veronica spoke more generally about ‘new possibilities to learning’. She was determined to develop essential ICT skills before her vision deteriorated any further.

Betty: I am able to do simple things like open a word document and save it. I can now open up Explorer [Internet Browser] and type in a web address. This is good because I can now read the news online. I’m not so good at getting around the ACE website… it is still quite difficult for me to find my way around.

Veronica: I suppose it is still early days for me. I’m a slow starter and I have been finding it difficult to get used to using the new screen-reader. I wish it was easier to use, but I’m determined to get a few skills before it gets any worse. I suppose this project has opened up new possibilities to learning. The meetings we had were good because I could hear what the possibilities are for people with little or no vision.

Ed, Brian and Sarah, participants on the business course, said they were satisfied with the content of the course, finding parts of it extremely useful. However, they remained disappointed with the way the course had been designed despite the recent technical changes. They seemed to feel under-challenged by the activities that were
designed to achieve the 'deeper, meaningful learning' (Garrison & Anderson, 2004) that they were expecting. All three participants had previously experienced other e-learning environments and were able to compare these with the VLE they were testing. Furthermore, as third level students, Sarah and Brian were also able to access Blackboard and WebCT and compare the different functionalities with the tested VLE. As a result, they were able to cite some missed opportunities that could have increased their level of interaction on the VLE. In spite of these missed opportunities, Ed said that he managed to establish a very good working relationship with his twin-learner, Emma, although it was 'purely by chance we happened to hit it off'. He stated there were few opportunities for them to sample new ideas apart from sharing them in the discussion room. Ed felt that the course did not add value to the visually impaired community but that the VLE interface itself had much to offer in terms of exemplary design.

**Ed:** I strongly believe the design of the interface should be held up as an excellent example of good universal design. I have been surfing for a number of years and have a fair idea of what is out there.

Brian and Sarah both responded positively to the pilot, saying how it had helped them to demystify the term 'VLE.' Both said that as university students they had some experience of e-learning but that this VLE enabled them to test different communication tools for the first time (e.g. filling out an online diary and participating on the discussion board). They felt more empowered as a result of trying these new e-learning tools. They felt comfortable with the fact that there were only a small number of adults participating on the VLE.

**Brian:** I'm usually quite a shy person online, but this project has helped me to take a few risks to try out some of the online tools. I think the discussion board was the most useful tool for me, though the learning diary was interesting.

**Sarah:** I was able to see the site, unlike most of the other people doing this project, so I was hoping to see some more multimedia like short films, or people being interviewed. I just found it quite static but then it was useful for making friends and making some progress on how to use computers. It was great to actually chat to Brian, who is studying at the same university!
One of the purposes of the second set of interviews was to learn about the differences in the participants' learning characteristics after engaging in the e-learning courses. Table 21 captures all ten participants' learning characteristics before and after their engagement in the e-learning programmes. The table also shows how much of the listed course they completed and whether they successfully finished any of the assignments. Participants were encouraged to share their progress as well as any difficulties they encountered while following the course. Six of the participants (Emma, Nicky, Tim, Brian, Veronica and Ed) successfully completed either one module of the ECDL or six modules of the e-business course. Two participants managed to complete only half of the EDCL module (Betty) or e-business course (Sarah). David reviewed the two ECDL modules but was more interested in learning about how to write the 'back-end' script for the VLE. He was also interested in participating in the project to find out more about how a VLE worked.

I find the whole idea of VLEs exciting...they are going to change the way we learn and work. Having experienced ACE I can now understand how people get so excited about e-learning.

During the engagement in the e-learning courses, all nine participants experienced different levels of progress, which are captured in the summary section of Table 21. Notable cases included Emma who was able to explore new business opportunities with the Irish Enterprise Board in setting up her own website.

I was delighted to find out ways of getting funding for a 'news-talk' website I have been dreaming about for so long. I guess the e-business course has given me the skills and confidence to contact the right people.

Similarly, Ed was able to apply some of the business concepts he had learnt on the course to his own business and website. He was particularly praiseworthy of the peer-to-peer exchanges he had with Emma and the discussions in the forum.
I feel a new impetus having followed the course, though the assignments were not really of any interest to me. It has given me some more ideas on how to promote my business outside of Ireland.

Betty had mixed views about how much progress she made when she was asked to share some of her achievements. She greatly valued her learning experience with the volunteer tutor who helped her grasp some of the fundamental electronic skills of using Microsoft ‘Word’ and using an Internet web browser. Betty confirmed that she lacked sufficient confidence to take any risks when asked to log onto the ACE VLE. She felt that e-learning was not something she wished to pursue in the immediate future.

I’m pleased that I joined the project and learnt something about how to use a computer. I struggled half-way through the ECDL module and didn’t even complete it. I know that ACE and e-learning is not for me...too complicated. I prefer doing my own thing with the volunteer.

Two case studies have been prepared to illustrate the differences in two participants’ learning characteristics before and after their engagement in the e-learning course. These two case studies (one person with blindness and one with low vision) show the learning differences between a participant with low vision and another with blindness. Although it is difficult to draw any comparisons, it is interesting to compare two participants who followed the same course.

Case Study One (see Appendix M) presents a unique case as the participant has invested enormous time and energy into developing his own goat farm business and the economy of the island he lives on. Ed was remarkably skilled at using technology at the beginning of the project, but was interested in learning more about e-business to develop the skills he needed to manage his own business and to promote the island’s trading activities (e.g. tourism, fishery, handicrafts).

Ed’s case was particularly interesting given his remote location, his career path, his personal ambitions and how he learned. In Ed, the project team found a perfect match, someone who lived in a completely remote location and was enthusiastic...
about developing his electronic skills and knowledge of e-learning. He showed great ability to learn on his own, an essential requirement for the project. The main barrier was not being able to spend long periods of time interacting with other participants because of the high cost of dial-up connection and the lack of Internet speed to download and listen to files.

The second case study (see Appendix N) is equally interesting. Sarah, followed the same course as Ed, but as a person with low vision she had different learning expectations and outcomes. Sarah was comfortable using the Internet and had had previous e-learning experience at the university she was attending. She had set some specific learning targets, which were partially met by following the e-business course. Unlike Ed, Sarah had no immediate plans to use what she learnt from the course but some of the content was helpful for her professional development. The case study also captures some of the difficulties Sarah encountered while she was following the e-business course.
### Table 21. A comparison of learning characteristics before and after engagement in the e-learning courses

<table>
<thead>
<tr>
<th>Participant, visual status and chosen course</th>
<th>Summary of learning characteristics before engagement in the e-learning programmes</th>
<th>List of completed ECDL course modules/e-business</th>
<th>Summary of learning characteristics after engagement in the e-learning programmes</th>
</tr>
</thead>
</table>
| Sarah (low-vision) e-business                | Good knowledge of basic ICT skills (word-processing, e-mail) and use of screen-magnifier. | Completed 3 out of 6 learning objects. Did not complete any of the assignments. | • Able to log-on, navigate and participate in VLE and e-business course independently.  
• More confidence in using other VLEs (e.g. Blackboard).  
• Greater confidence in using discussion forum |
| Emma (Co-researcher) e-business              | Considerable knowledge of the Internet (able to use search engines, navigate websites using JAWS) Overall – Excellent ICT skills. Unsure about how to develop and set up own online website for young people with visual impairment in Ireland. | Completed all 6 learning objects. Did not complete any of the assignments. | • Able to apply some of the key concepts to own situation e.g. explore business opportunities with the Irish Enterprise Board to set up own 'Newstalk' website. |
| David ECDL                                  | Excellent ICT skills. Able to design websites but does not have some basic skills e.g. Word, Spreadsheets. | Reviewed modules 3 & 7 for interest but did not complete them. | • Learnt how to write script with the help of Ace web-designer. Did not wish to take any of the courses, but said he enjoyed the experience of being on a VLE with peers. |
| Nicky (co-researcher) ECDL                  | Some basic knowledge of ECDL course and e-mail but not confident at using the Internet to carry out online transactions (e.g. booking a flight). | Successfully completed Module 7 (web-browsing and Communication) and all the tasks. | • Developed more experience of browsing the Internet and using search engines for specific research purposes.  
• Not completely confident at using the Internet to carry out online transactions and e-banking. |
| Tim ECDL                                    | Acquired some basic computer skills e.g. Word. Able to use the Internet and e-mail with some help. | Completed module 7. Did not complete any of the tasks. | • Acquired some basic understanding of how to open an Internet browser and how to use a search engine.  
• Still not confident at navigating webpages and identifying links to other websites. |
### Table 21 continued...

<table>
<thead>
<tr>
<th>Participant, visual status and chosen course</th>
<th>Summary of learning characteristics before engagement in the e-learning programmes</th>
<th>List of completed ECDL course modules/e-business</th>
<th>Summary of learning characteristics after engagement in the e-learning programmes</th>
</tr>
</thead>
</table>
| Brian e-business                            | Good knowledge of basic ICT skills and use of JAWS screen-reader. Confident at using ICT for studies. | Completed all 6 learning objects. Completed two of the written assignments. | • Developed much more confidence participating in online discussions.  
• Confident in carrying out online transactions. |
| Betty ECDL                                   | Some previous knowledge of how to use a PC and a screen-reader. Little experience at using Word or e-mail. | Completed half of module 3 (Word-Processing) with support of visiting tutor. Did not complete any of the tasks. | • Able to open up a word document and save it.  
• Open up a web browser and type in a web address and add to favourites.  
• Still experiences difficulty in navigating the VLE (finding discussion forum, using the learning diary). |
| Veronica (low vision) ECDL                  | Rudimentary knowledge of how to use a screen-magnifier. Basic ICT skills, can touch-type write word documents. | Completed module 7 successfully with support of visiting tutor. Completed all the tasks. | • More proficient at using screen-magnifier.  
• Able to open Internet browser and type in a search engine address e.g. Google. |
| Ed e-business                                | Good knowledge of how to use the Internet. Confident at using e-mail and the Internet. | Completed all 6 modules but did not do any assignments. | • Able to apply some of the e-business concepts.  
• Enjoyed experiencing peer-to-peer learning with twin - Emma.  
• Integrating some aspects from e-business course to own website promoting own goat business. |
| Catherine ECDL                               | Some previous knowledge of basic ICT skills but not a confident user. | Withdrew from project after one month. | No second interview took place. |

### 6.8.3 Applying learning strategies to support e-learning

The participants were asked whether the e-learning course helped them to apply new learning strategies to new situations. The purpose of this question was to determine which, if any, tool (e.g. language, abstract reasoning, use of memory or signs) helped them learn better.
One of the youngest participants, David, found it more difficult to read passages that contained too much theory and not enough practical examples. He liked to reorganise information in what he called 'stacks,' labelling them with a word that would aide his recall. David said he used this learning technique on the e-learning course but admitted he knew most of the concepts as a result of studying the course two years ago.

**David:** I sort of work out a system of my own which allows me to reorganise the information in what I think is in a logical way. This may be a completely crazy way for most people, but it sort of works for me. It doesn't always work but has helped me a bit.

Previously, Veronica said that she liked to write in black felt pen to help her remember what she had learned. She would draw a type of flow chart that helped her recall the 'sequence of actions' she took to successfully compose and send an e-mail. She found learning how to use the PC to be one of the most difficult things she had ever done, claiming she was 'never manually dextrous'. Veronica also spoke about ways of trying to aide her memory so that she relied less on her visual memory and more on what she called her 'auditory memory'.

**Veronica:** The course has really forced me to think about how I should be learning as a visually impaired person. I find it hard to memorise sequences of how to say use a Yahoo account but I find it easier if I say the steps as I do them. Louise [volunteer tutor] is helping me to learn the steps too.

Betty said she used tactile aids to help her navigate the keyboard. She also said that if she did not have to worry about the keys she could concentrate more on learning tasks. She also spoke about making notes and trying to remember how to access a saved word document on her computer.

**Betty:** I have sticky bumps on some of the keyboard keys. It's an old keyboard and I still keep hold of it. When I get a new computer I just change the new keyboard with my one. I'm used to it, so I don't have to think about where the letters are.
Tim was not too sure how the experience on the VLE helped him to learn. He experienced problems reading the long descriptions in the course units and tended to skim over large parts of it until he arrived at a task. He said he worked backwards from the task, tabbing up and down from the set task to the instructions in order to answer the questions.

**Tim:** I like to know what I have to do first and then work backwards from there. If I’m reading a load of notes on how to use the Internet without knowing what I will be doing, then that makes it less interesting and more difficult to learn.

The more technically experienced participants who followed the business course spoke about techniques they usually used to learn key facts. Both Ed and Brian said they preferred to discuss what they had learnt with a friend or colleague, although this was difficult to do unless peers were online at the same time. They found sharing their learning diary with a peer a useful way to consolidate what they had learnt. Ed sometimes found it easier to learn using a screen-reader but stipulated that it had to be near enough to the human voice not to feel uncomfortable.

**Ed:** When you are listening to an ordinary human voice speaking you are looking for a whole set of things. It is partly the information that they are trying to convey, but there is also a lot other information: what kind of mood they are in, are they happy, pleaded to be saying what they are saying, or are they losing their patience with you? All those kind of things. With a synthesised thing, it is an irrelevant thing. This thing is not going to change moods, it is predictable, it is just going to pour information at you. You drop all the other things and then it gets more easy. You don’t feel as stressed looking for information.

**Brian:** I must be lucky in that I have a pretty good memory. I have always been interested in technical and scientific things and was pretty good at maths when I was at school. I guess this ability helps me to memorise information without too many problems. I do have problems with learning when I’m given too much reading. It is a real turn off for me. If I can read a bit, take some notes, then go for a break and then do some more reading for say twenty minutes, I feel I can hold it in my head longer. I still have to be interested in what the reading is
about, but then there are some things you just have to learn even if you don't like it. I always say this to my kids and they get annoyed with me (laughs).

Finally, Sarah said that her law course had really 'pushed [her] to the limits,' challenging her to read large volumes of books and reproduce cases in exams. She found it easier to listen to the lecture while her personal tutor, provided by the University Disability Support Services, took the notes. She recognised that this was a 'necessity' while she was at college, as she would not be able to draw on this help when she finally graduated at the end of the academic year. Sarah said she thought 'visually' all the time because she would nearly always access all her information through her eyes. She said that she liked to use colours to highlight important points on documents, which she did on the business course.

Sarah: I would copy and paste the text from the webpage onto a word document and then use different colours available on the word toolbar. I could also put the text in bold and increase the size so it was easier to use than reading it off the Internet. I'm not sure if this is e-learning but that was the way I did it and it helped!

6.8.4 Information-age skills for the visually impaired

The participants were asked to think about whether they perceived themselves as part of the 'information building society.' This question sought to determine whether the experience of the VLE itself contributed to a new sense of belonging to the 'digital society' and, if so, in what ways. There is a need to consider the potential exclusion caused by technical developments. It is also important to consider how they can be re-developed to promote more inclusive practices in the information building society. Ideally this might even open up new possibilities for the visually impaired community if the Internet is used to liberate them from environments which have excluded them from full participation. The data from the final interviews and round-table discussions suggest that visually impaired adults are enjoying some of the benefits promoted through more inclusive practices, but this has only been achieved more recently through web accessibility initiatives and new legislation (e.g. the Disability Act, 2005).
Half of the participants said they were spending more than five hours a day on the computer reading downloadable books, listening to music or chatting to friends. Two participants, David and Ed, said they liked to discover the latest in technological changes for visually impaired people on the Internet.

**David:** I just love to log-on in the morning and hear what has been happening over night while I've been asleep. The Internet has almost turned me into a cyber-space junkie (laughs). I just love chatting to others about technical stuff – finding out where I can source the best code for my own website.

**Ed:** I find I can't do without the Internet. Living on an island has isolated me physically from my friends and family, but the Internet has helped me to stay in touch more frequently than when I visited them.

### 6.8.5 Inclusive design of e-learning courses increases confidence and independence

The participants were asked to reflect on how their performance over the five months affected their levels of *confidence* and *independence*. The main reason for asking this question was to determine whether participants had a frustration threshold when using the Internet. Some participants believed that testing the VLE and participating in e-learning activities had increased their levels of confidence and independence considerably. Research evidence from other studies suggest that visually impaired people are prepared to put up with the frustration of technical difficulties and 'imperfect technology,' and the additional amounts of time, all because of the advantages of being independent to a reasonable extent (Gerber, 2002). Evidence from this research affirms a similar trend, but there are thresholds against which the visually impaired cannot continue to struggle, such as very poor design and difficult to use technology.
All the participants made references to the fact that the technology they use on a daily basis did cause different levels of frustration. Five said that one of the most annoying problems they encountered was poorly designed websites. They agreed that testing the VLE had heightened their awareness of what constituted bad or good design. Three said the e-learning course (ECDL) should have carefully considered how to use layout in the course in a way that enabled a screen-reader to capture all the sections without accidentally skipping them. They felt it was important to have an area for 'links' that took the learner to important learning concepts, useful terms, a help menu of shortcut keys and a list of assignments. One suggested placing clear indicators such as links within the text of the learning materials. (This suggestion could be helpful to some but not all learners.) Another participant said that it would be more helpful to have a separate page of links that could be located in the same area of each webpage. All these recommendations could reduce the amount of time on searching for information and allow more time on actual learning tasks.

David: I think there are some basic things that web-designers can do to make e-learning a much better experience. Something like putting clearly indicated links in the body of the text that tell the reader to go here. I get annoyed when the 'hyper-link' tells me very little about where I'm going to. I don't really know much about other e-learning courses, but the one we tested still needs some work doing to it to make the course successful.

Paul: So you rate the VLE itself as highly accessible, but not the courses?

David: I think so. The website is great and a joy to spend time on. I just feel the courses could have done with some more thought. But, then, it is the first time. It is hard to get things right the first time.

Veronica said she was unable to say if the time spent on the VLE had increased her confidence and independence, although she felt a little frustrated by the fact that the ECDL course had only been written for JAWS screen-readers.

