2012-1

ICTs in Education: an Evaluation of the Dublin Inner City Schools' Computerization (DISC) and HP Managed Learning Environment (MLE) Projects

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January 2012

ACKNOWLEDGEMENTS

I wish to express thanks to my supervisor, Dr. Edward Brennan at the Dublin Institute of Technology and to my family members Liam Quinn, Niall Quinn, Conor Quinn and Meadhbh Quinn for their support throughout this time.

DECLARATION PAGE

I certify that this thesis which I now submit for examination for the award of MPhil, is entirely my own work and has not been taken from the work of others, save and to the extent that such work has been cited and acknowledged within the text of my work.

This thesis was prepared according to the regulations for postgraduate study by research of the Dublin Institute of Technology and has not been submitted in whole or in part for another award in any other third level institution.

The work reported on in this thesis conforms to the principles and requirements of the DIT's guidelines for ethics in research.

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Signature Elizabeth Devinn Date January 17, 2012

ABBREVIATIONS

AT	Activity Theory
CHAT	Cultural Historical Activity Theory
CLiC	Computers in Learning Communities
DES	Department of Education and Skills (Republic of Ireland)
DISC	Dublin Inner-City Schools Computerization
DIT	Dublin Institute of Technology
DOE	Department of Education (Finland)
ICT	Information and Communication Technology
ISO	International Standards Organization
LNI	LearningNI (Learning Northern Ireland)
MLE	Managed Learning Environment
NI	Northern Ireland
OECD	Organisation for Economic Co-operation and Development
ROI	Republic of Ireland
SDT	Special Duties Teacher
VLE	Virtual Learning Environment

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ABSTRACT

The Dublin Inner-City Schools Computerization (DISC) Projects initiative was established with the aim of achieving equality of access, opportunity and training in Information and Communication Technology (ICT) in thirty-eight inner-city schools and innovative use of ICT in the classroom. This report seeks to evaluate the project to include the ICT projects Initiative and a pilot Managed Learning Environment (MLE) called LearningNI (LNI) currently being run by C2k in Northern Ireland (NI). This report finds that while the DISC project overall has been broadly welcomed by many schools, some schools are not engaging with the programme and the objective of integrating ICT into the curriculum has still not been met. The ICT Projects Initiative has been enthusiastically embraced by some schools but it needs to be more curriculum-relevant in order to achieve ICT integration. The MLE had some success but issues of internet connectivity; bandwidth; and school participation need to be addressed. The DISC initiative has now ceased and been replaced by Computers in Learning Communities (CLiC). Suggestions made for the future of DISC/CLiC (CLiC 2011) include reducing the number of schools involved; developing an MLE to support, train and encourage participating teachers; facilitating increased technical support to schools similar to C2k in NI; increased liaison with the Department of Education and Skills (DES) to develop curriculum-relevant software; and a re-launch of the DISC/CLiC programme. This report uses Cultural Historical Activity Theory (CHAT) as a theoretical framework for research design and analysis.

CHAPTER 1: INTRODUCTION

Background to Research Report

The Dublin Inner-City Schools Computerization (DISC) Projects initiative was established in 1998 with the aim of achieving equality of access, opportunity and training in Information and Communication Technology (ICT) in thirty-eight inner-city schools. DISC is part of the Community Links Programme in the Dublin Institute of Technology (DIT).

In 2003, the ICT Projects Initiative was added to the DISC programme with the aim of integrating innovative technology with the Primary School Curriculum and expanding to the use of ICT in post-primary schools. Schools received relevant software, and in some cases hardware, required to run their projects along with appropriate teacher training.

In August, 2007, DISC, Hewlett-Packard and C2k agreed to pilot a Managed Learning Environment (MLE): MLEs refer to the whole range of information systems and processes that contribute directly and indirectly to learning and its management. The MLE is called LearningNI (LNI) and has been designed by C2k and their service provider, Hewlett Packard, as a safe and secure online learning environment intended to enable new methods of teaching and learning (C2k 2009).

C2k as an organization is responsible for the provision of an ICT managed service to all schools in NI and is supported by the Department of Education for NI and part-funded by the European Union under the Building Sustainable Prosperity programme. LNI includes a library of digital resources licensed from educational publishers and customized to the revised NI Curriculum and also contains a range of safe areas for learners to learn online with one another and their teachers, supplementing the learning which takes place in the

classroom (C2k 2009, C2k 2011; Hewlett Packard 2007).

Background to Development of DISC

'Schools IT 2000' is a policy framework set out by the DES in 1997 seeking to integrate Information Communication Technology (ICT) in primary and second-level schools in the Republic of Ireland (ROI) (DES 1997, p. 13). The main policy objectives were to ensure all students 'would have the opportunity to achieve computer and Internet literacy and to equip themselves for participation in the information society' along with teacher support, training and development (DES 1997, p. 13).

Schools IT 2000 brought about major developments in the provision of ICT equipment and support to Irish schools through the establishment of the National Centre for Technology in Education (NCTE) in 1998 to implement the policy (DES 2008b, p. 6). The National Policy, Advisory and Development Committee (NPADC) was also launched by the Minister for Education and Science in November, 1998 to assist the NCTE and ensure that e-Learning would be developed for all students (DES 2008b, p. 8). The main task was to equip schools with IT resources, train teachers in the appropriate use of IT in the classroom, and establish web-based support and pilot projects to determine models of best practice in using information and communication technologies in education generally.

A further 3-year capital investment programme was introduced to supplement Schools IT 2000 called The Blueprint for the future of ICT in Education for 2001/3 to increase ICT capital provision; increase access to, and use of, internet technologies; further integrate ICT in teaching and learning; and enhance ICT development for teachers (DES 2001; DES 2008b, p. 8).

As part of the support service for teachers and schools, a schools portal, Scoilnet, was set up in September, 1999 featuring curricular material and advice, chat groups and subject teaching groups (Scoilnet 2010). Other projects such as The Schools Integration Project (SIP) were also established as part of the Schools IT 2000 policy to foster whole-school development in ICT integration (SIP 2001; DES 2001, p. 13) and was aimed at identifying additional and complementary policy, pedagogical strategies; classroom resources for ICT adoption in Irish schools, and training and support models (NPADC 2001, p. 8).

One of the SIP projects established in 1998 was The Dublin Inner City Schools Computerisation (DISC). DISC was an initiative of the Dublin Institute of Technology (DIT), the Dublin Inner City Partnership (DICP), the DES through the NCTE, Fujitsu Siemens Computers and twenty Dublin inner city schools – eleven primary and nine post-primary schools. By 1999, there were 40 schools involved – 31 primary level and 9 post-primary level and Hewlett Packard had become involved in Phase 2 of the Project to upgrade 4 schools to 'resource school standard' with 15 computers to be networked along with 2 printers, a scanner and digital camera (DISC 2001).

Two Government reports *Investing Effectively in Information and Communications Technology in Schools 2008-2013* and *ICT in Schools* (DES 2008d; DES 2008b) were published in 2008 that reported on investment priorities for successful integration of ICT in education and an evaluation of the outcome of ICT on education respectively. As a result of these two reports, the DES acknowledged the important role of the Principal and the ICT co-ordinator in promoting the use and integration of ICT in schools and have indicated the role of the ICT co-ordinator, in particular, will be prioritized in future strategies 'in keeping with international best practice' (DES 2008a). In the ROI, the role of the ICT co-ordinator

is not clearly defined: some schools appoint the position as an 'add-on' to a full-time teacher role with teachers' paid an additional stipend with the majority of schools attaching the role to an existing 'post of responsibility' such as the role of special-duties teacher (SDT) or assistant-principal (DES 2008b, p. 73).

In the report 'ICT in Schools' (DES 2008a) it is indicated that future strategies will shift from ICT hardware and software provision to the actual use of ICT by learners, that will be important for DISC or its replacement CLiC to take into consideration in future planning. This strategy seems to be occurring already: since the most recent provision of computer equipment worth €5,000 per classroom to seventy-two primary schools in 2009 (DES, 2009), no further funding for equipment has been indicated. The focus has now moved to the expansion of the Schools' Broadband Scheme with the report '*Building Ireland's Smart Economy*' aims to upgrade the post-primary broadband connectivity to 100MB per second with a vague commitment to 'enhancing ICT use in schools' in conjunction with industry without identifying specific goals/objectives or organizations willing to assist (Department of the Taoiseach, 2008, p. 15-16). While acknowledging that the government is committed to integrating ICT into the educational system, this report notes that investment in schools' ICT 'will be pursued within available resources', indicating that future funding may be severely restricted due to the difficult economic circumstances at this time.

The most recent ICT Action Plan (2012) 'Meeting the high-level skill needs of enterprise in Ireland' reiterates many of the goals of the reports from 2008, but the emphasis now seems to be more on the post-primary level with the broadband upgrade not now likely to be completed until 2014. Promotion of ICT skills now seems to be targeted from Transition Year (16 year olds) onwards with the apparent aim of encouraging more second level

students to select ICT at third level rather than the emphasis being on integrating ICT into the curriculum generally for students of all ages (DES 2012, p. 15).

Scale and Scope of DISC project – ICT Projects Initiative and LNI

By 2009 and the start of this research report, the DISC project consisted of two main aspects: 1) the ICT Projects Initiative with an ICT Projects Co-ordinator employed on a part-time basis by DISC to provide support, encouragement and training to teachers in all thirty-eight schools involved in the DISC programme and 2) the LNI pilot with an LNI co-ordinator employed on a part-time basis to co-ordinate and provide support and training to the three DISC schools selected to participate.

Aims and Objectives of the DISC programme overall

According to the last review of the DISC project, the aims and objectives of the project at that time were as follows (DISC 2001, p. 8-9):

1. To implement a co-ordinated structured programme for the upgrading of inner-city disadvantaged primary and post-primary schools to high-specification multimedia computer capacity with peripherals
2. To develop and implement a relevant teacher training programme in the use of ICTs for current and future curriculum needs
3. To locate and evaluate appropriate educational software
4. To develop a series of programmes to engage students and teachers in the integration of ICTs into the curriculum
5. To provide on-going administrative, software and technical support

Objectives of LNI

In an LNI report, 2009 (DISC 2009a), the following are stated as nine specific objectives of the pilot LNI programme:

1. Create a meaningful online learning experience that engages students and enhances learning
2. Link schools (teachers and students) in the North and South of Ireland so they can communicate and collaborate with each other to deliver educational material
3. Produce multimedia projects to be shared via MLE

a. Primary: Local History

b. Post-Primary: Geography and Maths

4. Set-up video conferencing sessions between schools in the North and South of Ireland
5. Set-up discussion forums between schools
6. Re-motivate and retrain current teachers and involve interested teachers to increase the number of active teachers to 8.
7. Promote MLE access from home
8. Development of project support material (courses) relevant to subject area
9. Develop and train the trainer initiative within the DISC schools so that teachers can train each other and share and disseminate knowledge

ICT Projects Initiative

In the DISC report July to December, 2008 (DISC 2009b) it was reported that the first DISC ICT Projects Initiative started in September, 2003 and continued until June, 2005. It was considered that this project was very successful in generating enthusiasm in teachers to use ICT to deliver the school curriculum using a variety of short-term projects (DISC 2009b, p.4). The second ICT Projects Initiative commenced in January, 2008 and was

intended to be a 2-year project. However, as noted by the current ICT Projects Co-ordinator, by commencing in January, this meant starting in the second term of the school year as the school year runs from September to June each year which resulted in it effectively being an 18-month project (DISC staff 3, Interview).

The emphasis for the second project was stated to be on teacher training in order to encourage teachers to engage with ICT through more long-term initiatives in order to deliver the national curriculum. The ICT projects, for example, Stop-go Animation, Table-top animation, Video making, Podcasting, Lego, Game Making and Google Sketch Up were: "designed to help teachers meet the ICT requirements of the Primary School Curriculum and provide an added dimension to the use of ICT in post-primary schools" (DISC 2009b, p.4).

While teacher attendance was considered to be good at ICT Projects' training courses, workshops and introductions, relatively few teachers proceeded to try these projects in their classrooms with one DISC staff member noting "the minority [of teachers] are passionate about incorporating ICT into the school or the classroom" (DISC Staff 3, Interview). DISC staff suggested that while an introductory talk on available projects could be given to all teaching staff, training should be targeted at those expressing a particular interest in specific initiatives rather than providing training to all (DISC 2009b, p.7).

The stated aim of the DISC Project overall is to improve literacy and numeracy skills, concentration, behaviour and pupil motivation with the anticipated result that absenteeism would be reduced and retention increase. The key benefits for students in using ICT as a tool for learning are viewed as: providing a means of engaging students in learning in an enjoyable way; developing collaborative learning and problem-solving skills; catering for

different ways of learning through visual, audio and kinaesthetic media; increasing ICT skills and building self-confidence. Additionally, ICT use is seen as enabling teachers to present students work to their parents, and the wider community (DISC 2009b, p.4).

The ICT Projects Initiative is supported by DISC staff using a range of communications and activities with teachers, for example, a monthly Newsletter is issued to all Principals, ICT co-ordinators, teachers, Special Needs Assistants (SNAs) in the DISC Project containing tips and links that may be useful to teachers in delivering their lessons and sourcing suitable software and materials to link in with the curriculum. A website is also hosted on www.discproject.ie with information on all the latest projects, links to the primary school curriculum and provides a platform for individual school projects to be demonstrated and shared with other schools in order to provide encouragement and ideas. Additionally, the IFestival is conducted each June in the ILAC Library in Dublin, facilitating individual schools to showcase their ICT projects over a period of a week (DISC 2009a). Regular meetings are also held to which all the ICT co-ordinators of each school are invited: new software and equipment is demonstrated at these meetings and teachers pool their ideas, recommendations and experiences to each other.

In conclusion of the first full school year of the DISC ICT projects programme, the DISC team reported that the focus of 2008/9 had been on three key areas: 1) demonstrating the full range of ICT projects available and training teachers to use the relevant hardware and software 2) keeping regular communication with schools in the form of visits, the monthly newsletter and regular contact by phone or email and 3) supporting and encouraging teachers to complete projects for inclusion in the IFestival in June.

LNI Pilot Project

The LNI was piloted in the ROI over an eighteen-month period commencing in early 2008 with a view to rolling out the project to all 38 DISC schools subsequently. Four DISC schools were initially selected to participate: Primary School 2 (age 11); Primary School 4 (age 9); Post-primary School 1 (age 15); and Post-primary School 2, but due to logistical difficulties, Post-primary School 2 did not proceed with the project. Training on the LNI for both primary schools and the post-primary school was initially carried out in February, 2008 at the C2k offices in Belfast with a further training session in Post-primary school 1 for that school only in December, 2008.

In 2009, the 18-month pilot was extended for a further 12-month period to be completed in May, 2010 (Stage 2): a new LNI co-ordinator was appointed by DISC on a part-time basis to co-ordinate Stage 2 and provide training and support to ROI schools. The Stage 2 pilot involved matching the three DISC schools in the ROI with three schools in NI and devising projects that would encourage students to interact about the culture, beliefs and history of both their own communities and their partner school's community. It was envisaged that students in NI and the ROI would collaborate and communicate by means of email, discussion boards and video-conferencing using the LNI with the program with the aim of targeting numeracy and literacy skills for primary level and the subjects of geography at post-primary level. Schools had access to existing LNI content in addition to material uploaded subsequently by the pilot users themselves such as photographs and videos of their localities (DISC 2009a).

In October, 2009 the teachers involved in the pilot project from NI and ROI met at the C2k offices with DISC, C2k and Hewlett Packard personnel to receive 'refresher' training on

the LNI platform and to agree and devise suitable projects for completion by each class group (age 9, age 11, age 15). The emphasis at primary level was on literacy and numeracy skills whereas the post-primary level emphasis was on geography. The classroom teacher and ICT Co-ordinator from Primary School 4 (age 9) and Primary School 2 (age 11) were present along with the classroom teacher and school principal from Post-Primary 1 (age 15): the schools from NI were represented by their classroom teachers. This researcher was present in an observational capacity.

Subsequent to this meeting, schools began to communicate with each other primarily through the classroom teachers and with the support of the LNI co-ordinator at DISC for teachers in ROI and the support of C2k for NI teachers. Each school in ROI appeared to operate their projects independently of each other with each school collaborating and communicating with their partner school in NI through email, discussion boards and video-conferencing using the LNI.

The first LNI session in Primary School 2 (age 11) was observed by this researcher on December 2, 2009. Subsequent sessions were not directly observed due to either school timetabling difficulties or technical issues with the internet connections leading to sessions being rescheduled.

Timeline for Research

This research report commenced on October 1, 2009 and was facilitated by a 2-year Research Scholarship funded by Hewlett Packard for a Masters level research student to carry out an evaluation of the DISC Project overall and the LNI pilot specifically over a 2-year period to finish in December, 2011. However, in late December, 2010 it was

announced that DISC and the Digital Community Programme would be merged into Computer Learning in Communities (CLiC) with Hewlett Packard having no further role in the DISC/CLiC program. The rationale given for this move is:

> *This merger will allow both groups to benefit in terms of resources and personnel expertise as well as giving us the opportunity to create a more structured programme that maps clearly the educational and career opportunities offered through learning ICT. All DISC schools have been informed about CLiC and given the opportunity to join the programme in the New Year (DISC Newsletter, December 23, 2010).*

The school year timetable and university academic year dictated the timeline for the collection of the data as it was envisaged that a draft report would be prepared before September, 2010. Preliminary interviews, collation of DISC reports, literature reviews, design and preparation of questionnaires and semi-structured interview questions took place between October 1, 2009 and December 31, 2009. The questionnaires were sent out in January, 2010 with the cut-off date for return of questionnaires being the end of April, 2010 to allow time for data analysis. DISC staff interviews were carried out in February with seventeen teacher interviews carried out over the months of March and April, 2010. Teacher Interviews and the student focus group were carried out in the post-primary school prior to early May, 2010 as the school staff were occupied with exam preparation and school closure in late May. Interviews, focus groups and classroom observations in primary schools were carried out before the end of May as teachers indicated that June was a difficult month for them due to curriculum requirements and the impending school closure for the summer holidays.

The academic year 2010-2011 was then taken up with more in-depth analysis of both the quantitative and qualitative data; the preparation of a Business Report; and the compilation of this academic research report.

Purpose of this research/Research Questions

The purpose of this report is to evaluate both the DISC project overall (ICT Projects and LNI generally) and the LNI Project in more detail and assess whether both programmes achieved their stated aims and objectives (DISC 2001, p. 8-9; DISC 2009a, p. 3). Specifically, the research questions are: to investigate whether the DISC project improved ICT access for students in areas of disadvantage; did teachers and students engage with DISC; was ICT used innovatively in the classroom; was the curriculum implemented using ICT; was teacher training effective in increasing use of ICT; how ICT was used in the classroom; what difficulties were encountered; what factors influenced the use and implementation of ICT; and to make recommendations for the future of the DISC and LNI projects. In relation to the LNI, the report will specifically look at whether a meaningful and engaging online experience was created for students; whether partner schools successfully collaborated and communicated; how students and teachers engaged with the LNI platform; and whether the LNI could be rolled out to all schools.

This report uses Cultural Historical Activity Theory as a theoretical framework for the research design and analysis (outlined in Chapter 3, p. 32) and its findings may assist DISC/CLiC in designing future initiatives and targeting existing resources and personnel.

CHAPTER 2: BACKGROUND LITERATURE

> *ICT is 'an umbrella term' used to describe a range of technology such as computer hardware and software; digital broadcast technologies; telecommunications technologies…the world wide web and CD-ROMs (Selwyn 2004, p. 347).*

In undertaking a review of the literature relevant to the introduction of ICT in a primary and post-primary educational context, the main areas that seemed most relevant were in the area of policy; student access to ICT; socio-economic disadvantage factors; assessment of learning outcomes; teacher training and teacher pedagogical strategies; and support for ICT introduction. For the MLE, literature related to e-learning along with usability/navigation issues were also useful in addition to the literature reviewed above, particularly in relation to teacher training and pedagogical strategies. As CHAT was also to be used as a theoretical framework for design and analysis, the AT literature was also consulted and this will be covered in the next chapter (Chapter 3, p. 37).

As previously outlined in the Introduction (Chapter 1, p. 7), Irish Government Policy on ICT in primary and post-primary schools was set out by the DES in 1997 in the 'Schools IT 2000' with the main policy objectives to ensure that all students would be afforded the opportunity to be ICT literate with their teachers being provided with training, support and development (DES 1997, p. 13). As a result of this policy, schools were initially equipped with IT resources, teachers were provided with training and organizations such as the NPADC and NCTE were set up to ensure that e-learning would be developed for all schools (DES 2008b, p. 8). Programmes such as DISC were also encouraged to develop through the establishment of SIP to aid in identifying further policies, pedagogical

strategies, and develop training and support models as a result of this Government Policy (NPADC 2001, p. 8).

Two further Government reports *Investing Effectively in Information and Communications Technology in Schools 2008-2013* and *ICT in Schools* (DES 2008d, DES 2008b) evaluated the outcomes of the ICT strategy since *Schools IT 2000* and identified the importance of providing support to teachers through the deployment of ICT co-ordinators in schools and reiterated Irish Government policy to prioritize this in line with best practice internationally (DES 2008a).

Government policy has considerable influence on how schools are equipped and kept up-to-date with Government also directly responsible for devising and directing how the curriculum can be taught; how teachers are trained in both ICT skills and the use of ICT pedagogically; and providing supports for teachers so that all students have equal access and opportunities regardless of income. The literature, therefore, on socio-economic disadvantage; digital literacy; teacher training; and support for teachers will assist in providing a context to explore the research questions for this report relating to access and use of ICT by students in disadvantaged areas in the DISC programme.

Policy of ICT introduction

ICT use forms a major component for comparison by the Organisation for Economic Co-operation and Development's (OECD) Programme for International Student Assessment

(PISA) with the ROI being one of the OECD countries compared [1](OECD 2005, p. 2).

ICT introduction forms a major part of educational policy agendas in OECD countries as 'ICT can facilitate new forms of learning and because it has become important for young people to master ICT in preparation for adult life' (OECD 2005, p. 3). However, ICT introduction is very variable throughout the OECD with frequency of use of computers not being correlated with learning outcomes (OECD 2005, p. 69).

Denmark, Finland, and Norway are three OECD countries that have invested heavily in ICT with a general policy goal 'to get teachers to innovate with ICT in the classrooms' (Ottestad 2010, p. 478). Despite very specific government ICT policy goals, most teachers who use ICT, report they use it in 'confined periods of time and not on a daily basis' (Ottestad 2010, p. 488). Teachers are also required both to teach ICT to students and use ICT in their practice but cite frustration that 'they are required by statute to use ICT extensively in their practice, but no one tells them how they should do this' (Erstad and Quale, 2009, p. 565 cited in Ottestad, 2010, p. 489).

Student access to computers

Students have increased access to computers with the PISA report (2003) finding that the OECD average for students having computers at home is 79% with those not having access

[1] OECD countries: Australia, Austria, Belgium, Canada, the Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Japan, Korea, Luxembourg, Mexico, the Netherlands, New Zealand, Norway, Poland, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States (OECD, 2005).

more likely to come from low socio-economic backgrounds (OECD 2005, p. 16). In the ROI, 80% of students have a computer at home which is just above the average however, we rank considerably behind the Netherlands (96%), Sweden (95%) Australia (93%) and the United Kingdom (91%) (Ainley and Enger 2007 cited in Moyle and Owen 2008, p. 8). The OECD average student-computer ratio (SCR) for computers at school is 6.3 whereas ROI is 9.1, Netherlands 7.1, Sweden 6.3, the United Kingdom 4.1, and Australia 3.6. The latest PISA 2006 statistics indicate that almost all children now have access to computers at home with the majority having internet access (PISA (OECD 2006) cited in Moyle and Owen 2008, p. 48).

Socio-economic disadvantage

Research is limited into the ways ICT can improve learning, particularly for students who experience disadvantage by gender, disability, indigenous, ethnic and socio economic background (Blackmore, Hardcastle, Bamblett and Owens 2003). For the purposes of this report, disadvantage will refer primarily to socio-economic disadvantage.

As computers become more widely available and have become almost 'essential' for living in the Western world, at least, new forms of disadvantage may arise through lack of internet access, outdated hardware and software compounding existing forms of disadvantage such as lack of economic resources, rural isolation, gender and other factors (Blackmore et al., 2003). The term ‘digital divide’ is used to describe the difference between those who have access to the best technology and fastest internet access to those who don’t (US Department of Commerce, 2000 cited in Selwyn 2004, p. 341). However, some researchers caution that ‘access’ to a physical computer does not necessarily mean ‘equal access’ as issues of

location, quality, time, privacy, skills and quality of internet connectivity all may affect students' interaction with and use of technology (Selwyn 2004, p. 343).

ICT Access/frequency of use

A study of the relationship between availability of computers with student educational achievement found a negative relationship for home computer use and insignificant results for school computer use when the data was extensively controlled for both family background and school characteristics (Fuchs and Woessman, 2004, p. 12). This report also found that students in homes of higher socio-economic brackets did not necessarily have increased access to ICT over students in lower socio-economic brackets as might be expected (Fuchs and Woesmann, 2004, p. 8).

An OECD report found that students having little access to ICT in the home regardless of frequency of use at school scored 'one proficiency level below the OECD average' even allowing for socio-economic differences (OECD 2005, p. 52). Conversely, Fuchs and Woesmann (2004, p. 12) found that merely having a computer at home distracts from learning, with student outcomes in Maths and literacy being lowest in students with more than one computer at home. It is also claimed that 'gaming' detracts from learning (Fuchs and Woesmann, 2004, p. 2) although the OECD found that 15 year olds use a 'wide variety' of computer applications other than games gaining skills and confidence in ICT. These skills could, with teaching guidance, be harnessed to attain higher level skills such as creating multimedia content and computer programs (OECD 2005, p. 5) suggesting that teachers and schools need to build on the experiences and skills students have already gained at home.

In the school setting, however, both reports found that students with either very high/frequent use or low/infrequent use of computers scored less well than those with moderate usage indicating it is the software and activities students engage in that counts (OECD 2005, p. 69; Fuchs and Woesmann 2004, p.16).

These findings may have implications for DISC's promotion of greater access to computers in the home environment as it would appear that the skills students gain at home that they can apply to the school ICT environment are more important to consider than mere 'access' at home. Additionally, findings in this report suggest that many DISC students appear to have more frequent access to technology and the internet in the home than might be expected in areas of economic disadvantage (Chapter 7, p. 136, p. 150).

Digital Literacy

There is limited research on the use of ICT in disadvantaged schools and whether ICT enhances learning and student outcomes (Blackmore, Hardcastle and Bamblett 2003, p. iv). However, some case studies and major systemic literature reviews found parents and teachers view ICT as motivating and stimulating for students' learning and attach importance to students acquiring communication skills enabling them to network locally and globally (Meredyth 1999, Wenglinsky 1998, Comber and Green 1999, Lankshear et al. 1997 cited in Blackmore et al. 2003, iv). Acquisition of these skills is described as 'digital literacy' (Oliver and Towns 2000 cited in Blackmore et al., 2003, p. 4) and incorporates technical knowledge; culturally appropriate use; and the role and value of ICT in society (Lankshear et al., 1997 in Blackmore et al., 2003, p. iii) enabling students to engage with the new knowledge society in a meaningful way appropriate to their needs (Wenglinsky

1998, p. 34).

In developing these digital literacy skills, one researcher claims that current students' brains are physically different as a direct result of the introduction of new technology (Prensky 2001, p. 1). Prensky describes students as 'digital natives' claiming they like to access and receive information quickly; multi-task; and prefer games while teachers or 'digital immigrants' learn and teach slowly and prefer 'serious' work (Prensky 2001, p. 2). These views and terms have been reproduced in other research since (Gaston 2006; Gros 2003; Long 2005; McHale 2005; Skiba, 2005 cited in Bennett, Maton and Kervin 2008, p. 777) although they are unsubstantiated due to 'weak empirical and theoretical foundations' suggesting researchers need to apply more critical analysis in future research (Bennett, Maton and Kervin 2008, p. 777).

It is acknowledged by many researchers that teachers are primary in implementing school curricula reforms (Baileys, 2000 in Lloyd and Albion 2005) and the failure of schools to adopt ICT is frequently blamed on 'technophobic teachers' (Lloyd and Albion 2005, p. 1). However, Lloyd and Albion (2005) found that teachers, in their attempts to integrate ICT into the classroom, became more concerned with teaching ICT rather than teaching 'through' ICT as a tool. This may be partly attributable to the varying skill levels among their students as despite 15-year olds being very skilled at negotiating the internet, they lack basic skills in compiling documents or creating presentations (OECD 2005, p. 3) which are important for creating projects at school.

Is ICT use positive for learning?

There is little evidence to show that ICT use has a positive influence on learning with the

authors of a meta-analysis maintaining that many studies in the educational literature are not rigorously designed making it difficult to make informed policy decisions based on their findings (Burns and Ungerleider, 2003, p. 47). However, economic studies deemed to be 'rigorous' did not find a positive causal relationship between ICT use and pupil performance (Angrist and Lavy 2002, Leuven et al. 2004; Goosbee and Guryan 2005 and Rouse et al 2004 cited in Machin, McNally and Silva, 2006, p. 1). Banerjee et al. (2004 cited in Machin, McNally and Silva, 2006, p. 2) did find improvements for maths where computer programs are used in a drill/practice manner for students in disadvantaged areas. Other studies have found improvements in English at primary school level although it is noted that where ICT is used, it is predominantly deployed in English so the improvements may be due to increases in time devoted to the subject rather than ICT use itself (Machin, McNally and Silva 2006, p. 2). Hepp, Hinostroza, Laval and Rehbein (2004, p. 52) suggest that Science and Maths are two subjects that could benefit from ICT use, particularly for simulation of science experiments, for example, where real-life experiments may be difficult to accomplish (Roschelle 2000, p. 79).

Pedagogical strategy/Teacher beliefs

In educational contexts, ICT use along with pedagogical strategies has been shown to facilitate the development of cognitive skills at a high level (Fontana, Dede, White, and Cates 1993; Jonassen and Carr,2000; Jonassen, Peck, and Wilson 1999; Kearney and Treagust 2001; Oliver and Hannafin 2000 cited in Lim and Chai, 2004, p. 216). However, ICT availability cannot be viewed as 'a panacea to learning in schools' as students may not necessarily have the learning strategies required or the motivation to learn (Lim and Chai 2004, p. 216, 218).

It is not digital technology itself that makes a difference, but 'the pedagogical way in which it is used' (Salomon, 2002, p. 75) with many educators not improving their educational practice through the wide availability and use of ICT (Säljö 2010, p.55). However, as Salomon also asks, what is this 'difference' that researchers speak of in relation to ICT and education? If it is improved learner outcomes, then there is no evidence of this (PISA 2003) although Salomon also argues that much of the research in the area of ICT and education may be measuring the wrong indicators (Salomon 2002). If research is seeking to compare traditional versus new technology with traditional indicators of learning success, then traditional methods are probably better, however, if comparing students ability to 'tackle intelligently novel, real-life, and complex problems', then technology-rich learning environments may be more successful (Salomon, 2002, p. 74).

A constructivist teaching approach requires teachers to facilitate students in actively participating in their own learning rather than a traditional teacher-centred approach requiring teachers to impart knowledge to passive students (Tondeur, Hermans, van Braak and Valcke 2008, p. 2544-5). Teachers with constructivist beliefs use computers as 'a learning tool' and encourage students to use computers in innovative ways. Innovative use of ICT is defined as 'the use of ICT applications that support the educational objectives based on the needs of the current knowledge society' (Drent and Meelissen 2008, p. 187).

The classroom is described as a place where students 'participate continuously in activities that are structured to organize and facilitate the acquisition of knowledge' (Nuthall 1999, p. 143). A constructivist approach to teaching is related to a constructivist approach to learning influenced by Vygotsky's (1978) views on the Zone of Proximal Development (ZPD) described as 'the range of potential each person has for learning, with that learning

being shaped by the social environment in which it takes place' (Nicholl 1996). The teacher facilities this potential ability to develop by guiding and assisting students through their greater expertise (Wertsch 1991 cited in Nicholl 1996) with learning occurring through activity rather than passively receiving information or instruction (Nicholl 1996).

Some researchers have found that teachers who adopt a constructivist 'educational belief' tend to integrate ICT into the classroom more than teachers who adopt a traditional teaching approach with the teacher as instructor and student as passive learner (Hermans, Tondeur, van Braak, Valcke 2008, p. 1499). Educational beliefs are defined as 'individual concepts about desirable ways of teaching and conceptions about how students come to learn' (Hermans, Tondeur, van Braak, Valcke 2008, p. 1500). Other researchers attribute differences in teachers' integration of ICT in the classroom to 'computer experience' (Becker 2001 in Hermans, Tondeur, van Braak, Valcke 2008, p. 1500) and attitudes to ICT (Albirini 2006).

For this report, it will be important to look at how ICT is being used in the classroom and whether the emphasis is on using ICT to improve or facilitate effective teaching and learning curriculum-relevant material rather than focusing on using ICT for its own sake. DISC teachers participating in this report represent a wide range of ages, experience and teaching approaches: by becoming involved in the DISC programme they have already demonstrated an interest in pursuing innovative ways of teaching through ICT.

Teacher training

Some research suggests that ICT teacher training does not have a significant influence on innovative use of ICT within the curriculum but that teachers' attitudes (Galanouli, Murphy

and Gardner 2004, p. 67) and principals' positive attitudes about ICT by stimulating and supporting teachers "personal entrepreneurship" (deemed to be an attitudinal characteristic) are influential (Drent and Meelissen 2008, p.197).

Additionally, a study of teacher training in ICT that resulted in policy changes in the Netherlands for pre-service teacher training found that innovative use of ICT had not been promoted in pre-service training and questions the role of a 'supply-driven approach' and 'school-based nature' of training recommending that ICT teacher training should be followed up after training ceases (Valcke, Rots, Verbeke, and van Braak, 2007, p. 804). However, although this study evaluates validity of current curriculum content and organisation suitability of current training approaches, it did not research the effectiveness of the training.

One report developed a 98-item questionnaire comprising both open and closed questions that sought to obtain teachers' perspectives of a specific ICT teacher-training initiative titled the New Opportunities Fund (NOF) in the UK had on the attitudes of 900 teachers in NI to the use of computers in teaching subsequently (Galanouli, Murphy and Gardner 2004, p. 69). This report found that teachers were not satisfied with the form and content of their training as it did not reflect 'good practice': tasks were described as 'meaningless' and irrelevant to classroom practice. Many also resented the time and expense they were expected to give and did not feel supported either technically or through improved resources afterwards to sustain and build on their training (Galanouli, Murphy and Gardner 2004, p. 72).

