The value of using ICT in the education of school students with learning difficulties

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Abstract

This article argues that whatever the 2015 OECD report says about the value of ICT in relation to PISA results, our research has shown that using ICT in the education of students with Learning Difficulties has great value in interesting, enthusing and inspiring these students, so leading to better educational outcomes. The term 'Learning Difficulties' (LD) is used to refer to a condition of a large group of children who need extra assistance with schooling and arises from a vast range of cognitive and physical impairments. The reported research was conducted in two Special Schools in metropolitan Melbourne with the goal of investigating whether, and if so how, ICT could be used to support school communities involving students with learning difficulties, and whether it could help these students with their learning. This research found that ICT certainly does improve LD students' attitude to learning and equips them with adequate skills to allow them to enter the workforce or continue with further study through various pathways. It provides evidence that for LD students, a significant attainment in skills and academic knowledge is facilitated by the adoption of ICT in the classroom.

Keywords

Students with Learning Difficulties, Special Needs Students, Education, ICT, OECD, PISA, Special Schools, Actor-Network Theory, social and collaborative technology, job opportunities

Introduction

A recent OECD report (2015) claims that, based on an analysis of PISA data (Programme for International Student Assessment), "where computers are used in the classroom, their impact on student performance is mixed at best". The report suggests that "PISA results show no appreciable improvements in student achievement in reading, mathematics or science in the countries that had invested heavily in ICT for education". It argues that even though "students who use computers moderately at school tend to have somewhat better learning outcomes than students who use computers rarely … students who use computers very frequently at school do a lot worse in most learning outcomes" (OECD 2015: 15).

In this article we will argue that whatever the OECD says about the value of ICT in schools in terms of PISA results, research has shown that ICT use can be of significant benefit to the education of students with Learning Difficulties. The study reported in this article presents results from participant observations in two outer suburban special schools in Melbourne catering for Special Needs Students aged 14-18 years. These students range from those with physical or cognitive disabilities, to

mainstream students placed temporarily in a hospital. The latter group received ICT support to continue their studies, facilitated through a virtual classroom environment. The goal of the research was to investigate whether, and if so how, ICT could be used to support students with learning difficulties, and whether it could help these students in their learning. Another goal was to look at the implications of using ICT for the transition into further education, work placement or training for students with LD. The research clearly shows that for this group of students at least, the use of ICT in their education can be of tremendous benefit.

Children with Learning Difficulties

The Good Schools Guide (2016) points out that: "Some students who have no obvious physical or mental impairment can have trouble managing tasks necessary for learning, such as concentrating, keeping still, making themselves clear or understanding tasks set in class". The term 'Learning Difficulties' (LD) is used to refer to this quite large group of children who need extra assistance with schooling that arise from a vast range of cognitive and physical impairments.

Several related terms are: 'Special Needs Students', 'Students at Educational Risk' and 'Students with Specific Learning Disabilities'. While the terms 'Special Needs Students' and 'Students At Educational Risk' mean essentially the same as 'Students with Learning Difficulties', the term 'Specific Learning Disability' refers to a distinct handicapping condition for a small sub-group of students who exhibit severe and unexplained problems (Adam and Tatnall 2003). In this article we will refer only to 'Students with Learning Difficulties'. In regard to the education of children, the term LD can refer to many different things spanning both physical and mental impairments (Adam 2011) and the study of LD is significant as these difficulties can, throughout life, affect a student's self-esteem, education, vocation, socialisation and daily living activities.

Learning Difficulties Australia (LDA 2016) notes that in Australia the term Learning Difficulty refers to those students "who experience significant difficulties in learning and making progress in school, but who do not have a documented disability such as an intellectual disability", and that about 20% of students (LDA 2016) have some form of learning difficulty in some aspect of learning. Most schools are able to help these students in some way by setting up special classes, working with teachers and parents to help them in ways of coping or by the use of specialists. In other cases Special Schools offering greater support and a specialised learning environment exist to cater for these students.

Research relating to Children with Learning Difficulties

The definition of Learning Disabilities is still a little vague (Keogh and Speece 1996), and although LD research continues to grow and to have a significant impact on special education its classification remains problematic due to the vagaries and antagonisms surrounding the definition (Mather and Roberts 1994). At present two definitions are well supported: a legislative definition from the United States found in the Individuals with Disabilities Education Act (IDEA 1997) and the one proposed by the National Joint Committee on Learning Disabilities (NJCLD 1994), a consortium of representatives from organizations interested in LD.