Veronica: I consider myself to be a very tolerant person. I suppose my teaching background helps me to think about things calmly and not to become too frustrated. But it is difficult to stay calm when you're worried about your sight. I
think I would have dropped out at the early stages of the project, if there wasn't the human support.

In an earlier interview, Brian testified that he had encountered considerable technical barriers when he first started using assistive technology. He considered himself to be quite a cautious user of the Internet and was often reluctant to carry out any online transactions on his own. In spite of these barriers, he felt he had succeeded in reaching a proficient level of ICT today. He added that his confidence had increased more as a result of talking to other participants about conducting online transactions on the VLE discussion board.

**Brian:** I just found the experience of being online with my peers a very uplifting experience. I have learnt loads about using one of these environments. I'm thinking about doing another online course if I have time.

Betty, the most inexperienced participant at the beginning of the study, seemed to struggle with the VLE the most. She felt she had made some progress from participating in the study, but was cautious in saying how much she had achieved. She was still unable to log onto the project VLE without help, and this frustrated her the most. She realised it would take some time before she felt ready to participate in any of the online learning activities. Yet she saw no reason to pursue learning online if she was able to learn basic electronic skills offline.

**Betty:** I was worried at the beginning that everyone was much better than me and that I wouldn't be able to keep up with them. I decided that I should go at my own speed and not worry about the others. I think having my tutor Siobhan helped me to stop worrying about not coping with the project.

**Paul:** How confident do you now feel about using the computer?

**Betty:** I'm much better at using Word, which is good for my work. I'm beginning to get to grips with e-mail and the calendar part of Outlook. I can now start putting in diary dates for my boss and booking appointments for him which is something I couldn't do a few months before.

**Paul:** So, you have developed some useful skills for work.
Betty: I have, but I'm not too confident at using the Internet, but then, I need to concentrate on work skills.

During the interpretation of the data, it was possible to identify short phrases and words that signified changes in the participants' behaviour and perspective to technology and learning over the lifetime of the study. Betty clearly felt unconfident at using technology at the start of the project. She claimed she had missed out on a lot of key learning skills as a result of being placed at the wrong school when she was a child. She also had some anxiety about being able to keep up with her peers until she decided to set her own learning pace and 'not worry about the others'. By the end of the project, Betty seemed to be more positive about her capabilities and these are reflected in the use of certain phrases e.g. 'I'm beginning to get to grips...', 'I'm much better at using word...' (see citations above).

The participants were encouraged to talk about their ambitions once the funded project came to a completion. Five wished to pursue either work or new learning goals. The other two were still uncertain of how they would be able to use their skills in the future.

Three participants said that they would feel more confident about changing jobs or renouncing any allowances if they were certain of receiving sufficient technical support and training to do their job. The following testimonies from the participants show that e-learning can provide new opportunities for visually impaired adults:

Sarah: I'm now considering doing a post-graduate degree in Law and then practicing at the bar in Dublin. I can now see the different possibilities that exist for the visually impaired in this profession. ACE e-business course and website has given me a chance to see that I can learn using distance learning.

Brian: I would be happy to take on some post-doctoral work or some research in history. I will do some part-time teaching and a bit of checking out and see what my next move will be, though I'm sure technology will play a part in it.
Veronica: I think it will be difficult to find another project like ACE with the security and the knowledge base. I hope I can use the skills I have learnt and use them in the future if I decide to do an e-Learning course.

The next section presents some of the reflections of the three co-researchers.

6.9 Visually impaired people reflect on their experiences as co-researchers

Emancipatory research has the vision of being transformative, relevant to and significant in the lives of disabled people (Barton, 2005). It is important that all co-researchers learn to recognise their limitations and that their work is sometimes partial and incomplete. We need to be open and self-aware in relation to our own values, priorities and processes of interpretation. Oakly (1994) sees this as a constant reflexive process in which re-working and re-understanding of observations and experiences lead to a story which represents the interaction between the culture of the researchers and the cultures of those being researched.

One way of articulating our own values and interpretations is to ask questions of ourselves so to reflect on how we performed as researchers. The co-researchers (Emma, Stuart and Nicky) agreed to meet and to discuss some questions that I had drawn up for a focused discussion. They were invited to reflect on their experiences as both researchers and participants during the second and third stages of the process. It was envisioned that the group meeting format would enable the co-researchers to listen to each other's perspectives and to encourage transparency and openness. The meeting would also provide an opportunity for the small group to voice any concerns they may have had during the research – a vital component in the adopted emancipatory research strategy.

A few days before the interview, the co-researchers were sent a short list of questions (see Appendix O) to prepare before meeting. The list of questions sought to elicit several views: any previous experience they had in conducting research; their initial
thoughts about the study; how confident they felt about carrying out the research; whether they felt supported by the other members of the research team; and which aspects of the research process they enjoyed or did not enjoy. The co-researchers were also asked to think about how the adopted research strategy influenced the design and delivery of the pilot study.

During the meeting, all three participants said they were excited about the idea of being part of a small research group. None of them had been involved in research before, although Stuart had previous experience of working on EU projects. He said that these projects did not have the same level of commitment to research and were not as participatory as this research. He also said that as soon as he heard about this research he could ‘see some of the immediate benefits for the target audience’. Emma and Nicky were unsure whether they could participate in the study having no previous research experience.

**Nicky:** I didn’t know what to expect... but I was keen to be involved in research that helped us to learn more about technology and e-learning. I was only interested in it for personal reasons at first.

When Emma and Nicky were asked whether they had difficulties taking on two roles (co-researcher and participant), Emma said she had some concerns also about being accepted by the other participants. She feared that they would mistrust her and not consider her as ‘a real participant’. She said that she felt more confident when she learned of Nicky’s participation. Conversely, Nicky viewed the two roles as complementary. Fortunately, neither Nicky nor Emma experienced any negativity from the other participants during the pilot study.

**Nicky:** When I was invited to join the project, too, I thought it was a great chance to get some first-hand knowledge of how an e-learning community actually worked. I also knew most of the participants and they knew that I was also acting in a research role.

The two co-researchers were invited to reflect on how the dual role affected the way they interpreted the data. Both had slightly different views on this aspect of their role.
Emma found it difficult to analyse the data objectively. She was concerned about the
danger of contaminating the results with her own interpretations. Nicky considered it
an advantage to have direct experience in the project and to 'see it from both sides'.
He was not as concerned about problems of subjectivity mainly because the research
involved 'visually impaired people talking about issues that affect other visually
impaired people'. He felt that as a visually impaired person he could better
understand the difficulties of his peers and could apply his own experiences to the
process. He said that a sighted person would not always be able to understand the
anxiety that some of the participants experienced using technology. He strongly
believed that the presence of other visually impaired people on the VLE was vital.
Stuart felt that this was true to some extent, but he believed it was important to have
a sighted person in the group who could contribute different perspectives and
knowledge to the study.

**Stuart:** I think it is important to have two of us in the project – it helps us get a
better understanding of what is going on. It's a shame I could not be part of the
group, but I felt I could not mix my role as a member of the project team with
another role. It would have got so complicated.

**Emma:** I know what you mean... it was hard enough running with two roles.

The co-researchers were asked to comment on the level of support they had during
the research process and to think about their role in delivering the field work. All three
felt sufficiently supported by the team, citing the following factors: the fact that they
already knew each other, that they had a strong interest in the research area and that
they were able to meet at least once a week to discuss issues around assistive
technology and computer usage. The close personal relationships between the four
co-researchers seemed to enhance the level of support they provided each other.

**Emma:** It was fantastic to have the chance to meet regularly with Stuart, Nicky
and yourself (Paul Lynch). I felt I could call anyone at anytime to get their
advice. I think it wouldn't be so easy if we didn't know each other as well.

**Nicky:** It would have been interesting to see how the group would have got on if
we didn't know each other.
The three were asked to reflect on parts of their role that they may have felt more uncomfortable doing. Emma said she occasionally found it difficult not to say too much at the round-table discussions. She said that she was a ‘strong-minded’ person and was not afraid to speak out if she was unhappy about something. She was concerned that she may have dominated the discussions, preventing the other participants from sharing their views. Nicky did not experience the same concerns as Emma. He found the whole experience exhilarating and wished he could continue this research role for longer. He also said that he would like to pursue a similar role if another opportunity arose. He felt more confident about carrying out research. He said it was a ‘completely new experience’ but something that was worthwhile and a valuable contribution to the visually impaired community.

Nicky: I have never done anything like this before. It was a breath of fresh air from my boring job (switchboard operator). I wish I could do something more interesting and challenging. I get frustrated travelling to the same job and doing the thing over and over again.

Finally, the three were asked how they thought visually impaired people could be involved in similar or different research in the future.

All three found the step-by-step process of inviting different stakeholders to contribute to the dialogic enquiry to be essential. Stuart was satisfied with the level of democracy and transparency, attributing this to the extensive ground-work that had been completed at the early stages of the study. He added that it would have been difficult to plan the early stages of the research without help from a sighted person.

Stuart: This research has given me a chance to take part in something that I have chosen to do and not another work project that leads to nowhere in particular. I wish we could have developed this research further... maybe we can find new opportunities to work together. I can't remember the name of the type of research but it seems to have worked well this time.

Nicky shared his 'vision' of how visually impaired could be involved in other research.
Nicky: This project has given me a chance to do something different... this is a real plus as we can get boxed into doing mundane work that has little effect on our lives. I think it can allow visually impaired people to get involved in research without having to know too much about it. Hopefully there will be more opportunities for others to have a chance to do something like this but they don't seem to come up too often.

These views provided some useful insights. None of the three had conducted research before, but this experience had empowered them to seek new research opportunities in the future. The research experience served an important role of demystifying the structures and processes of research by making it more accessible to disabled people. This approach created an opportunity for visually impaired people to share their experiences and to explore new ways of constructing the research in ways that empowered them and gave them a sense of ownership of the results.

6.10 Summary

Data from the interviews and round-table discussions generated a range of themes around the testing of a new virtual learning environment and supporting e-learning materials. The study identified a number of themes that show that the participants are able to fully interact with the virtual learning environment. All the participants experienced problems e-learning but this was mainly due to poor design and layout. The next two sections briefly summarise some of the broader issues that emerged from the study.

6.10.1 Pedagogical issues affecting e-learning content and delivery

The e-learning materials presented a number of problems to all the participants. These can be captured in the following statements:
• There was inadequate consideration for people using different screen-readers (such as JAWS) and magnifiers (such as Supernova). This led to some confusion and to the isolation of learners;
• A lack of consistency in course layout caused problems for participants who were unable to make sense of the courses' aims, structure or content. As a result, participants spent large amounts of time navigating from one section to another and less time was spent on 'doing' learning activities;
• The screen-readers were unable to distinguish the different visual cues (e.g. breaks between the paragraphs, bullet points) that normally help sighted readers;
• The VLE did not offer the sorts of collaborative learning activities that are commonly promoted through flexible principles of e-learning;
• The VLE did not maximise the different types of new mobile technologies that are being used by the visually impaired community;
• The VLE only managed to promote small amounts of collaboration between participants through the sharing of learning diaries between peers and focused online discussions.

6.10.2 Adapting the environment to meet individual and social needs

Visually impaired learners wish to be able to enjoy the same kinds of learning experiences as their sighted peers. The fact that they use different technology to access learning does not mean they should not have access to a maximum choice of learning activities and situations. Analysis of the data shows much more could have been done to ensure that a VLE and assistive technology matched the technical, social and learning needs of the visually impaired user. Many of the participants had different levels of need, which could have been better met by planning different blends of learning (face-to-face and online tuition) for each participant. Only a small number of participants (two) were able to benefit from face-to-face learning.

Phipps and Kelly (2006) state that courses that offer reasonable flexibility in how they are designed and delivered (termed ‘a holistic approach’) are more likely to suit the
individual needs of both blind and low vision people. This approach takes account of the local cultural and social factors that prevent people from accessing e-learning. Rather than standing as a 'one size fits all' model, it proved to be a 'holistic model,' deploying resources that can be tailored to the students' particular needs at a particular time. The tested VLE partially achieved this aim by allowing participants to decide how they wished to use the learning materials, though this was more as a result of having to make something out of their learning experiences.

6.10.3 Impact of the VLE and e-learning materials on learning outcomes

The study has identified a number of areas where participants experienced both technical and learning difficulties as a result of poor conceptualisation and design of the e-learning materials. All the participants felt that the content of the two courses was interesting and appropriate. However, both courses require substantial changes to the design and layout to make them more accessible to visually impaired learners.

The participants experienced a number of positive outcomes in spite of the technical and learning difficulties they experienced on the VLE. One of the most significant outcomes was the overall increase in levels of confidence and independence felt by most of the participants as a result of participating on the VLE. There was a strong sense of commitment to the VLE and to adapting it to their learning needs. This may have been a result of personal commitment to the study or reluctance to let their peers down by withdrawing. The participants were still willing to put up with the technical and infrastructural problems such as slow bandwidth in rural areas, high connectivity costs, computer break-downs and spending large amounts of time online in order to achieve a certain level of independence.

Another important outcome from the study was linked to participants' success in achieving their personal goals and their outlook on future engagement with technology for personal or professional use. These successes, both large and small, contributed to their sense of belonging to the 'information society.' They also felt that, to some extent, the playing field had been levelled as a result of participating in the
same activities as their sighted peers. The participants were excited about the greater choice of technologies available to visually impaired users. Furthermore, they were able to provide practical solutions to technical and pedagogical problems that prevented them from accessing all the online learning materials.

To summarise, this study invited a small number of visually impaired adults who were already using technology to take part in a short pilot study to test some of the principles that were defined in stage two of the research process. Through an emancipatory approach, the study succeeded in achieving a high level of dialogue, encouraging exchanges between the participants and the co-researchers during the interviews and round-table discussions. The participants were able to discuss issues that affected them as visually impaired users with their peers and with researchers who had some experience and understanding of what it is like to be visually impaired.
Chapter Seven – Discussion of Findings

7.0 Introduction

The aim of this research was to develop a framework for the development of a technology-based inclusive learning environment. This involved a commitment to working with visually impaired individuals to derive a coherent set of principles through an inclusive research strategy. This strategy planned to find out whether technology could be used explicitly to develop inclusive learning environments; secondly, how an inclusive approach could be pursued and, thirdly, whether it could be achieved. This chapter also examines these questions in relation to the methodological and pragmatic consequences of using an emancipatory framework. It highlights the challenges of the framework and considers which elements were more successful than others. It also identifies the implications of developing blended e-learning solutions though constructivist learning principles.

In Part One, the seven identified themes are discussed:

- Inclusive design increases accessibility to VLEs;
- Accessing training on the use of assistive technology;
- Using new mobile technologies that increase learning opportunities;
- Meeting the technical needs of the visually impaired to 'e-learn';
- Meeting the individual learning styles of the blind and those with low vision;
- Introducing blended approaches to e-learning (pedagogical solutions);
- Identifying other factors that affect accessibility to e-learning.

In Part Two, the five factors that were considered when implementing the inclusive research strategy are discussed:

- The effects of the emancipatory disability approach taken in the study;
The role of co-researchers;
A comparison of the findings in this study against six principles of emancipatory research;
Emancipatory research within the Irish context;
The limitations of adopting an emancipatory approach.

The final section considers the authenticity of the research, reflecting on the research as a whole, exposing potential research directions for the future, and a final presentation of the wider issues that have emerged from this research.

7.1 Part One: E-learning and blended learning for visually impaired community

Part One discusses the six key themes (listed above) that emerged from the data analysis. The analysis comprised a three-stage approach and the themes were derived from multiple methods (questionnaire, stakeholder workshop, interviews and round-table discussions).

7.1.1 Inclusive design increases accessibility to VLEs

This research shows that most of the visually impaired adults involved were able to independently access and navigate a VLE with the use of a screen-reader provided it complied with the W3C WAI guidelines. This finding will be described in more detail in the next sections.

The evidence from this study suggests that the tested virtual learning environment was indeed appropriately designed to enable the participants (blind and with low vision) to access the e-learning materials and use the online tools (see sections 6.3.1, 6.3.2). This finding demonstrates how effective inclusive design can lead to full accessibility of a VLE and e-learning materials. The participants were able to comfortably navigate the virtual learning environment experiencing no specific problems with the design of the interface. This pilot study revealed that a VLE could
be developed in a way that enabled visually impaired participants to use without any problem.

Some caution, however, is warranted as the technical opportunities offered by the design impeded a small number of participants who could not master some of the specific skills needed to access and navigate the VLE. These participants lacked the technical expertise to apply basic keystrokes to perform more complex tasks within an online course, or to use electronic tools to participate in online discussions. Furthermore, the prototype VLE (ACE) did not offer a complete range of e-learning tools available on other mainstream e-learning platforms (such as WebCT or Blackboard). As a result, whether the participants would have been able to use all the interactive functionalities of e-learning could not be determined.

Discussions with the participants, some of whom had problems accessing all learning materials and using the online tools, raised concerns about the layout of web pages with appropriate links to useful information about the course, about keystrokes and helpful notes that could enhance the visually impaired learner’s experience on the course. One solution would be to conduct a number of usability tests to determine whether all screen-readers (for blind participants) and all magnifiers (for participants with low-vision) are able to read all the learning materials and hyperlinks. Observations from these tests could identify any major pitfalls in course design and help website designers to design course reading materials that are completely accessible. The WAI Guidelines provide some basic and fundamental ‘rules’ for accessibility to on-screen materials. For example, text should not be embedded in tables and boxes that prevent a screen-reader from reading the script.

An increased interest in assistive technology by the research community has resulted in more research money being dedicated to this growing area. Extensive lobbying by disabled people’s organisations (such as Enable Ireland) and disabled academics (such as the Disability Studies Department at Leeds University and the Equality Studies Department at University College Dublin) has also helped spark new developments in improving the quality of assistive technology. Two breakthrough examples are ‘mark-up languages’ and the USB screen-reader pen. Mark-up languages, such as Voice Xtensible Mark-up Language (VXML), give web pages the
optional feature of built-in speech, thus avoiding incompatibility between assistive technology and ICT. The Dolphin USB pen contains a portable screen-reader that has the capacity to hold electronic files. This extends technology to the visually impaired community without creating an additional piece of complex hardware.