The lack of effective ICT teacher training at pre-service and in-service levels is an on-going concern for teachers and schools in ROI and this report seeks to assess the effectiveness of

DISC training to date and obtain teachers' views and expectations for future training.

Transfer of Training

Transfer of training is defined as 'the degree to which trainees effectively apply the knowledge, skills, and attitudes gained in the training context to the job' (Baldwin and Ford 1988 cited in Velada et al., 2007, p. 356). It is claimed that only 10% of all training experiences transfer to the job (Baldwin and Ford 1998 cited in Velada et al 2007, p. 356) while Wexley and Latham (2002) suggest 40% transfers immediately but reduces to 15% after one year. These findings suggest that there is very little effective training resulting from the time and funds invested which is a major concern for training organizations as they spend large amounts of time, effort and money on training (Cascio 2000; Noe et al. 2006 in Velada et al., 2007, p. 283)

Many individual characteristics affect the training process but self-efficacy, an individual's general belief that they may change their performance (Holton et al. 2000 cited in Velada et al. 2007, p. 287), has been found to strongly relate to both learning and transfer training (Velada et al., 2007).

In addition to trainee characteristics, other factors that influence transfer of training are training design [enabling factors] and transfer climate [work environment factors] (Baldwin and Ford 1988; Holton 1996, 2005 Tracey et al., 1995 cited in Velada et al., 2007). These findings may have implications for DISC teacher training as it suggests that ICT training may need to be specifically targeted and carried out regularly in order to ensure teachers use ICT subsequently in the classroom.

ICT Co-ordinator role - Coaching and Mentoring

Whereas training focuses on meeting identified requirements and requires explicit skills, coaching and mentoring are 'learning relationships which help people to take charge of their own development' where coaches and the person to be coached (coachee) negotiate a learning partnership sharing 'knowledge, values, attitudes, skills and experience' (Connor and Pokora 2007, p. 6). Coaching could, therefore, be said to be at the level of the individual whereas training can be done with several 'trainees' at once. There is currently a teacher-mentoring system in schools in the ROI and it may be possible to incorporate the ICT mentoring aspect into this as part of the DISC programme. ICT co-ordinators currently fulfil this mentoring role in some schools, however, all ICT co-ordinators are not necessarily qualified or skilled in ICT so many teachers may not be getting the mentoring support they need.

In the ROI, the role of ICT co-ordinator is usually seen as an 'add-on' and attached to an existing post of responsibility such as Special Duties Teacher (SDT) or Assistant Principal (DES 2008b): this is frequently the case in other countries also with a study in New Zealand finding that co-ordinators already occupy 'a dominant and visible leadership role in the school' leaving little time for the ICT role to be developed (Lai and Pratt, 2004, p. 464). The ICT co-ordinator's role is not clearly defined with many acting as planner, budgeter, educationalist, and technician: the technical role being primary (Devolder, Vanderlinde, van Braak and Tondeur, 2010, p. 11). ICT co-ordinators may be over-used for their technical skills and it is suggested they should be employed to promote the pedagogical use of ICT to fulfil curriculum requirements instead (Vanderlinde, van Braak, Hermans 2009) leaving the technical support role to be provided by qualified technicians

(Lai and Pratt, 2004, p. 474). In recognition of this, Flemish schools are provided with Government funding for qualified technicians to support teachers so that they don't need to be concerned with maintenance and technical issues (DOE 2002, p. 19). As some researchers note, with the ICT co-ordinator's primary role being a teacher, it seems more appropriate for them to guide ICT teaching and learning in their school rather than resolve ICT problems (Lucock and Underwood 2001 cited in Lai and Pratt 2004).

Teachers need to be given time and support to experiment with ICT methods in order to use ICT innovatively in the classroom as many government policies require (Granic, Wifsud and Cucusic 2009, p. 1055). In a study by Haydn and Barton (2008, p. 444), teachers were given free periods from teaching and encouraged to try out some ways of using ICT in the classroom through contact with other teachers and an end-of-year review – even if nothing had been achieved. Teachers indicated satisfaction as there was no pressure on them to perform: considerable amounts of work were achieved and teachers benefited from the collaborative process suggesting greater control of their own ICT learning agenda, may result in increased commitment to using ICT in their teaching (Haydn and Barton, 2008, p. 446).

It is possible that these findings may have application to the DISC project: many teachers in the 38 DISC schools seem reluctant to use ICT in their schools at all with some who do, using it in a very limited way. It may well be that increased contact with other teachers and end-of-year reviews without any pressure to achieve may have a role to play in encouraging more teachers to use ICT more. Newly qualified teachers in ROI have ICT modules in their pre-service training as standard now, although their ICT training does not necessarily translate into teaching through ICT in the classroom.

Principals' Influence

One study by Drent and Meelissen (2008, p. 197) suggests that teacher training does not have a significant influence on increased use of ICT within the curriculum as innovative applications 'are not promoted in the current approaches towards teacher training' (Valcke, Rots, Verbeke and van Braak, 2007, p. 806). Principals' attitudes, teachers' attitudes, and the school's approach to the use of ICT were more influential in promoting ICT use in the classroom than teacher training (Valcke et al., 2007, p. 806).

The school's approach can be heavily influenced by a school ICT policy or plan, considered essential to effective implementation of ICT in the classroom by teachers (Vanderlinde and van Braak, 2010, p. 545; Tondeur, van Keer, van Braak and Valcke, 2008, p. 222). However, while this plan may be instigated by the Principal, researchers suggest that all teachers need to be involved in ICT policy planning from the beginning with their views taken into account to ensure successful implementation (Tearle 2004; Tondeur et al. 2008, Vanderlinde, van Braak and Hermans 2009 cited in Vanderlinde and van Braak 2010, p. 545).

Differences between ICT in NI and ROI

The educational authorities in NI have formed a private-public partnership to provide and support ICT provision in schools that is updated and reviewed every three to five years to maintain both the infrastructure and curriculum content/relevance up-to-date that has resulted in very high teacher satisfaction with the project (PWC 2004, 2005 cited in Marshall and Anderson, 2008, p. 468). This contrasts with the situation in the ROI, whereby provision of equipment and support has been issued in a less structured way with

policy reports being issued at long time intervals such as *Schools IT 2000* in 1997; *Blueprint for the future of ICT' in 2001;* and *Investing Effectively in Information and Communications Technology in Schools, 2008-2013* in 2008.

A 'centrist' approach to ICT infrastructure has been adopted in NI with a large number of networked computers (SCR 1:5 primary, 1:4 post-primary); individual laptops for teacher use; high-speed broadband; and access to a wide range of curriculum-relevant content/software all provided at no additional cost to schools. This contrasts with a lack of centrist control of infrastructure in ROI that has led to "fractured delivery of digital technologies' and perceived lack of ICT policy coherence and implementation (Marshall and Anderson, 2008, p. 473). Technical support in NI is also widely available with problems mostly remedied online immediately or within hours by an engineer onsite leading to high teacher satisfaction (PwC 2004, 2005 cited in Marshall and Anderson, 2008, p. 468) in contrast to the ROI where ICT co-ordinators spend considerable amounts of valuable teacher time 'troubleshooting' technical problems (DES 2008b, p. 75).

While the LNI is being piloted in the ROI, much of the material on the LNI is more appropriate to the NI system as the curriculum is very different there with many 'centrally-licensed curriculum software titles' available to support teachers daily lessons. In the Republic, there appears to be very few resources specifically targeted at curriculum subjects and it seems to be left to teachers individually to develop materials (Marshall and Anderson, 2008, p. 468).

As one of the main objectives of the DISC programme is to use ICT innovatively to integrate with the curriculum and one of the main objectives of the LNI project is to create meaningful online learning experiences for students, it would suggest that if the LNI project

is to be adapted and used in an ROI curriculum context, then relevant and tailored curriculum content will need to be developed in order to achieve these two objectives.

Usability/Navigation

Usability is defined by the International Standards Organization (ISO) as 'The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use' (ISO 1997). 'Usability' of educational applications is not sufficiently considered by researchers when assessing their effectiveness in achieving education goals (Squires and Preece 1999). For an interface to be considered 'usable' there should be no need for additional instructions or guidelines (Norman, 1998, p. 9) with representations employed that users are familiar with (Squires and Preece, 1999, p. 480). For school students such as those in the DISC programme, this would seem to be particularly relevant as the emphasis needs to be on the educational achievements and outcomes rather than on the 'tool' such as ICT. However, despite much research on usability and HCI, MLEs continue to be difficult to navigate (UMBC 2002; UNC 2008; Quinn 2009).

Managed Learning Environments/E-learning

There is frequently confusion in the literature with the terms used for online learning platforms with the most common terms MLE and VLE (Virtual Learning Environment) used interchangeably (BECTA, 2003, p. 7). BECTA defines an MLE as 'the whole range of information systems and processes…that contribute directly or indirectly to learning and learning management' while a VLE is one component of an MLE defined as 'the components in which learners and tutors participate in "on-line" interactions of various

kinds, including on-line learning.' (JISC 2000b cited in BECTA, 2003, p. 7). The LNI platform referred to in this report is described as an MLE by C2k (2007, p. 4) although the pilot is effectively using the VLE component only so it will be referred to throughout this report as the LNI to avoid confusion.

Most of the literature on VLE's have been carried out at third level with some at post-primary level, however, there is little research done at primary level (Berry 2005, p. 2) as use of VLE's at this level are very limited (OFSTED 2009, p. 5). One study using Moodle, an open-source VLE, found it encouraged a 'social constructivist model of learning' but is only effective when used in combination with a range of teaching strategies rather than on its own (Berry 2005, p. 16). While a small positive effect on student outcomes was noted, it was not deemed statistically significant, but Berry suggests VLEs encourage a social dimension to learning that could be linked to increased student motivation (2005, p. 16).

Discussion Boards (DBs) are an element of VLE's defined as an 'on-line communication tool that allows members of a particular community to exchange questions, comments and responses for discussion' (Lang 2009, p. 1255). Little research has been carried out on students' attitudes to the use of DBs as online educational tools (Kay 2006 cited in Lang and Costello 2009, p. 1255): this feature is used in the LNI and will be referred to in this report.

In conclusion, the literature on socio-economic disadvantage and student access to computers, particularly in relation to whether the question of 'access' necessarily implies 'equal access' as outlined by Selwyn (2004, p. 343), may help in directing focus for the research on how ICT is being used rather than on the physical resources available. This issue is also connected to the literature on pedagogical strategy/teacher beliefs where

teachers' teaching approach – constructivist or traditional – also influences how teachers use ICT and whether they use it to facilitate effective teaching, encouraging students as active participants (Hermans et al. 2008, p. 1499) or focus on the use of ICT for its own sake.

The lack of satisfaction by teachers with the form and content of ICT training in other countries (Galanouli et al. 2004; Valcke et al. 2007) is very relevant to this report as one of the main research questions is assessment of the effectiveness of teacher ICT training both by DISC and by the DES, particularly at pre-service level. Findings relating to the lack of Transfer of training on teacher ICT courses (Cascio 2000; Noe et al. 2006 in Velada et al. 2007, p. 283) and teachers' need to have time to experiment with ICT methods free of pressure (Granic et al. 2009; Haydn and Barton 2008) are also relevant in assessing whether DISC training methods, course content and training locations are meeting DISC teachers' needs and if not, how they could be improved.

The role the ICT co-ordinator as provider of pedagogical support in ICT use rather than technical (Vanderlinde et al. 2009; Lai and Pratt 2004) and the recognition that on-demand technical support is required by schools (DOE 2002; Marshall and Anderson 2008) is appropriate in addressing three research questions: the factors influencing the use and implementation of ICT; how teachers use ICT and the difficulties encountered.

Finally, the differences between the curricula in NI and ROI (Marshall and Anderson 2008) and the usability of MLE interfaces (UMBC 2002; UNC 2008; Quinn 2009) may have implications for assessing the question of whether the pilot LNI was successful and could be rolled out to all schools or whether design changes are needed.

CHAPTER 3: THEORETICAL FRAMEWORK – CULTURAL HISTORICAL ACTIVITY THEORY

This chapter outlines some of the literature relating to Cultural Historical Activity Theory which has been selected by this researcher as the theoretical framework for design and analysis of this research. The chapter will describe the concept of Activity Theory (AT); the use of AT by other theorists in the Human-Computer Interaction (HCI) and Interaction Design (ID) research fields and the use of one strand of AT, namely Cultural-Historical Activity Theory (CHAT) as developed by Yrjö Engeström (1987) at the University of Helsinki, Finland which will be used for this report. The final part of this chapter will discuss the relevance of CHAT for this particular research and why it was chosen.

AT is a 'philosophical and cross-disciplinary framework' (Kuutti 1996, p. 25) that 'seeks to analyse development within practical social activities' (Sannino, Daniels and Gutierrez 2009, p.1). A*ctivity* is used as the smallest meaningful unit of analysis (Kuutti 1996, p. 26; Wertsch 1985, p. 151) with the nature of *activity* being central to AT in understanding how people interact with the world with purposeful action through the use of objects (Leont'ev 1978). Activity is 'a form of doing' (Isroff and Scanlon 2002, p. 78) motivated towards a specific object of activity and consists of *actions* which are aimed at specific goals and *operations* that are connected to specific tasks (Lektorsky 2009, p. 77). *Actions* are conscious acts while *operations* are unconscious acts that are carried out automatically, however, activity, actions and operations are not a hierarchy with changes between them taking place depending on the situation (Bødker 1989, p. 177).

For example, if a student or group of students are asked to complete a report using a word-

processing document, some of the 'actions' may consist of consciously opening the software and putting in headings: the 'operations' may consist of using the mouse, keyboard and icons without consciously being aware of how to use them.

Activity is motivated 'by the need to transform the object into an outcome'; the outcome may be tangible or it may be abstract such as an idea (Isroff and Scanlon 2002, p. 78). The AT focus, however, is not merely on *actions* by individuals (Wertsch 1991) but on the historical and collective nature of human activity (Sannino, Daniels and Gutierrez 2009, p. 3). This is why AT is increasingly being used in HCI and ID research as it enables the study of a user interface in particular work situations by focusing 'on the practice of a group of users' rather than individuals (Bødker 1989, p.173). Bødker (1989, p. 179) defines *Practice* as 'a group of human beings conducting a collective activity with a specific object or goal'. In recent years, AT is increasingly being used to inform and develop HCI and ID rather than just study them (Kaptelinin and Nardi 2006) with Bannon (2011, p.182) observing that the trend in ID is to 'privilege the human, social, and cultural aspects of computing'' in a more holistic way.

Engeström (1987) has further developed AT which is now known as Cultural-Historical Activity Theory (CHAT) to reflect 'the collective and collaborative nature of human activity' (Mwanza 2001, p. 4). CHAT is derived from the work of Lev Vygotsky (1978) and further developed by Vygotsky's colleague Alexei Leont'ev in the 1920s and 1930s (Engeström 2001, p.134). Engeström maintains there are three theoretical generations of AT with the first centred on Vygotsky's triadic representation of a 'complex mediated act' (X) transcending a Stimulus (S) and Response (R) (Figure 1a). This has now been reformulated in the literature to a triadic representation of a Subject, Object and Mediating

Artifact (Figure 1b) with the 'Object' now highlighting the 'object-orientedness' of the action as 'the key to understanding human psyche' (Engeström 2001, p. 134) rather than simply stating an individual's response.

A mediating artefact (or Tool) may be a material object, sign, or symbol (Hasu and Engeström, 2000, p. 63) that integrated with a subject (individual or group) and object (tangible object or 'problem space' at which activity is directed) form a unified activity system.

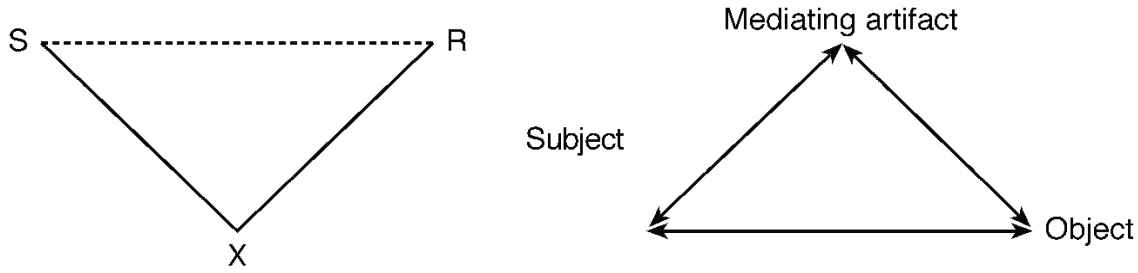

Figure 1:(a) Vygotsky model of mediated (b) model represented in literature (Source:Engeström 2001)

The second generation, according to Engeström (2000, p. 63), is attributed to Leont'ev who moved from Vygotsky's emphasis on the individual to the concept of 'collective activity'. Although no graphical illustration was provided by Leont'ev, Engeström (1987, p. 78) developed this work (Figure 2) with the addition of *Rules* referring to implicit and explicit rules that may constrain activity; *Community* comprising individuals and groups sharing a mutual object; and *Division of Labour* representing how tasks, status and power are divided among the community (Engeström 2001, p. 134).

According to Leont'ev (1978, p. 62) "the object of an activity is its true motive" with the 'object' in Activity Theory not just representing a physical object or tool (Figure 2) but could be 'a goal or a motive of activity' (Rückriem 2009, p. 103). In many representations

of the Activity System, the 'object' is represented by an oval shape indicating that object-oriented actions are influenced by how individuals and/or groups interpret or make sense of their actions leading to an outcome that they may or may not have intended (Engeström 1987, p. 78; Engeström 2009, p. 55). This indicates that the motive for action may change while the subject is interacting with their environment. For example, the 'object' of using the LNI platform for the teacher may be initially motivated by the need to fulfil the requirements of the DISC programme for students to interact. However, once the action starts, the teacher may find that it also facilitates teacher-to-teacher interaction and support that may not have been expected.

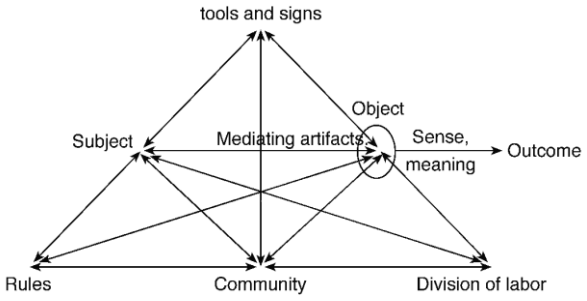

Figure 2: The structure of a human activity system (Source: Engeström 1987, p. 78)

The concept of mediation was revolutionary at the time as it challenged the traditional Cartesian view of the split between an individual and society (Engeström 2001 p. 134). Vygotsky and his colleagues' approach became known as a sociocultural theory of psychological processes where the individual and social environment could not be separated with both comprising 'mutually constitutive elements of a single, interacting system' (Cole 1985, p. 148).

The third generation is still being developed by Engeström and fellow researchers with the

emphasis on developing tools to analyse different perspectives and interactive activity systems (Engeström 1996, p. 133).

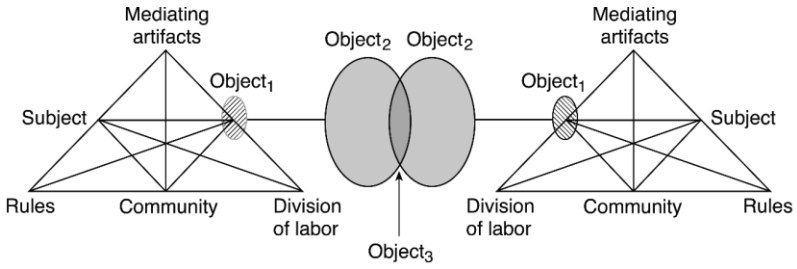

Figure 3: Two interacting activity systems (Source:Engeström 2001, p. 136)

Engeström's approach here is described as 'expansive learning' that is similar to Gutierrez and colleagues who discuss the notion of a 'third space' where students' and teachers' separate activity systems may occasionally meet with a 'shared object' and expand resulting in further development for both (Gutierrez, Rymes, and Larson 1995; Gutierrez, Baquedano-Lopez, and Tejeda 1999 cited in Engeström 2001, p. 156). For example, students may want to use the ICT technology available to them to have fun and interact with students from another jurisdiction whereas teachers may want students to learn using ICT. The use of the LNI by both teachers and students with their own separate 'objects' and activities may result in learning and enjoyment for both parties.

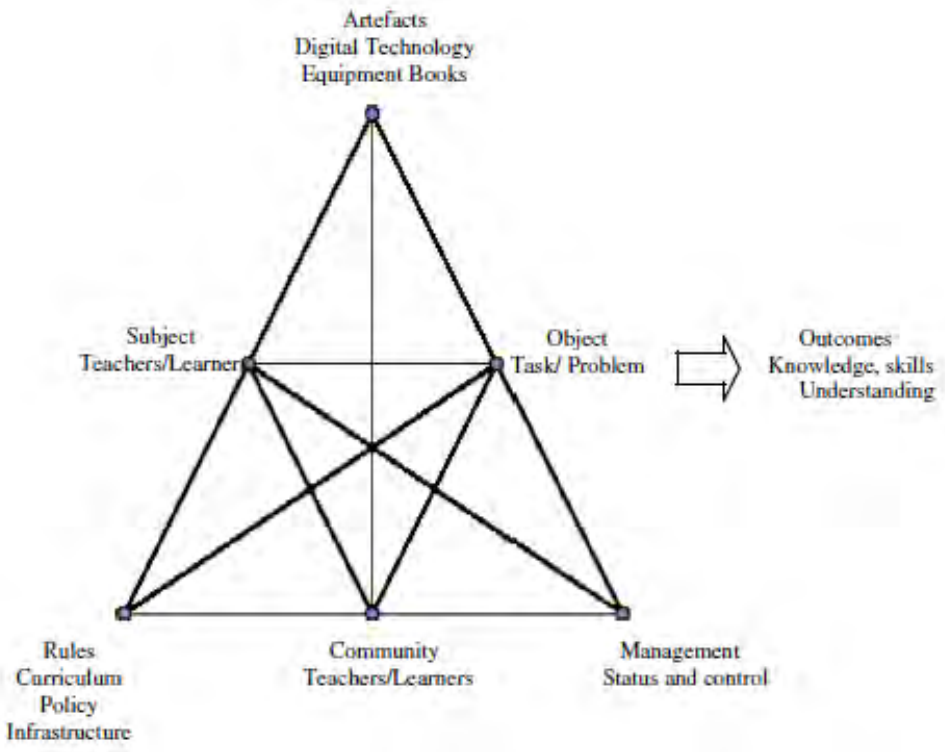

Figure 4: Activity System for teachers in schools (Source: Stevenson 2008, p.839)

CHAT's activity triangle (Figure 4) may be adapted for researching ICT with the top section representing the actions of both individual and groups (subject) in a collective activity system (Stevenson 2008 p. 839). *Mediating Artefacts* may be computers, software or MLEs); the S*ubject* may be students or teachers; the *Object* the particular task the student is required to do. The lower half of the triangle looks at the *Rules* that govern the student's use of the computer or software such as the curriculum, government policy or even school rules. The *Community* may consist of other learners, teachers and the wider community whereas *Management* or *Division of Labour* refers to how tasks, power and responsibility are negotiated by participants in the activity system (Lim and Hang 2003; Stevenson 2008) and may include teachers, school management, and the developers of the technology.

CHAT provides a useful research framework rather than being a predictive theory, providing language terms to describe people's activities in context, considered important when researching ICT and HCI (Mwanza 2001, p. 4). However, this leads to some researchers criticizing CHAT for being merely a descriptive theory (Turner and Turner 2001) that does not yet have established methods and guidelines to guide researchers (Mwanza 2001, p. 1).

To address this issue, Mwanza (2001, p. 6) proposes the use of an 8-step model (Table 1) that involves asking eight questions using the main components of the Activity Theory triangle (Figure 2) in order to provide a framework for research. These questions were applied to this research in the early stages when developing the questions for the interviews and later on in analysis of the data (Methodology section; Appendix A).

Table 1: 8-step Model (Source: Mwanza 2001, p. 6)

8 - Step Model: Identify the following:	
Component	**Question**
Activity	What sort of activity am I interested in?
Object (objective)	Why is the activity taking place?
Subjects	Who is involved in carrying out the activity
Tools	By what means are the subjects performing the activity?
Rules and regulations	Are there any cultural norms, rules or regulations governing the performance of the activity?
Division of Labour	Who are responsible for what, when carrying out activity and how are those roles organized?
Community	What is the environment in which this activity is being carried out?
Outcomes	What is the desired outcome from carrying out this activity?

In providing an analytical framework for activities, actions and operations, CHAT does not predict or describe each step as other task-analytical approaches to the study of ICT/HCI such as Card, Moran and Howell (1983 cited by Bødker 1999, p. 178). For this report, the research is not concerned with the technical aspects of students' and teachers' use of ICT but on how or why they use it. As Bødker (1999, p. 173) points out, users 'don't attend to the specificities of the user interface in everyday situations' but use the computer as a tool to achieve an end. The CHAT framework may also be employed for observing students' use of hardware and software by taking into account other influences such as their teachers,

principals, parents, curricula and government policy. The student using ICT is viewed in the context of their culture and their environment and not just studied in isolation. For example, constraints may be put on a student's activities by the expectations and requirements of their teachers, parents and the educational system in how and why they use ICT.

Contradictions

In addition to incorporating cultural, historical, situational and contextual features in the research process, CHAT also allows for 'contradictions and unintended consequence of activities' (Hasan and Crawford 2003, p. 187) to be identified. Contradictions are not necessarily conflicts but are seen as 'historically accumulating structural tensions within and between activity' that may arise when a new technology, for example, is introduced to a previously long-established system (Engeström 2001, p. 137). This aspect could be very relevant to this research where ICTs are being introduced into the Irish education system that previously relied on the written word for teachers to teach and students to learn.

Tensions can arise between different activity systems, for example, the student and teacher would have their own activity systems with students wanting to use computers for 'fun' while teachers want to deliver the curriculum.

While individuals experience the results of contradictions and difficulties in activity systems, the solutions can only be arrived at through collective action activities (Blackler 2009, p. 28). Students and teachers, for example, may have very different reasons or expectations for using ICT: students may see it as 'fun' whereas the adults may view it as a reward for good behaviour; a learning tool; or indeed as preparation for use in the world of

work or for education at third level.

The history and development of the ICT process (Lim and Hang 2003) is also relevant here as each time a student uses a computer or software, they are also benefiting from the learning and experiences of the developers who continue to modify and improve ICT for the benefit of current and future users.

Criticism of CHAT

Engeström's theory of activity systems is not accepted by all researchers with an interest in activity theory (Blackler 2009, p. 28). Bedny and Karwowski (2004, p. 134-135) maintain that translation of the original Russian texts on Activity Theory into English resulted in errors of basic concepts and terminology; restriction of AT to Leontiev's work only rather than encompassing the work of many other Russian scholars; and the 'blurring' of the distinctions between Vygotsky's sociocultural theory of the development of mind with AT. As Shchedrovitsky (1995 cited in Bedny and Karwowski, 2004, p. 136) observed, Vygotsky did not develop a theory of 'object-oriented, socially mediated, individual activity'. Despite many representations of Vygotsky's work in the West as being the foundation of AT, the word 'activity' was not used at all by Vygotsky nor was the term used to describe a basic unit of psychology in his work (Bedny and Karwowski, 2004, p. 137).

Langemeyer and Roth (2006, p. 28) question Engeström's representation of *activity* and the use of triangular representations suggesting they may mislead other researchers when interpreting their research. However, Kuutti (1996, p. 34) points out that while the triangular representation may appear too 'rigid', it is useful for 'the sake of representational

simplicity and convenience' for many researchers. Other researchers also argue that the triangular representations emerged from researchers' 'dialogue with practice' and that it provides a means of condensing and conveying theory between collaborating researchers (Sannino, Daniels and Gutierrez 2009, p. 13).

Despite their criticisms, Langemeyer and Roth also acknowledge that CHAT publications 'consistently develop their argumentation and often corroborate it with wide empirical research' (2006, p. 28).

As previously alluded to, some researchers criticize CHAT for being merely a descriptive theory (Turner and Turner 2001) rather than being predictive. Researchers such as Nardi (1996, p. 7) acknowledge that it is not a 'strongly predictive theory' but describes it as a 'powerful and clarifying tool' while Barab (2004, p. 40) emphasizes its usefulness in providing an analytical focus, particularly for digital technology research. Schneiderman (2002 cited in Kaptelenin and Nardi 2006, p. 28) postulates that theories may have five different roles or uses: descriptive, explanatory, predictive, prescriptive and generative with AT combining three of these roles: descriptive, in identifying important concepts such as mediation; explanatory by exploring processes and relationships; and generative by facilitating further creativity and discoveries.

CHAT has also been criticized by theorists within the CHAT tradition such as Lompscher 2004 (in Engeström and Sannino, 2010, p. 16) and Rückriem (2009) for assuming that print and writing are the predominant cultural media and neglecting the transformative effect computers and technology have had on society and development. Rückriem (2009, p. 94) further proposes that the dominant media shapes contemporary culture and analysis of work and learning environments cannot now be done without reference to digital media.

However, while Engeström and Sannino (2010, p. 17) acknowledge that computerization should be prioritized more, they argue that technology is not 'the direct cause of all societally important developments'.

According to Blackler (2009, p. 28), the emotional aspects of objects of activity have been neglected with the CHAT emphasis on behaviour externally influenced through 'tools, signs, and cultural, social and organizational factors' rather than on how individuals can 're-mediate' their own activities.

Roschelle (1998, p. 246) also criticizes AT research for being primarily qualitative in nature, neglecting quantitative aspects and emphasizing case-study research. Brennan, McFadden and Law (2001, p. 38) in a review of ICT introductions in educational contexts, argue that while quantitative methods are useful when researching specific learner outcomes, a combination of qualitative and quantitative methods gives a more balanced perspective (Mitchell and Bluer, 1996 in Brennan, McFadden and Law, 2001, p. 41). Brennan, McFadden and Law (2001, p. 38) further argue that qualitative methods are more suited to studying ICT introduction in educational settings as they analyse processes and not just outcomes while Karasavvidis (2009, p. 437) suggests an AT approach is appropriate for evaluating ICT introductions as it facilitates conceptualizing 'the tensions arising from an ICT-based innovation'. In this research report, a combination of both quantitative and qualitative measures is used with CHAT informing both.

Taylor (2009, p.230) criticizes Engeström's use of the 'community' concept, maintaining that it has been 'weakly conceptualized in activity theory' in being deployed as a 'parameter' rather than being viewed as a constructed object and outcome of an activity in itself. Taylor (2009, p. 232) further purports the role of 'authority' is foundational to

fostering and sustaining communities: Engeström (2009, pp. 314-7) accepts Taylor's criticism that 'authority' is not studied in depth in AT but maintains 'community' comes first with authority and agency arising from community recognition subsequently.

The reason CHAT was selected as a theoretical framework for this research is that

Reason for selecting CHAT for this research

In previous research on the use of Blackboard, an MLE used in higher education (Quinn, 2009) this researcher was introduced to the concept of Activity Theory by a previous supervisor who was very involved in a distance education programme in a leading Irish university. On reading the HCI and ICT in education literature, in particular, CHAT was used in several of the articles that researched the introduction and integration of ICT in either primary or secondary contexts in addition to the use of MLEs at all educational levels. For example: online learning (Barab et al. 2004; Levy 2008); ICT in higher education (Isroff and Scanlon 2002); integration of ICT in schools (Demiraslan and Usluel 2008; Lim and Hang 2003); e-learning (Liaw et al. 2007; Mwanza and Engeström 2005); ICT in primary schools (Romeo and Walker 2002); and interpretation of graphs (Roth and Lee 2004).

The concept of processes, such as the use of ICT in a learning environment, occurring at both the individual and social levels with mediating tools/artifacts (digital technology) linking processes together among subjects such as teachers, students, and principals (Lim and Hang, 2003, p. 51) is a major feature of AT. Researching an activity system composed of subjects (individual/collective), an object (objective) and mediating tools that also took account of the Rules (formal/informal), Community and Division of Labour that influenced, directed or even confined the activity seemed to encompass many of the aspects

of the DISC/LNI programme for this researcher.

The triangular representations of CHAT (Engeström 1987) along with the 8-step model (Mwanza 2001) that provided questions researchers need to ask, were very helpful in the initial stages of the research process in selecting the methods of data collection and devising the questions for the questionnaires and semi-structured interviews.

After data collection, the representations and questions again helped in focusing the data analysis, particularly for addressing the research question on identifying difficulties encountered on integrating ICT into the classroom.

A CHAT approach assists in highlighting contradictions in activity systems by its emphasis on the study of the 'object' and the actual outcomes which may or may not have been expected, and identifying possible areas for change (Engeström 2009; Engeström and Sannino 2010). Contradictions or 'breakdowns' are not viewed as negative issues in the CHAT framework, but seen as 'opportunities for change or learning' (Turner and Turner 2001, p. 1) that may improve the experience of all stakeholders in the process under research. It is this aspect on highlighting the contradictions and the differing interpretations of the 'object' by participants (teachers, DISC staff, students) that was most helpful in this research on the DISC/LNI project, particularly for analysis of the qualitative data.

An alternative theoretical framework that could have been used is Actor-Network Theory (ANT), based on the work of Bruno Latour, that views society as comprised of human and non-human actor-networks: 'non-human' refers to artifacts/material objects created by man such as operating systems and technology (Teles and Joia 2010, p. 4). While it is outside the scope of this research to deal in any detail with ANT or any other alternative theories,

the reason ANT was not selected while CHAT emphasises the role of artifacts or objects as mediating activity with humans as the actors (Blackler 2009, p. 31), ANT treats objects as actors or 'actants' (Latour 2005 cited in Blackler, 2009, p. 31) with agency equal to humans. As Miettinen (1999 cited in Kaptelinin and Nardi, p. 200) points out, only humans can take the initiative in constructing artefacts or creating the opportunities for tool use as humans do: for this researcher, CHAT seemed a more appropriate theoretical framework.