Coyne and Nielsen (2001) observed that screen-readers forced users to navigate pages in a serial way that was not always appropriate for the design of the page. The participants in that study experienced similar difficulties navigating webpages to locate essential course information and shortcut keys. On occasion, our participants said that they had accidentally left out exercises or key links because the screen-reader forced them to take a particular route around the webpage. Barnicle (2000), in a similar study, examined the interaction between graphical user interfaces and screen-readers and found that even though the obstacles encountered by users were slight, the cumulative effect led to delay and non-completion of the task. Our study did not examine the interaction between graphical interfaces and screen-readers as some were present on two VLEs. But it is important to note that some participants experienced problems with small, built-in features, such as field boxes where they had to insert their username and password.

7.1.2 Accessing training on the use of assistive technology

The ability to use screen-reader software effectively to access and navigate the VLE and e-learning materials was a recurring theme throughout this research. Participants who were unable to use their screen-reader experienced the most problems in terms of accessing and navigating the VLE. This may seem an obvious finding, but little provision had been made to ensure that all participants were completely conversant in using the software at the beginning of the project. All of the participants agreed to the significance of basic training on the use of screen-readers. Only those who had a good working knowledge of assistive technology effectively accessed and used all the functionalities of the VLE (e.g. the discussion board, the audio materials).

Finding a suitable training course in their local town proved to be one of the biggest problems for many of the participants. Data from the telephone questionnaire (see section 5.2.3) revealed that nearly all the training courses were only available in the
large cities. The results from the questionnaire showed that 50% of visually impaired people (n=36) had not received any training on how to use the computer or the assistive technology software. Around 60% had little knowledge of training opportunities leading to formal qualifications in towns where they lived. It is therefore unsurprising that at least three participants in the pilot study were unable to operate the screen-reading software on their computer without the help of a tutor. One of the participants decided to discontinue participating because of the technical obstacles the software and computer presented her when she tried to access the Internet. Two participants used the project to develop their own personal skills with the support of volunteers and this had positive learning outcomes for both of them. The project served as a catalyst, inspiring them to plan their own learning programme and their own learning pace. Furthermore, this study showed how participants, who received help were able to 'scaffold' their own learning, for example by reducing tasks into manageable steps. In addition, the tutors were able to draw attention to key points of information, reminding them about the problem to solve and giving prompts, suggestions and possible shortcuts when required (Bruner, 1986; Kolb, 1984). The combination of direct tutoring interspersed with small intervals of e-learning proved to be successful for the less technically experienced and less confident participants.

7.1.3 Using new mobile technologies to increase learning opportunities

This research found that many of the participants are using mobile technologies on a regular basis for communication and leisure purposes. These technologies could be further exploited to provide more inclusive e-learning activities such as listening to podcasts or lectures at home or while travelling on public transport. Ireland has experienced a rapid increase in the number of people using new mobile technologies (MP3 players, mobile phones and iPods) to listen to music, documentaries, lectures and radio programs, partly due to the digitalisation of TV and radio. Increasing numbers of visually impaired people are downloading sound-files onto their mobile phones and players (see section 2.6.2). A small number of participants said that they already use mobile phones and MP3 players on a daily basis and are comfortable using them at home or when they travel. Most new forms of assistive technology (e.g. Braille note takers, USB screen-reading pens, DAISY
players) are able to connect with mainstream technology so users can upload and download information and sound files in different formats (e.g. CD's,) that are accessible to visually impaired people.

The days are numbered for the maligned synthesised voice, a major problem with using assistive technology to access soundfiles on the Internet. In the literature, more mainstream mobile technologies (e.g. MP3 players) offer learners new ways of accessing information without having to use assistive technology. Emiliani and Stephanidis (2005) consider this as key to more independence and self sufficiency for disabled people. Personal devices that have built-in, multi-modal interaction functions, such as voice recognition and synthesis, pen-based pointing devices, vibration alerting and touch screens are providing visually impaired learners with more choices on how they wish to learn. The participants are spending many hours on the Internet every day using the different modalities. Five participants said they spent between four and eight hours a day on the computer searching for information, communicating with friends on MSN, Skype or e-mailing friends. They are also using the Internet to read downloadable books, or listen to music on their MP3 players. The Internet and supporting mobile technologies seem to be a panacea to helping visually impaired people connect and be part of the 'information society'.

This finding is supported by a study conducted by Morley et al. (1999). They reported profound excitement among nine blind participants who were given access to a wider variety of information. They employed a hypermedia system that made use of non-visual interface, non-speech sounds and three input devices. We found similar levels of excitement among the younger participants who were already communicating with friends using Microsoft MSN, listening to sound files on their MP3 players and using their mobiles to store information. The use of these technologies represents types of 'blended learning approaches' as well as 'ubiquitous learning', which encourage students to learn at any time and anywhere (Holmes and Gardner, 2006). Courses that rely entirely on e-learning, whether campus-based or distance-taught, remain unusual at the present time (Sener, 2002), although this trend could change quickly. A new generation of teachers and students, who are increasingly comfortable using technology at all levels of learning and teaching, will expect to spend large amounts of time e-learning and engaging in online discussions. How the technology will be
able to meet these changing needs is unclear, but there is still much that can be done in terms of developing an e-learning pedagogy that is based on inclusive principles of good design and delivery for visually impaired learners.

New e-learning pedagogies that promote constructivist learning in multimedia environments, such as VLEs, should find ways to minimise the 'working memory load' of learners by designing a mix of multi-media materials that help to build key mental concepts (Mayer, et al. 1999). Mayer et al. (1999) in their study found that sighted learners are able to connect both visual and verbal representations when both are stored in the working memory as long as the bite sizes do not exceed working memory capacity. This is more problematic for visually impaired (blind) learners who are only able to process auditory learning materials on a VLE. Mayer et al. argue that constructivist learning occurs when learners actively construct meaningful mental representations from concurrently presented information in both visual and verbal sources. What they found in their research is that too much narration or visual input hindered student performance on retention of knowledge. They conclude that there will be an overload of working memory if narrations or visuals are not broken into small 'chunks' or bites. If the size of the 'chunk' does not exceed the working memory capacity, the learner should be able to develop the mental modes that help them to retain newly acquired knowledge.

Although this study was based on how sighted students learn using both visual and auditory multi-media, there is a similarity in how visually impaired individuals can be impeded by listening to large chunks or bites (e.g. whole learning objects). The e-learning materials (ECDL and e-business courses) provide examples of how course materials are overloaded with too many concepts or tasks for the participants to read and retain. Many of the participants experienced this 'overload' when they were engaging with the course materials. It is suggested that pedagogues need to construct learning environments that encourage visually impaired individuals to vary cognitive load. This could be achieved by breaking course materials into small sections interspersed with frequent examples and consolidation exercises that use hypermedia and interactive input devices that increase learning through tactile modalities.
7.1.4 Meeting the technical needs of the visually impaired to ‘e-learn’

This pilot study shows that most of the participants felt more positive about themselves as technology users by the end of the project. A small number of participants were able to reflect on their earlier experiences of using technology and compare them with more recent experiences. They were positive about the changes in technology and how they were enhancing their learning opportunities. Brian, an enthusiastic technology user, was particularly satisfied with the new openings technology offered him today:

I can’t believe how much I have struggled in the past just to use a computer or a scanner. Now there are many more openings to using technology in different ways. Even the thought of doing an e-learning course a year ago was unreal. It’s just a matter of putting your mind to it... as long as the technology doesn’t break down (extract from interview with Brian).

Data from the final set of interviews show that much still needs to done to provide visually impaired people with the appropriate technical knowledge they need to access new learning activities and to be able to develop the critical skills they say they wish to acquire. Vygotsky (1993) considers our involvement in the socio-cultural world as something that makes us human, by ensuring that we develop higher mental processes. While some of us have an impairment of the natural processes of vision, audition or psycho-motor skills, new electronic interfaces can have a rehabilitative effect, which enable us to use the cultural processes of abstract reasoning, logical memory and voluntary attention in different ways. Visually impaired learners require basic skills to use electronic tools and support systems before they can start to engage in similar e-learning activities as their sighted peers. Even if the visually impaired are on a par technically with their sighted peers, there are still certain conditions that need to be in place to ensure that their learning experience is equal to that of sighted learners.

One of the biggest challenges for those working in the field of accessibility and e-learning is to find the technical solutions that will enable a visually impaired person to access learning on an equal level to sighted people. There are some basic technical
requirements that need to be met before visually impaired people can start to achieve equal status when participating in e-learning activities.

Maslow's (1954) hierarchy of five basic needs offers one way to view the prerequisite learning needs of visually impaired learners. Although widely used, Maslow's work has been challenged, particularly by Marxist critics (Muller, 1992; Pratt, 1993), who reject any notion of an 'autonomous self'. Instead, Marxists emphasise the determination of macro socio-economic forces on the shaping of any individual and they consider that human nature is human only by virtue of the society. Nonetheless, Maslow's hypothesised framework is helpful here in illuminating how visually impaired individuals need to pass from meeting their physical needs to securing the highest possible level of control over their learning.

Maslow's first level, that of 'physical needs', correlates to the need of visually impaired people to fully access the appropriate equipment and relevant training. His second level, that of 'affiliation' correlates to the technology's capacity to bring people together with those who have similar learning interests. This level underscores the needs for self-confidence and the ability to make choices and to express them. The third Maslovian level comprises 'intellectual achievement' which can be met through the provision of e-learning courses that provide flexible routes to learning using different blended approaches. However, when visually impaired learners cannot receive certain types of information, or when the information is confused, incomplete or comes much too fast, it can be overwhelming, leading to a 'cognitive load' on the working memory (Mayer, et al. 1999; Paas, Renki and Sweller, 2003) and possible reduction in self-esteem.

The two highest levels are achieved once visually impaired people have a good understanding of their learning needs (through meta-cognition) and how they think these needs can be best met. Visually impaired learners could take more control over their learning by deciding on the different modalities that best suit their learning styles (Maslow's level 4: 'aesthetics') and also finding new solutions to existing barriers to learning (Maslow's level 5: 'self-actualisation'). If the basic need of accessibility is not met, visually impaired people have little chance of extending their learning through technology.
7.1.5 Meeting the individual learning styles of the blind and those with low vision

The interview data showed quite distinct differences between how blind people and those with low vision learnt. There were also differences between how the individuals with low vision learnt. In the case of the two participants with low vision, one participant was able to use her residual vision to learn, but in a way that mentally prepared her for an inevitable change in learning modality, that is, from visual to auditory. She realised the importance of remembering 'sequences' of items; without this ability, information that depended on sequence, such as spoken language, could not be retained and later understood and analysed. She said that she found sequential learning difficult but was using aids such as flow diagrams to help her to remember different learning sequences.

The second low vision participant, Sarah, had more functional vision although her poor visual acuity meant that she was entitled to have a personal note-taker for all of her law lectures. She knew that this 'luxury' would no longer be available once she completed her exams and that she would have to develop alternative learning strategies. For now, because her vision remains stable, Sarah can still apply visual-based strategies, such as highlighting texts in different colours, a technique commonly used by sighted scholars when trying to learn or memorise information. She was able to adapt the prototype e-learning courses to her own needs, even though they were not specifically designed for people with low vision.

I would copy and paste the text from the webpage onto a word document and then use different colours available on the word toolbar. I could also put the text in bold and increase the size so it was easier to use than reading it off the Internet. I'm not sure if this is e-learning but that was the way I did it and it helped!

Alternatively, the blind participants used a range of strategies to memorise and recall information. Testimonies from the interviews confirm that most of them experienced
difficulty absorbing all the large 'chunks' of learning materials on the e-learning course. Poor layout and the lack of clear course markers of where key information was located sabotaged their efforts to extract meaning from the text. One male participant, who was congenitally blind, talked about a labelling system he used to organise his learning into theory, concepts and practice. He used mental patterns to organise the information in his memory, a 'stacking' system, which could have been based on childhood haptic experiences rather than vision (Hollins, 1995).

What was particularly revealing was the importance participants placed on audio clues (such as ping sounds for new headings, or differently pitched sounds to announce hyperlinks). Such cues could help them to access the material more rapidly and spend more time learning. Similar to sighted users' use of visual clues (such as headings, sub-headings and bullet points), audio cues could help the navigation of online materials. It may be possible to introduce different short-pitched cues to signify main headings, sub-headings and/or hyperlinks to facilitate the learner. These pitches or sounds would need to be built into the screen-reader. The JAWS screen-reader already has a range of sounds it uses to announce capital letters and hyperlinks on webpages. Newly developed screen-reading software could develop and test these new features with visually impaired computer users.

Research carried out by Pring and Painter (2002) revealed that visually impaired (blind) people had superior pitch memory. They more accurately recalled perceptual information, such as whether a man or woman said the words, whereas sighted adults lost this information. Pring and Ockelford (2006) attributed this ability to blind children's interest in music, having good pitch memory, and potentially absolute pitch abilities. Recent research, carried at the Sonic Arts Centre, at The Queen's University Belfast, (Kuber, et al. 2005) found that using haptic force-feedback mice (i.e. a mouse that gravitates towards hyper-links on a webpage) could enable visually impaired people to recall spatial layout more easily. Kuber, et al. found that haptic cues significantly helped participants to quickly recognise nodes and structure of a website. They also found that auditory cues alone did not speed up hyperlink recognition, but when they were combined with haptics both hyperlink identification and webpage structure recognition significantly improved. This result demonstrates that haptic feedback plays an important role in enabling people to recall spatial layout. Further
research could explore ways of integrating haptic and audio cues into e-learning scenarios. User tests could be run to measure the impact of how both modalities impact on the learning experiences of visually impaired learners.

Two male participants, who developed blindness in their later years, both found that discussing their new learning had a positive impact on their ability to memorise and consolidate information. One participant, Ed, preferred the non-human voice of the screen-reader than a person’s voice while listening to the computer because it did not have the ‘distractions’ of a human voice or any emotion that prevented him from accessing the information. Conversely, a small number of other participants felt the synthesised voice reduced the quality of their learning experiences and preferred to listen to a human voice instead.

New research evidence (Pring, 2008; Dulin, 2008; Pring and Ockelford, 2006) suggests that blind people are able to perform in surprising ways by achieving similar levels of intellectual and educational attainment as their sighted counterparts. In spite of their loss vision, the blind process speech at a faster rate than sighted people. Future research could address how these strengths could be used to increase e-learning performances, particularly in relation to how textual information is processed and memorised. Such research could impact upon the design of e-learning programmes and the ability of their users to develop their own learning strategies in new and innovative ways.

7.1.6 Introducing blended approaches to e-learning

Evidence from this research indicates that the participants would like to have had greater access to different blends of e-learning that could accommodate their preferred learning styles. The tested VLE contained elements of blended learning, but not enough to maintain the participants' interest in the learning environment. Participants complained about the lack of flexibility of the learning objects (ECDL and e-business courses) and the limited use of online communication tools (i.e. the discussion board and learning diary), which they believed reduced their learning experience to mere mechanical learning of facts and figures. They felt a sense of
'frustration and disappointment' because of the lack of 'teaching and social presence' (Garrison and Anderson, 2004). A small number of participants who had little experience of e-learning advocated the addition of more combinations of media blends (both audio and video) with e-learning activities. Older-aged participants, particularly, wished for online discussions with tutors. Arbaugh (2000), in a study of Internet-based MBA courses, found that perceived usefulness and flexibility of the VLE were positively associated with student satisfaction with the course. The lack of inter-activity on this VLE could have had a negative impact on how the participants perceived the online learning materials, although, in this case, the quality of learning materials were unsatisfactory and had to be reviewed.

Blended learning can be considered as a first stage toward the full adoption of e-learning for visually impaired people, as it seems less threatening than a complete transition to fully online or fully computer-mediated courses. This approach suits learners who prefer to have face-to-face exchanges with a tutor; however, this learning is 'wrapped around' (Littlejohn and Pegler, 2007) online resources, such as discussion boards or a collaborative wiki tool (an online resource that allows users to add and edit content collectively). Both the pedagogical perspectives of the course provider and the learning preferences of its learners could inform the proportion of online interaction against the amount of face-to-face interaction.

There is a danger, observed in this research, that some visually impaired learners could become over-dependent on one learning technology to the neglect of others, relegating the e-learning activity to a simple delivery of information. Yet e-learning may be the only solution for learners who live in remote areas and are unable to travel to meet tutors or attend lecturers. One participant lived on an isolated island off the West Coast of Ireland and had little chance of leaving the island for face-to-face training.

I find I can't do without the Internet. Living on an island has isolated me physically from my friends and family, but the Internet has helped me to stay in touch more frequently than when I visited them (extract from an interview with Ed).
E-learning is used solely in large countries where great distances separate institutions from their students and where weather conditions hinder long-distance travel. Both Australia (Deakin and Monash Universities) and Canada (Athabasca University) offer e-learning without face-to-face teaching. Using e-learning solely may be the only solution for some visually impaired people who cannot travel. However, evidence from this study shows that other free external e-learning communication tools, such as Skype and e-voice conferencing, could be used to enhance participants' learning experiences.

I think there are some basic things that web-designers can do to make e-learning a much better experience. Something like putting clearly-indicated links in the body of the text that tell the reader to go here. I get annoyed when the 'hyper-link' tells me very little about where I'm going to. I don't really know much about other e-learning courses, but the one we tested still needs some work doing to it to make the course successful (extract taken from interview with David).

An important part of an e-learning policy is to ensure that those who are most disadvantaged should be prioritised to receive the most up-to-date technology for e-learning access. The possibilities are endless when we consider the different flexibilities of blended learning for the visually impaired community today. The successful implementation of this type of learning requires efficient support structures that meet the satisfaction, self-efficacy and academic performance of this group of learners. At the same time, the fast pace of change in this area, coupled with the different complex needs of learners with blindness and low vision, makes it challenging for pedagogues and website designers to offer quality and effective support. The visually impaired community in this study have demonstrated that they are ready to engage in blended e-learning. It is now the turn of those who are able to restructure existing e-learning courses and materials to plan ways for this community to engage in blended e-learning activities.
7.1.7 Identifying other factors that affect accessibility to e-learning

As technology becomes more sophisticated, planners and designers of e-learning materials must heed the experience of the visually impaired, such as those in this study. The use of more graphically oriented materials, for example, often limits or prohibits accessibility for the visually impaired. Flash-based plug-ins used to create animated messages and other aesthetically pleasing visuals are attractive to sighted users but often useless to blind users. Recent legislation (Disability Act, 2005) should help to reduce the volume of inaccessible websites. In spite of new policy that enforces website developers to comply with WAI guidelines, some may choose only to provide alternative text-only versions and not consider multi-media alternatives that could be presented in more accessible ways.

Even if the technology is in place to enable access to the visually impaired, there is still no guarantee that they will be able to learn with it. This study illustrated that participants who were technically ready for e-learning were ‘frustrated and disappointed’ with the low level of pedagogical support. The literature on e-learning and learning theories clearly states the need for a strong teaching presence to help students to co-construct knowledge with their peers (Garrison and Anderson, 2003; Riel and Polin, 2004).

As discussed earlier, participants in this study were ready to engage in the different activities associated with e-learning (such as using learning objects, discussing learning with peers and sharing personal diaries). One of the biggest challenges for visually impaired students is to be able to use these activities effectively and within a reasonable time frame. In one sense, these participants were able to enjoy using a VLE that was specifically designed for them. They did not experience the pressures of having to complete learning tasks and assignments in the same timeframe as sighted learners. In a comparative study of sighted and blind students in the UK, Evans and Douglas (2008) discovered that blind students took twice as long as sighted participants on a task and fared less well on the learning performance. The blind participants were still as satisfied as the sighted students with the experience of using the e-learning materials, in spite of the apparent barriers to learning. It would
seem irresponsible of pedagogues and web designers to ignore the needs of this sector of the marketplace (i.e. the visually impaired).

Finally, this study shows that visually impaired e-learners require more human (i.e. the teacher) support in accessing and using learning materials. Three participants expressed a desire to have more face-to-face contact with tutors on a regular basis. Two learners who received regular teaching through face-to-face exchanges became better able to apply newly acquired skills to more complex learning experiences where they can develop more critical thinking skills associated with e-learning. They testified that they would not have been able to participate in any of the online courses unless they had face-to-face human support. One of the two placed such enormous value on the learning support she received that she has begun to alter the ways she learns in general. She was able to mediate with peers and her tutor to explore how she should best approach e-learning. Many of the participants felt a strong sense of community in wishing to share their knowledge with others. Some participants were able to leave their own 'imprint' by sharing their experiences through mediation with other people who were experiencing similar problems and could empathise. Towards the end of the study, participants started talking about their 'community' and how they would like to take ownership of it by creating and contributing their own learning objects or multi-media materials (such as audio stories). This is the result of a multi-vocal process whereby the participants were encouraged to contribute their ideas to the creation of new learning resources (Holmes and Gardner, 2006).

7.2 Summary

The pilot study has successfully shown that it is technically possible to develop an inclusive learning environment that can be accessed by visually impaired people with the support of assistive technology. Problems arose from the way the learning materials had been developed and loaded onto the website. In practical terms, tutors and e-learning designers should continue to think carefully about the technical accessibility of their materials and constantly explore ways of refining and updating them to optimise the learning experiences of learners who are visually impaired.
This discussion highlighted some areas where the VLE was successful and some areas where it was less successful. There is evidence that an inclusive approach to the design and delivery of the research could have led to a virtual learning environment that was completely accessible to all the participants, (both blind and low vision). Through a three-stage collaborative process, we were able to identify areas within an inclusive design that could enhance the learning experiences of visually impaired people. Collaboratively, the peer-reference group and co-researchers were able to decide on a set of principles that could be tested on a prototype VLE. These principles proved to be extremely useful in measuring the impact of the tested VLE against the larger agenda issues affecting equal access to learning using technology.

A summary of the main technical and pedagogical issues are summarised in light of the inclusive principles proposed in chapter five:

- VLEs that are built to the highest level of the WAI Guidelines (AAA) can enhance the learning potential of visually impaired people. Adherence to principles of universal design can help prevent major pitfalls in design. Various usability tests with different types of screen-reader can increase levels of accessibility and can identify any problems in course design. Websites that have predictable and easy to understand layouts could reduce the time spent on navigating webpages and allow more time for learning. Reduced use of graphical displays could also decrease levels of inaccessibility and help visually impaired learners complete all e-learning tasks.

- High quality technical training should be provided to both e-learning tutors and visually impaired learners on how to use screen-readers with the Internet. Learners who do not have the basic skills on how to use screen-readers risk missing new opportunities of experiencing e-learning. A good basis of how to use assistive technology should result in higher levels of confidence and self-esteem for visually impaired learners.

- The introduction of new mobile technologies to e-learning platforms could help to reduce levels of dependency on assistive technology. All new media would need to be available in different formats that are completely accessible to screen-
readers. Visually impaired learners should have access to the same quality learning materials as their sighted peers on the same e-learning platform.

- E-learning pedagogues and website developers should explore ways of developing e-learning content in ways that increase active learning through constructivist learning principles fostering the development of critical thinking skills and enquiry-based learning.

The next section discusses how the emancipatory framework adopted for the research led to the above findings. It will be argued that this framework was instrumental in obtaining the views, opinions and perspectives of the participants and the co-researchers.

7.3 Part Two: Review of emancipatory framework

This part of the chapter critically reviews the framework used to conduct the different stages of the research. It evaluates whether the adopted emancipatory strategy managed to relocate the research away from more traditional approaches to a more engaged approach. The following sections reflect on the collaboration of the co-researchers and how this led to a study based on informed choices and the sharing of skills and experience in the field of e-learning and assistive technology. It also measures the impact of our (the co-researchers) interpretation of emancipatory research against six principles identified by Stone and Priestley (1996). Even though these principles are more than a decade old, they are still relevant to the discourse around the social model of, and research, into disability. This section considers how emancipatory research fits within the Irish context.

The following themes are considered before discussing the larger issues resulting from the research as a whole:

- The effects of the emancipatory disability research approach taken in the study;
7.3.1 The effects of the emancipatory disability research taken in the study

The decision to adopt an emancipatory approach was based on a deliberate effort to include the perspectives of the people being researched. This effort ensured that the issues of accessibility in e-learning were addressed most thoroughly by collaborating with the actual users, mainly through discourse, the sharing of personal experiences and finally the testing of these principles in a pilot study. The research represents a shift away from a more traditional 'top-down' approach, which often consists of retrofitting or adding on new functionalities after consulting disabled users to a 'bottom-up' approach, which in this case involved a small number of visually impaired people (co-researchers) in the construction, review and amendment of inclusive policy (Roulstone, 1998; Shakespeare, 2002; Barnes, 1997). The collaboration met this expectation, demonstrating how the flexibility and rigour of an emancipatory framework enforces inclusive principles.

Advocators of emancipatory disability research have expressed their disappointment in both the quantity and quality of emancipatory projects in areas of sensory impairment in the past (Finkelstein 1980; Walmsley, 2001; Duckett and Pratt, 2001). This project sought, in part, to redress the lack of emancipatory research with visually impaired people in Ireland. In so doing, it shifted away from more traditional approaches to a more engaged approach. To make this shift viable, careful negotiations with the visually impaired community ensued, a process that took considerable time. Perhaps the principal challenge was to build a strong partnership, one that would ensure the trust of those sharing their personal experiences to the benefit of the researcher and ultimately to the wider public.
This process transformed the relations of research production, avoiding any possible alienation and mistrust from the research participants when conducting interviews and round-table discussions. The results provided a clearer view of how visually impaired people used technology to e-learn and how they also struggled with technology to access e-learning environments.

It was important to also consider what would have happened if we had not used an emancipatory approach. Disability research that does not involve disabled people is vulnerable to the criticism of those groups the research is aiming to help. Lewis et al. (2008) argue that it is 'not tenable to undertake research that aims to impact on the lives of disabled people without involving disabled people themselves' (p.82). If an emancipatory approach was not used, we would have faced problems of accountability. If the research had not included the voices of the researched group, it would have been extremely difficult to make any real claims about its effects.

I found that to enable an effective coalition, I had to establish a reciprocal relationship in which I, as principal researcher, was informed by co-researchers but was also able to impart my knowledge and skills to the co-researchers. These skills included specific technical advice that helped participants make informed choices. I found myself in a privileged position, built on mutual trust and respect for each other's views, perspectives and opinions. The relationships that developed throughout the lifetime of the study have continued beyond the conclusion of the project. I am still in contact with all three co-researchers. Two of them still provide technical advice on how to ensure maximum accessibility of e-learning materials and multi-media on large e-learning platforms such as WebCT.

The dialogue between principal and co-researchers involved continual access to the co-researchers' perspectives and understanding of the evolving data. This was achieved through a spiralling of data, co-researcher interpretations and then the scrutiny of more data. As a result, the co-researchers were able to elucidate why certain results from the quantitative data showed anomalies or peculiarities.
The role of co-researchers

The introduction of a peer reference group was based on a recommendation from the stakeholders. The reference group effectively shifted the focus of the project away from merely a discussion about e-learning materials to a dialogue about accessing learning on a VLE. The group's main task was to critically assess the quantitative data and to identify key areas that could be tested if an opportunity arose to develop an inclusive learning environment for visually impaired adults.

Over the course of the research process, the three co-researchers and I (the lead researcher) established a close working partnership. This process compelled me to take on a mediation role. I became more aware of the co-researcher's struggle and was able to somehow empathise with them. I also facilitated the evolution of the process, such as offering to make contact with stakeholders and participants at the appropriate time and intervene whenever I felt the research was not moving forward.

It was also important for me to think about the consequences of such a high level of personal contact with visually impaired people upon the research effort. I had to be careful not to raise any expectations that the project might lead my collaborators to more opportunities in research. I had to be clear that this enquiry was purely exploratory and was not designed to engage visually impaired people on a contractual basis. My efforts to do so were greatly facilitated by the National Council of the Blind, Ireland (NCBI) who helped with the logistical arrangements of the research.

When recruiting members for the peer reference group and the co-researcher group, the NCBI considered how the results from the research could benefit them in other ways. This is a recommendation made by Lewis et al. (2008) when they carried out research for the Disability Rights Commission (DRC). It was important that those who participated in the research at all levels could benefit in some way, either through skills development or increasing confidence to seek other employment opportunities. The research process provided Nicky with new opportunities to learn more about himself and his own capabilities to increase his knowledge of and confidence in
conducting research. While at times destabilising for him, the experience had a positive impact on how he perceived himself as a researcher.

I have never done anything like this before. It was a breath of fresh air from my boring job [as a switchboard operator]. I wish I could do something more interesting and challenging. I get frustrated travelling to the same job and doing the thing over and over again (extract taken from co-researcher interview with Nicky).

Stuart, who worked for the NCBI, had more at stake by participating as co-researcher. As a member of the funded team, who developed the VLE and e-learning materials, he found himself in a particularly vulnerable position, concerned about the duality of his role and how he could move between being a co-researcher and a member of the funded project without experiencing personal or professional difficulties. This duality proved not to cause too many problems and in some respects was advantageous to him. Stuart was able to use his role as co-researcher to help influence the way the prototype VLE was iterated and later tested. While the dual role was successful in this research, it could be problematic for other co-researchers in future research. The dual role might prove to be difficult to manage, particularly if the research findings were critical of the way their organisation carried out the research.

7.3.3 A comparison of this study against six principles of emancipatory research

The final step of this section takes the key findings from the co-researchers' focus group interview as well as the research procedures and compares them with an emancipatory research paradigm developed by Stone and Priestley at the Disability Research Unit, University of Leeds. The reason for choosing this paradigm is to provide a way of measuring the impact of a small piece of research against the wider context of disability research. Stone and Priestley (1996) identified six principles of emancipatory research based on their own research. They use the strong term of 'parasites' to refer to researchers who exclude disabled people from the research process and lead to their 'isolation and alienation' (Oliver, 2006). The six key
principles of emancipatory research implicate the theory, the goals of research and the research practice:

- The adoption of a social model of disablement as the epistemological basis for research production.
- The surrender of claims to objectivity through overt political commitment to the struggles of disabled people for self-emancipation.
- The willingness only to undertake research where it will be of practical benefit to the self-empowerment of disabled people and/or the removal of disabling barriers.
- The evolution of control over research production to ensure full accountability to disabled people and their organisations.
- Giving voice to the 'personal as political' whilst endeavouring to collectivise the political commonality of individual experiences.
- The willingness to adopt a plurality of methods for data collection and analysis in response to the changing needs of disabled people.

These challenges will be briefly discussed in turn by problematising the methodological aspects of our work in relation to the principles of our research.

This research made a strong statement by framing the three-stage enquiry process within a social model framework of inclusive research. The epistemological 'standpoint' of disabled theorists (Finkelstein, 1980; Oliver, 1990) sees a shift from models adopted by positivist theorists who cast themselves as 'experts' to one which focuses on the identification and removal of disabling physical and social barriers. This research took the theme of technology and visual impairment and explored how new technological developments helped or impeded access to the new technology with the help of visually impaired people, many of whom were committed technology users. The research was therefore situated within the social model paradigm, although it was opposed to squeezing the global experiences of disabled people within one unitary model or set of ideas. I am of the view that we should engage in empirical investigations with disabled people and with the policy issues facing the disability community at different levels. I would therefore favour new conceptual
interpretations of the social model which look at the historical-materialist version of the social interpretation of disability supported by Finkelstein (2001) which does not consider 'disabled people' as the subject matter but more the 'disablement' i.e. the social oppression of people with impairments, as the subject matter.

The second principle is clearly related to emancipatory disability research which encourages the opinions, views and perspectives of the visually impaired by consulting with them in different meetings and fora. These consultations led to a series of recommendations and finally some inclusive principles that served as a test-bed for a pilot study led predominantly by visually impaired people. Furthermore, I did not 'sit comfortably within the academy' (Stone and Priestley, 1996, p.5) but engaged, as far as possible, with the visually impaired community and invited them to enter a dialogue which would lead to a set of inclusive principles that were established by the co-researchers.

The third and fourth principles relate to the relevance and benefit of the research to the visually impaired and whether there was 'anything in it for them' (Stone and Priestley, 1996, p.6). It is difficult to assess whether I was able to emancipate the group in the same sense as these principles suggest, but the process of identifying issues and concerns that mattered to visually impaired people was paramount. It was important to recognise the visually impaired as 'experts' which, in turn, helped to reverse the research hierarchy by increasing their role as active participants and not as 'passive research subjects' (Abberley, 1987). The term 'relevance' is open to different interpretations but if we keep in line with the social or interpretive models, relevance means the identification and removal of disabling social and physical barriers. The adopted framework led to the construction of a 'peer reference group' which was able to identify 'relevant' issues where technical and social barriers were hindering access to e-learning environments for the visually impaired community. It was also able to identify, through a pilot study, potential areas where specific adaptations to a VLE supported by blended e-learning could be potentially beneficial to visually impaired computer users. This small-scale study was able to increase the role of the visually impaired co-researchers by creating a space for them to share their experiences. This yielded authentic new perspectives and ideas on exploring
mechanisms through which inclusive principles to promoting technology could be applied and tested.

The fifth principle of personalising the political and politicising the personal is the most contentious in disability research. In a sense, this research provided a space for visually impaired people to frame their research and analyse the way it was carried out. It was possible to collectivise some of the participants' experiences with the help of the chosen methods, but at the same time it managed to acknowledge individual realities through interviews with all of the participants. In this way, the research was able to recognise both commonality and difference in the experience of disablement. This research brought about change in our knowledge about how visually impaired people use technology to learn and also a change in those who carried out the research.

The sixth principle, which is related to the plurality of methods for data collection and analysis, responds to the changing needs of disabled people. Stone and Priestley believe it is problematic to associate emancipatory research with qualitative data. The main problem is not the qualitative nature of the data but the theoretical paradigm which guides its collection and analysis. Abberley (1987) argues that if a social model of disability is to be incorporated into disability research, then large scale and detailed empirical work needs to be carried out on what he states as the material conditions of disablement. Barnes (2006) advocates the use of qualitative and quantitative data within the emancipatory approach. This research took a less ambivalent approach to deciding on which methods to use by identifying the central issues and hence the research questions which led to the decision to use a mixture of a quantitative method (questionnaire) and qualitative methods (interviews and round-table discussions).

This comparison has problematised my role in relation to the six identified principles in an attempt to link the conditions of emancipatory research to this research. A further principle that should also be discussed is related to the extent that this research satisfies the demands of academic rigour by ensuring the data are valid and reliable. This issue is discussed in the next section. Finally, Stone and Priestley argue that it is possible to achieve academic rigour but there is also a further aim of
promoting a political campaign for emancipation and equality. This research has endeavoured to take two goals (emancipatory research and satisfying academic rigour) that have been held as inherently conflicting and find ways to reconcile the two.

7.3.4 Emancipatory research within the Irish context

This research was designed at a time when there was much discussion around the drafting of the two prominent Disability Acts in Ireland: the Disability Act 2005 and the EPSEN Act 2004. Both acts were undergoing revisions based on consultations with national disability organisations and special interest groups representing disabled groups in Ireland. The visually impaired community had been quite critical about how far their views and opinions were being listened to by the government. It was therefore a sensitive time to ask those who were disappointed with previous consultations on disability to enter into a new dialogue about issues that were not being sufficiently addressed by legislators. It was, however, a good opportunity to take some of these ripe issues around technology and accessibility and try to turn their issues into areas for discussion and possible action.