CHAPTER 4: METHODOLOGY FOR EVALUATION OF THE DISC PROJECT

This evaluation of the DISC project addresses two main aspects:

1) DISC Project overall
    a. ICT Projects
    b. LNI project generally
2) The LNI pilot project in detail

In investigating these two projects, this report asks whether DISC's original objectives and the LNI pilot project objectives have been achieved. The report outlines the experiences of teachers, ICT co-ordinators and principals who have engaged with the DISC/LNI programmes. It also reveals the factors that have influenced their attempts to integrate the use of ICT into their schools and classrooms. Finally, the report also assesses students' experiences, observations and levels of engagement with the DISC/LNI programmes and makes recommendations for future development of the programmes.

Rationale for Methods Used

Methods of assessment

A review of the literature relating to online education and training in Australia (Brennan, McFadden and Law 2001, p. 38) criticizes the use of quantitative methods in evaluating ICT as their 'performance criteria' may be too limited or task specific to result in meaningful data. By contrast, qualitative methods, such as the use of interviews or focus groups, are suggested as being more appropriate to obtain more detailed data by addressing

the ‘communicative and interactive capacities of the technology as opposed to its mass distributive functions’ (Brennan, McFadden and Law 2001, p. 38)

Other researchers recommend the use of a mixed methods approach as the data obtained from using both quantitative and qualitative methods may be used to ‘capture the richness, complexity, and interdependence of events, actions, and conditions in the real classroom’ (Kozma and Anderson 2002, p. 390).

Research Methodology for DISC research

This report employed a mixed-methods approach using questionnaires; semi-structured interviews; focus groups and classroom observations. Questionnaires are used to obtain an overall assessment of the DISC project from all schools; semi-structured interviews with three DISC personnel to gain background knowledge and current issues; and a case study of six schools was used to probe more deeply into the specific LNI and ICT projects. The case study includes semi-structured interviews for teachers, principals and ICT co-ordinators; classroom observations to observe actual use of ICT in the classroom; and focus

QUESTIONNAIRES

One hundred and fifty-two questionnaires were sent to principals, ICT co-ordinators and teachers involved in 38 schools in the DISC programme. Seventy-two questionnaires were returned, representing a response rate of 47 per cent. The questionnaire was divided into sections on:

1. Personal Background of teachers
2. The ICT facility and use in the school
3. Teachers’ qualifications, experiences and training in ICT
4. A section on the DISC programme specifically

All questions are 'closed' with an 'open-ended' section provided at the end of the questionnaire for any additional comments.

CASE STUDY

A case study is defined as 'an investigation to answer specific research questions, requiring a range of different evidence from the case setting' using methods such as interviews and observations and is considered a valid means of investigating issues relating to ICT and e-learning in educational settings (Ssemugabi and de Villiers 2007). This method is being used to 'triangulate' the data from different sources to provide an overall view of the different perspectives of teachers, students and DISC staff. This is in line with Bakhtin's (1982 in Engeström, 1987, p. 165) idea of 'multi-voicedness' where each 'community' such as a school has 'multiple points of view, traditions and interests that can be a source of trouble or innovation leading to possibilities for change in activity systems (Engeström, 2001, p. 136).

To examine the views of Principals, Teachers, ICT Co-ordinators, IT Post-holders, and students, the report presents a case study of six schools where the DISC programme is studied in more depth. These schools have been selected to represent a range of school situations and level of programme commitment, for example, very committed schools, reasonably active schools and uncommitted schools. One 'uncommitted school' was extremely difficult to contact and a replacement 'uncommitted school' was selected with three interviews and one observation session carried out and completed. The four schools involved in the MLE project have been included with two additional schools participating in the ICT projects initiative only.

SEMI-STRUCTURED INTERVIEWS

Twenty semi-structured interviews were conducted with three DISC staff and seventeen teachers consisting of: six Principals (four male/two female), five Classroom Teachers, and six ICT co-ordinators/IT post-holders (three male/eight female); Five Principals are aged 50+ while all five teachers (excluding IT post-holders and ICT co-ordinators) are aged 26-34 years. For the purposes of this report, no distinction will be made between ICT co-ordinators and post-holders: they carry out the same function but ICT co-ordinators receive an additional stipend in their salary from the state whereas post-holders may receive an additional stipend from the school.

Eight general areas were covered with interviewees encouraged to talk freely within these sections. Sections covered were: teaching motivation; familiarity with DISC; feelings about DISC; suggestions for future; school ICT facility; students' interaction; ICT Teacher training; support for ICT; and the last section open to any additional comments (Appendix B). The questions asked are designed to link in with the 8-step model proposed by Mwanza (2001) that was also used for a similar evaluation research project on the integration of ICT in Turkish Schools (Demiraslan and Usluel 2008, p. 459).

Table 2: Questions asked in semi-structured interviews related to Mwanza's (2001) 8-step model

Activity Theory	**Actual Questions – semi-structured interviews**	**Information to elicit**
Subject	Question 1: How did you get into teaching?	Teacher (teaching experience, teaching approach, the personal, administrational and instructional use of ICT, the place of ICT in daily life, the necessity of knowledge and skills related to ICT).
Object	Question 3: How do you feel about the DISC project?	The goals of using ICT in teaching-learning process (knowledge and skills acquisition, and problem solving).
Tools	Question 5: How do you feel about the ICT facility in your school? Question 7: Have you any thoughts on Teacher training in ICT?	ICT and the tools other than ICT, methods which are used, problems which are encountered.
Rules	Question 2: Tell me about the DISC project?	Expectations of the teacher/principal/DISC, rules of the school, curriculum.
Community	Question 5: How do you feel about the ICT facility in your school? Question 6: How have the students interacted with the DISC programme?	Students, teachers, school administration, ICT co-ordinator, DISC
Division of labour	Question 7: Have you any thoughts on Teacher training in ICT? Question 8: Do you feel that you are supported to use ICT in your school?	The roles and responsibilities of students and teachers, cooperation among teachers, the support of administration.
Outcome	Question 3: How do you feel about the DISC project? Question 4: Would you have any suggestions for the DISC project in the future Question 9: Have you any other thoughts on the DISC project?	The reflection of the use of ICT in teaching-learning process to the learning of students and instruction (Demiraslan, 2005 in Demiraslan and Usluel, 2008, p. 459).

Adapted from (Mwanza, 2001 and Demiraslan and Usluel 2008, p. 459)

FOCUS GROUPS AND OBSERVATIONS

While there has been some research in recent years on the importance of seeking students' perspectives on the impact of online teaching technologies on teaching and learning (Farrell, Danby, Leiminer, and Powell 2004; Jackson 2004; Whitehead and Clough 2004 in Moyle and Owen 2008) little research in the area has actually been carried out.

One method of gaining student perspectives is the use of focus groups, described as a form of 'group interview' (Merton, Fiske and Kendall 1990; Puchta and Potter 2004 cited in Moyle and Owen, 2008, p. 3), where the conversations generated can be considered as 'research conversations' (Moyle, 2008, p. 3). Focus groups enable researchers to explore and clarify issues while facilitating different views 'to be both challenged as well as accepted', however, care needs to be taken to avoid vocal individuals dominating the discussion (Moyle, 2008, p. 4).

Three classes were observed: a junior infant class that were being taught English spelling using a specific software programme and a 3rd class and a 5th class who were using laptops to do specific projects on Egypt and volcanoes respectively.

Focus groups were held with the three schools who are actively involved in the LNI project: to preserve anonymity, these schools will be referred to in this report as Post-primary School 1 (age 15); Primary School 2 (age 11); and Primary School 4 (age 9). The students from Post-primary School 1 were all boys aged 14-15 in second year; students from Primary School 2 were girls aged 10 to 11 and students from Primary School 4 were girls aged 8 to 9. The focus group approach was used as it made the best use of the limited time available and enabled these sessions to be carried out with the assistance of and supervision of the teachers.

Students were asked about their perceptions of Learning NI, what they liked and disliked about the interface and using it along with feedback on their trips with their link school in NI. Students were mainly positive about their experiences in using the LNI although they did have some reservations and suggestions for future changes. These are discussed later in this report.

Data analysis

For the purposes of data analysis, SPSS 18 was used for the quantitative data compiled from the seventy two questionnaires returned and NVivo 9 was used for the qualitative data collected from the twenty semi-structured interviews; three focus groups; three classroom observations; the open questions from the questionnaires; and the LNI session.

Ethics

This research received full permission from the Ethical Committee of the Dublin Institute of Technology and complied with all regulations fully.

CHAPTER 5: RESULTS OF QUESTIONNAIRES

Demographics

Questionnaire response

152 questionnaires were distributed to all thirty-eight schools in the DISC Project: four questionnaires per school for completion by the principal, the ICT co-ordinator or IT post-holders, and two teachers. The questionnaires were delivered in January by both email and post with reminder emails sent out at two-weekly intervals. 72 questionnaires were returned resulting in a response rate of 47 per cent. The questionnaires were returned by 19 principals representing 50 per cent of all 38 DISC schools participating in the survey: 21 ICT co-ordinators/IT post-holders and 32 teachers also responded.

The majority of respondents (81%) represented primary schools and about a fifth from post-primary Schools. Over half of schools participating in the study taught boys and girls, whereas a quarter of schools were boys' schools and a quarter were girls' schools. For the purposes of this report, the term “teachers” will be used to include principals, ICT co-ordinators, IT post-holders and teachers without specific posts unless otherwise stated.

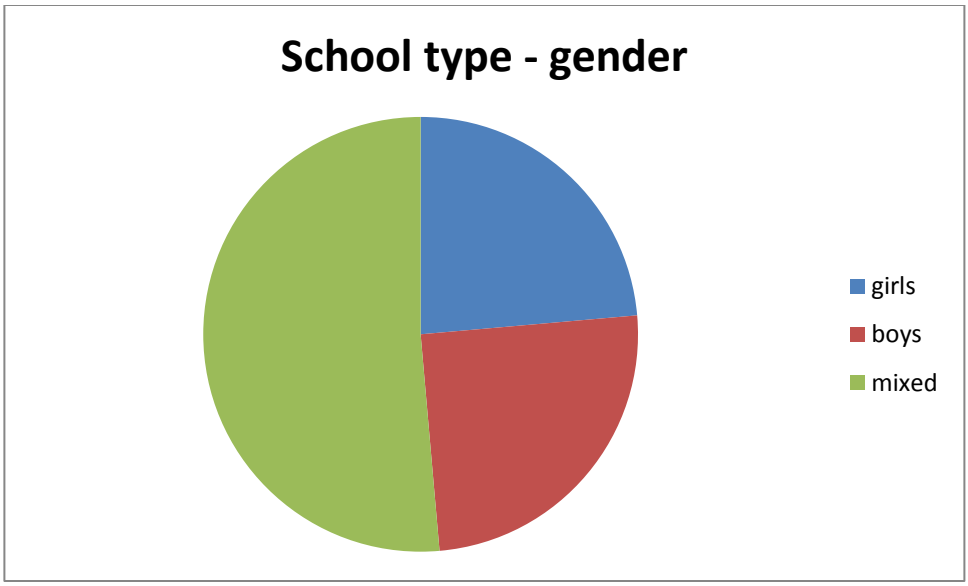

Figure 5: Type of School by gender (N = 72)

Profile of teachers who responded

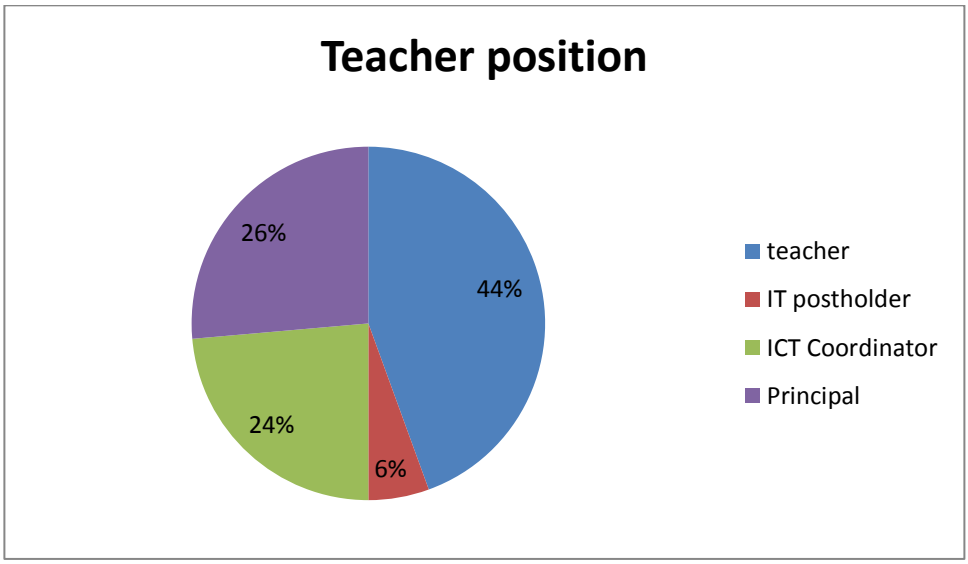

Figure 6: Position of Teachers who responded (N=72)

The largest group of respondents are classroom teachers with almost equal numbers of ICT co-ordinators/IT post-holders and principals. Therefore, almost three-quarters of respondents are actively teaching in classrooms as principals are in non-teaching roles.

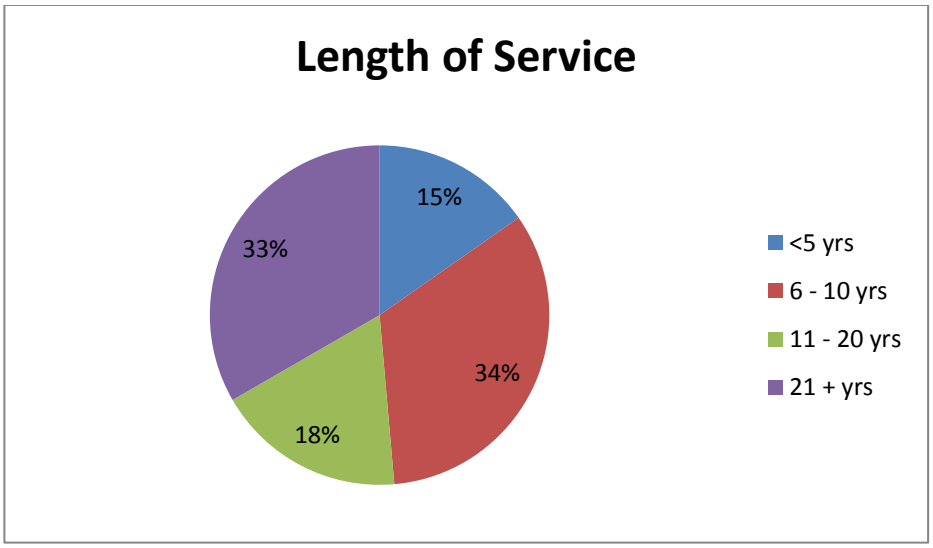

Figure 7: Length of Service (N=72)

A third of teachers have served for more than twenty-one years (33%) with another third in the 6-10 years age bracket. Less than a fifth of teachers who could be classed as newly-qualified (<5 years) responded. As teacher training during pre-service training was introduced as a result of IT2000 (DES 1997), it could be presumed that well over half of all teachers are likely to have received ICT training during their pre-service training.

Three-quarters of teachers who responded are aged between 26 and 49 (71%) with the smallest group in the 18-25 years group (5%) while about a quarter of respondents are aged 50+ (24%). Three-quarters are female (76%) while a quarter (24%) is male.

Table 3: Breakdown of Teacher Age by Teaching Position held (N=72)

Position	Teacher Age				Total
	18 -25	26 - 34	35 - 49	50 +	
Principal	0	1	7	11	19
ICT co-ordinator	0	3	10	4	17
IT post-holder	0	2	1	1	4
Teacher	4	22	5	1	32
TOTAL	4	28	23	17	72

By analysing the responses by teacher age and teacher position, the largest group are teachers in the 26-34 age bracket with principals next from the 50+ age bracket and ICT co-ordinators in the 35-49 age bracket. There appears to be a relationship between teacher position and age with older teachers generally holding more senior posts.

ICT in Schools – Questions 1-9

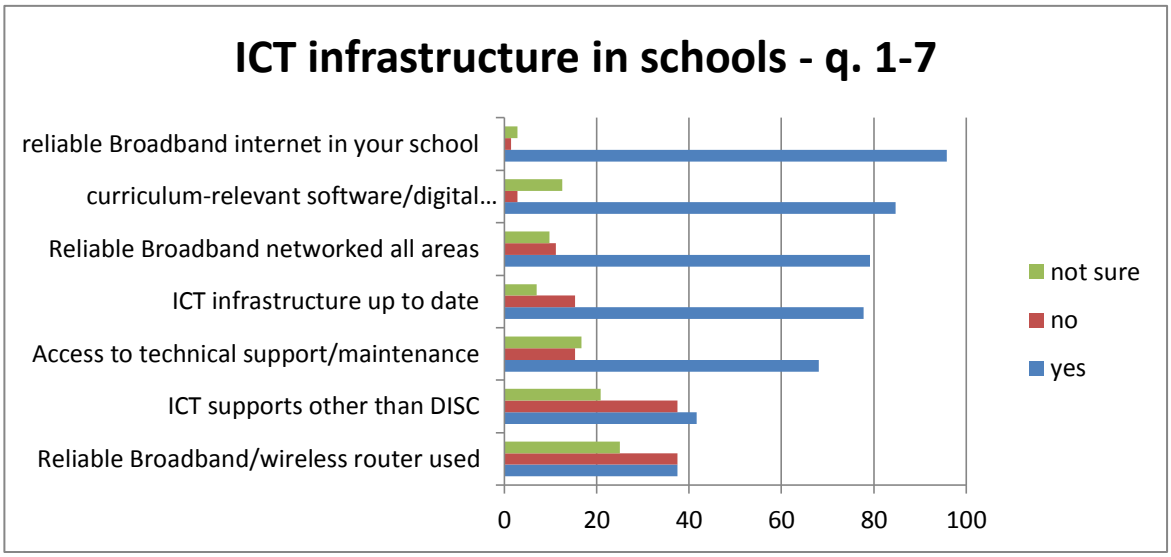

Figure 8: ICT infrastructure in schools (N=72)

Teachers were asked six specific questions about the ICT facility in their school (question on broadband had two parts). Almost all respondents had reliable Broadband internet in the school with over three-quarters responding that the internet was networked to all areas; however, just over a third responded that a wireless router is in use while 63 per cent of teachers either did not know or are unsure if a wireless router is being used. Almost three-quarters of respondents are aware that they have access to technical support and maintenance, but a third is either unaware or unsure. More than three-quarters of respondents indicated that the school infrastructure was up-to-date and they had ready access to curriculum relevant software or digital content. Almost half of respondents said their school was solely dependent on DISC for formal ICT support and structures, however, an equal number had access to other sources, for example, the Digital Hub, with 15% of respondents unsure about whether there are additional supports in the school.

The vast majority of teachers felt that ICT is a useful tool for education; however, this still

left a small number of teachers who indicated that it was not a useful tool.

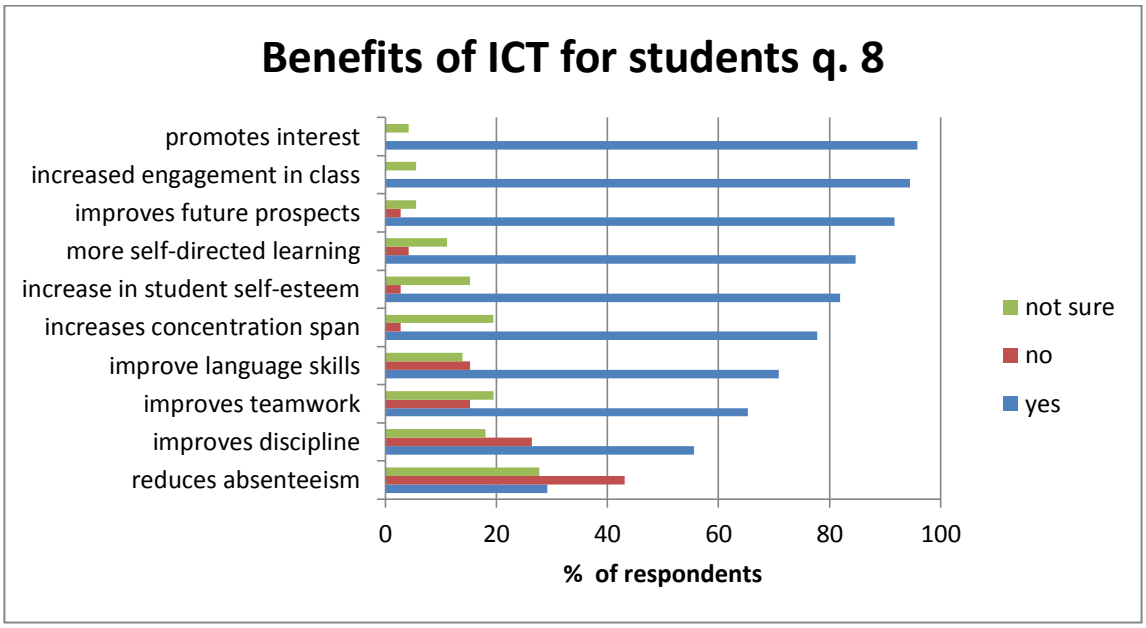

Figure 9: The perceived benefits of ICT for students (N = 72)

Teachers are asked if ICT has any of the listed benefits for students. The three areas in which the vast majority of teachers view ICT as having a very positive benefit for students is in promoting interest in learning generally; increasing class engagement; and improving future job prospects. Respondents also indicate that that ICT use encourages more self-directed learning; leads to increases in student self-esteem; increases attention span; and improves language skills. Negative findings were: a third of respondents indicate ICT use in classrooms does not improve teamwork; a quarter do not view ICT as leading to improved class discipline while almost half of all respondents said ICT use does not reduce absenteeism with just under a third being unsure.

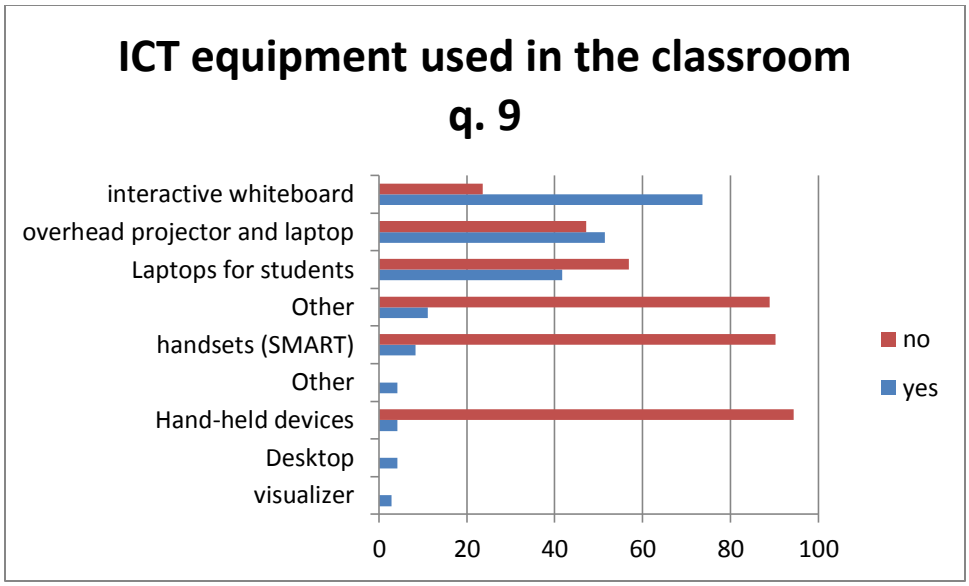

Figure 10: ICT equipment used in the classroom (N=72)

Three-quarters of teachers used interactive whiteboards with just over a half using a laptop with overhead projector to present lessons. Despite the NCTE recommendation that the preferred option for classrooms is a fixed projector with laptop (DES 2008a, p. 66) with schools subsequently supplied with a grant for this, only half of respondents have this equipment in their classroom (Flynn November, 2009). This may suggest that schools have secured financial resources for whiteboards outside of the government grant or schools are putting the total grant money towards the purchase of whiteboards.

While 41% of teachers said they used laptops in the classroom, 12% used hand-held devices with a very small number using desktops (2%). The majority of respondents do not appear to use hand-held devices of any type. The use of desktops is extremely low, however, this may suggest teachers are using laptops or laptop trolleys instead with teachers in interviews indicating their preference for having laptops available in the classroom rather than having to move students to another room (Teacher 1, Primary School 3).

ICT usage and ICT training (questions 10-17)

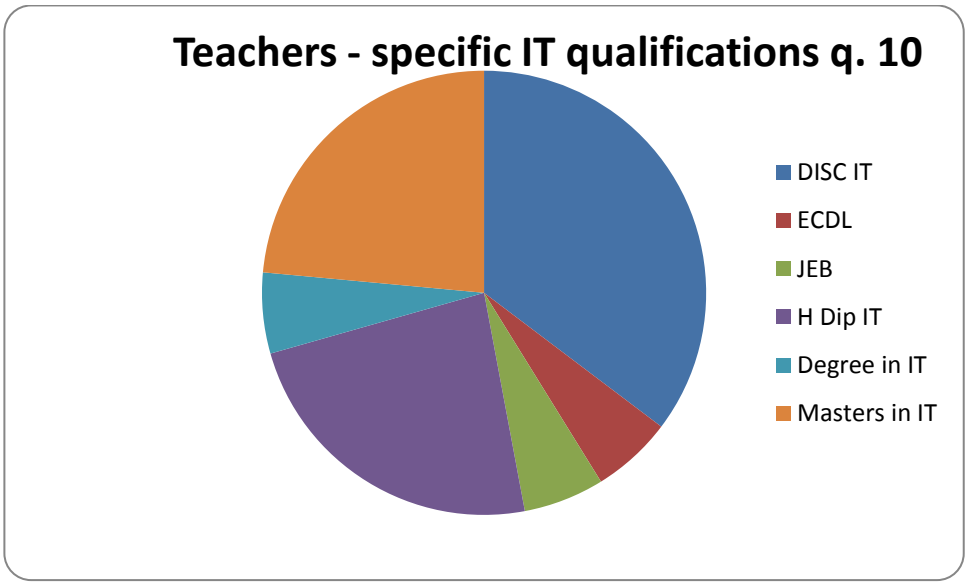

Figure 11: Teachers with specific IT qualifications (N=17)

More than half of the seventy-two respondents indicated they had high levels of post teacher-training qualifications such as a Masters in IT; H Dip in IT or degree in IT. Almost three quarters of respondents had some form of IT qualification including JEB or ECDL. While only a third had availed of the IT qualifications provided by DISC, which seems to be in contradiction with the view that all teachers have been trained in some way by DISC, it is possible that most of the respondents did not need to attend DISC courses due to their existing qualifications.

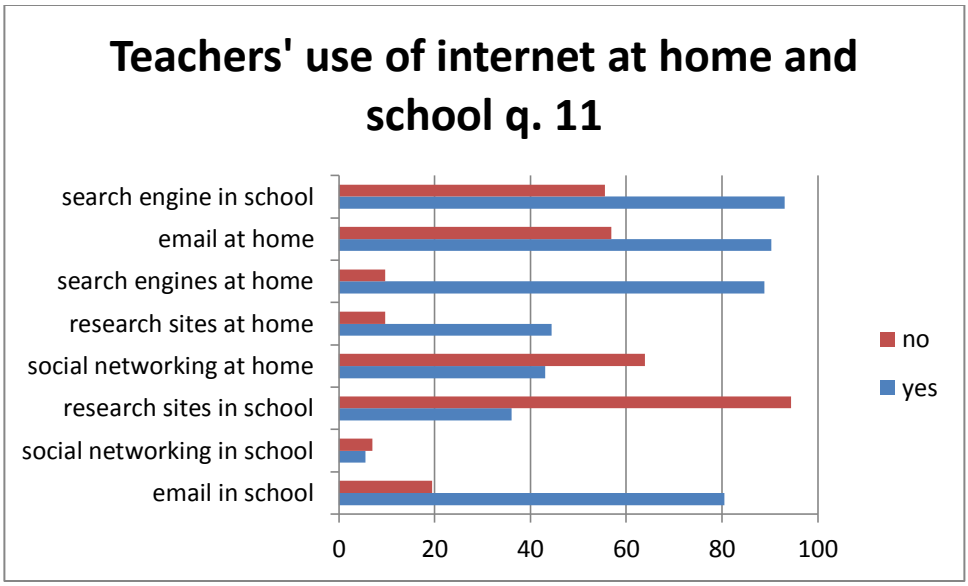

Figure 12: Teachers' use of the internet at home and/or at school (N=72)

The majority of teachers who responded used Search engines and email both at home and at school. A considerable number of teachers responded that they did not use research sites either at home or at school: the majority of teachers who did use research sites, used them more at home than at school. The vast majority of teachers did not use social networking sites at all in the school environment whereas over half of teachers used sites such as Facebook at home.

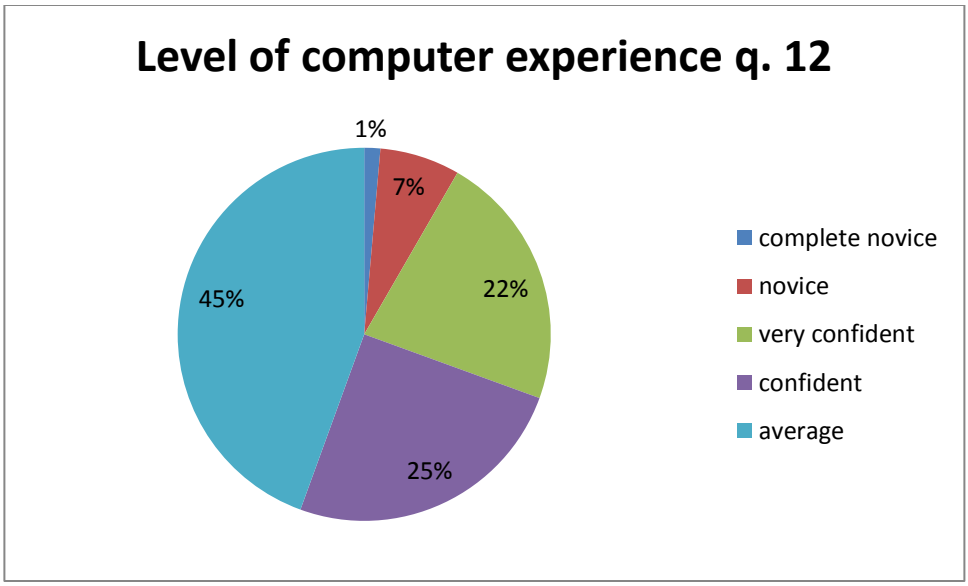

Figure 13: Level of computer experience (N=72)

Teachers are asked to self-rate their computer experience on a scale of 1 to 5 with 1 being a complete novice to 5 being a very confident user. Just under half of teachers rate their level of computer experience as 'average' with a similar amount as either 'confident' or 'very confident'. A small number of teachers report that they are still 'novices' with just one teacher reporting that they are 'a complete novice'. It is difficult to say whether teachers' self-reported level of proficiency is related to actual proficiency. In Question 12 three-quarters of respondents had significant IT qualifications while in Question 17 teachers' cite 'lack of confidence' as a major reason for not using ICT in the classroom. This suggests that despite possessing significant IT skills, teachers still do not feel qualified or confident to use ICT pedagogically.

More than half of teachers responded that they did not receive ICT training during their degree while just under half did receive some form of ICT training. Using SPSS 18 to prepare a cross-tabulation of teacher age with ICT training at pre-service, all of the teachers aged 18-25 years received ICT training almost three-quarters of the 26-34 age group did.

However, only a third of teachers in the 35-49 age group and a tenth of teachers in the 50+ age group received ICT training at pre-service level.

Table 4: ICT training at pre-service teacher training by teacher age (N =72)

Did you receive ICT training in pre-service teacher training?						
	Teacher Age					
	18 -25	26 - 34	35 - 49	50 +	Total	% Total
yes	4	20	8	2	34	47
no	0	8	15	15	38	53
Total	4	28	23	17	72	100

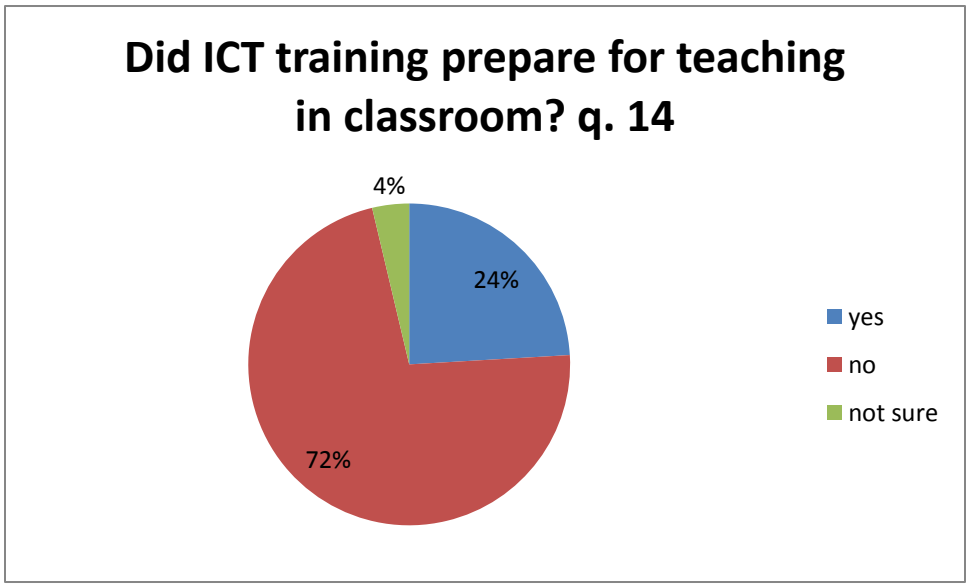

Figure 14: Did ICT training prepare for teaching in classroom? (N=72)

Of the teachers who responded to the question of whether they received ICT training during their pre-service teacher training in College, 72% said that this training did not adequately prepare them for using ICT in the classroom while 24% said that it did prepare them with

4% left unsure whether the training prepared them or not.

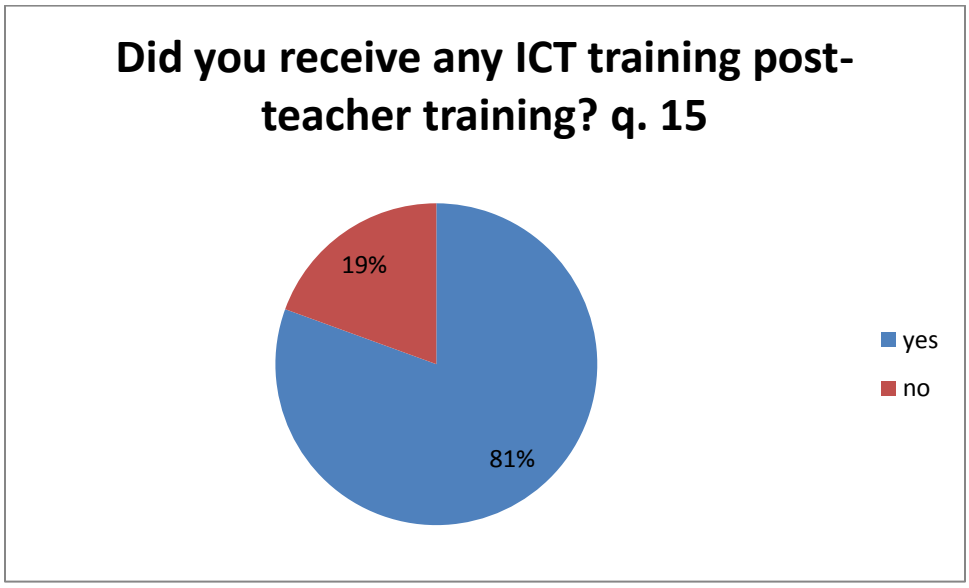

Figure 15: Have you received ICT training since you started teaching? (N=72)

While almost half of teachers stated they had no ICT qualifications post-teacher training, a majority of teachers have received some ICT training since they started teaching while almost a fifth did not. Some of this training may have been carried out by DISC or other service providers but may not be considered as a formal qualification by teachers.

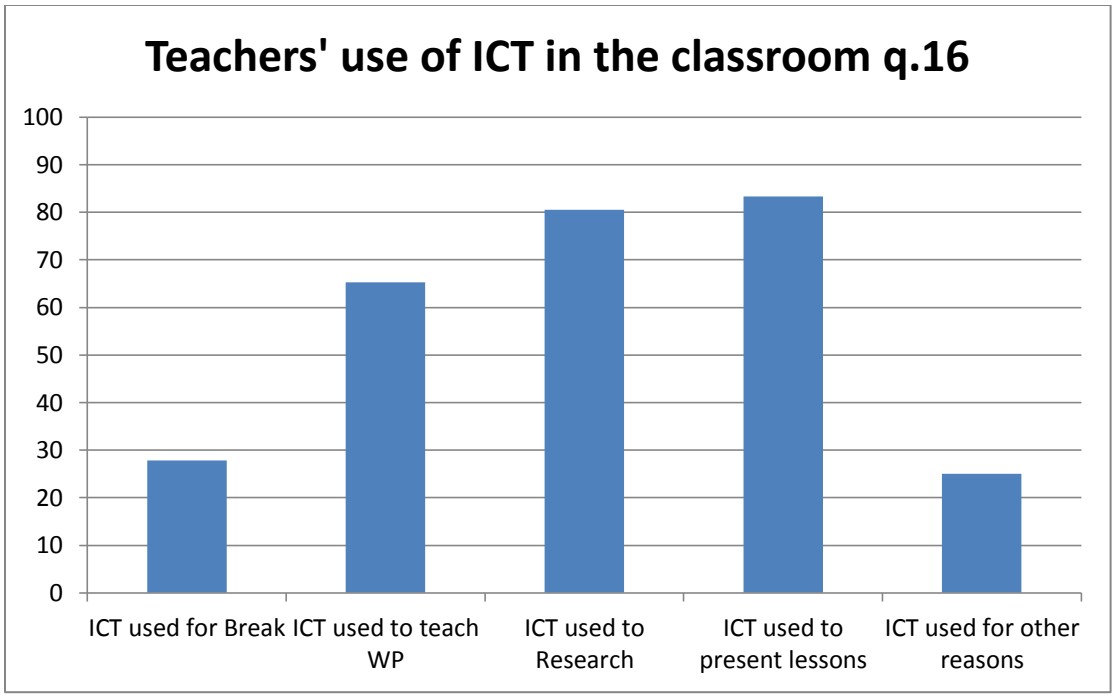

Figure 16: Teachers' use of ICT in classroom (N=72)

Less than a third of teachers used ICT as a 'break': this may indicate that the majority of teachers do not view ICT as a reward but as a tool for learning. The main uses for ICT in the classroom are teaching word-processing skills; facilitating students to research topics on the internet; with the majority of teachers say they use it to present curriculum-relevant lessons to students. A quarter of teachers cite other specific uses for ICT in the classroom are related to creative projects; problem-solving; and career-research at second level. One teacher commented that all subjects and all direct teaching time was conducted through *ICT 'almost all direct teaching time - all subjects'*, while another teacher considered it important for skills to be transferred: *'get them using IWB pen correctly, identifying icons on computer pen tool, magnifier tool'* while another teacher commented that using a computer in class facilitated students to learn *'to tell a story, present work, follow procedures'*.

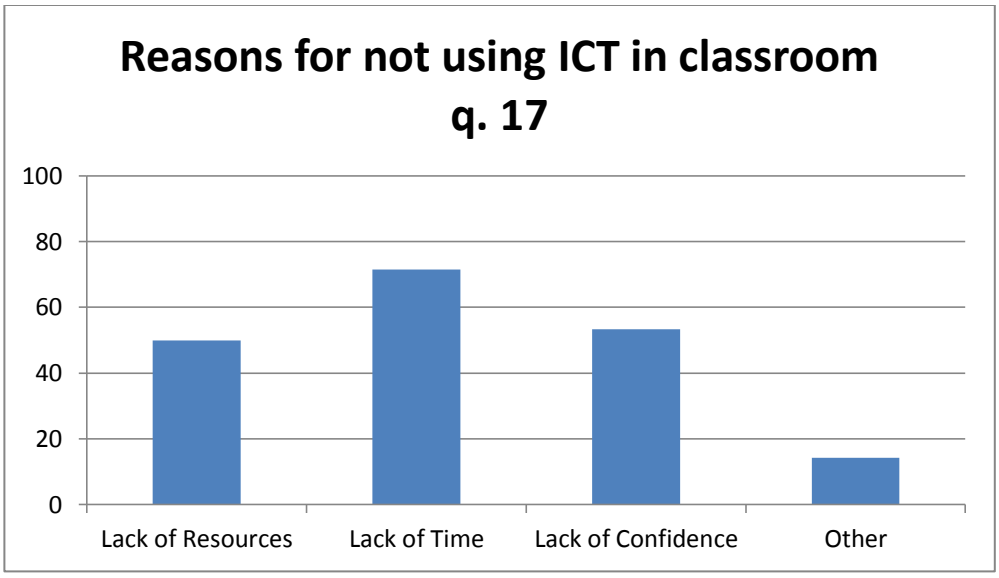

Figure 17: Reasons for <u>not</u> using ICT in the classroom (N=14)

The majority of teachers responded that ICT was used in the classroom in some form. Of those teachers who did not use ICT in the classroom (14 teachers) the following reasons are cited: 'lack of resources'; 'lack of time'; 'lack of confidence' and 'other' reasons such as lack of planning. The final section of the questionnaire related to teacher's views of the DISC programme in particular.

Teachers' perception of DISC Programme (Q. 18-21)

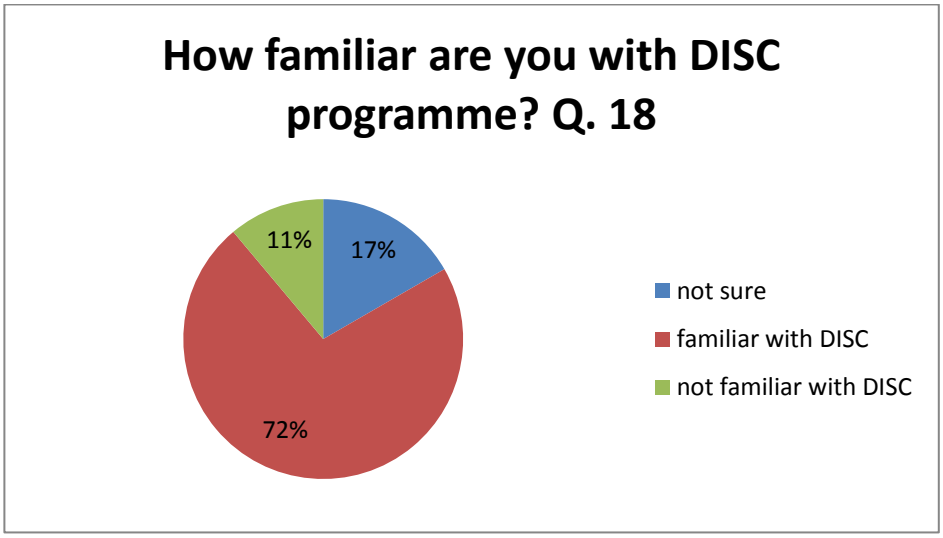

Figure 18: Familiarity of teachers with DISC programme (N=72)

While the majority of teachers surveyed are familiar with the DISC programme and its services, a significant number of teachers said they are either unsure or unfamiliar.

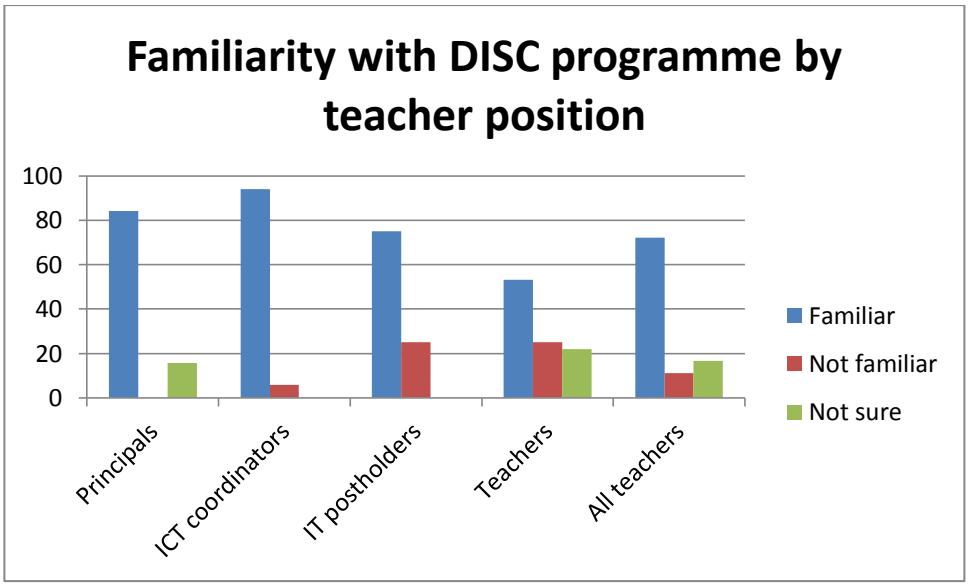

Figure 19: Familiarity with DISC – by teacher position (N=72)

Using a cross-tabulation in SPSS 18 to compare familiarity with what DISC had to offer between teachers based on teacher position, the ICT co-ordinators are most familiar as would be expected with principals next and then IT post-holders. However, just over half of teachers are familiar with DISC, well below the other groups, with 22% responding they are not familiar at all and 25% unsure of the programme. This may suggest that either ICT co-ordinators, IT post-holders and principals are not disseminating information to teachers effectively or alternatively that teachers may not be as motivated to use ICT and find out about DISC programmes. This may be an area for DISC to consider in future activities, for example, ensuring all teachers receive information through the newsletters directly.

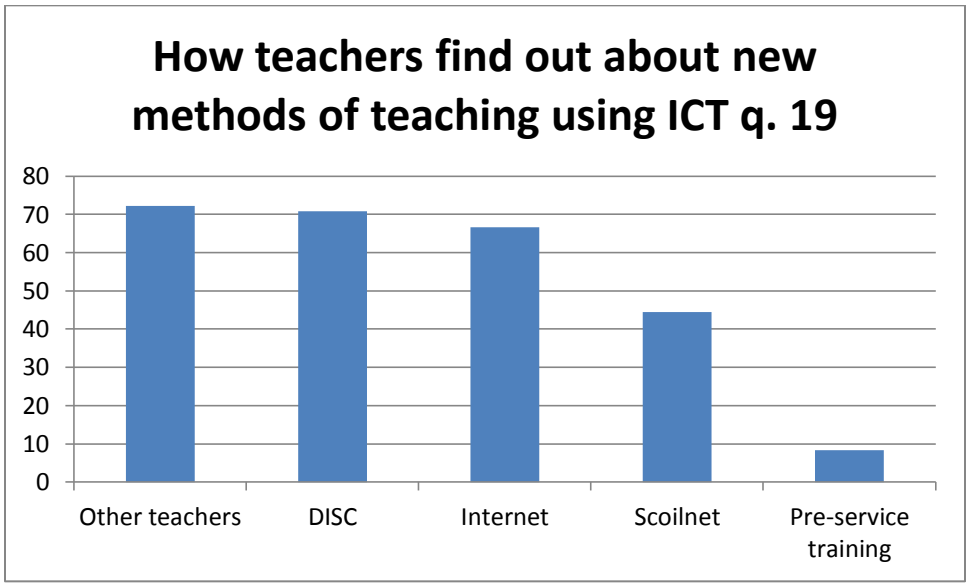

Figure 20: How teachers find out about new methods of teaching using ICT (N=72)

Almost three-quarters of teachers found that other teachers are a good source of information about new methods of teaching with a similar number finding DISC useful. DISC does provide opportunities for teachers to come together to support each other in the form of regular ICT co-ordinator meetings and training sessions, so it is possible that the figure in relation to 'other teachers' may be related to these meetings and not confined to the

teacher support in their own schools.

A very small number of teachers attributed their pre-service training as informing them about new methods of teaching using ICT while a significant number of teachers used the internet to research more about innovative methods of using ICT. This figure for internet research may be related to the figure for DISC and other teachers as it is likely that specific internet sites and material is suggested by these sources for teachers to access in their own time. Less than half of teachers found Scoilnet a useful source of information: this may have relevance to teachers' comments on the lack of curriculum-relevant material available from government or Irish sources. One principal found that the regular principals' conferences are a good source of information on ICT.

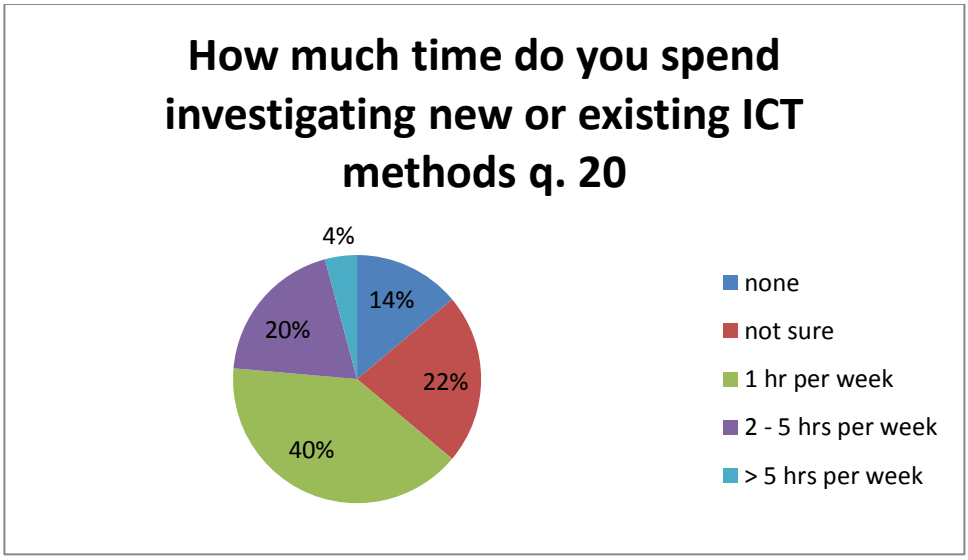

Figure 21: How much time spent investigating new or existing ICT methods (N=72)

Two-fifths of teachers spend about one hour per week researching new methods of using ICT in the classroom with a fifth spending between two to five hours per week.

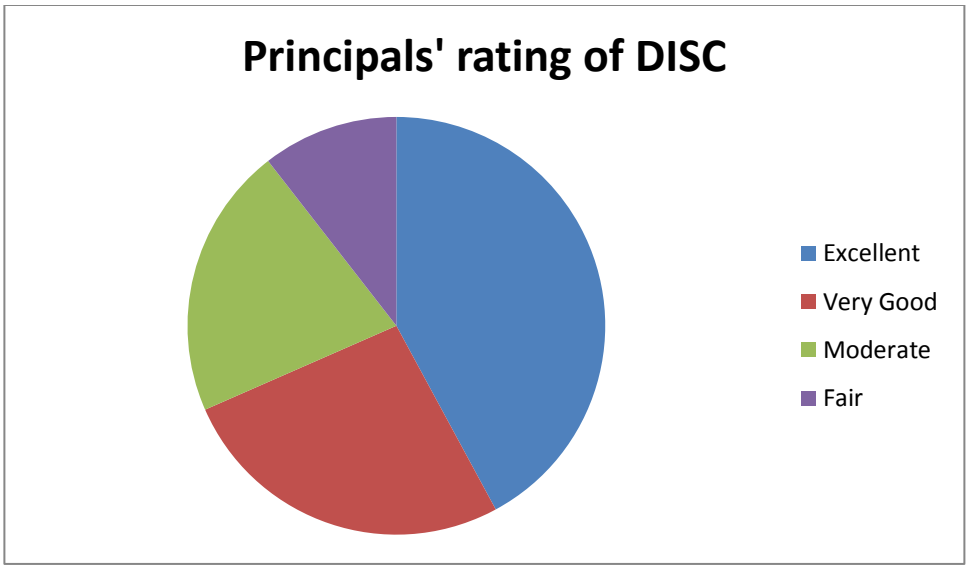

Figure 22: Principals' rating of DISC programme q. 21 (N=19)

Principals' are asked to rate the DISC programme on a scale of 1 to 5 with 1 being 'excellent' and 5 being 'poor'. Almost three-quarters of principals rated the programme as 'excellent' or 'very good', however, a third of principals rated the DISC programme as either 'moderate' or 'fair' with none rating it as poor.

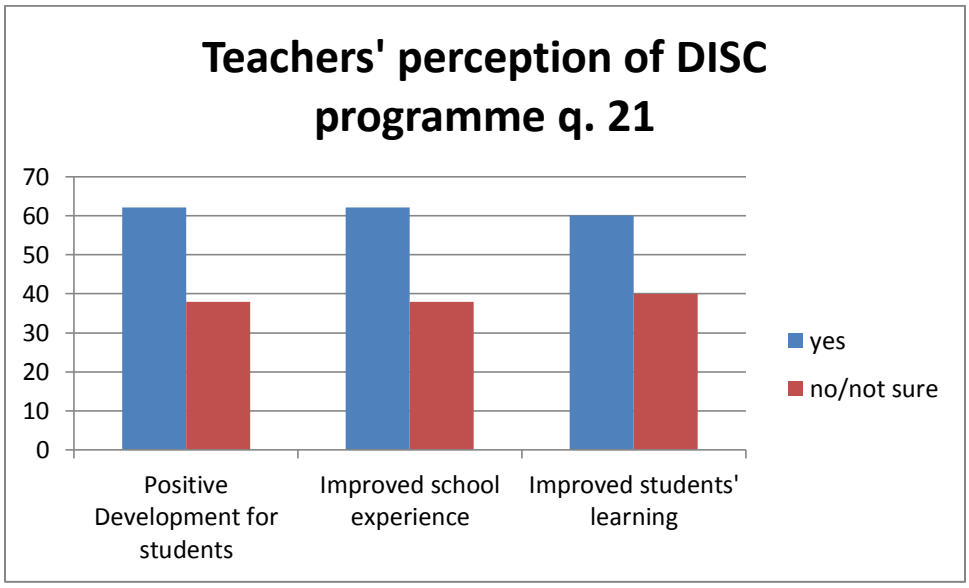

Figure 23: Teachers' perception of the DISC programme (excluding Principals) (N=53)

Teachers, IT post-holders, ICT co-ordinators and teachers are asked to rate the DISC

programme more specifically in relation to how the DISC programme affected their students: 1) was it a positive development 2) did it improve the school experience 3) did it improve students' learning. Over three-fifths of teachers consider the DISC programme to be a positive development for students and improved students' school experience and learning. However, when teachers, IT post-holders and ICT co-ordinators are analysed separately, there seems to be a considerable variance in response.

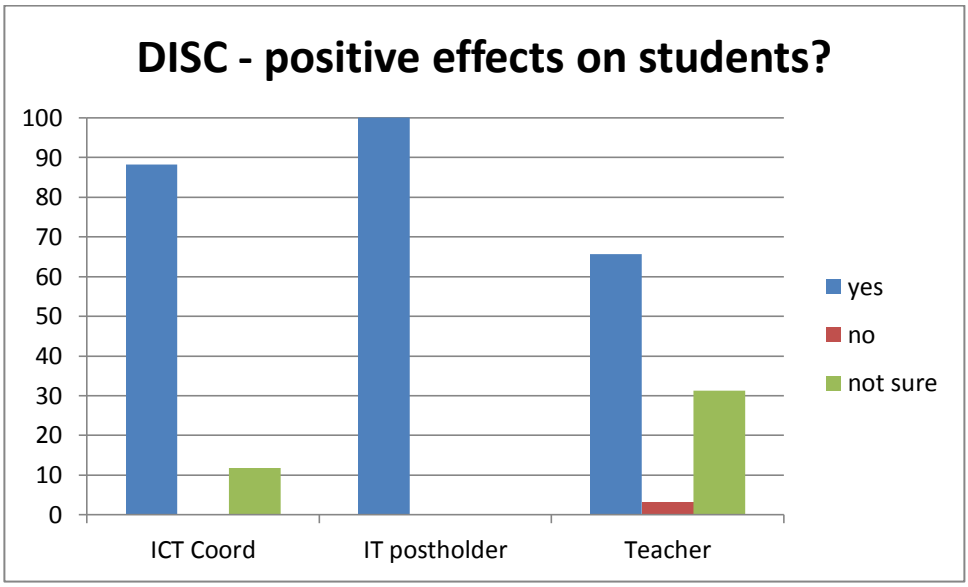

Figure 24: Has DISC been a positive development for students – teachers' views (N=53)

All IT post-holders who responded to this question said that DISC had been a positive development for their students with the majority of ICT co-ordinators close behind. However, less than two-third of teachers responded that DISC had been positive with a third unsure with a small number responding that it had not been a positive development.

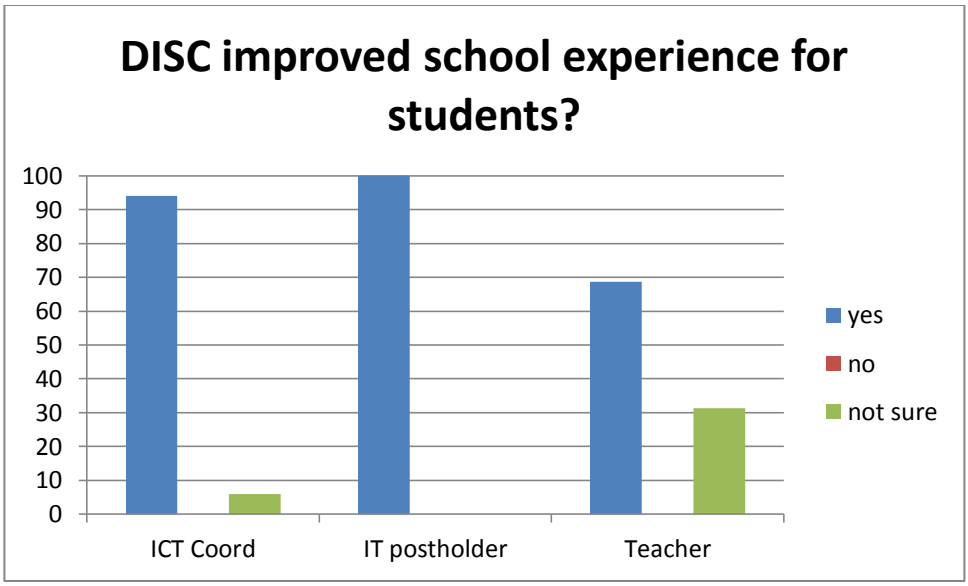

Figure 25: DISC improved school experience for students? (N=53)

All IT post-holders responded that DISC had improved their students' learning with the majority of ICT co-ordinators responding that it had although just over a tenth are unsure. However, a much smaller group of teachers felt that DISC had improved their students' learning with over a third of teachers' unsure.

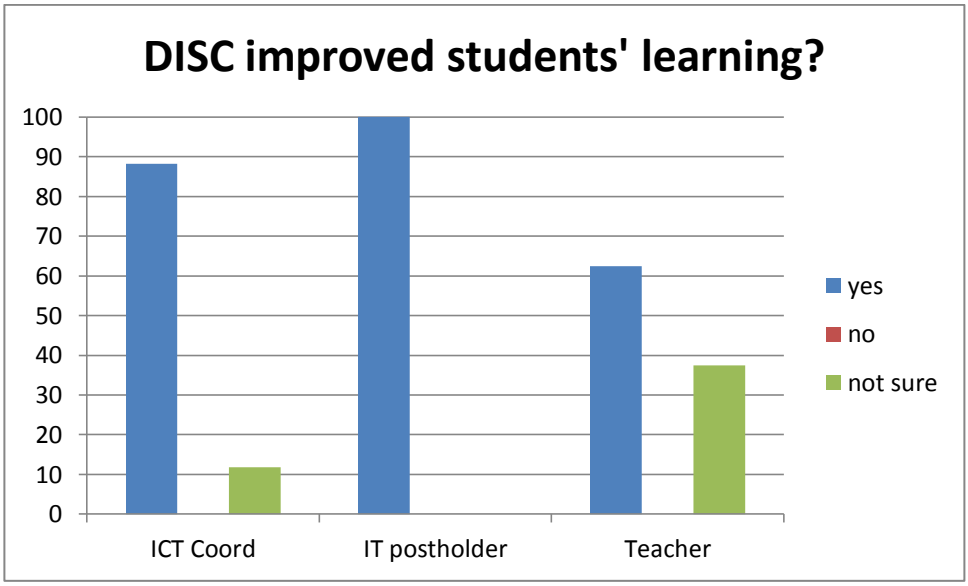

Figure 26: DISC improved students' learning? (N=53)

Figures for ICT co-ordinators and IT post-holders are very similar to those on an improved school experience, however, well over a third of teachers rated the DISC programme as not having improved their students' learning. This figure may be worthy of future study as to why teachers who are directly implementing the DISC programme perceive DISC to be less effective than the ICT co-ordinators and IT post-holders.

Other comments that teachers made predominantly referred to the support and advice they received from DISC. This support seemed to motivate teachers and increase their confidence in using ICT in the classroom (Appendix C).

SUMMARY OF QUESTIONNAIRE RESULTS

Questionnaire response: 47% response rate to survey. 50% of all DISC schools replied

Respondents: Principals: 19 (26%); ICT co-ordinators/IT post-holders 21 (30%); Teachers 32 (44%)

School types: Mixed: 51%; Boys: 25%; Girls 24%. Primary: 81%, Secondary: 19%.

Teacher demographics

Length of service: 15% < 5 years; 34% 6 – 10 years; 18% 11-20 years; 33% 21+ years

Age: 5% 18-25; 39% 26-34; 32% 35-49; 24% 50+

Gender: Female 76%; Male 24%

ICT infrastructure in school	
Reliable broadband:	96%
Internet networked all areas:	79%
Wireless router:	37%
Technical support/maintenance:	68%
Dependent on DISC for ICT support:	42%
Access to other sources for ICT support:	42%
Teachers' views	
ICT useful tool in education	94%
ICT promotes interest	96%
ICT improves job prospects	92%
ICT encourages self-directed learning	85%
ICT leads to increase in self-esteem	82%
ICT increases attention span	78%
ICT improves teamwork skills	65%
ICT does not improve teamwork	35%
ICT leads to reduced absenteeism	29%

ICT usage/Teacher training	
Whiteboards used	73%
Laptop/projector used	51%
SMART handsets/handheld	12% (8.3% SMART)
Teachers:	
Use email at home	90%
Do not use research sites	56% (home), 64% (school)
Use Facebook/social networking	57%
Computer experience	45% average; 47% confident/very confident
ICT training during pre-service	47%
ICT did not prepare for teaching	72%
Post teacher-training IT qualifications	24%
Post teacher training	81%
Teachers use of ICT in classroom	83% lessons; 81% internet research; 65% word-processing
Teachers don't use ICT	71% lack of time; 53% lack of confidence
DISC programme	
Familiarity with DISC programme	72%
Informs on new ways of teaching	71%
Other teachers good source	72%
Principals' rating of DISC	40% excellent; 25% very good; 35% moderate/fair
Teachers' rating of DISC	62% positive student experience; 60% improved learning

Discussion on Quantitative Results

Despite the significant investment by DISC in equipment the provision of a grant to schools for a laptop and projector for all classes, and a recommendation by the Inspectorate Report (DES, 2008, p. 66) that all classrooms should be equipped with 'with a computer for use by the teacher, broadband internet access with adequate bandwidth, and a fixed data projector and screen for use by the teacher in presentations', the questionnaire responses indicate this has not occurred. The apparently low availability of laptops for students and desktops seemed to contradict teachers' statements of satisfaction that their schools' ICT infrastructure is up-to-date and that they had reliable broadband.

This may indicate that teachers have low expectations of funding and equipment provision for their schools and perhaps they may be grateful to receive whatever they can. Alternatively, a significant number of schools did not appear to be completely dependent on DISC for support, with 42% indicating they received support from other organizations such as Digital Hub (Questionnaire 9, 65, 68). It is possible that schools may not like to admit that they are fully equipped in case they may miss an opportunity to access further equipment from either DISC or the DES.

Those teachers that do have access to equipment seem to predominantly use whiteboards that Stevenson (2008, p. 838) maintains is used to reproduce traditional chalkboards rather than promoting the use of innovative, new methods of teaching with teachers tending to favour technology that gives them a high degree of control in the classroom rather than encouraging student-centred learning.

With the majority of teachers aged less than 50, it could be presumed that the majority of

teachers have some level of computer experience in their non-teaching life so that ICT would not be entirely unknown to them. With almost half of teachers described as 'confident users' with the majority using email and half using social networking, this may suggest that low levels of ICT use in classrooms is linked to lack of training in the pedagogical use of ICT rather than ICT skills alone. 64% of those who did receive ICT training during their pre-service did not find that these skills helped them in the classroom suggesting they either did not receive ICT training from a pedagogical perspective or they did but these skills are not relevant to real-life classroom practice. While many researchers may agree that ICT cannot improve instructional practice (Clark 1994 cited in Merrienboer and Brand-Gruwel 2005, p. 408), ICT may 'enable the use of innovative instructional methods that may help to make learning more effective, efficient and appealing (Merrienboer and Brand-Gruwel, 2005, p. 408).

One of DISC's stated benefits for ICT Projects is 'to make the use of ICT in the classroom an important element in fighting absenteeism and encouraging young people to remain in school' (DISC, 2009c, p. 4). Some researchers have also claimed that 'students can become highly motivated towards learning (even toward regularly attending school) if technology makes up part of their classroom experience' (Hepp et al., 2004, p. 3). However, this benefit did not seem evident to teachers in the DISC programme with over 43% of respondents maintaining that ICT use did not reduce absenteeism with 28% being unsure. ICT use may assist in motivating students to learn while in attendance, but studies using PISA data have also found that computers may be a distraction in some situations (Fuchs and Woessman, 2004, p. 2) possibly resulting in displacement of 'other, more effective, teaching techniques (Machin 2006, p. 4).

CHAPTER 6: EVALUATION OF DISC OVERALL

Background to Interview setting

The semi-structured interviews formed the primary source of information on 'themes' for this report. Interviews were carried out with principals and teachers in their schools, usually in the principal's office as this was often the only available location. Interviews lasted between fifteen and forty minutes as time available was limited, particularly in the primary schools as teachers had to arrange for a colleague to supervise their class during the interview time. Post-primary teachers were limited to the time of a free class which was usually between thirty-five and forty minutes. Interviews, particularly with principals, were often subject to interruption due to telephone calls or students and/or teachers knocking on the door. With nine questions to pose during the semi-structured interviews, the restricted time available and the location of interviews may have affected the depth of the qualitative data obtained. Teachers were very cooperative and eager to assist with this evaluation, however, many expressed concern that the DISC programme may not continue and may, as a result, have been reluctant to express negative views.

Main themes

AT may be used as a 'theoretical lens and as an analytical tool' by enabling reflection on emergent issues and identifying tensions or breakdowns that may occur in activity systems (Barab 2004, p. 30). While AT informed the type of questions asked, in analysing the data subsequently, it was difficult to fit the issues that arose from the data with the seven elements of AT (Figure 2) as some issues were relevant to more than one element.

The issues that did arise were: teacher motivation/teaching beliefs; teacher training;

influence of Principals/School ICT policies; technical support/hardware replacement; ICT co-ordinator role; students' interaction; Government policy/administration; and DISC support. By taking these issues and inserting them into the Table originally used to design the questions (Table 5), it was clear that several areas overlapped, for example, the ICT co-ordinator role is relevant to at least three areas: Community, Rules, and Division of Labour.

Table 5: Issues arising (Adapted Mwanza's (2001) 8-step model in Demiraslan and Usluel, 2008, p.459)

AT	Interview Questions	Information to elicit	Issues arising
Subject	Question 1: How did you get into teaching?	Teacher (teaching experience, teaching approach, the personal, administrational and instructional use of ICT, the place of ICT in daily life, the necessity of knowledge and skills related to ICT).	Teacher motivation Teaching approach/ICT influence DISC personnel motivation Position of students - disadvantage
Object	Question 3: How do you feel about the DISC project?	Goals of using ICT in teaching-learning process (knowledge/skills acquisition, and problem solving).	DISC's object of activity Teachers' object of activity Students' object of activity - interaction
Tools	Question 5: How do you feel about the ICT facility in your school? Question 7: Any thoughts on Teacher training in ICT?	ICT and the tools other than ICT, methods which are used, problems which are encountered.	Teacher training issues Technical support (see Division of Labour)
Rules	Question 2: Tell me about the DISC project?	Expectations of the teacher/principal/DISC, rules of the school, curriculum.	DISC's object of activity ICT co-ordinator role Principal role/ICT policy Teachers object of activity
Community	Question 5: How do you feel about the ICT facility in your school? Question 6: How have students interacted?	Students, teachers, school administration, ICT co-ordinator, DISC	ICT co-ordinator role Student interaction Teacher training issues
Division of labour	Question 7: Have you any thoughts on Teacher training in ICT? Question 8: Do you feel you are supported to use ICT?	The roles and responsibilities of students and teachers, cooperation among teachers, the support of administration.	ICT co-ordinator role Role of Government Role of Principal/ICT policy Teacher training issues Technical support
Outcome	Question 3: How do you feel about the DISC project? Question 4: Would you have any suggestions for the DISC project in the future Question 9: Any other thoughts on DISC project?	The reflection of the use of ICT in teaching-learning process to the learning of students and instruction (Demiraslan, 2005 in Demiraslan and Usluel, 2008, p. 459).	DISC's object of activity Primary/Post-primary differences Role of Government Student interaction Teachers' object of activity Teacher training Technical support

It is proposed, therefore, to discuss each of the areas that arose and make reference to activity theory and the ICT literature where appropriate.