The National Disability Authority (NDA) has been extremely supportive of emancipatory research and has even published a series of conference papers (2002) advocating its use in Ireland. It was immensely gratifying to know that the NDA supported inclusive paradigms that increased the participation of disabled people. The social model and emancipatory research have been interpreted by feminists and disabled women mainly through small case-study perspectives through work at the Equality Studies Centre, University College Dublin. Ireland is still in the process of understanding its own social history in relation to the lived experiences of disabled people over the past hundred years. It will take a number of years before it can claim to have its own set of interpretations based on Irish people’s experiences of disability.

The NDA has a strong hold of disability research in Ireland today, with a significant proportion of its work involved in commissioning research. Kitchin (2002) argues that Ireland is still developing its own agenda in terms of generating research that is
inclusive, emancipatory and empowering. He believes that, over time, inclusive research in Ireland will transform disability research and 'help empower those that undertake the research and the wider disabled community' (p.54). The research process I was involved in helped to transform disability research in Ireland by encouraging a small group of visually impaired people to take a role in the design and delivery of a small piece of research. What was particularly original about this research was the high level of commitment that came from all the stakeholders (organisations representing the interests of the visually impaired) who were directly and indirectly affected by issues that came out of baseline data during the initial stage of the enquiry process. It is now important to explore new research opportunities that could build on this foundation through the direct involvement of visually impaired people.

7.3.5 The limitations of adopting an emancipatory approach

My position is both epistemological in acknowledging that marginalised groups have specific knowledge of their own lives and for my part, having strong values and commitments on my part. This position is introduced in chapter one (section 1.5.1) and explored throughout chapter three.

I have tackled the problem of possible researcher bias by endeavouring to make explicit the ways in which I, as a researcher, may have influenced the way the research is represented and conceptualised. My own background, values, epistemological position, personality and motives have inevitably influenced the nature, foci and methodologies.

This research was based on my belief that visually impaired people could engage in e-learning provided that they had appropriate training to support their learning needs. This approach explored relevant issues for visually impaired people through informal partnerships with different stakeholders involved in the development and implementation of ICT training for visually impaired learners across Ireland. As part of my commitment to the emancipatory paradigm, I consulted the main groups and individuals including special interest group (VICS) and the national NGO for the blind in Ireland (NCBI) and shared the findings with them.
One of the biggest challenges of this research was finding an equal research relationship given its nature as doctoral research. I was primarily based in an academic institute, located in a different part of the country and in a different geographical location from the three co-researchers. It was therefore difficult to spend long periods of time with the other members of the research team to develop the research design. Shakespeare (1997) claimed that it is ultimately impossible to have an equal research relationship with those who are the subject of research, due to the nature of the research culture. Decision-making power is often presumed a requirement for a doctoral study (Katsui & Koistinen, 2008) creating extra challenges when applying a participatory approach, which (by definition) involves giving, or at minimum sharing, power with, and control to, the research participants. I experienced some of the constraints of being located in a research culture that does not have a tradition of participatory approaches in which those most affected by the issues are actively involved in the various research components.

A doctoral student is, traditionally speaking, expected to carry out an empirical piece of research located within an academic discipline and written according to generally accepted conventions (i.e. use of academic language, knowledge of the literature and theoretical frameworks, and an ability to use research methods appropriately). It was a challenge to find the right balance to achieve the academic rigour of demonstrating researcher impartiality and ensuring that the organisations and individuals I worked with felt comfortable with someone pursuing a research degree. I had to ensure the chosen research methods and their implementation was effectively carried out within the parameters of empirical research.

Even though the co-researchers were invited to play an active role, they had little or no previous experience in research. In retrospect, reflecting on this process, it would have been helpful to build in more preparatory work to ‘induct’ the ‘co-researchers’ into some of the essentials of conducting research. How this might be organised within a doctoral programme without extra funding, is a difficult judgement. It could be built into future research in which an emancipatory or participatory model is applied. I had to make key decisions about how the data should be entered on to the database and later analysed. The first coding was carried out by me, but all phrases and
statements were shared with the other researchers for their analysis and interpretation. This process took a considerable amount of time as data had to be rendered into accessible formats for the visually impaired researchers to read. There was a potential threat that this process could have reduced the quality of the data, but this was considered to be the most appropriate solution given the other researchers' inexperience in using qualitative software. Furthermore, an independent rater, who had had no direct contact with the research but was an experienced researcher and familiar with the field of special educational needs, was invited to code a sub sample (30%) of questionnaire transcripts independently (see chapter five).

With respect to the eight ACE participants who participated in the research – they were given a full briefing of the research (see section on Ethical issues and consent, section 4.4 and the letter of invitation in Appendix E) stating that it was for a research degree. All the participants signed a consent form agreeing to participate in the research as a result of an information meeting about the research. The main challenge for me, as the primary researcher was to seek opportunities to engage in activities that involved participants (e.g. shared decision-making) throughout the research process and work within the constraints of the research design of emancipatory research. This does not mean that I avoided issues pertaining to emancipation, but I recognised that 'ideal' approaches are tempered by 'real world' considerations.

A key question to ask at this stage is how far was this research emancipatory? In other words, how far did the research empower the visually impaired participants or co-researchers? In one sense, the research had already started before either the co-researchers or project participants were invited to take part. I had some conceptualisation of how the enquiry process would proceed and was conscious of the need to evolve the research into an empirical study. By conducting the initial stages of the research (i.e. formulation of research questions, choice of research tools) without the involvement of the visually impaired, I have not, according to Gollop's (1989) three fundamentals (i.e. reciprocity, gain and empowerment) fully met the conditions of emancipatory research. Furthermore, the immediate goals of the peer reference group and co-researchers were not necessarily the same as mine throughout the research process. In one respect, the partnership helped me to
produce some key findings about how visually impaired people use technology, but this may not have been the reason why the three volunteers agreed to join. Stuart, for instance, enjoyed the experience, mainly because it was more inclusive than what he had been already doing. He was aware of how much he was enjoying the work, mainly as a result of the friendly, relaxed and non-threatening space that had been created by the group. Nicky, felt empowered at the end of the process, but he was feeling disillusioned about his own work at the time. Could this approach have caused additional harm to what he was already experiencing through his work? It is difficult to answer this question, but researchers should be cognisant of the risks involved in inviting disabled people to take a co-research role in a study that could potentially be unsettling for them.

Reflecting on the outcomes from this research compared with the various definitions of emancipatory research (Walmsley, 2006; Barnes & Mercer, 1997; Oliver, 1992; Zarb, 1992), it would be more appropriate to say that this study was more participatory then emancipatory research. Having made this revelation, it does not reduce the validity of the research as it served as a useful framework. It was a strong intention to develop a reciprocal relationship between myself and the ‘research subjects’. The emancipatory framework was useful in building informal and then more formal consultations with the different stakeholders (see chapter 3, section 3.3). This research endeavoured to fulfil some of the conditions of this approach by planning and designing the study with the active involvement of a small number of visually impaired people. Reflecting on this whole process, it would perhaps be easier if the research participants in the pilot project were invited to take more of an active role in the design and delivery of the research. This supposition could be explored in new research led by the charity sector e.g. Joseph Rowntree Foundation, where the ‘research subjects’ are encouraged to take a lead in framing the research.

7.4 Authenticity of the research

It is useful in research to reflect on the underlying reality rather than simply the interpretations of the researcher. How can a researcher be sure of dealing with the weaknesses inherent in the chosen approach? Earlier, I tried to address this issue by taking six principles aligned with emancipatory research and measuring them against
the interpretation of the lead researcher. Johnson (1999) believes the trustworthiness in qualitative research depends on the concepts of 'credibility, dependability and transferability' (p.186). If someone else had conducted the same research would they have reached the same conclusions? Johnson argues that qualitative researchers should never make the claim that a study is totally replicable since to repeat it would constitute a different piece of work. One method of tackling the problem of 'indexicality', the notion that a representation is always linked to a particular time or setting and will change as settings and situations change, is to link the data to a framework. The framework in this case, emancipatory research, has helped to relate the data findings from the three stages to the documentary evidence from the co-researchers. I have made great efforts to present the findings as clearly as possible using verbatim citations from the group discussions and the interviews. Throughout the process I have been informed by the responses of the other co-researchers. Furthermore, my interpretation of events has changed over the study period and has provided sufficient perspectives to allow for a description which justifies the conclusions.

In the literature review I have highlighted the major issues and how they are related to the research aim of examining the potential of virtual learning environments for visually impaired people. I have also demonstrated how a research strategy can be committed to working with visually impaired people from the sharing of new ideas to the co-development and delivery of an empirical study. My expectation is that the people I worked with in this research will take some of this collaborative experience and seek new opportunities of co-constructing further research in the field of e-learning and visual impairment or other social agendas that affect them.

The concept of reflexivity has played an important part in this research and has been made explicit throughout my writing, as a researcher. I have spent about twenty years working as a practitioner and academic with disabled children and people in the UK and Ireland. These years have provided me with the background and motives to pursue this research with the support of disabled people. Furthermore, this research has shaped my thinking and will continue to inform my work in the future.
New technology is increasingly changing the lives of visually impaired people. Recent developments in assistive technology, particularly screen-reading, have become indispensable to the visually impaired community. The singer, Stevie Wonder, a strong advocate of assistive technology, testifies to the remarkable changes that have taken place over the past years but feels much more still needs to be done to encourage all manufacturers to produce products that are accessible to all.

The reality is, definitely between 20 years ago and now things are far better, I think; just as to having access to information, being able to read books, electronic braille and digital information that's accessible has made things far easier for a blind person (extracted from an interview between the editor of BBC 'Click' and Stevie Wonder, 2009).

7.5 Recommendations for future research

The pace of change in the field of e-learning is moving so fast that already there needs to be new research on the impact of this learning for visually impaired people. One potentially interesting area of new research would be to conduct a study which explores ways of developing and testing emerging new mobile technologies and multimedia e-learning materials for visually impaired learners.

An important outcome from this research was the importance participants placed on being able to better understand the design or layout of a website. It was suggested that additional help could be provided by developing and uploading course materials that are easy for screen-readers to navigate in non-serial ways (i.e. following the design of the course rather than systematically following tables and frames within a webpage itself). New features such as audio programmes or haptics (or both) could be introduced to help visually impaired learners access and engage with e-learning materials more successfully.

One argument, in this research, was to explore a broader approach to the provision of accessible e-learning environments by taking a more holistic approach to the development of e-learning resources which are tailored for the learner's individual
needs and their local cultural and social factors (Phipps and Kelly, 2006). New research could explore ways of refining the Phipps and Kelly model and to provide some examples of how it could be applied to blended e-learning for visually impaired learners.
7.6 Wider issues resulting from the research

This final section highlights some of the issues that have emerged and have wider implications for how visually impaired people could use technology to learn and communicate more effectively. These are areas that could be changed or adapted to increase the learning and communication successes of visually impaired people and foster the same level of enjoyment and benefits that e-learning offers sighted learners.

E-learning for the visually impaired

This research has identified a number of key areas that could be addressed by e-learning website designers and pedagogues to promote more inclusive learning environments for visually impaired adults.

1. Ensure visually impaired people have access to required software and equipment.
2. Ensure technical training on how to use assistive technology and how to apply it to the Internet.
3. Develop and test learning materials that maximise time on e-learning and reduce time on searching and accessing e-learning materials.
4. Explore new opportunities of integrating mobile technologies and personalised learning for visually impaired learners.
5. Adopt new blended approaches that enhance more flexible learning for the visually impaired learner.
6. Consider new radical solutions including alternative methods and multi-media for learning and teaching.
7. Develop e-communities that promote the building and sharing of learning through constructivist principles.
8. Explore new participatory approaches that encourage the continual development and testing of e-learning for the visually impaired.
Ensure visually impaired people have access to required software and equipment

Visually impaired people need to have the most appropriate and up-to-date assistive technology (screen-readers or magnifiers), computer equipment (e.g. refreshable braille displays) and internet connectivity. Being able to access information and communication facilities, on a par with sighted peers, is important for the visually impaired community.

Ensure technical training on how to use assistive technology and how to apply it to the Internet and e-learning

As new learning opportunities are hosted on the Internet, visually impaired people should be taken into account. They have a range of needs when it comes to accessing information, and targeted training courses in how to use assistive technology are imperative. Quality training on how to use screen-readers can enhance the learning and communication opportunities of visually impaired learners.

Develop and test learning materials that maximise time on e-learning and reduce time on searching and accessing e-learning materials

Advances in new technology are making it easier to meet the needs of individual learners. Learning materials should be structured so that visually impaired learners can easily access them and spend maximum time on actual learning tasks and not on searching for learning materials. Some frustrations can be reduced by following good design principles, such as the Web Accessibility Initiative (WAI), but pedagogical solutions can help in terms of designing and presenting learning materials in accessible ways.

Explore new opportunities of integrating mobile technologies and personalised learning for the visually impaired learner.

Visually impaired people are benefiting from new mobile technologies. Many of these technologies are portable and multi-purpose. There are also online Office tools that
can be used for social and communication purposes including wikis, blogs and discussion forums. Current trends in knowledge creation combined with increasing availability of low cost mobile technologies extend the potential of personalised learning for visually impaired learners.

**Adopt new blended approaches that enhance more flexible learning for the visually impaired learner**

Visually impaired learners are increasingly aware of the different modalities available within electronic learning environments. They are interested in being able to participate in more flexible learning activities, using different e-learning blends. Accessible virtual learning environments can offer quick and simple ways of using e-tools for online and blended learning. They can also offer visually impaired students personalised course information and access to learning resources. Visually impaired learners should be invited to contribute to the creation, adaptation and delivery of new learning materials. These materials should not be exclusively used by visually impaired students but should be available for all learners.

**Consider new radical solutions including alternative methods and multi-media for learning and teaching**

New initiatives in designing and promoting e-learning are increasingly more attractive to visually impaired students who wish to access the same learning materials, at the same place and at the same time as their sighted peers. The increase use of satellite technologies in telecommunications now means that even the most isolated students can access the Internet using mobile phones. The compact, and increasingly powerful, design of PDAs and notebook computers also means that tutors and students can undertake learning and teaching activities between classes and at home. The opportunities are endless, but they need to be based on solid principles of inclusion leading to an increase in the quality of the learning experiences of the visually impaired learner.

**Develop e-communities that promote the building and sharing of learning through constructivist principles**
Initiatives that encourage the participation of visually impaired people in the development and testing of online learning materials can empower learners. This is based on the premise that visually impaired individuals are the 'experts' in knowing about their impairment and are able to identify potential solutions based on their personal experiences of using technology in the past. An electronic community should ensure that learners can easily avail themselves of the support of their peers. This is at the heart of the provision and should contribute to the success of learning in the future. E-learning should provide visually impaired learners and all learners with the opportunity to reinvest in learning through the promotion of learning and the sharing of newly acquired knowledge in new ways.

**Explore new participatory approaches that encourage the continual development and testing of e-learning for the visually impaired**

New research into e-learning for the visually impaired should be grounded in informed epistemological understandings of what inclusive research is about. Inclusive research comes from the participation of those who are directly involved in the issues that affect the visually impaired. The transformative nature of emancipatory research means that it is difficult to replicate the research but the aims are the same: barrier removal and the promotion of disabled people's individual and collective empowerment. It is the role of the researcher to help facilitate these goals through the research process.

**Final comment**

This research has made a small contribution to the realm of emancipatory disability research in Ireland. It comes at a time when Irish people are becoming more aware of their historical and social past. The Irish government has been spending the past ten years reviewing studies on disability outside of Ireland. Statutory bodies, such as the National Disability Authority and the National Council for Special Education, are spearheading research into disability and special educational needs in Ireland which is a positive move. We need to strive for more research that ensures full
accountability, and more positively strives to be emancipatory to disabled people and their organisations.
References


- 262 -


- 264 -


Habraken, J. (1986) 'Towards a new professional role,' *Design studies*, 7 (3).


Lynch, P., Holmes, B. and Lawler, S. (2005) ‘The blind leading the blind: how the vision-impaired community are using a virtual learning environment to build and


- 283 -


## Appendix A - Research and ACE Project Timelines

<table>
<thead>
<tr>
<th>Year</th>
<th>Jan – Feb</th>
<th>March</th>
<th>Apr</th>
<th>May – July</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Research Degree:</strong> Stage One</td>
<td>Design of questionnaires and collection of data</td>
<td>Analysis of data</td>
<td>Stakeholders' workshop</td>
<td>Advertising and recruiting of peer reference group</td>
</tr>
<tr>
<td><strong>ACE Project</strong></td>
<td>Planning and design of VLE</td>
<td>Development and testing of VLE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>Aug – Sept</th>
<th>Oct – Dec</th>
</tr>
</thead>
</table>
| **Stage Two** | Peer reference group meetings (total no.4) | - Analysis of results and scoping for a pilot study  
- Review of VLE and e-learning courses |
| **ACE Project** | Awareness building and recruitment of participants | Development and testing of e-learning materials |

<table>
<thead>
<tr>
<th>Year</th>
<th>Jan – Feb</th>
<th>March</th>
<th>April</th>
<th>May – July</th>
<th>Aug</th>
<th>Sept – Oct</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stage Three</strong></td>
<td>Co-design of research tools for the pilot study</td>
<td>First set of interviews</td>
<td>First round-table discussion</td>
<td>First Data analysis</td>
<td>Second round-table discussion</td>
<td>Second set of interviews with participants and final data analysis</td>
</tr>
<tr>
<td><strong>ACE Project</strong></td>
<td>First testing period of VLE</td>
<td>Re-development of VLE</td>
<td>Second testing period of VLE</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix B – Telephone Questionnaire Schedule

Telephone Questionnaire Schedule

Name: ____________________________________________________________

Date: ____________

e-mail address: __________________________________________________

1. How often do you use a computer?
   - Every day □
   - Several times a week □
   - At least once a week □
   - At least once every two weeks □
   - At least once a month □
   - Don't use/never use □

2. Where do you use a computer?
   - Home □
   - Work □
   - Other ______________________________

3. What stops or prevents the respondent to use a computer (more often)?
   - Computer is too expensive.
   - Old PC needs changing.
   - Can't afford to change it.
   - No training to help me improve my skills.