1. Teacher Motivation/beliefs

A significant number of interviewees were motivated to become teachers by having a parent or family member as a teacher or a very influential teacher in their own schooling (10). Several teachers also mentioned they were particularly interested in teaching in areas of economic and social disadvantage that both initiated and has sustained their career in teaching since then:

> *Researcher: And what motivated you to get involved in teaching?*
>
> *Principal 1: I think all the usual sort of things, hoping that you can make a difference, the whole idea of working with children and then it seemed natural to get into disadvantaged teaching and from that sort of perspective and that's what I have done and I have remained in it for my whole career and probably will to the end now at this stage [Principal, Primary School 1].*

Teachers motivated to 'make a difference' for children with economic and social advantage may be attracted to using ICT in the classroom as one means to address the 'digital divide' for their students (Selwyn, 2004, p. 341). One principal acknowledged that access to ICT skills and equipment through programmes such as DISC would assist students to improve their life choices in the future:

> *Our mission in the school is to equip these kids to go out and make something of their lives- so computer literate, having qualifications in computers and that would*

be definitely one of our main aims and that is where DISC would be very helpful to us you know [Principal, Post-primary School 2].

However, while 94% of teachers found ICT useful as an educational tool (questionnaires), there is limited research on its effect on outcome in disadvantaged schools (Blackmore, Hardcastle and Bamblett 2003, p. iv). Some researchers criticize the learning outcomes of ICT as not justifying the financial investment finding no positive relationship between ICT and pupil performance (Angrist and Levy 2002, p. 20; Goosbee and Guryan 2005 in Machin, McNally and Silva 2006) or on teaching and learning (van Braak, 2004, p. 422). However, there may be too much emphasis in some research on learning outcomes rather than on engagement of students, particularly in disadvantaged schools. Teachers maintained that ICT promotes interest; increases attention span; and improves teamwork skills assisting them in teaching under challenging circumstances (Figure 9).

While many teachers had very positive attitudes towards ICT, deeming it to be an important factor in fostering ICT integration into classrooms, ICT may be used to enhance traditional educational practice rather than transforming it. Technology may merely substitute existing tools such as using a whiteboard as a 'glorified blackboard' (Karasavvidis 2009, p. 436-7). However, other researchers suggest that the use of learning technologies does lead to change (Isroff and Scanlon 2002, p. 83) with ICT 'used as a catalyst to change educational practices" (Rasmussen and Ludvigsen 2009, p. 83).

DISC staff expressed their views that new ways of using ICT was associated with teachers' innovative use of teaching methods generally while teachers who taught in more 'traditional' ways may only adopt ICT use in the classroom if it could be adapted to those traditional methods. This is in line with some researchers' findings that 'teacher beliefs' on

teaching practice affect why and how teachers adopt computers in the classroom with positive effects for constructivist beliefs and negative impacts for traditional beliefs (Hermans, Tondeur, van Braak and Valcke 2008, p. 1506). A constructivist teaching approach involves teachers facilitating students in actively participating in their own learning compared to a traditional approach with teachers imparting knowledge to passive students (Tondeur, Hermans, van Braak and Valcke 2008, p. 2544-5).

> *Researcher: Has it (DISC project) changed the way teachers' teach?*
>
> *DISC staff: I think for some teachers it has…..a very good teacher you know in [Primary School 3] who has sort of embraced the technology and at every opportunity tries to incorporate it into the classroom, I think that does change the way people teach. I think it's based on the traditional method of trying to you know, it's based on traditional teaching methods which are still valid as far as I'm concerned but I understand that there is a lot of theory about you know 'laissez-faire' type of teaching. But I think that probably teachers will embrace the technology if they see it as something useful within the way they teach rather than something they have to go and how to teach with it if that makes sense. [DISC staff 3, Interview]*

However, some case studies of Dutch teachers found that teachers changed towards a more student-oriented pedagogical approach in conjunction with their use of ICT innovatively when expected to use ICT and to accomplish specific educational goals (Drent and Meelissen 2008, p. 195). Additionally, teachers who actively engage in their own professional development were more likely to engage with ICT use as well as being open to change teaching approaches (Drent and Meelissen 2008, p. 197). A teacher, who has

embraced technology use and undertaken several post-teacher training and postgraduate courses in IT, seems to exemplify this point:

> *In this school it is very good, we switch and maybe 5th class, 3rd class, 4th class so it is a different curriculum, different subjects you are doing every year so that's very good and also there is a huge amount of kind of new teaching methods coming on board, you know integrating technology but also you know all the internet access we have, all the websites we have, all the different resources we have……..there's always new things coming on board that you have to integrate and check it out with the kids and learn it, it's never mundane, it's never monotonous, like there's always something new. [Teacher 1, Primary School 3].*

However, there does not seem to be a 'typical' type of teacher who adopts innovative teaching methods. Although one principal claimed 'older' teachers may still be reluctant to adopt ICT, ICT co-ordinators who take on additional duties to promote ICT use in the school and seem particularly enthusiastic, were generally older with many having had no pre-service training in ICT (Table 1, p. 44).

2. Teacher training

Teacher training does not have a significant influence on innovative use of ICT within the curriculum (Drent and Meelissen 2008, p. 197) as innovative applications 'are not promoted in the current approaches towards teacher training' (Valcke et al. 2007, p. 806). Teachers in this study complained that pre-service IT training was not relevant as it emphasized gaining skills in particular software packages rather than applying skills and technology to teaching 'I hated it! I did get some but I wasn't interested in it then. We

would have done Hyper Studio, Webquests' (Teacher 2, Primary School 3). This suggests that while 'innovative' software packages are being selected and taught to Irish teacher trainees, there is no linkage to their potential pedagogical use in practical ways and it is unclear whether they are being selected for educational relevance or to engage students' attention.

The lack of pedagogical relevance in ICT teacher training was also highlighted in the questionnaire data (Chapter 5, p. 83) where the majority of teachers did not find that their pre-service ICT training useful to their teaching in the classroom. As half of these teachers were confident users of ICT in their non-teaching life, this suggests that pre-service ICT training is not developing the skills and pedagogical strategies needed for teachers to use ICT confidently and appropriately in real-life classroom practice. This seems in conflict with stated DES policy to integrate ICT in teaching and learning (DES 2008b, p. 8) and to identify and promote 'pedagogical strategies' for on-going teacher training and development (NPADC 2001, p. 8).

In an OECD study of ten countries (not including ROI), findings also concluded that pre-service ICT training was not appropriate to classroom teaching practice: trainees found subject-specific workshops with time to experiment more useful than ICT skills classes that did not account for differing levels of IT ability and interest (Enocchsson 2010, p. 26). Teachers in DISC schools who had made considerable efforts to up-skill and innovate maintained that trainees need to be taught through ICT with ICT training forming part of every teachers' continuous professional development (CPD) so that it becomes the 'norm' for teaching in classrooms.

> *They really want to integrate IT into teacher training to be part of the daily life. I think continuous teacher training – like I think in any job... You don't qualify, graduate, and that's it, that's your education cap in. Like that day is gone and I think everybody has to continuously develop – I just don't think that's there for teachers – I think a lot of them would like to as well … it's expected in so many other profession [Interview, Teacher 2, Primary School 3]*

The difference in experience and ease of use of ICT for Irish primary school teachers may be attributable to the increased emphasis on ICT by other countries. Many OECD countries provide ICT qualifications in pedagogy for their trainee teachers while Denmark, the United Kingdom and France require teachers to have national certification in the use of ICT as a pedagogical method in order to graduate as a teacher (OECD 2010, p. 34). Principals and some teachers in DISC schools observed that teachers who completed their training or taught in other jurisdictions seemed more comfortable with using ICT in the classroom than Irish-trained teachers.

> *We would have a number of teachers on staff who did their teacher training in England where say interactive whiteboards were part and parcel of the day there so you know they are fine you know but I think if you have come through the Irish system, you probably need more training. [Principal, Primary School 4 (age 9)]*

It seemed that there was a difference in competence between post-primary school teachers and primary school teachers which may be explained by the teaching methods adopted by the various institutions. For example, teachers who were trained at Universities for single subjects used learning platforms such as Blackboard and other online methods during their courses and became very familiar with computer technology whereas primary school

teachers seem to be taught using more traditional classroom based lectures and may not have the same experience of ICT in their own learning.

> *Well you see ours [post-primary school teachers] are coming from different universities. You know the way a lot of the project work they do in the computers in colleges now, I have two sons in college myself and I know the laptop and linking back in with the college and the lecturer and emailing the lecturer with problems and you know what I mean, that's just what they do. [Interview, Principal, Post-primary School 1 (age 15)].*

By tailoring training to specific teacher needs, as well as providing on-going support and advice (Valcke et al. 2007, p. 805) this may serve to address differing levels of ICT literacy among teachers and assist in successfully integrate ICT into teaching practice. Many training courses provide general skills-type training, but Hew and Brush (2007 in Vanderlinde and van Braak 2010, p. 545) suggest that in order to provide effective professional ICT development, there needs to be a focus on content; providing opportunities for 'hands-on' work; and meeting specific teacher needs along with training on curriculum-specific materials and methods. However, teachers need to have time and space to experiment but they complain that the DES were continually adding subjects into the curriculum and not removing any that has increased time pressures leaving little opportunity to devote to any additional requirements such as ICT.

> *Yes, it's just the curriculum is so overloaded already that you don't want any more you know pressure to do things, it is very hard to fit everything in [Teacher, Interview, Primary School 4 (age 9)]*

However, even though some teachers display considerable enthusiasm and motivation for ICT use, many were not involved or active in the use of ICT which is attributed by teachers to lack of confidence, particularly when experiencing problems with the software or hardware.

> *There is a huge amount of teachers that are afraid of IT. If something goes wrong .....I know teachers in this school that just go it's not working and turn of the board and don't use it until someone comes and fixes it [Interview, Teacher 2, Primary School 3]*

Teachers in other schools also expressed concern that many teachers were still afraid of ICT and wanted DISC to provide more training on an on-going basis with some suggesting on-site training as being more relevant and desired by teachers. Both of these teachers seem to recognize that many teachers still lack basic computer skills despite the considerable amount of training that DISC and other stakeholders have provided.

> *The capital investment has been great…Where I would definitely see a need would be in training, in if possible in-house training, someone actually coming down and offering different levels of training. You know there is always more to learn but if you are at the stage when you don't even know what the power button does, it's too scary to be sitting in with people building websites. For the staff I'd love to see some kind of basic training offered and if possible in house. [ICT co-ordinator, Interview, Primary School 4 (age 9)]*

Despite teacher concerns about many of their colleagues lacking basic computer skills, one DISC staff member considered that all teachers now had sufficient training. This is not a

criticism of DISC staff as it could be questioned why teachers may still be lacking in basic computer skills despite ICT being 'an integral part of our personal and working lives' (DES 2008d, foreword). There are limited financial and staff resources in organizations such as DISC and perhaps resources may be better employed in providing training in pedagogical uses of ICT rather than ICT skills.

> *Like the original objectives were very fundamental in the sense of upgrade all inner city schools with computers and train the teachers but we have gone way, I think we have gone way beyond that like I mean teachers are all now computer literate, most of them are. [Interview, DISC 1].*

Teachers generally prefer to be trained in their own school setting (Valcke et al 2007) and tend to resent being required to attend teacher training outside of school hours or in locations at a distance from the school as teachers perceive this as 'exploitation' of their own time (Galanouli, Murphy and Gardner 2004, p. 71). This view was supported by principals who expressed their appreciation of DISC's willingness to accommodate teachers' training needs "Courses….in the evening in teacher centres weren't very attractive whereas DISC were prepared to come in and do it at times that suited the school" [Principal, Primary School 1].

However, even when training is provided in-house and at a time that suits teachers, ICT co-ordinators and principals complain that while training is generally well received by teachers, this enthusiasm does not necessarily translate into action. It seems clear that both the DES and teachers themselves still view ICT as an 'add-on' that requires additional time to use rather than forming part of their teaching methods.

I think for disadvantaged inner city schools – what they [DISC] are doing is great but it's hard for me to get, sometimes, it's hard for me to get teachers to do it in the school because they are a bit worried about taking on the problems and this that and the other and I have but to say that they [DISC] are very good the way they come in and [DISC staff 3] gave us a, a….. sort of a workshop there last week on Crazy Talk and Comic Life and Photostory and you know everyone is eager to do it all right but it's just people are a bit apprehensive about getting involved in it you know –[ICT Co-ordinator, Primary School 2 (age 11)]

Teachers mentioned the DISC training and courses provided as being most beneficial to them individually but also facilitated a 'train the trainer' facility in the school which is one of the objectives of DISC, increasing their positive feelings towards the DISC programme. However, some newly-involved teachers seem to have missed out on DISC training already carried out and don't seem to have benefited from the other teachers' training in the school. It seems that unless training is directly relevant to current teaching activities, teachers don't participate in training or don't apply it:

Researcher: Were there any courses then run by DISC?

Teacher: There were, but I never, because I didn't have a class up to now really [was in resource and special needs area], you are not involved, you don't have the same interest in doing it, you know the way, it's kind of wasted if you don't use it straight away. [Interview, Teacher 1, Primary School 4 (age 9)]

3. Influence of Principal and School Policies

With a study suggesting that teacher training does not have a significant influence on

increased use of ICT within the curriculum (Drent and Meelissen 2008, p. 197), teachers' attitudes (principals in particular), and the school's approach to the use of ICT, were more influential in promoting ICT use in the classroom than any other factor (Valcke et al. 2007, p. 797). In one of the schools interviewed, the principal and ICT co-ordinator have adopted a very positive and active approach to the innovative use of ICT which seems to have positively influenced several teachers in the school to use ICT regularly in their classrooms.

> *Researcher: Do you feel that you are supported to use ICT in your school?*
>
> *Teacher: Well we do. From the principal, and then from DISC definitely through [DISC staff member]. Supported and abused! [referring to own position as ICT co-ordinator]…more and more teachers see the value of it and they are actually using it a lot more…In fairness, if we need to get someone in we say, now look [Principal named], you have to get [IT consultant] in…If the Principal isn't in favour [of ICT], you can forget it. [Interview, ICT co-ordinator, Primary School 3]*

The principal plays a key role in the level of involvement of schools in the DISC programme with some principals who have increased both their own levels of ICT competency and encouraged their staff to do so, engaging at a high level. Conversely, principals who have not increased their own ICT competency and have relied on staff to do so seem to have low levels of engagement with the DISC programme resulting in their school being less active overall:

> *But technically speaking now I wouldn't be as knowledgeable about the DISC programme maybe as other principals might be. …The staff wouldn't know about the DISC, wouldn't be familiar with it or its impact but it would be, it would be seen*

as the area where the few, the high-tech people are involved in that you know. It's probably my fault too, it wouldn't be as well promoted or it should be better promoted to be honest now you know. [Interview, Principal, Post-primary School 2]

Principals, however, also require the support of the Board of Management (BOM) that comprises the school patron; teachers, parents and members of the local community, in order to devise and implement school policies that incorporate an ICT plan (DES 1999, p. 53). Development of specific and detailed ICT policies are considered important to achieve innovative use of ICT as they provide a 'blueprint' and an 'overall philosophy of technology use' that will enable teaching staff to explore how technology can improve their teaching and student learning (Baylor and Ritchie 2002). ICT co-ordinators need to 'have a clear mandate from the school community' to promote and spread the use of ICT in the school among teaching staff (Vanderlinde, van Braak and Hermans, 2009, p. 479) that may be facilitated by the BOM's allocation of resources 'the *School Plan* must take account of the needs of the staff in terms of training and familiarisation' (DES 1999, p. 53).

The Board of Management, they paid for some of my training and I paid them back by, definitely they got paid back [by implementation of IT in school] and so did [ICT co-ordinator] and there was a good atmosphere of IT. [Principal, Primary School 3].

From an AT perspective, overall school policy along with an 'ethos' of ICT use in the school (Rules) is strongly linked with the expectations of those involved in school management of ICT integration (Community) along with the need to allocate, manage and use ICT resources (DOL) in order for teachers (Subject) to enhance students outcomes through the use of ICT (Tool) for learning in the classroom (Object).

While specific school ICT policies were not discussed in detail during interviews, many references were made to an apparent lack of planning and continuity on ICT at the DES. One principal negatively compared the situation in the ROI with the perceived 'superior' situation in NI relating to ICT provision in schools:

> *But these are sort of once-off sort of things and there was nobody, I don't know if there is anybody in the Department of Education actually sitting down and saying now 'this is our vision in terms of ICT and here is how we are going to achieve this' and it's not going to be achieved by throwing money here and there now and again, there's no continuity'. ...Continuity and a bit of planning and a bit of vision for where this thing is going long-term. [Principal, Post-primary School 2].*

This view is supported by the work of Marshall and Anderson who compared the ICT situation in schools in NI versus the ROI and concluded that the lack of a centrist framework in the ROI has led to 'a fractured delivery of digital technologies across the educational landscape' (Marshall and Anderson 2008, p. 474). This compares to NI's centralized approach where C2k and the government in NI have formed a private-public partnership to provide and support ICT provision in schools resulting in very high teacher satisfaction with the project (PWC 2004, 2005 cited in Marshall and Anderson 2008, p. 468).

One principal attributed the lack of implementation of ICT in the classroom to individual teachers and has formulated an ICT plan for the forthcoming school year that will require teachers to carry out specific ICT projects. While an ICT plan is considered essential to effective implementation of ICT in the classroom (Vanderlinde and van Braak 2010, p. 545), it is unclear whether coercion will work as some researchers suggest all teachers need

to be involved in ICT policy planning from the beginning with their views taken into account to ensure successful implementation (Vanderlinde, van Braak and Hermans 2009; Tearle 2004 and Tondeur et al. 2008, cited in Vanderlinde and van Braak 2010, p. 545).

> *Well, I think what DISC is doing is all right, I think it is up to schools kind of to get more engaged. I have discussed it with my ICT co-ordinator already…next year, we are not going to ask teachers to do an ICT project, we are going to tell teachers [what to do]. We are expecting everybody to try and engage with some kind of project once in the year so whether you do a Comic Life with the children or you know the Easy Talk [Crazy Talk] [Principal, Interview, Primary School 2 (age 11)]*

Principals, seemed very appreciative with the teacher training provided by DISC, however, primary school principals and post-primary principals had different views on their school teachers' on-going need for training with post-primary school principals considering their staff, particularly more recently hired staff, as being sufficiently competent:

> *I mean all teachers were my own vintage, but in the past say three years now, I have practically replaced half my staff now I mean that means of course if you take say 13, 14 out of mine 27 staff, I mean IT is second nature to them because they have come through college where their lectures zapped to their laptops or whatever like whereas teacher training was a very important thing in the early days, nowadays it's not so much because practically every teacher that comes on board now, the most recent recruit is probably the most up to date with what's going on. [Principal, Post-primary School 1 (age 15)].*

However, this was not reflected in teacher and principal interviews where principals, in

particular, expressed views that not all teachers were engaging in ICT integration and that further training needed to be done.

> *One hopes that that people have made themselves literate, but the reality is that there are still teachers in a lot of schools for different reasons who haven't probably they would be at the older end of the teaching you know scale…there are still teachers in my opinion who are still not comfortable using IT. [Principal, Primary School 1]*

The criticism regarding training did not appear to be aimed at DISC but at the Government's perceived lack of adequate ICT training both at pre-service training and in on-going CPD. All principals were very positive about DISC, specifically in the areas of equipment provision as they were acutely aware of limited resources and funding and very appreciative of the overall benefits of the DISC programme for the schools in areas of disadvantage 'DISC have done tremendous work considering where they are coming from and…considering the climate we are in now really. [Interview, Principal, Primary School 1]

> *There is none [ICT teacher training] and we should have some it's just, dreadful! We are just kind of dependent on the likes of DISC coming in and training us and a lot of it depends on teachers' own personal interests. [Interview, Primary School 2 (age 11)]*

4. Technical Support/hardware replacement

Implementing a process of change, however, can be complicated and time-consuming with researchers finding no direct relationship between intentions and actual change in institutions generally (Barowy and Jouper 2004 cited in Rasmussen and Ludvigsen 2009, p.

85). While the government's intentions in IT2000 were to equip all schools with hardware/software; provide teacher training; and support (DES 1997, p. 13), a review acknowledged 'considerable challenges remain' in all three areas but particularly for technical support (DES 2008a).

In addition to concern about lack of training and funding for equipment, concern is also expressed about the lack of technical support and financial resources for maintenance and replacement of equipment by principals and teachers in interviews.

> *... the Department certainly has never really supported IT in a sense, well I mean they have paid lip-service to it, you are always encouraged to get on an do it and fundraise and everything but they never actually formally came out with proper grants and certainly whatever about buying hardware, they never ever supported on-going maintenance, on-going support and future purchase of obsolete equipment. So I mean I think for all the wonderful things you hear from our department, they have been certainly very lapse in the whole IT area. It's really being left to individual schools to do it. [Principal, Interview, Primary School 1]*

Principals expressed particularly strong and negative views of the DES's ICT approach suggesting it is unplanned and lacking policy focus yet schools were expected to develop school policies including ICT without having any technical expertise or certainty regarding future funding.

> *...funding is a key area…the big problem with ICT is that the Department always expected us to have plans but they didn't have a plan…were giving money willy-nilly and the problem with that is that unless you can see as a school, this is your*

funding into the future, how can you plan yourself into the future because if I have a brilliant computer system today, in 3 years' time it could be obsolete…you set up a dependency on IT you know and the more dependent you become on it, like if I come in some morning and broadband isn't working, I have got a problem. The whole place shuts down you know. [Principal, Interview, Post-primary School 1 (age 15)]

In response to this uncertainty about future funding, some schools proactively seek to obtain equipment through grants and sponsorship from alternative sources. However, it also seems to be an unplanned approach, obtaining whatever equipment is available rather than sourcing what they need. Additionally, some schools seem more successful than others in securing resources leading to levels of inequality even within the disadvantaged schools cohort.

Well, there is a certain contradiction here in the sense that the disadvantaged schools, the DEIS schools, if they play their cards right and they know where to get the grants, actually can … get basically any resource they really need to do ICT projects, you know, taking the cheapest ones, or the ones that are free. …It does depend on each individual school and each principal as to how they source the funding but the good ones can actually manage it …they seem to be able to find the funding when they require it. [Interview, DISC staff member 3].

Funding that is supplied by the DES for ICT does not appear to cover technical support provision. A third of teachers reported in questionnaires that they did not know they had any technical support available to them that may be a factor contributing to teachers' 'fear' in relation to equipment not working. Equipment breakdown may lead to lost time, frustration and ultimately lack of engagement with ICT. ICT co-ordinators, in particular,

were conscious that many teachers feel this way but do not consider they have sufficient technical skills to deal with many issues and were reluctant to engage the services of technicians due to the cost.

> *You know with the IT 2000 grant, you could not use that for technical support…you couldn't spend it on software as far as I remember, it was just hardware…the problem is with technical support and any of our teachers, if they are any way shy about using the computer and they come and something is not working, they won't go back. [ICT co-ordinator, Interview, Post-primary School 2]*

Lack of ICT expertise also made it difficult for principals or ICT co-ordinators to make decisions, based on limited funding resources, on when it was actually necessary to call in a technician recognizing that some issues could be resolved even over the phone. In NI, C2k provide a service to remotely remedy technical problems online without the need for 'call-outs': this may be one option either DISC or the DES could consider as a service that could be provided to schools at a reasonable cost:

> *I know they [DISC] are the advocates for the likes of us really, but I suppose if they ever did have somebody who could be maybe full time shared between a number of schools for maintenance, maintenance is the huge problem for us schools. If something goes down you kind of wait and hope period that it will correct by itself and then you know it's not and you have to get onto technicians. It's the time gap, or even if there was, yeah, if they had the luxury of a full-time person for a help line even you know. [Principal, Primary School 4 (age 9)]*

DISC staff also recognized the need for schools to have easy access to a technician;

however, this would require further funding for the DISC programme which may not be forthcoming. One staff member suggested that teachers should undergo technical training so that they could resolve minor issues, however, this would still require additional funding and commitment from teaching staff who may not necessarily view this as their function.

> *I know I've talked about this as well to set up a computer maintenance course for teachers – that's coming from the teachers themselves talking to me…like if DISC were to grow, it would be nice to see a technician come on board and again, funding is a problem. [DISC Staff 2, Interview]*

5. ICT co-ordinator role

Support for teachers is primarily provided by the ICT co-ordinators whose role is not clearly defined with many acting as planner, budgeter, educationalist, and technician: the technical role being primary (Devolder et al. 2010, p. 11). ICT co-ordinators have full-time teaching responsibilities and don't have free time to devote to the technical role, particularly for issues they may perceive as being 'basic' that other teachers should be able to address on their own:

> *I get called out a lot of times with basic hardware problems where it mightn't be plugged in and things like this so that's taking my time, and especially because we all have interactive whiteboards in the school, they need them to be working like you know so, it's just basic troubleshooting like that. [Interview, ICT co-ordinator, Primary School 2 (age 11)].*

Although ICT co-ordinators may be expected to fulfil the technical role, they frequently do not have specific or additional technical qualifications compared to other teachers and don't

feel equipped to fix many of the technical issues that may arise. ICT co-ordinators may be over-used for their technical skills and it is suggested they should be employed to promote the pedagogical use of ICT to fulfil curriculum requirements instead (Vanderlinde, van Braak, Hermans 2009) leaving the technical support role to be provided by a qualified technician (Lai and Pratt 2004, p. 474).

As the ICT co-ordinator's primary role is as a teacher, it seems more appropriate for them to guide ICT teaching and learning in their school (Lucock and Underwood 2001 cited in Lai and Pratt 2004). In recognition of this, Flemish schools were provided with Government funding for qualified technicians to support teachers so that they don't need to be concerned with maintenance and technical issues (DOE 2002, p. 19). While many schools have access to technical support services, they are considered to be expensive. When a technical issue arises, ICT co-ordinators need to assess if it important enough to pay the cost for a technician and admit to calling DISC first in order to make this assessment, although they were aware that this is not DISC's primary role. There seems to be an increasing expectation and requirement for teachers to use IT for all areas of their work with teachers recognizing that they need to up-skill and be familiar with ICT but perhaps feeling overwhelmed.

> *There's equipment, digital and technological equipment being used every day in classrooms constantly and if one person like me is meant to be overall of that and also doing their teaching job…I was never trained for that…we don't know what we are doing…I would see a big role for DISC in the future would be to try and get the Department of Education to see how big of a deal ICT is and that there needs to be at least one qualified person within an area maybe for a couple of schools, a*

technician basically that would be on call because it's not really DISC's job. [ICT co-ordinator, Interview, Primary School 4 (age 9)]

The difficult economic conditions have also led to a moratorium on posts so that schools were unable to appoint a replacement ICT co-ordinator if they go on medical leave or a career break leaving teachers to take on their positions without any extra pay. In some schools, teachers were not prepared to take on the ICT co-ordinator position without pay while those teachers that do volunteer seem to resent the extra perceived burden.

[The] post-holder is at present on career break so …and with cutbacks … is not being replaced. So it is a huge problem for us in the school because IT demands an awful lot of time [teacher named] gives some of this time but is not being rewarded for it which is very unfair [Principal, Primary School 1]

It also appears that some co-ordinators were not disseminating information they receive from DISC to their colleagues in an effective manner. This seemed to be supported by the questionnaire which found that ICT co-ordinators, IT post-holders and principals were most informed about DISC but only half of all teachers were with some aspects and a quarter reported they were not familiar at all. This lack of dissemination could be attributed to co-ordinators being overburdened with their own work but it would seem that DISC may need to consider other methods of disseminating information more widely than through the ICT co-ordinator alone.

I just think there hasn't been a huge amount of thought put into how to get the equipment used you know you can't have one person in DISC talking to one person in the school, putting all that pressure on one person when that person has a whole

other full-time job to do…and there isn't a space in the week for training your colleagues…[ICT co-ordinator, Primary School 1]

Another co-ordinator who is paid and very active in the school also cites time pressures as being a significant barrier and it is suggested that the DES will need to reconsider the responsibilities of the ICT co-ordinator if the role is to be carried out effectively. As previously alluded to, other countries such as Belgium have taken the technical aspect away from the post of ICT co-ordinator and this may help alleviate the situation for Irish teachers too:

I could spend my whole time away from the classroom away from my job like you know and spend my time engaged in IT and again… think it's something the department will have to have a look at in the long run like because it's probably taking up too much of the teacher's time. [ICT Co-ordinator, Primary School 2 (age 11)]

There appears to be a large element of 'fear' for teachers in adopting ICT use in the classroom but particularly around the area of technical computer issues with eleven of the seventeen teacher interviewees referring to this subject (Principals 4, ICT co-ordinators 4, Teachers 3). This 'fear' seems to develop once a teacher experiences technical problems during class time that may induce feelings of embarrassment for teachers, particularly if they feel they are less computer literate than their students 'the relationship between the kids and the teachers is such that the teachers would say 'look I am no use at this' (Principal, Post-primary School 2]. Suggestions are made that staff feel overwhelmed and this may be contributing to the lack of ICT use as teachers concentrate their time on fulfilling the curriculum requirements in traditional ways rather than using large amounts of time to fix

technical issues they feel ill-equipped for. DISC staff recognizes this 'fear' and acknowledges the need for on-going technical support as being important to increasing teacher confidence and encouraging them to innovate:

> *The whole managed approach is, you know, it is kind of technical support, the helpdesk, you know where you can just ring up if they have a problem. They are not kind of left on their own cause what can happen, technical problems or, people if they have come across a problem, a technical, they develop a fear and they don't want to go near it again and you can find that stuff is sitting there for a while – oh no, I don't want to touch that or whatever, whereas if they have the technical support on hand, they are more inclined to try a bit more with it. To experiment a bit more because they know, you know, I can call Tech Support and they will help me out if possible. [DISC Staff 2].*

6. Students' interaction with DISC

DISC staff members were very enthusiastic about the students' reaction to and interaction with the DISC programme with particular comments on the 'fun' and 'enjoyment' aspect of using ICT in the classroom:

> *It is really engaging for the kids and if you can make learning fun and make school a bit more enjoyable, kids are going to come to school more, they are going to stay in school and they are going to do better in school. Like you don't have to be a rocket scientist to work that out and that's our view here in Community Links. [DISC staff 1]*

The stated benefits for students of the DISC Project are to improve literacy and numeracy skills, concentration, behaviour and pupil motivation with the anticipated result that absenteeism would be reduced and retention increase (DISC 2009b, p.4). Teachers broadly agreed with many of the benefits to ICT use outlined by DISC (see Figure 9, page 33), however a quarter indicated that teamwork was not improved nor did ICT use lead to improved class discipline. However, the most surprising figure is that almost half of teachers maintained ICT use did not reduce absenteeism while a significant number said they were unsure. The reasons for absenteeism are varied and complex and while some studies suggest that ICT may improve absenteeism (Dwyer, 1994), there is little evidence for it. One study shows no significant effect for 'at-risk' students despite controlling for independent variables such as teacher use, student use and overall technology use (Muir-Herzig 2004, p. 127). Additionally, no significant effect was found for improvement in grades.

Despite this, it was evident from classroom observations and the focus groups that students did enjoy using technology and appeared to be engaged. It was less clear whether students were engaged with simply using the technology or having a break from writing but they did appear to be enjoying working in pairs or groups despite over a third of teachers declaring it did not improve teamwork. Classroom learning occurs in a social context with Graham Nuthall, a researcher in social-constructivist teaching, observing that students gain considerable cognitive learning experiences from their interaction and apparently aimless discourse with fellow students during classroom lessons as well as development of social and emotional skills (Brophy 2006, p. 529).

Some of classroom sessions observed did seem to have particular aims in mind: one was on

the history of the pyramids; another was on volcanoes while a third session with junior infants used a software package called 'Word Shark'. Both the pyramid and volcano sessions involved pairs of students working collaboratively together, however, some students seemed to be more interested in sourcing suitable graphics than on creating content. However, it should be noted that various methods of instruction had previously been employed by teachers with students making handmade representations of the material; lessons given through PowerPoint presentations; and students completing quizzes using hand-held clickers. The teacher of the junior class also involved individual students by inviting them to match letters with shapes which they all seemed very enthusiastic in doing.

By using different approaches, teachers were employing a constructivist and collaborative teaching approach that facilitates different learning styles resulting in a more flexible and enjoyable student learning experience for their students (Dimitrova 2004 cited in Granic 2009, p. 1054). Some teachers equated the use of ICT with any other 'tool' employed for teaching noting that children need guidance with educational material scaffolded to ensure students learn effectively:

> *ICT is a tool and it's how you use it that can be effective or non-effective. I think if you just sit children in front of the computer or in front of some application without any sort of structure or guidance is completely irrelevant. It's just like putting them in front of a book without any structure or guidance or background knowledge or anything. [Teacher 1, Primary School 3].*

Teachers who referred to 'scaffolding' had either gained ICT skills in an educational context abroad or had worked/studied in other fields prior to teacher training and seemed comfortable and undaunted by ICT use generally. Other teachers who appeared to adopt

more ‘traditional’ approaches, were older and had entered the teaching profession directly, acknowledged the usefulness of ICT in engaging attention or maintaining interest. One teacher used LEGO software in the special needs class to facilitate students to explore and attain achievable goals such as completion of a specific object (ICT co-ordinator, Primary School 3) whereas others used skill-based ICT software for ‘drill-and-practice’ sessions during after-school sessions as a means of reinforcing earlier learning (ICT co-ordinator, Primary School 1). While skill-based software may be associated with traditional teaching approaches (Niederhauser and Stoddart 2001 cited in Smeets 2005, p. 345), teachers with constructivist views can adopt a mix of skill-based and open-ended software to create powerful learning environments adapted to the needs of their students (Pisapia 1994 cited in Smeets 2005, p. 345).

Teacher age does not necessarily equate with having either a traditional or constructivist teaching approach with one principal noting that there was no difference in age or commitment to teaching approach or ICT use in that particular school (Principal, Primary School 4 (age 9)). A DISC staff member also observed that individual difference such as being open to new experiences was a more important factor than age.

> *And age as well, you know, some of the, the more mature teachers and who wouldn’t be very IT literate, you know, they have the interest, they want to learn about it, you know, and I think essentially there is quite a variety. One thing that does stand out to me is that teachers who have gone in as more, have worked in another field beforehand, they are more open to new things and more up for the challenge [DISC staff 2].*

However, one ICT co-ordinator in the same school claimed that older teachers were

reluctant to use ICT so it seemed that principals and co-ordinators may have different views of what constitutes ICT use or perhaps teachers are less likely to admit difficulties to principals and more likely to be honest with the ICT co-ordinator.

> *I know some of the older teachers now would be kind of a bit afraid of going near the laptop or setting up the projector and that kind of thing, and they'd rarely use it so like they will say they have never been taught. [ICT co-ordinator, Primary School 4 (age 9)]*

Alternatively, there may be some friction or resentment here between teachers and the ICT co-ordinator or other teachers who seem more computer proficient/confident, with one teacher appearing to suggest 'laziness' may be a factor as reluctance to use technology still persists despite training:

> *I give courses in the interactive whiteboard and what I come across particularly in the disadvantaged schools is there is a huge amount of teachers that are afraid of IT… I know teachers in this school that just go 'it's not working' and turn off the board and don't use it until someone comes and fixes it [Teacher, Primary School 3].*

Throughout the ROI, ICT use, regardless of age, is still low overall with over half of all DES inspector reports noting limited or inappropriate use with less than a fifth of observed classroom sessions using ICT in any form (DES 2008b, p. 163). Newly-qualified teachers and those who would have received ICT training are still reluctant to use ICT while despite many older teachers having had little exposure to ICT use in the classroom, almost half of teachers over 55 use software for teaching purposes, whereas just over half of under 35s did

(DES 2008b, p. 161).

Many students lack the learning strategies necessary to use ICT effectively with some expecting that they will learn simply by following online instructions or others being so concerned with achieving the 'right' answer they don't engage in higher order thinking or develop the 'intention to learn' (Lim and Chai 2004, p. 218). It is important that the object of both teachers' and students' activity systems need to be aligned in some way to achieve the overall object of the DISC programme that appears to be to teach the curriculum in a fun and engaging way through ICT. However, this only seems possible if teachers maintained the object as teaching the curriculum rather than focusing on using ICT as the medium or tool so that using ICT becomes the primary object.

Some principals and teachers acknowledged that many of their students would not be aware of DISC unless they were directly involved in the MLE project. Schools particularly active in ICT use said they were involved in ICT projects with other organizations so that their students did not necessarily identify ICT with DISC either.

> *We probably have not taken on everything that is being offered because we had been piloting other software over a long period of time so because we haven't necessarily participated in all that DISC were offering, it wasn't that we didn't want to or that we didn't think highly enough of it but it was because we were already linked in to other things and we simply couldn't do it all but as things like that fall off, we would turn back our attention to what DISC would have on offer maybe. [Principal, Primary School 4 (age 9)].*

However, this lack of identification with the DISC programme may not necessarily be a

negative issue but perhaps even a positive one in that teachers and students are incorporating ICT use into the classroom so that it is no longer seen as an 'add-on'. Teachers seem to be using the projects and equipment that suit their needs and their particular classes' need at the time with students benefiting from the projects in a 'fun' way which is one of the major objectives of the DISC programme.

Instead of students' identifying with the DISC programme, they do seem to recognize and appreciate the work of individual DISC staff members with many teachers citing the ICT projects initiative as being particularly attractive to them:

> *They don't realize they are in the DISC programme. We have never told them but they know [DISC staff 3] is from DISC and DISC supplied us with this…Like [former DISC staff member] was the Lego lady because [former DISC staff member] gave us all the Lego, they never actually realized that DISC was the Dublin Inner City Schools Computerization… I mean the thing is when we got the bank of computers first, we didn't realize why we were in DISC either or what the full extent of it was. It was only when the projects changed and we just kind of, we were getting supported, the school was, do the kids need to know? I don't know. [ICT co-ordinator, Primary School 3]*

7. Government Policy/administration

There seemed to be widespread disappointment expressed by DISC staff, principals and teachers at the perceived lack of support by the DES, and other bodies for the integrated use of ICT in the classroom and for programmes such as DISC. As previously noted, teachers were particularly frustrated by the lack of pedagogical relevance of ICT training

administered to teachers at all levels of their teacher training (Chapter 5, p. 83, Chapter 6, p. 91). Although government policies have been published, and provision of ICT equipment has received considerable media coverage, schools still perceive they are not being adequately supported to integrate ICT with education in ROI, suggesting that policy and practice are not in agreement.

> *...we are not supported by anybody at the moment. The Department of Education, the NCTE, the DICP, nobody. DIT are the only ones. No, we are not. Or indeed HP…It's the economic downturn I think. The business community too are always very reluctant to support jobs in programmes like this because if their funding for any reason is withdrawn, they are seen to have been the ones to terminate the programme…they are more available to put money into non-pay - like buying equipment and that kind of thing. I think it's down to the likes of our Department of Education to support these projects and they haven't. [Interview, Disc Staff 1]*

National governments throughout the OECD have put extensive ICT policies in place but they have had 'only minor influence for the visions and practice of the teachers on their use of ICT in education' (Meisalo, Lavonen, Sormunen, and Vesisenaho 2010, p. 6). This OECD report also recommends that government bodies and teacher training universities need to be more proactive in providing both material resources and on-going teacher training support and mentoring to assist and encourage teachers to use ICT innovatively in the classroom.

However, despite recent reviews and strategies regarding ROI's ICT policy (DES 2008 a; b; c; and d) teachers express considerable frustration and disappointment at the perceived lack of importance attributed to ICT with some suggesting that organizations such as DISC

and teacher bodies need to be more proactive in convincing the DES and NCTE to provide more support. It is difficult to see how much more DISC, in particular, can do within limited resources that they have not done already and most teachers seem to very appreciative of the work DISC has done to date. However, there may be some means whereby DISC and the representative teacher bodies could make joint submissions to the Department in the future.

> *It has concerned me for the last couple of years that there is not any intervention or any help from the Department of Education or even from NCTE…we're stranded here in the school and only for the DISC project helping me…So my suggestion…would be if between the DISC project and IT post-holders and co-ordinators and interested teachers, could try and get some kind of a I don't know a project or some kind of thing together where they could get the DES and NCTE to really see that IT is hugely, massively in schools at the moment. Like everything goes through IT. [ICT co-ordinator, Interview, Primary School 4 (age 9)]*

8. DISC/ICT Projects Co-ordinator support

The DISC ICT Projects Co-ordinator is mentioned directly by name in eleven of the seventeen teacher interviews and in comments on seven of the seventy-two questionnaires as having had a very positive effect and influence on teachers and the DISC programme generally.

For example, the co-ordinator's expertise and enthusiasm for ICT and its potential for use with students was particularly noted. Teachers indicated that they felt comfortable in asking questions of the ICT projects co-ordinator, particularly as they felt they did not have

the ICT skills to perform many tasks on their own. Some comments in the questionnaires suggested that DISC was actually saving the school money due to the continuous suggestions that were made to them.

> *The school has found DISC, especially [named Co-ordinator], to be a huge help in the development of ICT in our school. New software like Crazy Talk, Create-a-story, have been introduced successfully in our school in most classes with a short training session given by DISC staff beforehand. we need more of these! Technical support is very expensive but we have found [DISC staff 3] always helpful whenever we needed any help with software or hardware problems. We trust the opinion of DISC on new software so when one is recommended for a certain class group, we know that it has been tried and tested by other teachers saving us time and expense in purchasing unsuitable software. All classes, even Junior Infants, make use of our computer room and use software installed by DISC staff but ongoing support from DISC is vital to the development of ICT in our school [Questionnaires, number 56, ICT co-ordinator, Primary School].*

Concern was expressed by many teachers in both interviews and questionnaires that the future of DISC was in doubt. The ICT Projects' co-ordinator also seemed concerned at this and indicated that there was considerable work to be carried out yet as ICT projects had only been in existence for a relatively short time :

> *Even though I had the 2 year contract, really it was only a year because starting in the middle of one academic year and finishing in the middle of another academic year doesn't make any sense, it's really a year's contract [Interview, DISC Staff 3]*

The short academic year meant it was difficult to implement programmes with long summer holidays along with Christmas and Easter breaks making it difficult to sustain momentum and enthusiasm among teachers and students. It is claimed that the original objectives were being met but that a re-launch and extension of the programme would be warranted to generate enthusiasm and to encourage schools to become more involved 'a 5 year programme would be more beneficial and realistic. Long lead times required' (DISC Staff 3).

This point was also echoed by a post-primary school principal who admitted that their own school had not made full use of the facilities and support provided by the DISC programme and suggested that a re-launch might lead to further engagement by teachers.

> *For me, there would need to be a relaunch of it…I don't know how successful it is in other schools either or maybe we hadn't taken it up as much as other schools, I don't know but there would have to be a relaunch of it in this school anyway if not in the whole programme. [Principal, Post-primary School 2]*

The issue of only some schools being actively engaged seemed to be a major theme and this may well be an issue for further development of the DISC programme. There seemed to be little consideration given to evaluating why schools had not engaged and it is possible that those schools who were actively involved may have been actively engaged in ICT type projects anyway due to the interest of the principals and ICT co-ordinators. Some schools also mentioned that they were involved in projects with other organizations suggesting that while they may have appeared to be disengaged to DISC staff, they may be more active than this [Post-primary School 1; Primary School 1; Primary School 4 (age 9)].

There are still challenges there about getting the teachers to use the computers in their teaching. That's the problem…we have developed the ICT Projects Initiative which in the schools that have bought into that I think has been phenomenally successful and it's really the kids benefit enormously by it and the teachers that are plugged into it get a great deal from it, and the schools get a great deal from it [Interview, DISC Staff 1]

Challenges in ICT use also seemed to differ between the primary and post-primary school system with many teachers suggesting that both DISC and the DES were prioritising the primary school system, particularly in terms of grants for equipment. ICT co-ordinators and IT post-holders in are losing their paid positions due to cutbacks: the primary system to a lesser degree. The issue of the post-primary school curriculum and their particular requirements may be an area that DISC could investigate for future projects or perhaps restricting DISC activities to the primary school area first to maximise DISC resources may be another option.

I find it [DISC workshops] very primary-school oriented and that's fair enough…but for me I don't know how much I get out of it and I have to take time off school to do it so, and I haven't got a post. I had a post for IT, an acting-up post which I lost the day Batt O'Keeffe announced the new money for primary schools.[Teacher, Post-primary 2]

Objectives of the DISC project – what were they and were they met?

In activity theory, activity is collective, oriented towards an object and mediated by tools and signs (Engeström, Miettinen and Punamäki-Gitai, 1999). The main elements of

activity are subject, object, mediating artefacts, community, rules and division of labour (Hasu and Engeström, 2000, p. 346). However, different activity systems such as teachers and DISC staff (Figure 27, p. 124) may appear to be pursuing the same goals and objects but when looked at in more detail, even slight differences in object may lead to different outcomes.

The original objectives of DISC were not easily identifiable or similarly replicated in the various DISC reports supplied. In the DISC 2001 report (page 11) some objectives were outlined: a) upgrading schools' computer capacity b) developing teacher training in ICT for current and future curriculum needs c) locating/evaluating appropriate educational software d) engaging students and teachers in the integration of ICTs into the curriculum e) provide on-going administrative, software and technical support.

DISC personnel did not seem to have clearly-defined and agreed objectives for the DISC and MLE projects during initial meetings about this research (October 1, October 10, and October 13, 2009) and in individual interviews. While upgrading and teacher training was mentioned in all three DISC staff interviews, the issue of training and engaging students/teachers in order to fit in with the curriculum as stated in b, c and d was not mentioned. There did not seem to be a specific plan with stated objectives that could be realistically measured to a stated time plan and it would seem that the issue of the curriculum may well need to be addressed in future programmes in DISC.

> *The original objectives, as far as I know, were to first of all provide computers for the schools, for disadvantaged schools which didn't have any…provide training for teachers, to give them a bit of confidence because in IT 2000 you know, computers landed in the door of schools but nobody knew what to do with them so it was*

obviously to get teachers up and running and then they provided technical support at one point and then gradually, emphasis has been on getting teachers to use the technology in a fun, creative way with their students [Interview, DISC Staff 3]

Well it really was I think to engage with pupils from socially disadvantaged backgrounds and make learning fun, to kind of enhance the opportunities for social mobility…exploring new, innovative… innovative ways of learning and learning using IT [Interview, DISC Staff 2]

…the original objectives have been met without a doubt. Like the original objectives were very fundamental in the sense of upgrade all inner city schools with computers and train the teachers but we have …gone way beyond that.... [Interview, DISC Staff 1]

Each staff member had a different emphasis with DISC staff 1 concentrating on the issue of resourcing schools and training teachers; DISC staff 2 is primarily concerned with using innovative methods such as the MLE while DISC staff 3 is most concerned with teacher confidence and training. The emphasis overall, however, seems to be on getting the teachers to teach using ICT for its own sake rather than for the children's learning and in fulfilment of the current curriculum. It was also acknowledged by the staff that only some schools had engaged and that there were still many difficulties in getting teachers to use ICT in their daily teaching. It seemed to be suggested that lack of motivation or interest among teachers may be a reason rather than lack of computer literacy:

…like I mean teachers are all now computer literate, most of them are. All those that certainly want to be are you know" [Interview, DISC Staff 1]

Teachers and principals, however, seem primarily concerned with teaching their students while working within the constraints of time, curriculum demands, resources and teaching in areas of social and economic disadvantage. While the DISC programme is also constrained by these same issues, teachers need to have more support than they are currently receiving, but much of this support is outside DISC's control. For example, the curriculum is set by the DES as is the policy on integration of ICT into the classroom both of which teachers and schools are obliged to comply with. While ICT resources are not the primary focus at present, equipment will need to be maintained and replaced in the future with funding resources of government increasingly under pressure due to the difficult economic climate in ROI. Teachers still need to be trained but their current pre-service and in-service training is not fulfilling their needs.

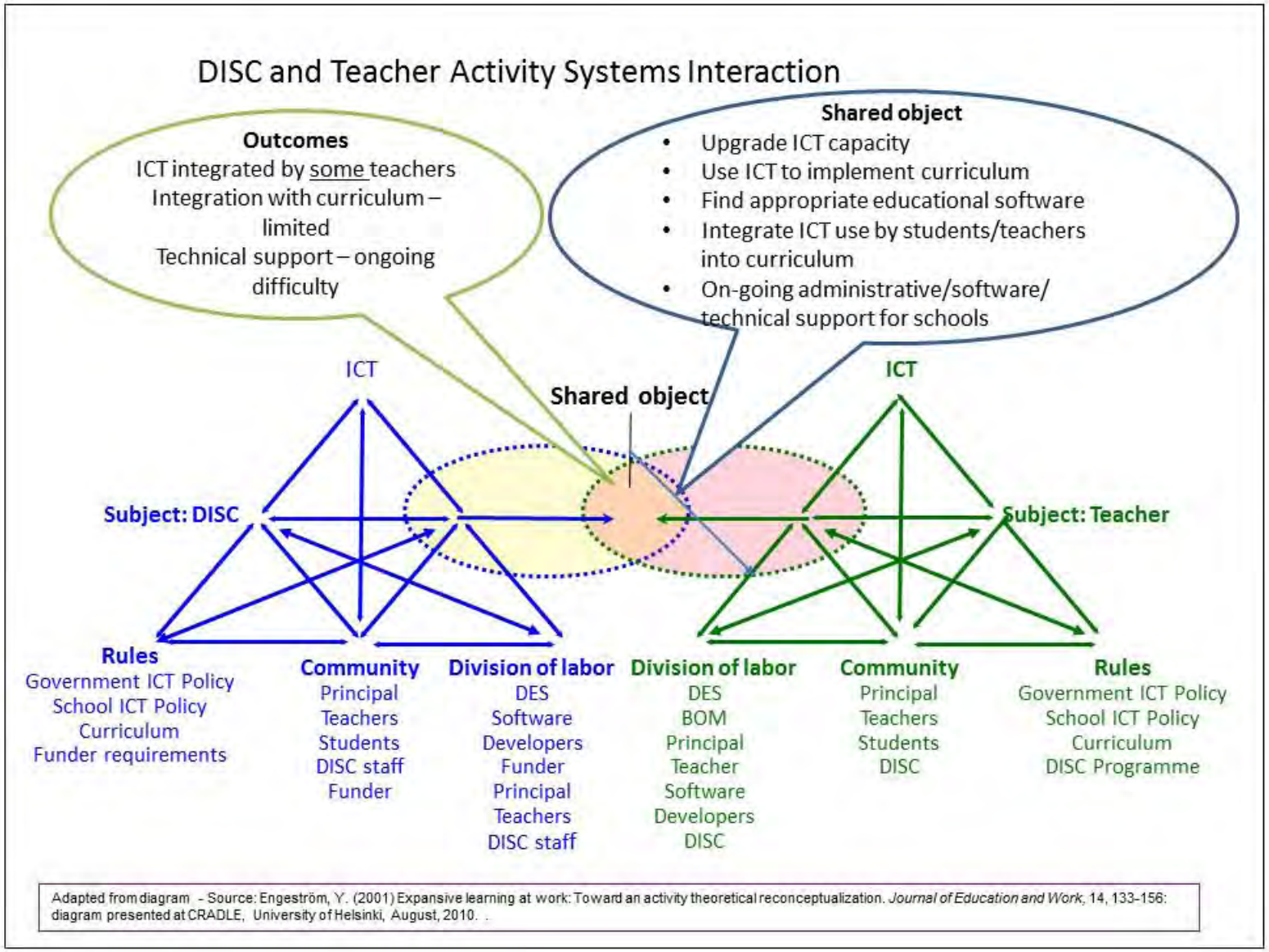

Figure 27: DISC and Teacher Activity Systems Interaction

CHAPTER 7: EVALUATION OF LNI

Outline of DISC LNI Project

The LNI platform was designed by C2k and their service provider, Hewlett Packard, as a safe and secure online learning environment intended to enable new methods of teaching and learning and this service has been operating in NI for a number of years (C2k 2009). LNI includes a library of digital resources licensed from educational publishers and customized to the revised NI Curriculum and also contains a range of safe areas for learners to learn online with one another and their teachers, supplementing the learning which takes place in the classroom (C2k 2009, C2k 2011; Hewlett Packard 2007).

In August, 2007, DISC, Hewlett-Packard and C2k negotiated to pilot the LNI in the ROI over an eighteen-month period to commence in early 2008 with the intention to roll out the project to all 38 DISC schools in the longer term. Four DISC schools were initially selected to participate: Primary School 2 (age 11); Primary School 4 (age 9); Post-primary School 1; and Post-primary School 2, however due to logistical issues, Post-primary School 2 could not engage with the project and did not proceed.

The LNI was targeted towards numeracy and literacy skills for primary level and the subjects of maths and geography at post-primary level. Schools had access to existing LNI content in addition to material uploaded subsequently by the pilot users themselves. The pilot was subsequently extended for a further 12-month period to be completed in May, 2010. This extended pilot (Stage 2) involved matching the four schools with schools in NI to encourage collaboration and engagement and educate students about the culture, beliefs and history of both their own communities and their partner school's community. It was

envisaged that students in NI and the ROI would collaborate and communicate by means of email, discussion boards and video-conferencing using the LNI.

Aims and Objectives of LNI Pilot

The overall objectives of the LNI pilot were stated to be a) the generation of DES and NCTE interest in the adoption of an MLE as part of the "curriculum development strategy" in the Irish Education system generally and b) to implement the LNI specifically in all DISC Schools (DISC 2009a, p. 3). Specific objectives for the Pilot related to engagement of students; linking schools in NI and ROI through video-conferencing, discussion forums and joint multimedia projects; development of course material; teacher training; and development of a 'train-the-trainer' initiative to increase participation in schools (Chapter 7, p. 158; DISC 2009a, p. 3).

Methodology – Case Study approach

A case study approach using six schools with varied levels of programme commitment was used to assess both the DISC project overall and the LNI programme in particular. The four schools originally selected to pilot the LNI were included in this case study: Primary School 2 (age 11); Primary School 4 (age 9); Post-primary School 1; and Post-primary School 2. As previously alluded to, Post-primary School 2 did not engage with the LNI pilot due to logistical reasons: this school was included in the Case Study as an 'uncommitted school' to provide a balanced overview of the varied experiences of schools with the DISC programme overall.

Using the Case Study approach, the evaluation of the LNI was carried out through the use of semi-structured interviews, an observation of an LNI session and focus groups with the

three participating schools in the LNI pilot: Primary School 4 were female, aged about 9 years; Primary School 2 (age 11) were female, aged about 11 years; and Post-primary School 1 were male, aged about 15 years.

SEMI-STRUCTURED INTERVIEWS

For the Case study, twenty semi-structured interviews were conducted with three DISC staff and seventeen teachers. Eight of the seventeen teachers were involved with the LNI pilot project: three Principals (one secondary/two primary), three Classroom Teachers (one secondary/two primary), and two ICT co-ordinators (primary). Eight general areas were covered with interviewees encouraged to talk freely within these sections. The areas were: teaching motivation; familiarity with DISC/LNI; feelings about DISC/LNI; suggestions for future; school ICT facility; students' interaction; ICT Teacher training; support for ICT; and the last section open to any additional comments (Appendix B) with the eight LNI teachers encouraged to discuss the LNI pilot project in particular.

OBSERVATION OF LNI SESSION

One actual LNI session was observed in Primary School 2 (age 11): students were all female and aged about eleven years old. The ICT coordinator and Classroom Teacher were present initially with other teachers arriving during the session to observe proceedings during their break from class. Two DISC staff and this researcher were also present. Students sat in three rows in a semi-circular fashion with the LNI DISC staff member and teacher seated at a desk in front of the computer at the front of the room with a large screen beside it for the students to view.

Difficulties had been experienced by both DISC staff and teachers prior to the session with the School Broadband facility and a mobile 'dongle' was employed in order to facilitate the

internet requirement for the session. There did not seem to be issues of connectivity or bandwidth during this session despite the use of the 'dongle' and the screen activity did not appear to 'freeze' or falter. The students in the partner school in Northern Ireland were all seated at their desks and appeared to have been given tasks to do while they were not specifically engaged in asking questions of a student in the ROI school.

Students had some knowledge of each other prior to this particular session: students in each school had prepared short descriptions of their interests and family situation and the students in the partner school had read them. For this session, students in the ROI had a prepared question they wanted to ask of a specific student in NI based on the transcripts they had previously read: for example, one student asked why another student found his brother annoying.

FOCUS GROUPS

Focus Groups were held with three student groups involved in the LNI project: nine year old females (Primary 4); eleven year old females (Primary 2); and fifteen year old males (Post-primary 1). Sessions were all held in the students' classroom and their teacher (who was also an interviewee) was present at all times. This researcher conducted the focus group with the teacher interjecting only to clarify points at the request of the researcher. Students were informed the sessions were to get feedback on the LNI; what they liked and disliked; any suggestions they had for the future; how they reacted to recent changes made to the interface; and how they fared with their trips to meet up with and engage with their partner schools from NI.

All students were encouraged to participate in the sessions by the researcher asking general questions to the whole group and then asking specific students to respond to avoid

domination of the discussion by particularly enthusiastic students.

LNI Evaluation

For the purposes of the LNI evaluation, the data collected from the semi-structured interviews (8 LNI teachers); the focus groups (3 classes) and the LNI observation session will be used to inform this section of the report. Using NVivo 9 to analyse the qualitative data, the main issues that arose were in relation to 1) student engagement; 2) the LNI interface; 3) LNI content; 4) social and collaborative aspects of the LNI platform; 5) technical difficulties (broadband and password access); 6) teacher training; 7) perceived lack of engagement by NI schools; and 8) student suggestions for the future.

Differences between post-primary level students and primary school are evident (Figures 28, 29, 30) with the two primary schools focusing most on the trip that was organized at the end of the project rather than the activities carried out during the pilot: they seemed to identify the whole project with the trip (Figures 29, 30). Post-primary school students mention the trip briefly but they discussed many other aspects of the project in more detail such as difficulties they experienced in negotiating the LNI interface (Figure 28).

Primary School 4 (age 9) seemed to either experience or seemed most affected by the technical issues that occurred (Figure 30) and the teacher was also quite negative toward the LNI generally (Interview, Teacher 1, Primary School 4 (age 9)). However, despite also experiencing technical difficulties, the ICT co-ordinator and teacher in Primary School 2 (age 11) (Interviews) seemed much more positive about the project in general compared to the teacher at Primary School 4 (age 9). This may be attributable to the support, encouragement and enthusiasm generated by the ICT co-ordinator in Primary School 2 (age

11), however, it is suggested that MLEs may be more suited to older students such as 6th year primary or post-primary level rather than the 9-year olds at Primary School 4 (Chapter 7, 154).

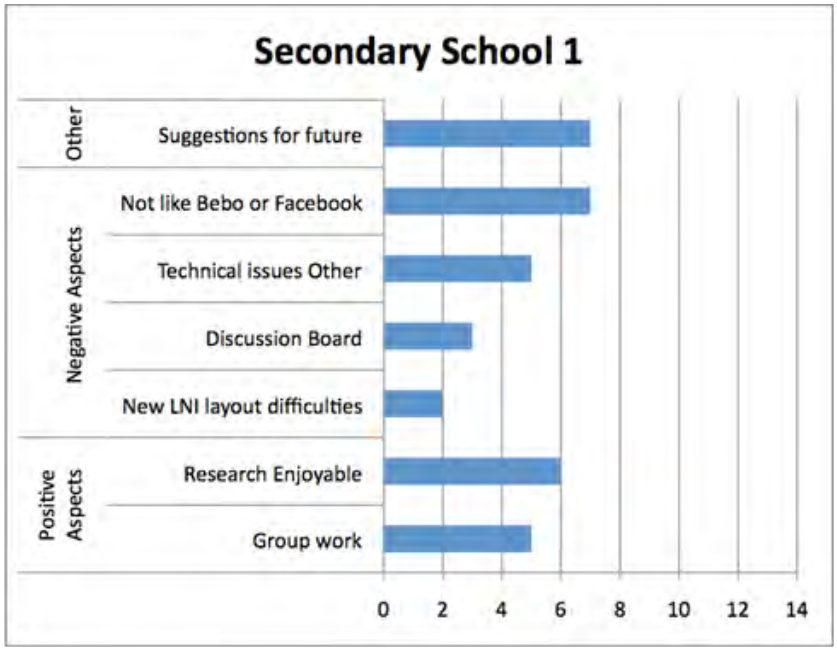

Figure 28: Secondary School 1(age 15) - main issues

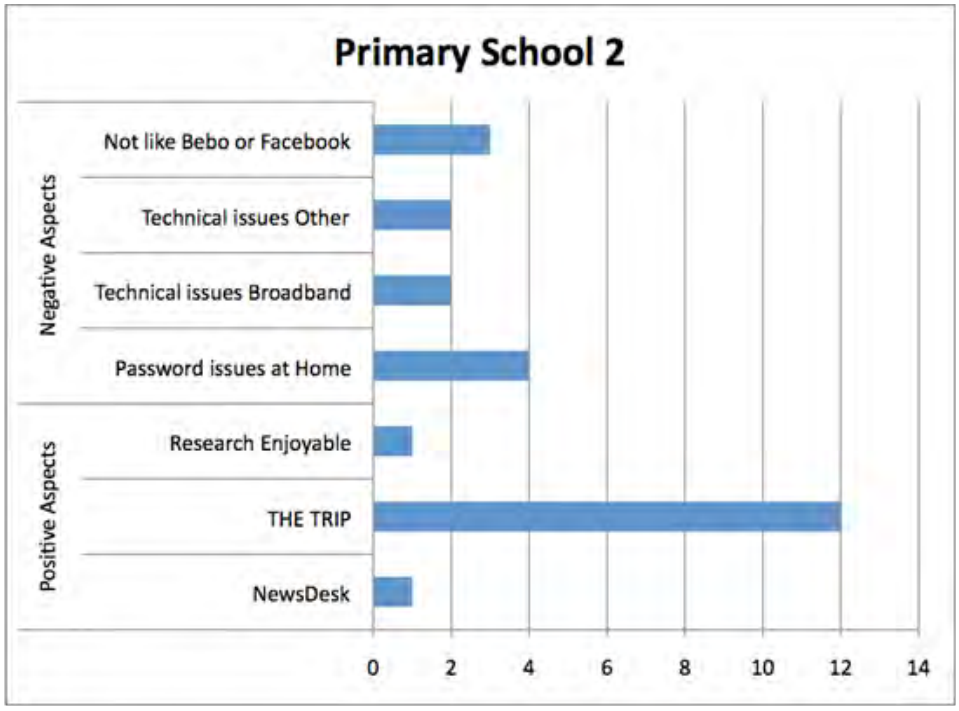

Figure 29: Primary School 2 (age 11) - main issues

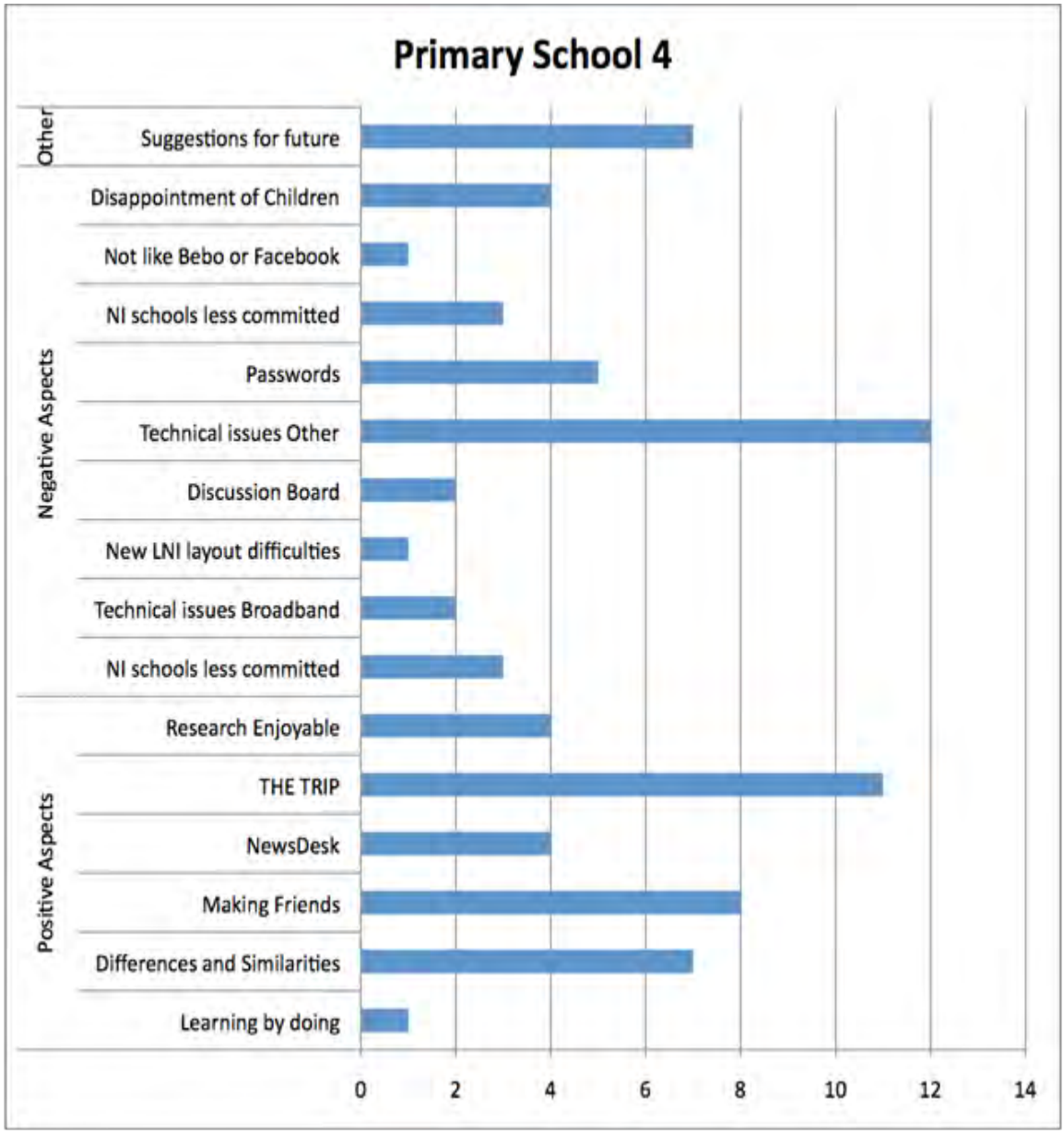

Figure 30: Primary School 4 (age 9) - main issues

1. Student engagement

From my direct observations of an LNI session in Primary School 2 (age 11), students were seated in a semi-circle facing the screen with the teacher seated at a desk at the top of the room close to the webcam and microphone. Individual students raised their hands in turn to be selected by the teacher to approach the microphone to ask pre-prepared questions to

specific students in the NI classroom and it appeared that students knew some details about each other through online communications prior to this session. The students in NI were seated at their desks and appeared to be drawing or writing and did not seem engaged with the process unless they were the subject of the question being asked by the student in Primary School 2 (age 11). There appeared to be merits to both approaches as the activities of the NI students possibly prevented them being bored while waiting their turn, however, the advantage of the students sitting in circle type arrangement meant that they were all engaged as a group rather than individuals as the students in NI. However, it seemed that a traditional-teaching/learning approach was being adapted to the use of an innovative technology with teachers maintaining full control of the process rendering students as 'passive' participants in the process rather than being 'active' (Tondeur, Hermans, van Braak and Valcke 2008, p. 2544-5). A constructivist teaching/learning approach may have facilitated students to direct and conduct this session in a more active way although the restrictions of timetabling and curriculum may have been a factor in teachers' maintaining control to ensure best use of available time.