4. What do you use computers for?
   - Word-processing □
   - Sending and receiving emails □
   - Internet □
   - Spreadsheets □
   - Databases □
   - Other ___________________________________

5. What screen-reading software do you use, if any?
   - Window Eyes □
   - Hal □
   - Jaws □
   - Supernova □
   - Zoomtext □
   - Other ___________________________________

6. Why do you use this software?
   - JAWS is better with the Internet.
7. Would you prefer different screen-reading/magnifying software from the one you are currently using?  

8. Have you received training on how to use your computer?  
   Yes ☑ No □ No response □  
9. If yes, what training did you receive?  
   [List of training topics like: Basics, how to use Windows, save a document.]  

10. Who provided the training?  

11. Did the training meet your expectations? If not, could you explain why it didn’t?  
   Yes, very good.  

12. Do you know of any computer course in your town that leads to a formal qualification?  
   Yes ☑ No □ Don’t know □ No response □  

13. Can you say which skills or tasks you would like to be able to use the computer for? List of priority skills (maximum 3 skills)  
   1. Familiar with MS Word (can manage it better)  
   2. Do an e-Learning course of house (return soon)  
   3. [Additional skill or task]
14. How do you think you best learn?

In a group - talking and listening to others  
not really sure about it

15. Have you had any learning experiences using the Internet?

Yes □ No ☐

If yes, what training?

16. Do you use any other types of technology?

Mobile phone □  MP3 Player □  Books on cassette □
Books on CD □  Braille note takers □  Other  

17. What aspect of VICS do you most enjoy?

Not a member

- 288 -
Appendix C – First Interview Schedule

1. Can you give us a little bit of background about yourself?

2. How did you become interested in computers and the Internet?

3. How have changes in technology helped you to learn?

4. What is your preferred reading medium?

5. Do you use any other type of technology?

6. Are you able to access the Internet?

7. What motivates you to use the Internet

8. How do you perceive yourself and others when using computers?

9. Have you experienced any other online learning apart from ACE?

10. How do you think you best learn?
Appendix D - Second Interview Schedule

1. How did the technical opportunities, offered by the project, help or impede your access to the VLE?

2. Did these opportunities promote the types of learning activities that you valued (i.e. as a visually impaired learner)?

3. Did the e-learning course you took help you to develop any new learning strategies? This question taps into the idea that visually impaired adults, mainly blind, may apply a process of internalisation or the application of a 'psychological tool' (e.g. language, abstract reasoning, use of memory or signs).

4. How have the communication tools e.g. discussion rooms, learning diaries, helped your learning experience, if at all?

5. What aspects of the VLE did you enjoy and/or dislike the most?

6. Do you think there should be dedicated VLEs for the visually impaired? Do they have anything new to offer the visually impaired?

7. Having experienced a pilot VLE, would you consider participating in another VLE? If so, what would you like to do?
Appendix E – Letter of invitation to participant

Queen's University
Belfast

Subject: Research for PhD undertaken by Paul Lynch at the School of Education, Queen's University Belfast.

Dear (name),

Many thanks for agreeing to attend this information meeting at the National Council for Blind, Ireland. I appreciate the time you have taken to travel to Dublin. I would like to take this opportunity to introduce myself and my proposed PhD research.

I am a PhD research student at the School of Education, Queen's University Belfast under the supervision of Professor Peter Clough (p.clough@qub.ac.uk) and Dr Eileen Winter (e.winter@qub.ac.uk). Both supervisors have agreed to oversee all the research activities I plan to conduct for this study.

My field of research 'Building and Sharing Knowledge for and with People with Visual Impairments: How a Virtual Learning Environment is Creating a New Learning Community', is an investigation into the potential role of inclusive learning environments in fostering effective learning for visually impaired people. The context of the research explores some of the main advances in the development of e-learning and assistive technology in providing new learning opportunities for the visually impaired community.

You are invited to participate in this exciting study which will run at the same time as the Accessing Communities for E-Business (ACE) Project. This research will follow your participation during the lifetime of the project, however, your consent is required to use the data collected during face-to-face and group recorded interviews, and feedback on the proposed virtual learning environment and e-learning courses.

Please be assured that:

- 291 -
all information shared will be treated confidentially;
should the nature of the research change, you will be notified;
no individual will be names unless by consent.

Your participation is critical and highly valued and will have an impact on the future research in the field of e-learning.

Thank you for your time and commitment to what I anticipate will be a worthwhile piece of research. If you have any questions about being part of the research please contact me at paul.lynch@qub.ac.uk or either of my supervisors at their email addresses above.

Yours sincerely,

☐ I agree to participate in the research detailed above.
☐ I understand that all information given will be confidential.

Signed ___________________________ Date _____________________
Appendix F – Extract taken from JAWS ECDL Course

Jaws and Windows Keystrokes and Keyboard Shortcuts for ECDL

Module 3: Wordprocessing using Microsoft Word

1. Open a document and save it to disk with a new filename.

First hit the “Windows” key and Jaws will respond “Start Menu”, now hit “P” for programs and then keep tapping “M” for Microsoft until you get to Microsoft Word. Now hit the “Enter” key and Microsoft Word will open, giving a new document upon which you can type. However we do not want this document, so close it by hitting “Ctrl + W”.

Locate the document to open, generally in your home directory called “My Documents”. To open the file, hit “Ctrl + O”, to locate the “My documents” directory hit “Alt + I” and then use the “up” and “down” arrows to find “My documents”, once you have located it hit “Enter”. To find the file keep hitting “Tab” until Jaws says “List view”, then either use the up and down arrows to locate the file or hit the first letter of the filename until Jaws responds with the correct file name and then hit “Enter”.

2. Change the orientation of the document so that it is in either Portrait or Landscape format.

Tap “Alt” to go to the “File” menu. Down arrow to go to “Page Setup” and then “tab” again to go to “Orientation”, Use the arrow keys to change the orientation and then hit “Enter”. Save your changes using “Ctrl + S”.

3. Change the font type of all the text in the document to a named font.

Go to the top of the document by doing “Ctrl + Home”, now use “Ctrl + A” to select all of the text. Do “Alt + O” to select format menu and then the down arrow to select “Font” and then tab to the Font list box and use the up arrow keys to select the required font. Finally hit “Enter”.

- 293 -
Module 7: Information and Communication

1. Open a web browser, and go to a web address by typing in a specific URL.

OK start by hitting the Windows key and hitting “P” for Programs and then hit “I” for Internet. A web browser will open. Now access the address bar by doing the shortcut “Alt + D” and type in the web address that has been given to you followed by “Enter”.

2. Locate and open a specified hyperlink. Complete an online form and activate a particular action button.

Find the hyperlinks on the page by doing the Jaws keystroke “Insert + F7”, then use the up and down arrows to select the required link followed by “Enter”. Alternatively, hit the “tab” key until you reach the required link followed by “Enter”. Start by reading the page by going to the heading hit “H” and keep hitting “H” until you get “Heading level 1”, then read the page a paragraph at a time by hitting “P”. Go to the first form field by doing “Ctrl + Insert + Home” and hit “Enter” so that Jaws echoes “Forms mode on” type in the required info and then hit the “tab” key to go to the next field.

3. Select a particular graphic on the page.

Navigate to the graphic by hitting the “G” key, if the web page has been well designed all the graphics will be labelled. However if this is not the case then you should be able to get a list of the graphics by doing “Ctrl + Insert + G” and then using the up and down arrow keys to select the graphic you require. Once the graphic is selected, switch from the Jaws cursor to the PC cursor by doing “Caps Lock + left square bracket” then simulate a right mouse button click by doing the Jaws keystroke “Caps Lock + 9” and use the up and down arrow keys to select “Save Image As”, followed by “Enter”. You will now be in the “Filename” part of the “Save As” dialogue box, start by giving the picture a name, and then check which directory you are in by doing “Alt + I” for “Look in”, use the up and down arrows to select the required directory and hit “Enter”. Finally “tab” round to the “Save As” button. If you need to swap back to the Jaws cursor at any time do “Caps Lock + Semicolon”.

- 294 -
Appendix G – Co-research Group Profiles

The following profiles provide a brief description of each person with reference to their experience and knowledge of the field of assistive technology and its interface with learning environments. All five participants were contacted by Paul Lynch and invited to participate in the research working group. The group agreed to meet at least once a month at a mutually accessible location close to public transport. All five received free travel and had either a guide-dog or used a cane to navigate to the meeting venue which was a large hotel in Dublin City Centre.

1. Stuart Lawler is in his early thirties and has been assistive technology adviser at the National Council of the Blind in Ireland (NCBI) for five years. He was born blind and was a boarder at a boys’ school for the visually impaired in Dublin. He learnt to use assistive technology at school and later on at university where he studied music. Stuart had already participated in other EU projects (Leonardo) for the NCBI and had developed a strong interest in the promotion of ICT training for children and adults with visual impairment. He develops audio programmes for the visually impaired and has carried out interviews for online news magazines for the visually impaired (e.g. Talkaround magazine).

2. Emma Tracey, a third and final year undergraduate studying communication studies at Dublin City University was contacted by Stuart Lawler and invited to take part in the newly developed VLE. She developed blindness as a result of a childhood accident. Emma had gained some experience of using an e-learning platform while studying at university. She was also a proficient user of assistive technology and the Internet and had played an active role in promoting its use with e-learning for students with visual impairment at VICS. She was editor of a popular monthly talk magazine targeted at young people that discussed issues that affected young people with visual impairment. Assistive and mobile technology e.g. mobile phones, MP3 players, etc. often featured in the monthly audio magazines as a result of frequent requests from the younger members (18 – 25) of the audience.

3. Nicky Kealy joined the civil service after leaving school at 18 and was working as a switchboard telephonist at the time of the study. He developed blindness at a very early age. Nicky is excited by new initiatives to introduce new online learning courses at third
level colleges in Ireland and is particularly hopeful that existing barriers to accessibility can be overcome with inclusive learning environments. He is a keen amateur journalist and has already covered news stories for the Visually Impaired Computer Society (VICS) audio magazine – InfoVICS. He also has experience in producing audio materials for radio shows and has worked with Stuart Lawler and Emma Tracy to produce a series of audio broadcasts for websites dedicated to issues around the lives of the visually impaired e.g. TalkAround Magazine and the NCBI monthly magazine.

4. Michael Lavin, who is in his early fifties, is a founding member and of VICS and was president of the society at the time of the study. He is blind and works four days a week as a computer programmer and is permitted one day a week to travel to a training centre in Dublin to train basic ICT skills to young people with visual impairment. Michael has considerable experience in using assistive technology and has been a strong advocate of its use across Ireland. He has supported campaigns such as the RNIB ‘Right to Read’ which is a campaign in the UK that lobbies for visually impaired people to be able to read the same book at the same time at the same price (RNIB, 2007). His other interests are in e-learning and how visually impaired people can benefit from appropriately designed platforms.

5. Ronan McGuirk is a fellow founding member of VICS and has developed great experience in using assistive technology over the past 30 years. He is a computer programmer in a large commercial bank in Dublin. He closely follows the rapid changes in technology for the visually impaired and is often invited to share these latest developments with his peers at VICS meetings. He developed blindness in his early thirties as a result of retinitis pigmentosa, an eye disease that commonly leads to blindness. Ronan was in the process of taking a two-year part time Masters course based on the full accessibility of a new e-learning course for people with visual impairment at Trinity College Dublin when he was invited to join the research working group.
Accessing Communities for E-Business (ACE) was a two-year study that sought to develop electronic business in urban and rural areas of Ireland. This arose partly from official pronouncements about lifelong learning by the UK and Irish governments and the European Commission's drive to promote the use of ICT in learning and training and the acquisition of key competences that would serve Ireland's advanced knowledge-based society through better job opportunities and social cohesion (ISC, 2005). Secondly, it grew partly out of discussions with organisations representing the visually impaired concerning the high percentage of unemployed visually impaired people over 35, particularly for those living in rural areas. The opportunities presented by e-learning to visually impaired adults could not only allow them to become valuable participants in the workforce, but also enable them to develop the skills that could be shared within their own communities. Rather than having to leave their communities, the hope was that through the project they would instead participate in new ones.

Aims

The project aimed to help visually impaired adults increase their knowledge of e-business concepts as well as develop rudimentary electronic skills that would increase their ability to compete in the workplace. It also aimed to develop and test an electronic community (e-community) where the visually impaired community could collaborate to build the skills to take part in and contribute to the changing workforce.

It brought together a group of ten visually impaired adults, both the blind and those with low vision, from both urban and rural communities. The participants were asked to test the learning materials and the VLE over a 10 month period. The training courses offered through ACE were a tutorial on how to use Job Access With Speech (JAWS), two modules from the European Computer Driving Licence (ECDL) and a new electronic business (e-business) course.

The project was planned to test whether the functionalities of a VLE enhanced the learning experiences of visually impaired people and to evaluate the level of engagement and successful learning outcomes that resulted from full participation on a new VLE. The team also planned to develop a completely accessible VLE that observes the highest standards set by the W3C WAI Accessibility Guidelines on inclusive design.
The key partners in the pilot project
The project team comprised an academic institution (Trinity College Dublin), a leading charity representing people with visual impairment (National Council for the Blind, Ireland) and a private e-learning company (Inishnet Ltd) who formed a small partnership to respond to a call for tenders by the Southern and Eastern Regional Assembly in Ireland in 2002.

Support systems
Three main supports were put in place to support the participants included an e-mailing list, a telephone helpline set up through the NCBI technical helpdesk and targeted one-to-one training for a small number of participants on a needs basis. The e-mail list was essential for transmitting important information about meetings and for informing the participants about changes to the VLE or the e-learning courses. It also drew on the support of an existing phone helpline to handle any specific queries on screen-reader technology or how to log on to the e-community. This helpline was manned during office working hours.

Recruitment of participants
Participants were recruited through a multi-stage process. The recruitment process focused mainly on people who lived in rural areas of the country. They could have either dial-up or a broadband connection but had to have access to the Internet at least three times a week. Recruitment was also based on those who attended an awareness event in a large city in South-East Ireland and those who had expressed an interest to the NCBI. The target number of participants the project team wished to recruit was no more than ten. This was to ensure all candidates received as much support as possible. The majority had to be living in rural parts of the country with at least two living on the Gealtacht areas including the islands (these are the most remote parts of the country by Internet broadband).

A total of ten (five men and five women) agreed to take part in the piloting of the e-community. All ten were registered blind and had been supplied with a computer and screen-reading software to run on it.

A list of criteria for selecting candidates
Each candidate was expected to meet most of the following requirements:

- To live in a part of Ireland where access to ICT training is poor.
- To have frequent access to the Internet (at least three times a week).
• To be able to use a screen-reader or screen-magnifier with reasonable proficiency.
• To be able to access and respond to their e-mail on a regular basis.
• To be able to make at least two group meetings during the testing period of ACE (either in person or virtually).
• To agree to take one of the e-learning courses (an ECDL module or the e-business course).

All the candidates were informed that the two e-Learning courses (ECDL and e-business) could not be accredited until they had been fully tested and passed by the ECDL Foundation and accepted by a Dublin-based business college. They were also asked if they could commit ten months of their time to test ACE. Finally, candidates were advised that they could choose when to log-on to do part of a module as long as they tried to execute a little bit at least three times a week.

Membership and Administration of ACE
All participants were set up with user names and passwords to log onto the VLE. They did not have access to the administration section which could only be accessed by password. This section of the site was used for the management, monitoring and evaluation of ACE. It had a section that provided information on log-in statistics, keeping a tally of how many times a person logged in and the date of the last log-in. An extra blocking feature was built into the website and again could only be used by a small number of administrators, including me.

An Audio Tour of ACE
A CD was produced to guide the participants through the different areas of the VLE and e-learning courses. The following section provides a summary of the recorded tutorial:

Once participants log onto the website they are automatically taken to their homepage which contains updated information on their learning progress, diary entries, and discussions. ACE was designed so that participants would not have to navigate too many web pages to obtain important information. The homepage would be updated each time a participant logged onto ACE, thus providing them with updates on discussions, recently audited websites, and messages from their study twin. The homepage provided an opportunity for each participant to find out key information and links on one page. This page also recorded new results from the course they were following.
Appendix I – Description of Pilot Group

The sample group consisted of eight adults who are blind and two with severe low vision and were aged between 20 and 65. The following descriptions briefly discusses some of their personal details.

Participant One: Emma
Emma is in her mid twenties and was completing an undergraduate degree course in Communication Studies in Dublin. She was planning to set up an Independent Audio Magazine in collaboration with Nicky (see participant five). This magazine programme was aimed at the younger listener, from 18 to 35. Emma became blind after an accident when she was very young. She has lived in a small rural village in the midlands for most of her life. She attended both mainstream primary and secondary schools. She has always had a keen interest in assistive technology and has acquired a good knowledge of how to use this technology over the past five years. Emma is a proficient user of JAWS and has recently learnt to use sound editing software which she uses for her audio magazine programme.

Participant Two: Tim
Tim is in his mid fifties and lives in County Dublin. He works as a braille press technician at one of the Government Departments in Dublin where he commutes by train every day. He wanted to increase his knowledge of how to navigate the Internet and to be able to carry out simple searches using Google and to carry out a number of electronic tasks including online banking. He operates the Braille Press which transcribes department newsletters and publications for members of the government staff who are visually impaired. Tim developed blindness in his later thirties as a result of Retinitis Pigmentosa. He has some understanding of how to use JAWS but does not feel comfortable using it on the Internet.

Participant Three: David
David is in his early twenties and lives in Dundalk where he was also studying an undergraduate degree in computer programming at a local institute of technology. His schooling years were spent as a resident at the school for the visually impaired in Dublin. He developed a keen interest in computers and other technology at school where he learnt to use a number of screen-reading software including JAWS and Window-Eyes. Once he completes his final year he wishes to find a job in programming in a computer company in Dublin. He has already completed
the ECDL but would like to play more of an advisory role in evaluating the two courses as well as the new website.