However, students in Primary School 2 (age 11) seemed satisfied with this arrangement and were very keen to have their turn and ask their question with little evidence of boredom during the entire session. Although students seemed a little shy at first, they seemed to gain confidence as the session progressed although it did appear to this researcher that students were more interested in accessing the microphone and having their 'turn' rather than in the replies they received to questions.

While I didn't directly observe Primary School 4 (age 9) using the LNI, their teacher maintained that these 9-year olds were unsure of what was expected of them and didn't

understand that video-conferences were occurring in 'real time' with 'real' students. This teacher suggested students may need to be a little older to fully appreciate and use this type of technology as this age group lack the social and learning strategies necessary to engage as found by Lim and Chai (2004, p. 216). In contrast, the students at Primary School 2 (age 11) who are two years' older appreciated the interaction was 'real' and understood the process while many of them had experienced both Facebook and Skype interactions at home and were familiar with this form of communication. The older students generally had more computers at home: increased home use and availability of ICT results in students gaining more experience, having a wider variety of ICT skills, and increased confidence than students with low use and access (OECD 2005, p. 69).

2. LNI Interface

Students' familiarity with a wide range of computer applications and social networking sites led them to expect the interface to be similar to Bebo or Facebook. Students at post-primary School 1 expressed frustration and confusion with the layout of the LNI workspace maintaining there were too many steps involved in accessing the workspace or Discussion Board:

> *Pupil 2: Like when you log in, you have to go into [step 1 named] and [step 2 named], then you have to go into the Discussion, and then something else and then there are 4 or 5 steps. [Focus Group, Post-primary School 1]*

While one student made this comment, other students in the room nodded agreement or tried to speak at the same time leading to a very animated discussion. Students were frustrated not only at the number of steps required to complete an action but that functions

were not either obvious or easily navigable leading them to seek the teacher's guidance which they seemed reluctant to do. Interfaces in educational environments need to be easily navigable so that individuals can concentrate on learning tasks rather than on navigation leading to students following a socio-constructivist approach in self-directing their own learning and working collaboratively with peers without needing additional tutor assistance (Squires and Preece 1999, p. 480). Navigation of the interface should be 'obvious' (Norman 1998, p. 9) placing a low cognitive demand on users with 'symbols, icons and names' used consistently throughout applications and similar to those the user is already familiar with (Squires and Preece 1999, p. 480).

> *On the workspaces, when you go in, you go into the workspace and you are not fully in it. It just says Launch Workspace there and then you have to go into that and then it comes up with a list of things.*
>
> *That's why we made the PowerPoint for the workspace [after Teacher showed them]. I never knew we could do that on workspace. [Students, Focus Group, Post-primary School 1]*

The Discussion forums were a particular source of concern as discussion threads were deemed to be confusing leading to frustration that was exacerbated due to the short time they had available (40-minute sessions).

> *You got all mixed up because there might have been 180 new messages and the lads didn't know which one was really for them. [Teacher, Focus Group, Post-primary School 1]*

But on Bebo or Facebook like you'd have your own page with and you'd have a list of comments on what's sent to you instead of just having everyone's all mixed up together [Pupil, Focus Group, Post-primary School 1]

Primary school students also found the LNI discussion board confusing and noted that they expected the format and procedure for using it to be the same as other Discussion Boards they had already used 'It would be easier if it was more like Bebo…the way it appears. [Pupil 4, Focus Group, Primary School 2 (age 11)]. It may be necessary to look at the format and design of the Discussion Boards to make it more relevant and familiar to the students so that they can engage with the process without being hampered with issues of usability (Squires and Preece, 1999, p. 480).

While the primary school students seemed to expect the interface to be more like Bebo or Facebook generally, post-primary students were more specific requiring individual profiles, their own pictures and getting emails to tell them that there was a message for them posted 'on their wall' just like Facebook. While they liked working in groups on research and projects, they seemed to prefer to interact on an individual basis with their counterparts in the North rather than as a group when discussing particular subjects.

Specific questions were asked on what they did on the computer at home with one reply being very representative of responses 'Go on Bebo, Facebook, MSN, games, helicopter games, robot and Unicorn Attack' (Student, Post-primary 1) that seems to support research that 15 year olds use computers at home primarily for gaming (Fuchs and Woesmann, 2004, p. 15). All students replied that they had access to computers at home (most having their own laptops) and that they used computers most days of the week. This seems to support findings that low socio-economic circumstances are not a barrier to students having

access to computers at home (Fuchs and Woesmann 2004, p. 8) with most students having frequent access to a wide range of applications (OECD 2005, p. 17).

Students in Primary School 4 (age 9) expressed satisfaction with the appearance of the LNI interface , particularly the colour scheme 'I thought the colours were colourful and beautiful', however they found it hard to discriminate sections in places with the LNI logo colour identified as particularly difficult 'You know where it says LNI, I think the writing should be black'. [Focus Group, Primary School 4 (age 9)]. Difficulties with identifying sections or features of the interface due to colour schemes used were exacerbated by the use of terms to describe them such as Discussion Board, NewsDesk and Forum. These young students seemed to view the LNI as one entity and could not distinguish between each type of feature, frequently mixing them up although this confusion is also found in research on adults in relation to similar MLEs such as Blackboard (Quinn 2009; UMBC 2002).

The following exchange illustrates that both the teacher and the students were confused about the different features and terms.

> *Pupil 1: I love it [NewsDesk]. I like the way you can ask questions…when it is Christmas or something.*
>
> *Teacher: Are you getting mixed up with the Forum now? That's the forum, where you communicate with the boys and girls from Belfast.*
>
> *Pupil: No, like when you write it.*
>
> *Teacher: When you write it, then that is the forum [Focus Group, Primary School 4 (age 9)]*

It may be useful for C2k to consider simplifying terms; reducing the number of features

available or designing features to more closely resemble those the students are already used to such as on Facebook, Messenger or Skype so that they can directly engage without the requirement to learn new terms and rules for engagement.

3. LNI content

Primary school teachers were very satisfied with the News Desk as a source of material for their lessons in many subject areas. While the News Desk is particularly useful for current affairs, history and geography, some teachers also found it useful for English as new vocabulary is introduced and explained in an interesting way with news being relevant and current:

> *The way the News Desk is actually laid out, you have got your whole lesson and your whole article and you can, you have got your words underlined, you have got your English dictionary words and then you have a whole other primary activity after that [ICT Co-ordinator, Primary School 4 (age 9)]*

Teachers suggest, however, that they would appreciate more Irish content although they acknowledge that current news provides a focus and stimulates discussion for 'whole class' lessons on particular subjects relevant to the Irish and European context

> *But in a classroom setting, in a whole class lesson, it's even more effective I think because I can lead the questioning and it's, you know, it goes deeper. [ICT Co-ordinator, Primary School 4 (age 9)]*

NewsDesk, Discussion Board and Forum

The NewsDesk is very popular with students in both primary schools: it seems they don't watch television news or read newspapers and prefer using computers: *'I liked the*

NewsDesk…I don't like reading the newspaper' [Pupil, Primary School 2 (age 11)].

Researcher: What do you think of the NewsDesk?

Pupil 1: I love it. I like the way you can ask questions. Like somebody, I don't know when it is, Christmas or something.

Teacher: Are you getting mixed up with the Forum now? [Focus Group, Primary School 4 (age 9)]

Once the issue was clarified, it seemed that the students in this school also preferred learning about current events from the computer rather than the television news:

Pupil: And they could tell us without looking at the News and the television, and it was better looking at it on the computer.

Researcher: It was better than on the television? Why was that?

Pupil: It was more detailed [Focus Group, Primary School 4 (age 9)]

The older students at Primary School 2 (age 11) also express a preference for obtaining news from computers and while they seem informed on current events such as the US Presidential election at the time, they seem more attracted by the visual facility of the LNI rather than text and content. However, some interactive features on the NewsDesk were popular with this age group that facilitates students to do further research, express their views and enter competitions that seems to motivate them to participate and design their own learning.

Pupil 1: *I liked the voting, where you vote. It has three different things and you have to vote.*

Pupil 2: *A survey. There could be a new car coming out and you could like choose whether you would like to ride in it, or cycle your bike, or what.*

Pupil 3: *Be Your Own Reporter. You write out a report about the news and all and it gets picked to be on the site. [Focus Group, Primary School 2 (age 11)]*

One teacher maintained that students become bored due to the apparent deficits of the LNI layout/appearance although still acknowledging that they learn more using LNI than the traditional way: 'It is just I suppose the layout and that but they say they learn more from doing that from learning it from a book' [Teacher, Interview Post-primary School 1 (age 15)]. For this teacher, being obliged to use the LNI for a subject such as Geography, has acted as 'catalyst for change' (Rasmussen and Ludvigsen 2009, p. 83) resulting in the adoption of a more student-oriented pedagogical approach (Drent and Meelissen 2008, p. 195)

The issue of change and new material also arose in Primary School 2 (age 11) with 5th class who complained that the content and material was not updated or changed over a considerable period: 'Stuff is starting to get boring' [Focus Group, Primary School 2 (age 11)]. The students here also found the multimedia approach exciting and interesting and they seemed very enthusiastic about researching and collecting information to upload on the LNI 'I thought it was really good. I just liked the way you found out the history of the two different, about the two different counties' [Focus Group, Primary School 2 (age 11)].

The prospect of meeting up with the students from the school in NI and the subsequent trip

to the Cavan Crystal Maze seemed to provide considerable motivation for the project: 'It was exciting and fun…like getting to meet up with the other people' [Focus Group, Primary School 2 (age 11)]. Similarly with Primary School 4 (age 9), when asked about the LNI they constantly referred back to their trip rather than the multimedia project with both myself as interviewer and the teacher having to bring the focus back onto the project. However, as the trip had been the most recent activity and they had enjoyed it so much, the previous activities with the multimedia project may have become post-primary.

The younger students at Primary School 4 (age 9) seem more attracted to the use of the NewsDesk and Discussion Board than the multimedia project itself so it may be worthwhile to consider other topics or subjects that could be explored and possibly a different mode of communication other than a multimedia project approach. Primary school students when asked about suggestions for the future mention activities such as 'making things' rather than recording historical information. Students also frequently used the term 'we' rather than 'I' when answering questions that indicated the 'social' nature of the activities involved and the importance of group activity to them 'we would like to make different things like…Make butterflies' [On the computer]. [Focus Group, Primary School 4 (age 9)].

During classroom observations of activities in Primary School 3, 3rd class students had just completed lessons on the Egyptians; had made clay figures and icons; and had hand-written up their information before they moved on to recording their project using PowerPoint and Word on their laptops. Each step of this project seemed to reinforce their learning that culminated in a 'quiz' on the topic using SMART clickers (hand-held devices) for each individual student to respond to questions with the results appearing on the screen. Both

students and the teacher seemed to really enjoy this session with the teacher observing 'quizzes' were seen as 'fun' when using the clickers rather than a trial: '… they [clickers] are great…it's so funny I say we are doing a test and they say 'yes!' [Teacher, Interview, Primary School 3].

Curriculum-relevant material

According to the DISC staff, the LNI was intended to meet the needs of the curriculum:' getting the schools to use ICT equipment in the delivery of the curriculum, that is what the MLE is all about' [DISC staff 1]. However, the curriculum in NI and the ROI is different with much of the LNI content more appropriate to the NI system. In the Republic, there appears to be very few resources specifically targeted at curriculum subjects and it seems to be left to teachers individually to develop materials (Marshall and Anderson 2008). A post-primary school Maths and Science teacher acknowledges that efforts were being made to provide maths material but the task of passing this on to the students seemed overwhelming due to perceived lack of resources, skills and time.

> *It comes down to economics and time and those issues aren't addressed by the Department…the Department are going down the lines of like it should just be integrated into every classroom, but number one, the teachers have to be proficient, number two, the [students] have to be able to use it, whatever you want them to use so they have to be able to know their way around so they have to learn that somewhere you know….we have the new Project Maths…we went to the in-service and they have a CD and they kind of went, 'well each of the kids should have one of those CDs'… well who is going to do that? 'you could get one of them to do it' [department said]…that's a lot of time you know and if they want to do it, they*

should be supplying one to each child in each school. [Teacher, Post-Primary School 1]

This may be a comment on the difference between the situation at post-primary and primary level, however, it may also be due to teacher motivation and views. A teacher at primary school level who uses ICT regularly in the classroom maintained ICT can be used for most subjects in a general way if the teacher is motivated. However, this teacher did acknowledge that there was not enough readymade curriculum-relevant material available, particularly in the area of Maths:

You can incorporate some element of ICT into most subjects, maybe not art or subjects like that, drama to that extent, but history, geography, English, Irish, Maths as well…. [Maths]…it's so broad and it has so many topics in it they could really… launch a few more things into that [Teacher 1, Primary School 3]

DISC staff recognize that many teachers are still not incorporating ICT into curriculum subjects 'the teachers need to be convinced to use it in their subject teaching, that is still a huge challenge, that is not happening fundamentally, it's not' [DISC staff 1]. However, with ICT curriculum-relevant software not readily available as printed materials are, incorporation of ICT depends on the initiative and enthusiasm of individual teachers. DISC cannot meet this need for curriculum-relevant ICT software without considerable investment in additional staff and expertise so the DES needs to be encouraged to do so for all schools countrywide.

4. Social and collaborative aspect

For the 9 year olds in Primary School 4, 'making friends' and noting the similarities and

differences is a major positive aspect for them. One activity they particularly enjoyed was taking turns to use the microphone during the video conference and asking their own prepared questions:

> *I really liked it when teacher would pick someone to go to the microphone and talk to the people and we would ask them like what do you do after-school clubs, or do you get detention, and details about their school? [Focus Group, Primary School 4 (age 9)]*

The most positive aspect of the LNI for Primary School 4 (age 9), however, was the end-of-year trip. As previously noted, this part of the focus group session had to be restricted due to time as students were so enthused and willing to share their experiences. The main attraction of the LNI seemed to be the opportunity to meet up with other children and 'make friends' with the trip being the highlight rather than the activities online during the year. They seemed surprised that children from another school would have similar experiences to them but they also noted the differences such as the accent which was initially difficult to understand. They found it even more difficult at first when they met face-to-face at the W5 Science Centre in Belfast so it was possible that they spoke more slowly when asking prepared questions on the LNI platform, finding it easier to speak more naturally on physically met each other. However, students found this difference to be positive and intriguing rather than a negative aspect 'When we met them, they were talking, lots of times I couldn't understand what they were saying without asking again' [Focus Group, Primary School 4 (age 9)].

The students at Primary School 2 (age 11) also spoke at length about their trip. The main aspect for them seemed again to be peer interaction, 'making friends', and they also noticed

differences “Like their uniforms were different? They had a summer dress. Their accents.” [Focus Group, Primary School 2 (age 11)]. As with Primary School 4 (age 9), they also referred extensively and in detail to the trip to a maze when asked if they would like to do the LNI project again next year.

Research Enjoyable

For the post-primary school students at Post-primary School 1 (age 15), the ‘research’ element seems to be very successful with students saying that they preferred to do geography through this medium rather than through the usual classroom environment and books. Research is described by students as being a ‘fun’ activity rather than ‘work’ but when asked directly about this, they seem horrified this researcher would think they were having ‘fun’ and not ‘working’.

> *Pupil 3: No, not 'not work', just 'fun work'. It doesn't seem like it is boring or too hard because it’s not too hard. You can google and do research about it.*
>
> *Pupil 5: The research helps you learn, to write up about it in your homework and all. [Focus Group, Post-primary School 1 (age 15)].*

In the interview, this teacher acknowledged that the project was enjoyable for both teachers and students but that students are reticent about this aspect when asked directly about whether they enjoyed it.

> *Now from my feedback, from what I have got from them they have actually enjoyed the project, the have enjoyed the idea of interacting with pupils from another country…they seem to enjoy the research end of things …They seemed to get a good buzz and good craic from it as well. You really have to ask them the question, like*

you know, I have asked them and 'it's good', that's all you get out of them….[Teacher, Post-primary School 1 (age 15)].

While students acknowledge the use of print and computers require 'work', it would seem that the use of ICT may encourage or promote the use of a research-based pedagogical approach that students did not previously experience from the usual textbook/teacher lecture format. When computers are used as 'tools' for learning rather than being used for their own sake, learning outcomes may improve (Salomon 2002, p. 74).

It's more interesting when you go on the computer and you get to look it up and everything on your own and then you write it out in PowerPoint or whatever. In geography class, you are just sitting down and have to do work and all. [Pupil, Focus Group, Post-primary School 1 (age 15)].

DISC staff members seemed to think that students would be more likely to present at school if they were having 'fun' although the questionnaires suggested that teachers did not view the DISC programme as having any link with absenteeism (Figure 9).

It is really engaging for the kids and if you can make learning fun and make school a bit more enjoyable, kids are going to come to school more, they are going to stay in school and they are going to do better in school. [DISC staff 1].

There may be a shared 'Object' here between DISC personnel, teachers and students with all three activity systems wanting 'fun' to be at the centre of learning with the 'Outcome' for all three apparently resulting in learning and engaging through enjoyment. Of the three schools involved in the LNI, however, the only references to the project being 'fun' are made by this post-primary school and their teacher. It is possible that the MLE-type

environment may be more suited to the older group of 15-year olds who may be more proficient and comfortable with social-networking anyway (OECD 2005; Schleicher 2005) and seem to enjoy the research-based nature of the projects. Anticipation of having 'fun' seemed to provide a motive for students to initially become involved and then maintained their own interest in the project by generating further enjoyment for both their own group and their partner school.

The most positive aspects of the LNI for Post-primary School 1 (age 15) were in relation to group work and the research aspect of working with the LNI. It transpired that they worked on one laptop in groups of four but when asked, they replied that this was a positive aspect and not a negative one as may be expected.

> *There is loads of spare computers. There is four to each one. Say one is typing up, and one is using the mouse, then another would go to a different computer and do the research and take it down in a copy and then when they bring it over they say it out to whoever is typing and we type and then when it is finished we all get to look at the slideshow together and [teacher named] comes over and looks at it. [Pupil 1, Focus Group, Post-Primary 1]*

It seemed that the social and collaborative aspect of working together was an important factor and that the task itself was almost post-primary. As Graham Nuthall has observed, students often learn more from discourse with each other than from direct instruction (Brophy 2006, p. 529). From a CHAT perspective, there was evidence of a Division of Labour here with each member of the group adopting a designated task leading to the completion of a task. It was not clear from this exchange how the roles were assigned, for example, by the teacher; by a group 'leader' or whether the group agreed upon these roles

together.

As previously mentioned, one of the post-primary schools, Post-primary School 2, did not proceed with the LNI due to difficulties with timetabling and subjects. The students at the Post-primary School 1 (age 15) completed projects on Geography and seem pleased to have produced projects and shared them on LNI with their counterparts in NI. It seemed to add another dimension to their learning to have to explain their locality to others and answer their questions in addition to finding out about places they had never been to in NI.

> *We had to do a project. We'd to, we put pictures up of national landmarks that are around our area and then they had to research theirs and then we learned then about the pictures that they put up and we had to research those and we learned about different places ...festivals and all that. [Pupil, Focus Group, Post-primary School 1 (age 15)]*

The students in Post-primary School 1 (age 15) seemed to have had positive experiences with their counterparts in NI, were able to relate lots of information about both their own locality and the locality of the other school, and seemed genuinely interested in the whole process. The teacher also expressed enthusiasm for the production of the multimedia projects as it added a new dimension to his teaching and he found the LNI a useful resource for his lessons.

> *I have enjoyed it now for the past year or so because it has given me a new challenge also that it is something I have never used before, the type of software is new. It has introduced me to video conferencing that I will definitely use in the future and it has also introduced me to the LNI website which is extremely good for*

resources and for interacting with other teachers and pupils as well and that so. [Teacher, Focus Group, Post-primary School 1 (age 15)]

The teacher observes that the 'novelty' of the multimedia approach does recede and acknowledges it is often difficult to engage the attention of this age group, however, the students still seem to learn more from the use of multimedia and PowerPoint presentations in particular than simply talking or using printed material :

I said 'how do you find say using PowerPoint instead of actually writing it'[addressed to students previously], well 'it is boring, but I remember the material that is involved'. [Teacher, Interview Post-primary School 1 (age 15)]

5. Technical difficulties

Video-conferencing sessions were set up between schools in NI and ROI; however, due to technical difficulties with the Broadband in the school at Primary School 2 (age 11), it proved difficult to conduct sessions using the video-conferencing facility. The initial session was observed where a mobile broadband dongle had to be used due to the issues with the Broadband and firewall system in the school that seemed to prevent the holding of the video-conference. The ICT co-ordinator reported that the technician engaged by the school could not sort out the issue so they could not have any more sessions:

We tried to get a technician in to sort it out and, I don't know, break down firewalls but he was doing more damage than good so he just put it all back the way it was…. So I was using my own mobile broadband then to try and get on as well but we're still having difficulties so [ICT co-ordinator, Primary School 2 (age 11)].

The issue of technical difficulties and lack of technical support in the school was frequently

mentioned by all schools in addition to the lack of consistent and reliable broadband connectivity and bandwidth. Students seemed particularly frustrated there were difficulties with the internet in school, referring to the screen as 'freezing' suggesting bandwidth issues 'when they said something like, the camera would show what they said a few minutes later'. [Focus Group, Primary School 2 (age 11)]. Students also expressed surprise there were bandwidth issues as they clearly did not experience these difficulties at home with many having frequent access to Skype and Messenger: 'My auntie lives in Australia and my other one lives in New Zealand and we talk to them on Skype' [Focus Group, Primary School 2 (age 11)].

While it is the responsibility of the NCTE, and not DISC, to provide technical support for broadband issues, they will only deal with the external line and not with difficulties within the school building requiring schools to access technical services at considerable expense.

> *Anything inside the school is our problem like our wireless network went down for a couple of days there a year or two ago and the NCTE didn't want to know because as far as they were concerned the connection was still coming into the school and after that it was our problem. And it's our money you know because as you know it's pretty expensive [ICT Co-ordinator, Primary School 1].*

In addition to the apparent demarcation issues of responsibility for lines, schools complain that they experience long delays in having any issues resolved which they found frustrating. It seems that while schools and staff may be very motivated initially to start and progress programmes such as DISC, the short timeframe available to schools due to the school year and the bureaucratic process of form-filling and approval may make it difficult to sustain motivation 'We signed off forms in September [9 months ago] for the NCTE are going to

come in and change our lines but it hasn't been done yet!' [Principal, Primary School 2 (age 11)].

Primary School 4 (age 9) also had difficulties with broadband and the video-conferencing at the beginning, although there were also technical difficulties in the school in NI that took weeks to address. While the problem was resolved, it may not have helped the motivation of the staff in the school to pursue the video conferencing and led to considerable disappointment for the children:

> *A few technical problems at the start…It was more on the school in Belfast's side than our side…something wrong with their laptop and then with their webcam and a few different issues… [Teacher, Interview, Primary School 4 (age 9)]*

Due to prior experience and lack of confidence, teachers also seemed to expect difficulties before they arose and seemed nervous about attempting new things as time lost may negatively impact on other aspects of teaching 'Just trying to fit it in with the ordinary timetable and things come up during the school year – it's hard to get a good run at it' [Teacher, Primary School 2 (age 11)]. Despite this, teachers seemed reluctant to criticize the DISC project and even ask for assistance although they clearly expected DISC to fix the issues. One teacher seemed very reluctant to make any type of negative comments at all and seemed to be trying to apportion blame between the school and DISC for any difficulties that had arisen 'well I think starting earlier in the year. I think we left it late to start' (Teacher, Primary School 2 (age 11)]. The comment made about starting too late in the year was echoed by the interview of DISC staff member 3 in relation to the ICT Projects 'starting in the middle of one academic year and finishing in the middle of another academic year doesn't make any sense' [Interview, DISC Staff 3]. Although the LNI pilot

was a 2-year project, delays reduced it to one academic year leaving little time for experimentation and increasing teacher confidence considered essential for any new innovation to be successful (Granic, Wifsud and Cucusic 2009, p. 1055).

Passwords

DISC acknowledged in a report that Post-Primary School 2 and Primary School 2 (age 11) had 'log-in issues in 2008 although they maintained these difficulties had been resolved by the end of 2008 (DISC 2009a): Primary School 4 (age 9) was not mentioned. However, in interviews Primary School 4 (age 9) and Post-primary School 1 (age 15) were still experiencing difficulties with school passwords. All twenty-three of the Post-primary School 1 (age 15) students expressed frustration with passwords with some students complaining that their passwords never worked throughout the period of the pilot: 'some people their account doesn't work. My account doesn't work'. Their teacher intervened at this point in order to quieten the room as the issue was generating considerable noise and frustration, and confirmed the difficulty.

Students in all three schools reported they had given up trying to access the LNI at home as they could not log on using their passwords.

> *First when I used to have the internet and I tried, to log onto LNI and then, I was trying to enter the password but it still said expired but the next time I done it but I lost the password but I couldn't and I lost the name so I couldn't remember. [Pupil, Focus Group, Primary School 4 (age 9)]*

Passwords changed frequently with one teacher (Primary School 4 (age 9)) noting that nine-year olds found it difficult enough to remember original passwords without having to change it every couple of weeks. The older students found the password changes equally

frustrating maintaining it frequently led to loss of their allotted time on the computers or having to abandon the session altogether leaving everyone disappointed [Focus Group, Post-primary 2].

Disengagement

While technical issues and broadband difficulties were significant issues for all three schools, it was most frequently mentioned in Primary School 4 (age 9). A related factor 'disappointment for children' was highlighted for this school as technical difficulties resulted in students becoming so disappointed and disheartened that the teacher became less willing to try further LNI sessions.

> *I felt a bit sad because I was really excited to see them…the first day we couldn't see them and they could see us and it was really hard and teacher was trying to find a way out to see. [Pupil 1, Focus Group, Primary School 4 (age 9)]*

DISC staff attributed the lack of engagement by teachers with the LNI due to a perception by the school of "a lack of support and communication since May" and suggested teachers did not have time as they were pursuing other teaching diploma courses (DISC 2009b, p. 4). However, it is possible that the school could not see the benefit of the LNI as fitting their curriculum needs, or their students' learning needs at that time. The teacher did suggest in the interview that the LNI might be more useful for an older age group as these 9 year old students did not seem to have the social and learning skills necessary to engage with it. This view is supported in some of the research literature (Lim and Chai 2004, p. 218) and may need to be taken into account when selecting classes and age groups for future use of the LNI.

But I suppose because they are young, 3rd and 4th, the forum would probably work better when they are a little bit older because it was their first taste of a forum and they didn't know what was expected of them so. [Teacher, Primary School 4 (age 9)].

6. Teacher training

During the first video-conferencing session, several teachers from the school came to observe and were clearly very impressed and interested in the whole process providing a good opportunity to train and motivate a group of teachers at the same time [Video-conferencing session, Primary School 2 (age 11)]. However, as the principal of this school noted, teachers often seem enthusiastic at presentations or training sessions but do not carry this forward through action acknowledging that schools need to be more proactive and follow-up on training. It was acknowledged that teachers need time to experiment during school hours (Granic, Wifsud and Cucusic 2009, p. 1055) in order to build on training, increase confidence and support other teachers' learning (Haydn and Barton 2008, p. 446):

We had two hours there last week where they [programs] were loaded onto the laptops and teachers actually did it. They played with it for two hours in our planning day and now they are more confident about actually [Principal, Primary School 2 (age 11)].

7. Lack of communication and collaboration between schools

The element of communication and collaboration is not evident in Primary School 4 (age 9) where the students and the teacher complain that very little material is being communicated by the other school in NI. This may have been partly due to technical difficulties, but

while the students expressed disappointment, they still enjoyed creating their own projects and researching their locality even though the other school did not respond. Although students lived in the inner city, they were not familiar with it and were eager to connect places and objects with information they already such as songs or stories:

> *We went to take pictures of Molly Malone and sang a song of Molly Malone.*
>
> *It was good that we put our, that we put our pictures that we took on the Internet, because people who hadn't been there could learn about the Dáil ... [Pupil 3 and 4, Focus Group, Primary School 4 (age 9)]*

In maintaining the partner LNI schools did not participate, this teacher admitted that difficulties with the internet and passwords had led to a lack of motivation and interest in the project.

> *I probably didn't bring them down enough to do the stuff downstairs in the computer, the computer forums and stuff. I should have. Yeah but that's my own fault…Just time and sometimes the passwords and stuff was very messy and I couldn't be bothered from then on. [Teacher, Primary School 4 (age 9)].*

Additionally, it would appear that the effort of booking the computer room (at ground-floor level) and moving the students down from the classroom on the top floor was a significant factor in reducing this teacher's motivation to participate in the project.

8. Suggestions for the future

Students offered many suggestions for future use of the LNI but many centred on the interface and usability issues that will need to be addressed before the LNI is offered to the rest of the DISC schools (Table 6).

Table 6: Suggestions for the Future (LNI)

Primary School 2: – 11 year olds	
Suggestions for LNI	**Direct quote**
Increased and new content	Some more stuff on it. Like a game. Stuff is starting to get boring.
Prizes for best poem/story	They could do the best poem or story in an area.
More detailed NewsDesk content	On the news, if they could put more stuff up. They don't tell you much
'Ask Someone' feature	They should have a little thing where you ask questions and they send you back answers about things. People on the LNI, like an Ask Someone
Internal chat for whole school	You should be able to talk to like your friends on it. Like it could be just people out of the class that's on it
Messenger type facility	you should be able to like talk to them, like not see them, like you know. Yeah, and then like you could keep friends with them
Primary School 4: 9 year olds	
Suggestions for LNI	**Direct quote**
Make and do projects	We would like to make different things like. Make butterflies. On the computer
Link with a new school	Meet a different school
Meet the students in other school first	Teacher: would it be better to meet them first and then do all the work? Yes. We would make friends with them and then...And know about them
Colour schemes-individualize	The colour I had was orange but I think it should be purple
Change LNI logo	you know where it says LNI, I think the writing should be black

Post-primary School 1 (age 15): Suggestions for the Future of LNI	
Suggestions for LNI	**Direct quote**
Themed Backgrounds	Background like themes
Bebo appearance/functions	More like Bebo
Profiles to be individualized	On your profile like you can have like different skins on the bottom
Improve appearance	And its very bland, its very, its not exciting
On-line indications	you don't know whether they are on line or not
Google link for research	When you go into the library, like there is this library and you search say on geography or history or anything, but…its very hard to get into it and then when you get into it, not enough things comes up and you have just to get out of it and go into Google to find stuff for research
Facebook/Skype type chat	Chat system, more like Facebook. Like Facebook or Skype

LNI original objectives

In an LNI report, 2009 (DISC 2009a), the following are stated as nine specific objectives of the pilot LNI programme:

1. Create a meaningful online learning experience that engages students and enhances learning
2. Link schools (teachers and students) in NI and ROI so they can communicate and collaborate with each other to deliver educational material
3. Produce multimedia projects to be shared via MLE
    a. Primary: Local History
    b. Post-Primary: Geography and Maths
4. Set-up video conferencing sessions between schools in NI and ROI
5. Set-up discussion forums between schools
6. Re-motivate and retrain current teachers and involve interested teachers to increase the number of active teachers to 8
7. Promote LNI access from home
8. Development of project support material (courses) relevant to subject area
9. Develop and train the trainer initiative within the DISC schools so that teachers can train each other and share and disseminate knowledge

Were original LNI objectives met?

While the LNI does seem to have engaged students and they seemed to have enjoyed the communication with the NI schools through the production of multimedia projects (Objective 1, 2, 3), the remaining objectives do not seem to have been entirely successful with little evidence of collaboration with Primary School 4 (age 9), in particular.

The video-conferencing sessions were infrequent although the students clearly enjoyed the sessions they did have. The discussion forums were confusing and along with the video-conferencing sessions were hampered by internet/bandwidth issues along with other technical difficulties that led to many sessions being abandoned.

It is suggested Objective 6 still needs to occur: existing 'active' teachers need to be re-trained and motivated to carry out some small and successful projects first with additional teachers selected who are already familiar with social-networking outside of the school arena.

The issue relating to passwords needs to be resolved in order to facilitate and promote LNI access from home (Objective 7) while it is still clear that curriculum-relevant material still needs to be accessed and provided. It is suggested that the NewsDesk initially could be made more relevant to the ROI by the inclusion of more relevant News.

It would seem that there needs to be a lot more work done on addressing the difficulties and issues regarding broadband connectivity, passwords and teacher engagement/motivation before a 'Train-the-Trainer' initiative could be established and progress.

As only three schools participated in the pilot, it may be useful to consider a re-launch of the pilot programme to include another couple of schools for the next year. In selecting suitable schools, consideration should be given to good broadband facilities and connectivity as LNI platforms require a consistent internet connection in order to be effective and these issues lie outside of DISC's control.

CHAPTER 8: CONCLUSIONS AND RECOMMENDATIONS

Limitations of Research

Due to the wide number of schools involved in the DISC programme, it was not feasible to visit all of them. While six schools were selected for the Case Study to represent all thirty-eight schools involved, it was difficult to assess how representative the classroom observations, in particular, were to the daily use (or non-use) of ICT in the classrooms generally.

While the response rate to the questionnaires was reasonable at 47 per cent, the views and experiences of many schools were still not received. For future research, it may be worthwhile to carry out a more longitudinal study with a selected group of schools visited on a regular basis.

Additionally the structured report format initially devised to obtain data to provide a Business Report for DISC and Hewlett Packard was somewhat restrictive when writing up this final report which is more qualitative in nature. For future research a more open-ended interview process along with more interaction with and observation of students use of ICT may be more appropriate in order to move away from the traditional approach of reform research that may be 'too preoccupied with looking for the intended changes' rather than looking at actual changes at micro-level (Rasmussen and Ludvigsen 2009, p. 83).

Conclusion

In conclusion, the DISC project was successful in providing schools initially with hardware and software, and promoting an 'ethos' of ICT innovation and use in schools in the thirty-eight selected DISC schools. Teachers, ICT co-ordinators and principals seem very satisfied with the commitment, input and enthusiasm of all DISC staff and relevant

stakeholders and are generally concerned that the programme should continue, though some suggest a re-launch may be valuable in re-motivating teachers and schools to engage.

The LNI pilot was received well by three of the four schools selected initially, although there is evidence that one of the schools, Primary School 4 (age 9), were not as engaged as they could have been while schools in the ROI did suggest that NI schools could also have shown more commitment. Despite the technical difficulties, students clearly enjoyed the social aspect of the LNI, particularly the 'trip' at the end of the project.

While hardware and software may be sufficient for schools' present needs, continual upgrading is essential to prevent schools' equipment becoming outdated. Technical support, or lack of it, is a major issue for schools and this issue needs to be addressed by the DISC/CLiC and DES in order to promote teacher confidence, maintain teacher motivation, and avoid teacher frustration.

Recommendations are made for the provision of ICT policies; increased technical and teacher support; increased liaison with the DES; and a reduction in the number of schools included in any future project to maximise limited resources and to harness the enthusiasm and commitment of those schools and teachers who are willing to engage in seeking to integrate innovative technology into their everyday teaching in the classroom (Recommendations, p. 164).

It should be noted that many difficulties that teachers and schools encountered in their attempts to integrate ICT use into their classrooms were outside the scope of a programme such as DISC. Government policy on ICT and provision of resources is key to any further integration and use of ICT in Irish schools. While government policy reports and action

plans acknowledge the importance of ICT skills and use for students at all levels for their future participation in the workforce, the focus is still on acquisition of ICT skills rather than on integrated ICT use by all participants in the educational process.

This process has to start with the DES assuming that ICT will form the basis of all future education: the curriculum being devised and curriculum-relevant support material being readily available to schools along with ICT trained teachers competent to teach in the new information age backed up by technical and pedagogical support. As many teachers noted in this report, all aspects of our daily lives are now governed by ICT and the government needs to recognize this and implement its policies in practice.

Recommendations

1. **DISC staff:** DISC staff need to be employed on a full-time basis so that they may devote more time to school visits initially and/or provide telephone support for the duration of the project.
2. **Introduce an ICT policy**: devise an ICT policy for the DISC/CLiC schools in consultation with teachers that has some defined targets for schools that are achievable within the school-year timeframe.
3. **Teacher training:** consideration should be given to providing teacher training during the summer period before the start of the school year and intermittently throughout the year as required. Training could be provided in smaller groups (see Recommendation 5) on the school premises of one of the members of the group.
4. **Technical support services:** need to be improved to assist in increasing teacher confidence and to leave them more time to concentrate on pedagogical use of ICT. Many software companies now having the facility to remotely take over the computer system in order to fix software issues without the need for a 'call-out', perhaps consideration could be given by the DES for this form of support to be available to all schools in the project.
5. **Reduce the number of Schools in programme:** Due to restricted financial and staffing resources, it may be advantageous to restrict the number of schools to even 20 and group them together geographically to support each other (4 groups of 5 schools).
6. **Restrict activities to Primary School area:** the issue of the post-primary school curriculum, and their particular requirements, may be an area that DISC/CLiC could investigate for future projects or perhaps restricting activities to the primary school area first to maximise resources may be another option.
7. **To redesign the format of the LNI**: consideration needs to be given to a redesign, particularly of the Discussion Boards, to make it more relevant and familiar to teachers and students so that they can engage with the process without being hampered by usability issues.

a. Post-primary school students would like to be able to customize their own profiles.
b. Both Primary and post-primary school students would find it easier to engage with a platform with similar formats and procedures to the social-networking platforms they are currently used to such as Facebook and communication platforms such as Messenger or Skype.

8. **Facilitate school groups for support:** Teachers need to be given time and support to experiment with ICT methods without pressure in order to use ICT innovatively in the classroom. This could be achieved by grouping schools (five or six) that are close geographically and scheduling 'hands-'on' sessions in schools on a rotated basis with end-of-year reviews facilitated by DISC/CLiC.
9. **Forum for ICT co-ordinators:** Although it is outside of DISC/CLiC's remit to appoint co-ordinators, consideration should be given to encouraging schools to appoint ICT co-ordinators that are more qualified and enthusiastic about ICT use. DISC/CLiC could, however, assist in setting up a forum of ICT co-ordinators to support each other.
10. **Provision of MLE for teachers:** DISC/CLiC needs to consider other methods of disseminating information more widely than through the ICT co-ordinator alone. DISC/CLic could consider setting up an MLE for teachers using an open-source platform such as Moodle where teaching resources could be accessed by teachers and facilitating teachers to interact with each other more.

REFERENCES

Albirini, A. (2006), Teachers attitudes toward information and communication technologies: the case of Syrian EFL teachers, *Computers and Education*, 47, 373-398.

Bannon, L.J. (2011), 20 Years A-Growing: Revisiting From Human Factors To Human Actors In Reframing Humans In Information Systems Development, eds. H. Isomäki and S. Pekkola, Springer, London, 181-188.

Barab, S., Schatz, S. and Scheckler, R. (2004), Using Activity Theory To Conceptualize Online Community And Using Online Community To Conceptualize Activity Theory, *Mind, Culture, and Activity*, 11(1), 25-47.

BECTA (2003), A Review Of The Research Literature On The Use Of Managed Learning Environments And Virtual Learning Environments In Education, And A Consideration Of The Implications For Schools In The United Kingdom, Available from: http://dera.ioe.ac.uk/1645/1/becta_2003_reviewmle_report.pdf. Accessed December 6, 2011

Berry, M. (2005), A virtual learning environment in primary education, Available from: http://www.worldecitizens.net/ftp/Primary%20VLE.pdf. [Accessed December 6, 2011].

Bennett, S., Maton, K. and Kervin, L. (2008), The 'Digital Natives' Debate: A Critical Review Of The Evidence, British Journal of Educational Technology, 39, 5, 775-786.

Blackmore, J., Hardcastle, L. and Bamblett, E. (2003), Effective Use of Information and Communication Technology (ICT) to Enhance Learning for Disadvantaged School Students, Deakin Centre for Education and Change; Institute of Koorie Education, Deakin University; Institute of Disability Studies.

Blackler, F. (2009), Cultural-Historical Activity Theory And Organization Studies In (eds) A. Sannino, A. Daniels, H.

Bødker, S. (1989), A Human Activity Approach to User Interfaces, *Human-Computer Interaction*, 4(3), 171.

Bødker, S. (2009), Past Experiences and Recent Challenges in Participatory Design Research. In Sannino, A., Daniels, H. and Gutierrez, K.D. (eds.), *Learning and Expanding With Activity Theory*, Cambridge University Press, Cambridge, 274-285.

Brennan, R., McFadden, M. and Law, E. (2001), *Review of Research: All that glitters is not gold: online delivery of education and training*, National Centre for Vocational Education Research (NCVER), South Australia, Australia.

Brophy, J. (2006), Graham Nuthall and social constructivist teaching: Research-based cautions and qualifications, *Teaching and Teacher Education*, 22, 529, 537.

Burns, T. C., and Ungerleider, C. S. (2003), Information and Communication Technologies in Elementary and Post-primary education: State of the Art Review. *International Journal of Educational Policy, Research, and Practice*, 3(4), 27–54.

C2k (2009), *Welcome to the C2k web site*. Available from: http://www.c2kni.org.uk/ [Accessed February 23, 2011].

C2k *, (2011), C2k Services for Schools*. Available from: http://www.c2kni.net/c2k_services.html [Accessed February 23, 2011].

CLiC, (2011), Computer Learning in Communities, available from: http://www.clicdublin.ie.

Cole, M. (1985), *The Zone of Proximal Development: Where Culture And Cognition Create Each Other* in (ed) Wertsch, J.V. Culture, Communication, And Cognition: Vygotskian Perspectives, Harvard University Press, Cambridge, Massachusetts, 146-161.

Connor, M. and Pokora, J. (2007), What is effective coaching and mentoring at work? In Connor, M. and Pokora, J. *Coaching and mentoring at work: Developing effective practice*. McGraw-Hill: Open University Press, 4-22.

Demiraslan, Y. and Usluel, Y. (2008), ICT Integration Processes In Turkish Schools: Using Activity Theory To Study Issues And Contradictions, *Australasian Journal of Educational Technology*, 24(4), 458-474.

Department of Education (DOE) (2002). Vision Paper ICT in Education. Brussels: Ministry of the Flemish Community. Available from: http://www.ond.vlaanderen.be/ict/english/archives/Vision_text_ICT_in_education.pdf [Accessed November 11, 2011].

Department of the Taoiseach (2008), Building Ireland's Smart Economy: A Framework for Sustainable Economic Renewal. Government Publications, Dublin. Available from: http://www.taoiseach.gov.ie/attached_files/BuildingIrelandsSmartEconomy.pdf. [Accessed December 5, 2011].

DES (1997), *Schools IT 2000. A Policy Framework for the New Millennium.* Department of Education and Skills, Dublin.

DES (1999). School Planning: Developing a School Plan – Guidelines for Primary Schools. Department of Education and Skills, Dublin. Available from: http://www.education.ie/servlet/blobservlet/padmin_school_plan.pdf. [Accessed December 5, 2011].

DES (2001), Blueprint for the Future of ICT in Irish Education Three Year Strategic Action Plan 2001 – 2003, Department of Education and Skills, Dublin.

DES (2008a), Reports on ICT in Schools Published. Available from: http://www.education.ie/robots/view.jsp?pcategory=10861&language=EN&ecategory=54200&link=link001&doc=41700 [Accessed April 14, 2011].

DES (2008b), *ICT in Schools: Inspectorate Evaluation Studies*, Department of Education and Skills, Dublin: Ireland.

DES (2008c), *Information and Communication Technology (ICT) in First and Second Level Education*, [Homepage of Department of Education and Skills], Available from: http://www.education.ie/home/home.jsp?maincat=&pcategory=17216&ecategory=206

58&sectionpage=12251&language=EN&link=link001&page=1&doc=18624) [Accessed February 12, 2010].

DES (2008d), Investing Effectively in Information and Communications Technology in Schools, 2008-2013: The Report of the Minister's Strategy Group [Homepage of ICT Strategy Group: DES], Available from: http://www.ncte.ie/media/Final ICT Strategy_group_report.pdf [Accessed February 12, 2010].

DES (2009), Minister O'Keeffe announces EUR2.2m in grants for high-tech classrooms. Available from: http://www.education.ie/robots/view.jsp?pcategory=10861&language=EN&ecategory=54195&link=link001&doc=42678 [Accessed February 12, 2010].

DES (2012), ICT Action Plan: Meeting the high-level skills needs of Enterprise Ireland, Available from: http://www.education.ie/servlet/blobservlet/pub_higher_ed_ict_action_plan_2012.pdf. [Accessed January 30, 2012].

Devolder, A., Vanderlinde, R., van Braak, J. and Tondeur, J. (2010), Identifying Multiple Roles of ICT Co-ordinators, *Computers and Education,* In Press, Accepted Manuscript.

DISC. (2009a), *DISC LearningNI Pilot Stage 2*. Dublin: Dublin Inner City Schools Computerisation (DISC): DIT.

DISC. (2009b), *DISC MLE Project Report December 2008*. Dublin: Dublin Inner City Schools Computerisation (DISC): DIT.

DISC (2009c), *DISC Report January to June, 2009*, Dublin Inner City Schools Computerisation (DISC): DIT, Dublin.

Drent, M., and Meelissen, M. (2008), Which factors obstruct or stimulate teacher educators to use ICT innovatively? *Computers and Education*, 51, 187-199.

Dwyer, D. (1994, April), Apple Classrooms of Tomorrow: What we've Learned. Available from: http://www.ascd.org/readingroom/edlead/9404/dwyer.html. [Accessed November 25, 2011]

Engeström, Y. (1987), Learning by Expanding: An Activity Theoretical Approach To Developmental Research, Orienta-Kondultit, Helsinki.

Engeström, Y. (1996), Developmental Work Research As Educational Research: Looking Ten Years Back And Into The Zone Of Proximal Development, *Nordisk Pedagogik*, 16(3), 131-143.

Engeström, Y. Miettinen, R. and Punamäki-Gitai, R.L. (1999), Perspectives on Activity Theory, (eds) Cambridge University Press, Cambridge.

Engeström, Y. (2001), Expansive Learning at Work: Toward An Activity Theoretical Reconceptualization, *Journal of Education and Work*, 14 (1), 133-155.

Engeström, Y. (2009), Expansive Learning: Toward An Activity-Theoretical Reconceptualization. In *Contemporary Theories of Learning: Learning Theorists in their own Words*, (ed.) K. Illeris, Routledge, London, 53-73.

Engeström, Y. (2009), The Future of Activity: A Rough Draft. In Sannino, A., Daniels, H. and Gutierrez, K.D. (eds.), *Learning and Expanding With Activity Theory*, Cambridge University Press, Cambridge, 303-328.

Engeström, Y. and Sannino, A. (2010), Studies Of Expansive Learning: Foundations, Findings and Future challenges, *Educational Research Review*, 5(1), 1-24.

Enochsson, A. (2010), ICT in Initial Teacher Training: Sweden: Country report, OECD, Available at: http://www.oecd.org/dataoecd/4/43/45214586.pdf. [Accessed November 3, 2011].

Fuchs, T. and Woesmann, L. (2004), Computers And Student Learning: Bivariate And Multivariate Evidence On The Availability And Use Of Computers At Home And At School, *CESIFO Working Paper no. 1321, Category 4: Labour Markets, November 2004,* Available from: http://www.cesifo-group.de/portal/pls/portal/docs/1/1188938.PDF [Accessed November 16, 2011].

Galanouli, D., Murphy, C., and Gardner, J. (2004), Teachers' Perceptions of The Effectiveness Of ICT-Competence Training. *Computers and Education*, 43(1–2), 63–79.

Granic, A. Wifsud, C. and Cucusic, M. (2009), Design, Implementation and Validation of a Europe-wide Pedagogical Framework for E-Learning. *Computers and Education*, 53, 1052-1081.

Gutierrez, K. D., Baquedano-Lopez, P., and Tejeda, C. (1999), Rethinking Diversity: Hybridity And Hybrid Language Practices In The Third Space, *Mind, Culture, and Activity*, 6(4), 286–303.

Gutierrez, K. D., Rymes, B. and Larson, J. (1995) Script, Counterscript, And Underlife In The Classroom. Brown, James versus Brown v. Board of Education, *Harvard Educational Review*, 65(3), 445–471.

Haydn, T. and Barton, R. (2008), 'First do no harm': Factors influencing teachers' ability and willingness to use ICT in their subject teaching, *Computers and Education,* 51, 439–447.

Hasu, M. and Engeström, Y. (2000), Measurement In Action: An Activity-Theoretical Perspective On Producer User Interaction, *International Journal Human-Computer Studies*, 53, 61-89.

Hepp, P., Hinostroza, E., Laval, E. and Rehbein, L. (2004), *Technology in Schools: Education, ICT and the Knowledge Society — UN-APCICT* [Homepage of World Bank], Available from: http://www.unapcict.org/ecohub/resources/technology-in-schools-education-ict-and-the-knowledge-society-1 [Accessed January 2, 2010].

Hermans, R., Tondeur, J., van Braak, J. and Valcke, M. (2008), The Impact Of Primary School Teachers' Educational Beliefs On The Classroom Use Of Computers, *Computers and Education,* 51, 4, 1499-1509.

Hewlett Packard (2007), *C2k Review for Ireland*, Report No: Outsourcing Services UK & Ireland FY'08 Business Plan V1.42, Hewlett Packard Development Company, UK, 1-12.

International Organisation for Standardisation (1997) ISO 9241-11: Ergonomic requirements for Office Work with Visual Display Terminals (VDTs). Part 11 – Guidelines for Specifying and Measuring Usability. International Standards Organization, Geneva, Switzerland. [also BSI, London (1997)].

Isroff, K. and Scanlon, E.(2002), Using Technology In Higher Education: An Activity Theory Perspective, *Journal of Computer Assisted Learning*, 18, 77-83.

Kaptelinin, V. and Nardi, B. (2006), Acting With Technology: Activity Theory and Interaction Design, The MIT Press.

Kozma, R.B. and Anderson, R.E. (2002) Qualitative Case Studies Of Innovative Pedagogical Practices Using ICT, *Journal of Computer Assisted Learning*, 18(4), 387-394.

Kuutti, K., (1996), Activity Theory As A Potential Framework for Human-Computer Interaction Research in *Nardi, B.A., (1996) Context and Consciousness: Activity Theory and Human-Computer Interaction*, MIT Press, Massachusetts, USA.

Lai, K. and Pratt, K. (2004), Information And Communication Technology (ICT) in Secondary Schools: The Role of the Computer Coordinator, *British Journal of Educational Technology,* 35, 4, 461-475.

Langemeyer, I. and Roth, W.M. (2011), Is Cultural-Historical Activity Theory Threatened to Fall Short of its Own Principles and Possibilities as a Dialectical Social Science?, Outlines. Critical Practice Studies. Available from: http://ojs.statsbiblioteket.dk/index.php/outlines/article/view/2090/1854. [Accessed October, 10, 2011].

Lankshear, C. and Snyder, I. with Green, B. (2000), *Teachers and Technoliteracy. Managing Literacy, Technology and Learning in Schools*, Allen and Unwin, Sydney, Australia.

Lankshear, C., Bigum, C., Durrant, C., Green, B., Honan, E., Morgan, W., Murray, J., Snyder, I. and Wild, M. (1997), *Digital Rhetorics: Literacies and Technologies in Education, Current Practices and Future Directions*. Three volumes, DEETYA, Canberra. ACT.

Lektorsky, V.A. (2009), *Mediation As A Means Of Collective Activity in Learning And Expanding With Activity Theory*, eds. A. Sannino, H. Daniels and K.D. Gutierrez, Cambridge University Press, Cambridge, 75-87.

Leont'ev, A. (1978), Activity, Consciousness, and Personality, Prentice-Hall (Original work published in Russian in 1975), Englewood Cliffs, N.J.

Liaw, S. S., Huant, H. M. and Chen, G.D. (2007). An Activity-Theoretical Approach to Investigate Learners' Factors Toward E-learning Systems. *Computers in Human Behavior*, 23, 1906–1920.

Lim, C. P. and Chai, C. S. (2004), An Activity-Theoretical Approach to Research of ICT integration in Singapore schools: Orienting activities and learner autonomy. *Computers and Education,* 43, 215-236.

Lim, C.P. and Hang, D. (2003), An Activity Theory Approach To Research Of ICT Integration In Singapore Schools, Computers and Education, 41, 1, 49-63.

Lloyd, M. and Albion, P. (2005), Mistaking the Tool for the Outcome: Using Activity System Theory to understand the Complexity of Teacher Technophobia, 1480-1487. Available: http://www.editlib.org/p/19250 [Accessed October 26, 2011].

Machin, S., McNally, S. and Silva, O. (2006), *New Technology in Schools: Is There a Payoff?* The Institute for the Study of Labor (IZA), Discussion Paper No. 2234 July 2006, Bonn.

Marshall, K. and Anderson, J. 2008, The Emperor's New Clothes? A Meta-Study of Education Technology Policies in Ireland, North and South (1996–2006), *Computers and Education,* 50(2) 463-474.

Meisalo, V., Lavonen, J., Sormunen, K. and Vesisenaho, M. (2010), ICT in Initial Teacher Training: Finland Country report. Available from: http://www.oecd.org/dataoecd/4/43/45214586.pdf. [Accessed November 1, 2011].

Miettenen, R. (1999), The Riddle of Things: Activity Theory and Actor-Network Theory as Approaches to Studying Innovations, Mind, Culture, and Activity, 6, 3, 170-195.

Moyle, K. and Owen, S. (2008), *Students' Voices Learning With Technologies. Students' Expectations Of Learning With Technologies: A Literature Review.* Available from: http://www.aictec.edu.au/aictec/webdav/site/standardssite/shared/Student_Voice_Literature_Review.pdf [Accessed October 22, 2011].

Muir-Herzig, R. G. (2004), Technology and its Impact in the Classroom, Computers and Education, 42, 2, 111-131.

Mwanza, D. (2001), Where Theory Meets Practice: A Case For An Activity Theory Based Methodology To Guide Computer System Design, Proceedings of INTERACT' 2001: Eighth IFIP TC 13 Conference on Human-Computer Interaction, 9-13 July 2001.

Nardi, B. A. (1996), Context And Consciousness: Activity Theory And Human-Computer Interaction, MIT Press, Massachusetts, USA.

NPADC 2001, Report and Recommendations to the Minister for Education and Science: The Impact of Schools IT2000, National Policy Advisory and Development Committee, Dublin.

Norman, D.A. (1988), The Psychology of Everyday Things, Basic Books, New York.

Nuthall, G. (1999), Introduction and Background, *International Journal of Educational Research,* 31, 3, 141-256.

OECD (2005) Are Students Ready for a Technology-Rich World? What PISA Studies Tell Us, Available from: http://www.oecd.org/dataoecd/28/4/35995145.pdf. [Accessed October 24, 2011].

OECD (2010), ICT and Initial Teacher Training – National Policies: Country Report Presentation. Available from: http://www.oecd.org/dataoecd/9/46/42236291.pdf. [Accessed November 3, 2011].

OECD (2007), ICT Familiarity Component for the Student Questionnaire. Programme for International Student Assessment (PISA) 2006. Available from: http://pisa2006.acer.edu.au/downloads/Comp_ICT06_Dec07.doc [Accessed October 22, 2011).

OECD (2003), Information and Communications Technologies ICT and Economic Growth: Evidence from OECD Countries, Industries and Firms, 4, Paris: OECD.

OFSTED (2009), Virtual Learning Environments: An Evaluation Of Their Development In A Sample Of Educational Settings. Available from: http://ofsted3.openanswers.com/Ofsted-home/Publications-and-research/Browse-all-by/Documents-by-type/Thematic-reports/Virtual-learning-environments-an-evaluation-of-their-development-in-a-sample-of-educational-settings, OFSTED [Accessed February 15, 2010].

Ottestad, G. (2010), Innovative Pedagogical Practice With ICT In Three Nordic Countries? Differences and Similarities, *Journal of Computer Assisted Learning,* 26(6) 478-491.

Prensky, M. (2001), *Digital Natives, Digital Immigrants*. On the Horizon, NCB University Press, 9, 5.

Quinn, E. (2009), *A Study Of Users' Use Of Blackboard In UCD: Can The Interface Be Improved?* Unpublished Conference Paper , University College Dublin.

Rasmussen, I.L., S. and Ludvigsen, S. (2009), The Hedgehog and the Fox: A Discussion of the Approaches to the Analysis of ICT Reforms in Teacher Education of Larry Cuban and Yrjö Engeström, *Mind, Culture, and Activity,* 16, 83-104.

Roschelle, J. (1998), Review: Activity Theory: A Foundation for Designing Learning Technology? Context and Consciousness: Activity Theory and Human-Computer Interaction, *The Journal of the Learning Sciences*, 7(2), 241-255.

Rückriem, G. (2009), *Digital Technology And Mediation: A Challenge To Activity Theory*. In A. Sannino, H. Daniels, and K. Gutiérrez (Eds.), Learning and Expanding With Activity Theory. Cambridge: Cambridge University Press, 88-111.

Säljö, R. (2010), Digital Tools And Challenges To Institutional Traditions Of Learning: Technologies, Social Memory And The Performative Nature Of Learning. Journal of Computer Assisted Learning, 26, 53–64.

Salomon, G. (2002), Technology and Pedagogy: Why Don't We See The Promised Revolution? *Educational Technology,* , March-April, 71-75.

Sannino, A., Daniels, H. and Gutierrez, K.D. (2009), *Learning and Expanding With Activity Theory*, Cambridge University Press, Cambridge.

Schleicher, A., (2005), Are Students Ready for a Technology-Rich World? What PISA Studies Tell Us [Homepage of OECD], Available from: http://www.oecd.org/dataoecd/28/4/35995145.pdf [accessed October 24, 2011].

Scoilnet (2010), *Scoilnet: Portal for Irish Education*. Available from: http://www.scoilnet.ie/ [Accessed January 5, 2010].

Selwyn, N. (2004), Reconsidering Political and Popular Understandings of the Digital Divide. *New Media and Society,* 6, 3: 341-362.

SIP (2001), *SIP - Schools Integration Project - Projects: Home*, Available from: http://www.sip.ie/ [Accessed February 2, 2010].

Squires, D. and Preece, J. (1999), Predicting Quality In Educational Software: Evaluating For Learning, Usability And The Synergy Between Them, *Interacting with Computers*, 11(5) 467-483.

Ssemugabi, S. and de Villiers, R. (2007), A Comparative Study of Two Usability Evaluation Methods Using a Web-Based E-Learning Application, *SAICSIT 2007,* Sunshine Coast, South Africa, 2-3 October.

Stevenson, I. (2008), Tool, Tutor, Environment Or Resource: Exploring Metaphors For Digital Technology And Pedagogy Using Activity Theory, *Computers and Education*, 51, 836-853.

Taylor, J. R. (2009), The Communicative Construction of Community: Authority and Organizing. In Sannino, A., Daniels, H. and Gutierrez, K.D. (eds.), *Learning and Expanding With Activity Theory*, Cambridge University Press, Cambridge, 228-239.

Teles, A. and Joia, L.A. (2010), Assessment of Digital Inclusion Via The Actor-Network Theory: The Case of The Brazilian Municipality Of Piraí, *Telematics and Informatics*, 1-35 [accepted manuscript], doi: 10.1016/j.tele.2010.09.003.

Tondeur, J., van Keer, H., van Braak J., and Valcke, M. (2008), ICT Integration In The Classroom: Challenging The Potential Of A School Policy. *Computers and Education,* 51, 212-223.

Turner, P. and Turner, S. (2001), A Web Of Contradictions, *Interacting With Computers*, 14(1), 1-14.

University of Maryland, Baltimore County (UMBC) 2002, *Blackboard Usability Study: Blackboard User Analysis.* Available from: http://www.umbc.edu/oit/newmedia/blackboard/usability/. [Accessed October 24, 2011]

University of North Carolina (UNC) (2008), Report Of The Learning Management System Evaluation Committee. Available from: http://lmseval.uncc.edu/index.php?option=com_docman&task=cat_view&Itemid=59&gid=43&orderby=dmdate_published. [Accessed October 22, 2011].

Valcke, M., Rots, I., Verbeke, M. and van Braak, J. (2007), ICT Teacher Training: Evaluation Of The Curriculum And Training Approach In Flanders, *Teaching and Teacher Education ,* 23, 795-808.

van Braak, J., Tondeur, J., and Valcke, M. (2004), Explaining Different Types Of Computer Use Among Primary School Teachers, *Journal of Psychology of Education*, 19(4), 407-422.

van Merrienboer, J.J.G. and Brand-Gruwel, S. (2005), The Pedagogical Use Of Information And Communication Technology In Education: A Dutch Perspective, *Computers in Human Behavior,* 21, 407-415.

Vanderlinde, R., van Braak, J., De Windt, V., Tondeur, J., Hermans, R., and Sinnaeve, I. (2008), Technology Curriculum and Planning For Technology In Schools: The Flemish Case. *TechTrends*, 52(2), 23–26.

Vanderlinde, R., van Braak, J. and Hermans, R. (2009), Educational Technology on a Turning Point: Curriculum Implementation in Flanders and Challenges for Schools, *Educational Technology Research and Development*, 57, 4, 573-584.

Vanderlinde, R. and van Braak, J. (2010), The E-capacity of Primary Schools: Development of a Conceptual Model and Scale Construction from a School Improvement Perspective, *Computers and Education,* 55, 541-553.

Velada, R., Caetano, A., Michel, J. W., Lyons, B. D., and Kavanagh, M. J. (2007), The Effects of Training Design, Individual Characteristics and Work Environment on Transfer of Training. International *Journal of Training and Development*, 11(4), 282–294.

Wenglinsky, H. (1998), Does It Compute? The Relationship Between Educational Technology and Student Achievement in Mathematics, Educational Testing Service, Center, Princeton, New Jersey. Available from: http://www.ets.org/research/pic [Accessed October 24, 2011].

Wertsch, J.V. (ed) (1985), *Culture, Communication, and Cognition: Vygotskian Perspectives*. Cambridge, Cambridge University Press, 1985, Cambridge.

APPENDIX A – ACTIVITY THEORY APPLIED TO DISC

AT component	Questions	Applied to DISC project
Activity	What sort of activity am I interested in?	The use of ICT in primary and post-primary schools in the DISC project
Object (objective)	Why is the activity taking place?	• ICT is being introduced to: • To train the teachers and engage as many of them as possible in small, long-term sustainable ICT initiatives that link in with the national curriculum and the work they are already doing in class. • DISC projects are designed to help teachers meet the ICT requirements of the primary school curriculum • DISC projects to provide an added dimension to the use of ICT in post-primary schools. • Provide a different type of learning experience for children that is both engaging and enjoyable • Develop social skills through cooperative learning and problem-solving • Extend the range of learning experiences afforded to children, offering opportunities to learn through visual, audio, and kinaesthetic media, as well as through text. • Give teachers different mediums of children's work which may be easily presented to parents on prize giving days or other interested stakeholders at any time. • Increase ICT skills. • Build self-confidence and self esteem • Source: DISC report June to December, 2008
Subjects	Who is involved in carrying out the activity	• DISC staff • Principals • ICT Co-co-ordinators • Teachers • Students

Tools	By what means are the subjects performing the activity?	Using technology such as: • Interactive whiteboards • PCs • Desktops • Laptops • Lego technology • Mp3 players/recorders Using software such as: • Animation software • Video making/Multimedia (Photo story and PowerPoint) • Games Development (Game Maker) • Podcasting • 3-D (Sketch up)
Rules and regulations	Are there any cultural norms, rules or regulations governing the performance of the activity?	• DES guidelines for schools' use of technology • DES Inspectorate on ICT (2008) • Whole School Evaluations (WSE) • Primary School Curriculum • Post-primary School Curriculum • Primary School tests (e.g. Drumcondra) • Post-primary School Examinations (e.g. Junior Certificate, Leaving Certificate) • Latest ICT technology and developments • ICT School Policy • Subject restrictions (see also DOL) • Schedules (also see DOL) • Timetables (also see DOL)
Division of Labour	Who are responsible for what, when carrying out activity, and how are those roles organized?	DISC: • Provision of equipment • Provision of software • Provision of expertise • Provision of support
		Principals: • ICT policy for schools • Obtaining funding for equipment • Providing resources for teacher training and

		purchase of equipment and software • Allocation of computer resources to individual classes
		ICT Co-ordinator: • Introducing ICT to teachers • Supporting teachers to introduce ICT to students • Implementation of school ICT policy • Ensuring teachers are trained
		Teachers: • Accessing training • Introducing ICT to students • Implementing curriculum through the use of ICT • Organizing ICT in the classroom • Developing lesson plans to incorporate ICT • Assisting students to develop their own learning skills through ICT • Using appropriate software
		Students: Carrying out instructions of their teachers
		• Subject restrictions (see Rules/Regulations) • Schedules (see Rules/Regulations) • Timetables (see Rules/Regulations)
Community	What is the environment in which this activity is being carried out?	• Primary schools • Post-primary schools • Resource facilities • Computer room – dedicated • Classroom
Outcomes	What is the desired outcome from carrying out this activity?	• Teachers trained in carrying out small, long-term sustainable ICT initiatives that link in with the national curriculum • Teachers using ICT in an innovative way to support the work they are already doing in class • DISC projects helping teachers to meet the ICT

		requirements of the primary school curriculum • DISC projects providing an added dimension to the use of ICT in post-primary schools. • students engaged and enjoying their learning • students have developed social skills through cooperative learning and problem-solving • Students' have had opportunities to learn through visual, audio, and kinaesthetic media, as well as through text. • Teachers can demonstrate children's work to parents on prize giving days or other interested stakeholders at any time. • Students have gained ICT skills. • Students have increased self-confidence and self esteem

APPENDIX B – SEMI-STRUCTURED INTERVIEW QUESTIONS

Question 1: How did you get into teaching?

Probe questions:

a. Initial motivation
b. Current motivation
c. Will they continue?

Question 2: Tell me about the DISC project?

Probe questions:

a. Are they familiar with programme?
b. How do they get their information?
c. Has it had an effect on your students? If so, in what way?

Question 3: How do you feel about the DISC project?

Probe questions:

a. Has it changed the way you teach? /use ICT?
b. Has it increased confidence in your ICT abilities? / teaching strategies?
c. Do you have much contact with the DISC staff?

Question 4: Would you have any suggestions for the DISC project in the future?

Probe questions:

a. What changes would you make?
b. Are there any activities you would like to add/take away?

Question 5: How do you feel about the ICT facility in your school?

Probe questions:

a. Is the ICT facility any use to you?
b. What equipment do you have?/ enough equipment? Up-to-date equipment?
c. Do you need more or different equipment?

Question 6: How have the students interacted with the DISC programme?

Probe questions:

a. Do they appear interested or engaged or bored/What does engage them?
b. What have they not responded to well?
c. Any differences in response based on, for example: gender; ethnicity; age; teacher engagement?

Question 7: Have you any thoughts on Teacher training in ICT?

Probe questions:

a. What training did you receive in teacher training?
b. What training have you received since: Department of Ed or DISC?
c. Was the training of any value?
d. Could the training be changed/improved/removed?

Question 8: Do you feel that you are supported to use ICT in your school?

Probe questions:

a. Do you get any support?
b. If so, what type of support do you get?
c. If not, why is this?

Question 9: Have you any other thoughts on the DISC project?

APPENDIX C – COMMENTS ON DISC IN QUESTIONNAIRES

Some of the teachers who responded to Question 21: Has DISC improved my students' learning? - added the following comments to this question:

- *[DISC] has provided us with equipment and training. Our school has improved greatly through being part of DISC. The support and help that is offered has helped me a lot in being ICT co-ordinator (Questionnaire 53, ICT co-ordinator, primary).*
- *DISC have been extremely helpful and approachable. I am particularly pleased with the user-friendly website for our school and all the help given to me particularly by [DISC staff 3]. Thank you. [Questionnaire 44, ICT co-ordinator, primary]*
- *As someone with a keen interest in IT in the classroom, I really feel DISC is an excellent programme. The support and advice I receive from DISC is invaluable. I would not be able to use IT in the classroom the way I do without the support of DISC. [Questionnaire 28, Teacher, primary]*
- *DISC has provided many opportunities for the children to complete ICT projects and programmes, e.g. Lego robotics, Mind Storms, Comic Life, etc. They have really enjoyed these projects, engaged well with them and have developed both technical skills and the ability to work in a collaborative, cooperative way. [Questionnaire 29, Teacher, primary]*
- *Great support network and constant drive with the school toward ICT. Keeps teachers motivated and more confidence at using ICT in the school; supports all areas of ICT in school. [Questionnaire 30, Teacher, primary]*
- *An excellent resource for the school with very professional and knowledgeable staff. [Questionnaire 52, Teacher, primary]*