**Participant Four: Veronica**
Veronica is in her early fifties and has developed very low vision as a result of macular degeneration, a condition that impacts considerably on a person's central vision. She lives and works in Dublin where she works as a career guidance counsellor at a girls' secondary school. Veronica has only recently started using the PC for her work, but has been encountering considerable problems as a result of her declining vision. She also has lost considerable confidence in using the computer as a result of continuing sight loss.

**Participant Five: Nicky**
Nicky is in his early thirties and lives in County Carlow and works in Dublin. He commutes everyday with his guide dog to the centre of Dublin by train. He has been a switchboard operator at an Irish civil service department for over ten years. Nicky was born blind and was a resident student at the boys' school for the visually impaired in Dublin. He has already studied ECDL before, but would like a refresher course though he is a proficient JAWS user and is able to use the Internet and e-mail. Nicky has a keen interest in journalism and is an amateur reporter. He has worked with Emma and Stuart Lawler on producing a number of audio magazines in the past. He expressed an interest in participating in the research and as a co-researcher. He was particularly interested in conducting some of the interviews as part of a new feature of the VLE 'audio-diaries'.

**Participant Six: Ed**
Ed is in his late fifties and lives on an island off the coast of West Cork. He used to be a sociology teacher in England but decided to move to Ireland in his thirties to set up a goat farm. He developed blindness in his late thirties as a result of the degenerative eye condition of Retinitis Pigmentosa. He has had a strong interest in breeding goats for over twenty years and has been running courses for anyone who is interested in learning about goat rearing, milking and habitation. Ed is a proficient user of assistive technology (JAWS) and had become involved in a project which involved the setting up and provision of affordable accessible e-commerce to small and medium enterprises on the Cork Islands. Ed has developed his own website that promotes his business and summer tourism on the island.
Participant Seven: Brian
Brian is in his early forties and lives in County Cork. He developed Retinitis Pigmentosa in his later twenties and was completely blind in his early thirties. He was made redundant from his job as a result of losing his vision and decided to study braille and learn how to develop his assistive technology skills. After successfully completing a course in braille, he decided to take up full time studies in history right through to pursue a PhD in medieval history at University College Cork. He now provides some tutoring at the history department on an ad hoc basis. Brian is a proficient user of JAWS and is able to use the Internet and e-mail without any problems. He plans to lecture and conduct further research into medieval history once he completes his PhD.

Participant Eight: Sarah
Sarah is in her early twenties and is a law student pursuing her Master in Cork. She has a number of eye conditions aniridia, nystagmus, colomba and glaucoma which she developed at birth and later on in her life. She has severe low vision in both eyes and wears sunglasses when she goes outside or uses the PC. Sarah plans to work in the field of law once she has completed all her law exams. She was finding it very difficult to read documents on the screen for long periods of time because her eyes become extremely tired. She finds it difficult to listen to screen-reading software because she found the ‘the voice is so robotic’ (Taken from interview September 2004). As a result, she uses a screen-magnifier: Zoomtext as long as possible without the sound (maximum 30 minutes) and then switches on the sound to read for the remainder of her study time. Sarah wished to take the e-business course as she had a particular interest in accessing legal documents online and being able to use Microsoft’s MSN.

Participant Nine: Betty
Betty is in her mid-fifties and lives in County Dublin with her husband who is also blind. She works as a full-time receptionist/secretary at a Government Department in the centre of Dublin. She commutes by train to work with her guide dog every day. Betty had only limited experience of using a computer at the time of joining the project. She developed blindness in her late twenties but has experienced a severe hearing loss since her early childhood. She was sent to a school for the hearing impaired during her primary years but was later transferred to a mainstream secondary school where she stayed until she completed her Junior Leaving Certificate. Betty was particularly interested in learning how to word-process, use the Internet and e-mail. She wanted to start the ECDL modules which she agreed to do both at home and work. She requested some one-on-one tuition to get her used to using JAWS and the Internet.
Participant Ten:  Catherine

Catherine is in her early sixties and lives in County Louth. She was just retiring from the Civil Service where she was working as a switchboard operator. Catherine has been blind since her early childhood. She has developed some understanding of how to use JAWS but says she does not use it enough to be completely proficient. Catherine had studied the ECDL two years previously but has forgotten much of the content from the six modules.
Appendix J – Interview with Brian

Interviewers: Paul and Emma

P: Can you give us a little bit of background about yourself?

B: I live in Cobh where I have lived for most of my life. I’m studying at University College Cork doing a PhD in medieval history. I’m married with two children, a girl and a boy. The girl is 13 and the boy is 9. When I finished school I got a place in college, but at the time my eyesight was deteriorating. It was a problem for me to see very well and this affected my learning at school. I got a job for 8 years and then had to leave it and went back to college as a mature student, and technology that stage made it easier for me to study at least.

E: Could you tell us about how you would describe your vision?

My sight had been deteriorating right through secondary school, but I hadn’t been diagnosed; this is back in the seventies. It was a case of, I was badly short-sighted, and took it for granted that it was that, but I had a condition a deterioration of the cells in the retina – Retinitis Pigmentosa; I wasn’t diagnosed till I was about 20 even though I was attending a specialist for so many years. I had to force them to diagnose me, he didn’t realise even though I had been seeing him since I was 4 years old. Isn’t that crazy? I made the wrong career choice as I was going to be a lab technician and do science at CIT [Cork Institute of Technology]. The instruments I was using I just could not manage, so I jacked it in and got a job in a shipping office in Cobh for 8 years. I was frustrated with the lack of career guidance at the time. No one seemed to know what I should do. I think things have improved quite a bit since then, though I have concerns about my daughter who is partially sighted. I think schools didn’t have a clue about how to teach children with low vision. It took me so much longer than anyone else to read books. I’m sure the teachers thought I was a slow learner.

P: How did you become interested in computers and the Internet?

B: I guess I became most interested when I was laid off the job at the shipping office. Even at that stage my sight was going against me even though I was using a CCTV, but the speech software like JAWS wasn’t developed at that stage. When I was laid off I got some technology
with some of the redundancy money I received and made myself familiar with computers. A
great guy Aidan introduced me to the first talking computers like the BBC and the BBC Master.
He is blind himself and had been using these computers. I contacted him through the NCBI in
Cork and he invited me round to try out the software. This speech software gradually came into
use when the PC came out for personal use. I decided to buy a little laptop with DOS so that I
could then install the software. It took me a couple of months to get used to the speech software,
which was quite unreliable at the time, but I used Word Perfect and started a BA Degree at
University College Cork (UCC) in social sciences at 30. It was a chance for me to do something
new after experiencing all these knocks.

E: Did you enjoy it?

B: Yes, I loved it. I kept on history and didn't think I would be interested in medieval history, but it
was a lot more interesting now than then. I just got into technology big time. It was tough at first
but I soon got used to the student life, though it wasn't easy studying with two young children.

E: How did you get on with technology while you were studying?

B: Well, for the BA degree it was really taking notes and writing essays I used it for word-
processing. The scanning equipment was very pre-historic at the time. It was full of corruption
and inaccuracies. UCC bought one, but it wasn't being used because it was so bad. I bought
tapes and recorded the lectures or tutorials and then used a laptop to type my lectures. I tried to
pick up as many skills as I could before I lost my sight – typing and Braille. I was being practical
but at the same time... I was enjoying it, little challenges, I suppose. So, I prepared for college, I
had developed the typing skills, even though I was very nervous about going back. I had the
laptop for typing. It was my lifeline, I don't know how anyone can tape notes, it is easier with a
laptop. You just get all the notes you need. They are ready to be used for essays and
assignments.

P: How have changes in technology helped you to learn?

B: Well technology has improved quite a bit since I started studying. Now I'm doing my PhD in
medieval history, I need all the help I can get from technology. Disability Support Services are
able to scan my materials for me most of the time. I have to give them plenty of notice because it
can take a few weeks to get texts back. Most of the material have scanned a lot of my material
by myself. But over the last couple of years, the services have improved a lot. Now all my
material is scanned for me and proof-read by volunteers who are also students at the university. It is wonderful for those who are coming into study now. The level of services today seems to be much better now than even five years ago.

P: What is your preferred reading medium?

B: Well, I would say the computer now, but when I started losing my sight I used braille. It was tough trying to learn braille after using print for so many years, but I didn't have any real option 20 years ago. I didn't know enough about technology then and wasn't really up to date about JAWS and other screen-readers. Now I mainly do most of my reading through the computer. I still do some braille reading...though it takes me much longer to read.

E: Do you use any other type of technology?

B: Well, I use my mobile phone a lot...it is great to be able to phone my wife when I have finished a lecture or tutorial. I listen to CDs or talking books when I'm at home or travelling on the train. I already mentioned the scanner which is really useful for reading bills and bank statements when I'm alone.

P: What motivates you to use the Internet?

B: I find it useful for me personally. I don't really use it for my work. I would use it for databases and libraries, that would be useful. When I go to UCC I can't see what is on the shelves, but when I go home I can browse the shelves, even though I can't browse the books themselves, but at least I can browse the authors and titles. So, I would go in and get the books and bring them home. I have more access to the library at home.

P: You talked about it earlier being used as a tool?

B: Definitely, the main tool I would use it for would be for word processing and e-mail. Sending material I had written to my professor or she would be sending material back to me or to colleagues. I would use it to read and write. Everything I read is done through the computer. I scan using Kurtzweil. That would be the big use for the computer. Internet would be used for databases, library and email, use it to look up stuff for the kids.

E: Would you do any online shopping?
B: I have bought books on the Internet. I have booked flights for my brother and things like that. I would be on the Internet for half an hour but I wouldn't be a big user. I find the Internet very slow. You want to do a specific job, you could spend an hour getting a very small amount of information.

P: How do you perceive yourself and others when using computers?

B: I feel comfortable using computers, though feel a bit unsure of going on the Internet and using a credit card. I always feel that I'm going to lose all my money to some scam or one of these dodgy Internet hackers. Apart from that I enjoy the freedom to do what I want when I want. It is great for contacting my supervisor at the university or home...saves me the journey to Cork which means having to ask my wife to take me and then she needs to then wait for me and take me back. If I can do some of my tutorials using e-mail I feel I am getting somewhere. I think this is the way we should go. That's why this e-learning project is very good because it helps everyone learn in easier ways. I'm not saying we should all stay at home and learn that way, but I think it can save a lot of time for blind people if they can use the Internet at home to get their lectures. The problem with studying medieval history is not being able to access manuscripts you need because they are too old and cannot be removed from the library. I'm sure there will be a way of getting many of these old manuscripts onto electronic catalogues before they disintegrate into dust (laughs).

P: Have you experienced any other online learning apart from ACE?

B: I did learn Latin using a distance education course in the States and they stopped the course when I was three-quarters through the course. I also did The Hadley School for the Blind course which was available in braille. My braille wasn't very good when I stated using it. I received material on disc in the post and then I would work through it on the laptop. I would then send the assignments using e-mail and she would send me back the corrections.

E: Do you think that was e-learning?

B: I don't think it was, but then it seemed to suit me at the time. This was about ten years ago, so e-learning wasn't really that well known then. I didn't know about it until I started studying at university and they introduced me to Blackboard. I don't really use it much...not sure how I'm supposed be using it. I'm sure there are some good things happening on it but I think doing a
PhD sort of isolates you from the rest of the students. I guess undergrads are using it for their lectures and to talk to each other. So, in a way, I’m interested to find out more about e-learning as I seem to hear about it more and more.

P: You have had a small taste of ACE now. How do you compare your short experience on your perception of online learning?

B: As I said earlier, I only have a small idea of what the Blackboard site does. I was given a short tutorial on it but wasn’t too sure how I was supposed to use it. It seemed quite a good idea but then how would I be able to use it...I was really studying on my own now and didn’t have any real need to go onto the website for anything. All my correspondence was through e-mail and that was enough for me. I’m still curious how it really works. I haven’t been on ACE for long, but I see great potential for such a website for many visually impaired students. It would be good if ACE could take on a project with a third level college to offer such a course to the visually impaired who might otherwise not have the opportunity to attend a course like this. By offering courses to the visually impaired in Ireland there would be no problems in gaining students if the right e-learning structures were put in place. I don’t know if this is going to be possible but I see a future here for visually impaired people.

P: A last question, Brian, but how do you think you best learn?

B: I find reading for very long periods of time not very productive... Writing down ideas is very important in consolidating information and in highlighting places of weakness in my reading. I find discussion is also crucial... Ideas must be discussed and bounced off other minds. Discussion is crucial for me as ideas must be discussed and bounced off the minds of others. When I do my research I can spend up to two months on my own without meeting my supervisor, so I feel it is important for me to have this discussion when it comes. If I’m working on something I’m having difficulty with it would be important to meet much more frequently. I think students should have frequent discussions and when studying break up reading with writing sessions. That’s how I think I best learn but then it is a very personal thing. I know some students who leave everything to the last minute and try and cram it in before an exam or stay up the night before an assignment is due. I can’t do that but there are some people who are able to do that. May be it is an age thing (laughs). I probably did a bit of cramming when I was at school. It is harder for me to remember things as well these days.
Appendix K – ACE E-Business Course

The online e-Business Course has, as a target audience, members of the visually-impaired community who are self-sufficient in IT skills and who wish to exploit this expertise through the development of e-business skills.

The course will assist participants to investigate the role played by the development of technology in e-business, to understand the potential social, legal and economic aspects of e-business and to appreciate the new opportunities offered by e-business – particularly in terms of accessibility and e-inclusion.

Topics covered in the course will include:

1. The evolution of Networks,
2. the Internet and the World Wide Web and their part in the development of e-business;
3. issues of security and privacy in an online world;
4. online research, advertising and marketing;
5. e-business strategies;
6. website development and
7. the potential economic, social and legal impacts of e-business.

Participants will be encouraged to constructively contribute to the development of their own understanding of the issues by interacting in an e-community through the exploitation of technologies involved in delivering the course.

As an integral part of the course, participants will investigate and compare the e-business and website strategies of different organisations. They will analyse the social, legal and economic impacts arising from the adoption and growth of e-business and they will investigate and analyse an opportunity particularly suited to e-business and develop a suitable e-business strategy to exploit the opportunity.
Appendix L – Interview with Veronica

Interviewers: Paul and Stuart

P: How do you think the technical opportunities, offered by the project, help or impede your access to ACE?

V: The ACE Project has been a doorway to new skills and a doorway to information and a doorway to education. Essentially the starting point for me has been this project. I would still be grappling with very basic skills if I hadn’t joined this programme. Though, without the tutor system, without my volunteer. I would have given up because the programme. There was so much on the computer and the Internet...it was just too much for me to take in at first. I have found the Supernova voice (Screen reader and magnifier) that I had on my computer was so robotic that for the most part I switch it off. This was a nuisance because I had problems seeing the screen even when it was magnified. What I zoned in on was e-mail. I’m pretty good at e-mail now I don’t know everything about it but I’m able to receive and send mail.

S: What parts of the e-learning course did you find the most useful?

V: I have only been able to use parts of the ECDL course for my own purposes. But I wouldn’t have been able to do it without Louise (volunteer tutor). I was lost at the discussion meetings when everyone was talking about JAWS. I really wanted to keep up with everyone else but realised there were some people who were miles ahead of me. That was fine and encouraging to know that younger people were able to use the technology in such advanced ways. I just wanted to learn how to do the basics by the end of the course and I can say that I have achieved this goal.

P: Did these opportunities promote the types of learning activities that you valued?

V: The course has really forced me to think about how I should be learning as a visually impaired person. It has been an incentive to find out what is happening at the moment, though it was difficult for to memorise sequences of how to say use a Yahoo account but I find it easier if I say the steps as I do them. If the tasks are broken down I feel I can manage them better. But this wouldn’t have been possible without my volunteer.
P: So you feel that Lisa has helped you?

V: Immensely.

P: How often did you meet Lisa?

V: Well, it started off once a week... every Thursday at 7.00 pm. I made sure I was free every Thursday evening so that I could work with Lisa for an hour. It was so helpful to have someone who could take me through the basic steps. This arrangement worked well up to the summer time and then I was out of the country and a lot of things happened. It was difficult to get back to computer after such a long break. We are only beginning to pick up on this Thursday 27th January. We will go on a weekly basis. Generally we try to be quite faithful to it. I realise Lisa is a volunteer and really value her time with me but I don't want to be a burden on her. I tell her that it is fine if she wants to work with another person who needs help. I think there are lots of people like myself who need help and I can't keep possession of her. Lisa has been such a patient tutor to someone with no natural knowledge of the computer.

S: Did the e-learning course you take help you to develop any new learning strategies?

V: Decidedly it has. When I was reading I could absorb quite a substantial amount, but it was sequential for my memory. For something quite mechanical, I was never manually dextrous. So, coming on this course, my question was 'How can I aid memory in a set of steps that are sequential and are not native'? So to me, because I haven't been familiar with that way of doing things, I have tried to think about sequencing and learning things that way.

P: Can you tell us how you did that?

V: Every single night I took notes and dated them, particular things we did. Lisa used a black felt-tip pen. So we took out things I needed to learn. I'm not afraid of the computer any more. Lisa was at pains to tell me that you can't break the computer. I need to write everything. Lisa or I wrote it all down. One way I found useful was to copy and paste the text from the webpage onto a word document and then use different colours available on the word toolbar. I could also put the text in bold and increase the size so it was easier to use than reading it off the Internet. I'm not sure if this is e-learning but that was the way I did it and it helped!

P: so that is the way you prefer to learn?
V: Yes, that is the only way I like to learn. People talk about sound bytes... these are really learning bytes for me. I now like to see what is new in the technology field. Whenever there is an exhibition on technology I like to go to see what is new. I'm always looking for a voice programme that is better than the one I have. The last time I went, months ago. There is one, but it isn't on the market yet. I can't remember the name of it now, but I have written it down at home. I have always learnt better verbally than in any other way; frequently in like discussions or whatever. Interesting thing is to organise information in my head; I have to have a visual representation of where it is. This helps me, but I'm not sure how long I will be able to do this. It takes me so long to get all the stages in the right sequence in my head.

S: How have the communication tools e.g. discussion rooms, learning diaries, helped your learning experience, if at all?

V: I have only filled out the learning diary a couple of times. I haven't really made much use of the different communication things on ACE. I didn't want to be distracted by all these other things because I know they would confuse me even more. I remember Betty feeling the same as me. Was she not receiving tutoring too?

P: Yes, she is.

V: Oh that's great. I hope she is managing to keep up her classes. It is so easy to put them off to another week or two weeks. She sounded like she needed to know how to use the computer for work. I don't have the same pressures...coming to the end of my teaching career and have managed pretty well so far. I think it is more urgent for people who really need to use technology at school or at work.

S: Did you get a sense of a community on ACE?

V: Strangely enough I felt most part it when we met as a group at the NCBI. I don't think I would have been able to join in the activities and find out who was 'out there' if we didn't meet as a group. I now know the names, like the launch of Emma's TalkAround magazine. I asked Lisa to help me find it on the Internet. We listened to a couple of the broadcasts and I enjoyed them. If I had never met Emma, it wouldn't mean as much to me. The community has given me an appreciation of what people with no sight at all can do and what they they can do for one another. Computers have become a common link for us.
P: What aspects of the VLE did you enjoy and/or dislike the most?

V: I enjoyed the human contact the most...the meetings at the NCBI. I have to say that Lisa was an enormous help. I also found the e-learning course, the ECDL, very helpful but was continually floundering with it.

P: Can you explain why?

V: I think it was mainly due to the fact that the course was intended for JAWS users. The instructions were always referring to certain keystrokes that would allow me to say cut and paste or open a word document. I would try some of these strokes and nothing would happen. I spoke to you Stuart about this a few months ago, do you remember?

S: Yes, I do and I told you not to worry about all these keystrokes.

V: Yes that was helpful but I still needed to know how to open a document using my software and there was nowhere to get that information on ACE. I consider myself to be a very tolerant person. I suppose my teaching background helps me to think about things calmly and not to become too frustrated. But it is difficult to stay calm when you're worried about your sight. I think I would have dropped out at the early stages of the project, if there wasn't the human support. I keep saying how important it is to have the support of people who understand what you are going through. I have felt uncomfortable talking about my personal problem but this project has forced me to think about the future.

S: Do you think there should be dedicated VLEs for the visually impaired? Do they have anything new to offer the visually impaired?

V: I was worried about this at the beginning and said that it could have negative consequences for those who are blind and have partial sight. Do we want to say that we need something different? May be we do need some support but does this have to be on a separate website? I'm not an expert on these matters and I'm only speaking about how I would like to be able to use another e-learning site. I doubt this will happen now or in the future...but thinking about younger people with vision problems, I feel that they should be introduced to the more mainstream websites as soon as they are able to use the Internet. ACE has offered much so in some ways I think similar projects could help blind students...
learn the basics like how to use a screen-reader and then move them onto other non-visually impaired websites.

S: Having experienced a pilot VLE, would you consider participating on another VLE? If so, what would you like to do?

V: I think it will be difficult to find another project like ACE with the security and the knowledge base. I hope I can use the skills I have learnt and use them in the future. I suppose it is still early days for me. I'm a slow starter and I have been finding it difficult to get used to using the new screen-reader. I wish it was easier to use, but I'm determined to get a few skills before it gets any worse. I suppose this project has opened up new possibilities to learning. It is a shame the project is only here for a short time, but hopefully I can continue to meet with Lisa and work with her after this is finished. Do you think I will be able to do this, Stuart?

S: I don't think there is any problem at all as long as you are both happy with the arrangement. The volunteer programme is very much on an informal arrangement between the volunteer and the student. There are no formal arrangements though we like to make sure they have experience of working with visually impaired people. We provide some training and give them some ideas on how they should work with people who are blind and have low vision. I think Lisa has been with us for over two years now and she is a great asset to us.

V: That is a relief. I was concerned that I would have to give her up once the project finishes. As I said earlier I don't want to keep her away from other students. So do let me know if she is really needed somewhere else.

S: Don't worry Veronica, she isn't at the moment, but we'll let you know if there are other people waiting in your area.
Appendix M – Case Study (One)

Background

Ed is in his fifties and lives on a small island off the coast of West Cork. He has a great passion for goat farming and runs a small farm (27 acres). Over the past 15 years, the island has been experiencing a decline in population that threatens the island’s viability as anything more than a holiday destination. Cork County Council has made considerable improvements to the island which now has better access and physical infrastructure. Ed taught post-sixteen students sociology for eight years before moving to the island. He was more recently Project Manager of a scheme to provide affordable, accessible e-commerce to small and medium enterprises on the Cork Islands and in remote areas, and to provide affordable and accessible communications in the same areas.

Ed has been concerned with the inclusion of rural communities in the information society. He strongly believes new technology can increase employment and commerce on the islands as well as improving education and entertainment.

It is clear that the technologies of the information society present new opportunities to address traditional problems of disadvantage and exclusion in society. ICTs deliver new channels of access and participation and have the potential to offset the disadvantages associated with remoteness and restricted mobility. To be on the wrong side of the digital divide means less opportunity to take part in the information society, in which more and more jobs will be related in some way to use of ICTs.

Once accessible e-business has been established on the island communities, there is no reason why directly education or social elements could not be linked in. For example computer gaming for a distance learning programme or a dating agency!
Ed was delighted to hear about the ACE project and more specifically the e-business course, considering it to be a perfect opportunity to develop the skills he needed to manage his own business. Ed only had access to dial-up Internet connection and was concerned that he would be unable to participate in the project and research. He felt ACE would be a helpful introduction to the rapidly changing world of e-business. He had never followed an e-learning course in the formal sense but was enthusiastic about the course. A member of the Visually Impaired Computer Society (VICS), Ed has relied on the Society's e-mail list for help with technical problems with his computer or with the JAWS program he was using.

The main problem with a mail list is the trawling that I have to do in order to get to the piece of information I require. It could be a simple piece of script language or a shortcut key. We always seem to get the same questions on the VICS list and it would be great to have a more organised system where anyone can search for specific key words and locate the answer quickly. It saves having to post a message again and ask again.

Ed had specific goals that he wanted to achieve by the end of the testing period. Newly acquired skills could be applied to his business venture.

**Learning characteristics before engaging in e-learning programme**

Ed was completely comfortable using e-mail and the Internet using JAWS. He was also able to develop his own website using a simple site-building software. He said he would like to use the Internet more frequently but poor connectivity was impeding access. A newly installed satellite should increase access to the Internet on the island but it was proving to be quite inconsistent at times. Ed experienced the digital divide; he felt he was losing touch with important changes in technology and felt he was becoming increasingly marginalised from the rest of the country. He hoped that the e-business course would 'fill in some of the gaps' of his knowledge, particularly in relation to setting up a card payment system on his company's website and conducting business transactions over the Internet.
Two of the co-researchers (Stuart and Paul) had the opportunity to visit Ed and interview him at the beginning of the project. Ed was able to share some of his first impressions of the VLE during this visit.

S: What are your first impressions of ACE?

E: It seems pretty straight-forward to use...basically for the eBusiness course I have read through it and had a look at some of the links. I have been getting quite distracted with the links and not getting on with the course. It will take me quite a while to read through the whole course.

Ed had vision until he developed Retinitis Pigmentosa in his thirties. He learned braille soon after he became blind and still reads in braille at home. He said he was beginning to experience sensation problems with the first two fingers on his right hand. As a consequence, he has been finding it difficult to read at a fast enough speed to maintain his interest; he therefore leaned toward the computer because with it he could read much faster. He said using a screen-reader was a difficult learning curve as it did not have 'a physical existence'. He considered the screen-reader as a virtual document - 'you develop your own peculiar way of doing things.' Ed also found the speed option useful when scanning for specific information on a document. He said that he sets the JAWS screen-reader at a very fast rate until he reaches the desired section and then slows the reader to a much slower pace.

E: I tend to lose patience if there is a load of rubbish there or if I'm looking for something specific, then I just wind up the speed until I get closer to what I think is more relevant and slow it down again. With practice you can go at a hell of a rate, without actually having to hear all the words. But you don't actually have to hear all the words because you are looking for a couple of key words.

P: How do you think this mechanism of scanning will help you to learn?

E: Well, I developed an ability to 'scan-read' when I was at university years ago. This was something I was able to do visually and used this technique even when I was losing my sight. I have been able to apply this skill, if you like, but using my
ears. The only problem is that I have to pay much more attention to what I hear, whereas, I could just glance through a newspaper quickly and get the gist of it pretty quickly.

P: Do you think ICT is changing the way you learn?

E: I don't think there has been any major change or shift in the way I learn. But I tend to be somebody, probably due to a necessity, tends to rinse out every last ounce of information there is and not worried about where that information came from, though if there is some information I picked up on the radio programme a while ago. I'm blessed on the whole, the connections are made. If I come across something in a book 6 months later, I will probably realise the two things are connected.

Learning characteristics after engaging in e-learning programme

Ed was invited to the NCBI office in Cork City six months later to share some of his impressions and learning experiences since the first interview. Ed had managed to complete all six modules of the course but did not complete any of the assignments. He said he found parts very helpful (e.g. network security, how to encrypt credit card numbers and set up Visa/MasterCard accounts) and others not relevant to his immediate needs (e.g. EU directives and policies). He said he quickly read through all the units in each module and then returned to the beginning and worked through all the links. He said that there was too much information to absorb with few opportunities to stop and review the key concepts. He said he was disappointed with the lack of interactivity on the site although he was overall satisfied with the quality of the content and its relevance.

Ed considered the VLE to be completely accessible before the technical changes had been carried out. He realised that he had an advantage over some of the other participants who he thought would struggle with the VLE domain. He did not realise how much other visually impaired people knew about the Internet and e-learning until he started discussions in forums. It was an experience that he enjoyed particularly when he could contact his twin partner to discuss specific items of the course.
I hadn't realised how cut off I was until I started chatting to the others in the discussion part of ACE. Emma was a great help too. The course could have done with more direction from course tutors who had up-to-date information about e-commerce.

Ed noticed some improvements to the course once it had been reviewed but still felt it lacked a sense of dynamism. He was unsure whether the course had been purposely made more textual because of the visual acuity of the participants, but encouraged more audio case studies to enhance the course and maintain learners' levels of interest. The course arrived at the right time for Ed as he was planning to carry out some research into e-commerce for potential funding applications for the island.

Ed had made some progress in increasing his knowledge of electronic business although he did not complete the written assignments. He felt the assessments were 'pointless' and had little relevance to what he was doing. Having been a teacher Ed was able to provide some useful advice about how to help learners plan learning. He was encouraged by the strong sense of communal learning and believed the twinning process, if better prepared, could be a key way of helping inexperienced learners to take 'risks' when faced with technical or pedagogical problems.

It isn't easy for visually impaired people to take risks when they have had little chance of trying something out. We need to be confident that what we do won't crash the PC or empty out our bank account [laughs]. A community like ACE can help us to develop those skills without worrying about the danger of fraudsters or unscrupulous dealers out to make a penny or two.

Finally, Ed was invited to make recommendations for future learners:

I have a course that I would like to set up on emara.com that takes goat breeders through the essentials of how to raise goats. This would be a pre-course which is virtual; then interested parties could spend a week or two on the island to do the hands-on part. I have already started advertising the hands-on course and have
received some requests from the States. I could set up the site for bookings and deposits which would be useful.
Appendix N – Case Study Two

Background

Sarah is in her twenties and is from Cork City. She was in the process of completing a dissertation at the time of the project for a Masters degree in Law. She has severe low vision as a result of developing glaucoma in her right eye and nystagmus and collaboma in her left eye. She has only 5% vision in each eye and is registered as blind. She also suffers from frequent episodes of severe pain in her right eye and must frequently go to hospital to check its pressure. In spite of her severe low vision, she uses her residual vision to read using a magnifying glass which she tilts at an angle using her wrist.

Sarah uses a screen-magnifier called Zoomtext to increase the font size of screen text. She uses the voice output when her eyes become tired, preferring to listen to text being read out to her while her eyes are closed. She sometimes finds the voice too robotic to concentrate on her studies and felt it impeded her work rather than helped her. She also experienced problems with glare from certain Internet websites that contain too much colour or have poor colour contrast.

This is a problem when I go out… I can't cope with the sun as I have no pupils in my eyes to help reduce the light. I let in way more light than the average individual, so that is why there is a squint there. So when I look at a page or computer that is all white, I would take in much more glare than an average individual who might only be taking in half amount. So if the sky is a white glarey sky, that would even be a worse day for me, as opposed to a sunny day.

Sarah said she developed sufficient skills to be able to use the computer to type her essays and use e-mail while at secondary school, particularly during transition year.
We were given a module where you were given a typing module and a computer’s module, so I became familiar with Office, Excel. Obviously with ECDL you go into Excel and all that, in transition year we went into that too.

Sarah finds the learning facilities at her university excellent saying she is ‘in heaven’. She learnt that she could make some basic changes to the settings on her own computer that could have made studying much easier if she or her teachers had known.

Learning characteristics *before* engaging in e-learning programme

Mainly as a result of her third level studies, Sarah was quite comfortable writing Word documents, sending and receiving e-mail and using the Internet (e.g. negotiating search engines, navigating websites, using Zoomtext). She said she could log onto the university e-learning platform (Blackboard) but was not completely at ease with all the functions, e.g. her e-portfolio, the discussion board and virtual classroom. She also experienced problems with the online assessment tools (self-tests, quizzes and surveys) often failing to fill them out correctly. The e-learning platform seemed to cause Sarah anxiety when she tried to participate in online discussions.

I was often left on my own to learn because it took me longer to finish tasks. I like to take lots of breaks after reading texts and then write what I can remember. This may change after trying ACE out, but I don’t know if I will be able to keep up with the rest.

Sarah was excited to hear about the ACE Project hoping it would build her confidence in using her university e-learning platform. She was also looking forward to learning more about e-business, particularly within a legal context. Sarah wished to find out more about the legal implications of setting up an online business – an unexplored area.

Looking through the course modules, I’m expecting to learn a lot about security aspects of doing business online but I’m more interested in the legal aspects of e-business and the new opportunities offered to Irish companies. It could be a field I wish to work in when I graduate, but don’t know until I have completed the course.
Sarah's views as a low vision user of the VLE and e-learning course materials were particularly relevant to the project. Sarah was asked to share some initial thoughts about the VLE as a 'sighted user'. Her main concern was the lack of multimedia and relative 'plainness' of all the pages. ACE seemed to be completely functional and easy to navigate but she thought it lacked dynamism compared with the e-learning platform she was using for her course.

The website is so easy to use...well it does take getting used to, but then it is fine. The course looks interesting, but there seems to be a lot of reading and not much else. It is difficult to say whether I will find the course helpful. I just hope it is easy to understand.

Learning characteristics after engaging in e-learning programme

Sarah was invited to the NCBI offices in Cork City six months later to share some of her learning experiences since the first interview. Study commitments meant that she was able to complete only half of the six modules and none of the written assignments. She found the legal parts of the course the most interesting but she found the modules on e-business strategies and website development rather tedious. Sarah believed the lack of tutorial presence and direction did not help her advance through the course. She therefore did not feel motivated to complete the whole course and felt under-challenged by the activities that were designed to engage her. She was, however, fairly satisfied with the content and accuracy of the course materials.

S: I went through the whole course very quickly to find out what it is all about. It seemed to get distracted by all the links to other websites. I ended up then going from one link to another and forget what I was supposed to be doing. I guess not being guided meant me spending too much time on other things.

P: Why didn't you do any of the assignments?
S: I didn't think it was worth it. I was interested in the subjects but didn't feel sufficiently motivated to write a 1,000 word essay on them. Sounds a bit of a cheek, but I had urgent assignments to hand in for my Master's course.

Sarah said her level of confidence had increased considerably when using the discussion forum and posting comments to it. This was an activity she had previously found quite difficult to do on Blackboard, but she was now able to use this tool quite freely thanks to ACE. She also felt more at ease navigating other websites and making purchases online. She was still uncertain if the e-business e-commerce inspired her sufficiently to specialise in this field when she completed her Master's. Sarah made some progress in using the screen-magnifier more effectively. She was able to spend more time listening to course materials and making notes of any important concepts or passages. She was still not completely comfortable with the synthetic voice of the Zoomtext software but felt she could complete more tasks listening to the online course rather than trying to read the text at a much slower pace.

I felt more relaxed reading the course with the voice on. I guess this is because I didn't have to pass any formal written test. I'm sure my ability to listen to long paragraphs of text has improved, though I still find it difficult to concentrate. This project has motivated me to use the Blackboard website and not feel so left behind.

Finally, Sarah was invited to make recommendations to future learners:

This experience has really helped boost my confidence and I think it has boosted the other participants' confidence too. There seems so much out there to learn but we can quickly become saturated with the volume of information. ACE helps to filter out all the distractions that can be so difficult to cope with. I would like to see the website open to more people who have low vision. I think we have very specific needs and something like ACE could really help us.
Appendix O – Interview Schedule for Co-researchers

1. Have you been involved in any previous research before this study? Had you received any training to carry out research before?

2. What were your first thoughts about the study and how confident did you feel about carrying out some of the research?

3. Were the research aims and questions clear? Were you comfortable with the research focus and the choice of methods? Did you have enough ‘say’ in how the study should be delivered?

4. How well do you think you were supported by the other members of the research team? Can you please state any areas where you did not feel supported.

5. Did you experience any difficulties that prevented you from carrying out any part of the research? (online and face-to-face)

6. What aspects of the study did you enjoy doing the most?

7. What aspects of the study did you not enjoy?

8. Did you experience any problems in taking a dual role of researcher and participant?

9. Would you change any part of the way we conducted the research?

10. Can you comment from your recent experience how you think people with visual impairment could be involved in similar research in the future?