A great deal of research has been done on students with learning difficulties, but little of it relates to the use of ICT with these students. Much of the recently published research deals with specific subject areas. For example Graham and Harris (2005) investigate whether those struggling with their writing can do better if explicit instruction is provided. Witzel, Mercer and Miller (2003) investigate teaching algebra to LD students using "explicit concrete-to-representational-to-abstract sequence of

instruction". Klingner, Vaughn and Boardman (2015) research the teaching of reading comprehension to students with LD.

Woolfson and Brady (2009), on the other hand, look at factors impacting on mainstream teachers' beliefs about teaching LD students. Their study involved relationships between professional development, teaching experience and beliefs and attributions about teaching these students. Richards et al. (2007) consider how the US federal special education law, PL 94-142 (1975) has helped in the identification and assistance of students with learning difficulties.

Many countries have tackled the dilemma of school membership for students with learning difficulties considering whether these students should be kept in mainstream schools or moved into Special Schools designed to cater for their needs (Adam, Rigoni and Tatnall 2006, Teoh, Cheong and Woo 2008, Benda, Havlíček, Lohr and Havránek 2011, Laabidi, Jemni, Jemni Ben Ayed , Ben Brahim and Ben Jemaa 2014). Should students with learning disabilities should receive their education in mainstream classrooms or in some form of special schools (Adam and Tatnall 2003)?

Although many researchers claim that it is best to integrate these students into classes within mainstream schools, numerous 'integration' or 'remedial' programs in mainstream schools have proved ineffective for the total learning of this group of students (Adam and Tatnall 2003). A number of researchers support the view that students with LD require an alternative approach to their learning, while others claim that it is best to integrate these students with mainstream classes (Bulgren 1998). Overall, however, there is considerable evidence to support the existence of special schools to cater for the needs of LD students (Adam and Tatnall 2003). These schools often exist on a small amount of funding support from the government, but try to cater for individual differences in a significant way.

Numerous 'integration' or 'remedial' programs have proved inefficient towards the 'total' learning of this group of students. Researchers including Agran (1997) and Bulgren (1998) support the view that students with learning disabilities require an alternative approach to their learning. The literature shows that in some selected fields, for example in maths and social studies, specialist instruction has been applied to this group of individuals with little success (Johnson, Gersten and Carmine 1998, Klinger 1998, Swanson 1999). There is strong evidence to support the existence of segregated Special Schools and there are around 35 Special Needs Schools in metropolitan Melbourne (Australian Schools Directory 2016). Many previous studies on LD have focused on only one or two specific factors such as IQ, but the literature shows that IQ does not yield valid results or assessments here (Detterman and Thompson 1997). The literature also provides examples of where these students in normal classroom settings achieve little success in situations where technology was not regarded as an integral part of the curriculum (Zammit, Meiers and Frigo 1999).

Research on the use of ICT with Special Needs Students has been undertaken by Florian and Hegarty (2004); Adam and Tatnall (2008b, 2010, 2012, 2014); Williams, Jamali and Nicholas (2006a), Blackmore, Hardcastle, Bamblett and Owens (2003) and others. In each case these studies found that the use of ICT with these students had a variety of beneficial effects, especially involving an increase in confidence and interest in their studies.

Methodology

The research underpinning this article was primarily undertaken in two Special Schools in metropolitan Melbourne: Sunbury and Macedon Ranges Specialist School and Concord School, concentrating on their use of ICT and computers in classrooms. Several classes and a number of

teachers and the School Principals at these two schools were involved. Discussions were also held with two local polytechnics, and an industry training organisation on the possible effects of ICT on the further education of these students.

This research was qualitative, framed by actor-network theory, and involved case studies at two special schools in suburban Melbourne over several years by one of the authors who attended and observed specific classes at these schools on a regular basis. Due to the sensitive nature of this area special approval needed to be obtained from the Victorian Education Department. This allowed a *single* researcher to enter and observe activities in the school classrooms. The case study data described in this article was collected mainly between 2003 and 2008 (Adam and Tatnall 2012) and consisted of interviews with the School Principal, Teachers and Parents (Adam 2011, Adam and Tatnall 2014) on student learning, attitudes to learning and overall progress. (School pupils could not be formally interviewed under Education Department ethics rules, although informal discussions with some students were held.) As this was exploratory research and the data sample was not large, no claim is made to the generalisability of our findings although we suspect that further research would confirm them.

Special Schools are especially complex socio-technical entities and research into their infrastructure, organisation and curriculum needs to take account of this complexity. A significant difficulty arises in framing research in a situation like this that involves both technological and human actors ranging from students and teachers to computers, software and broadband connections. When dealing with the related contributions of both human and non-human actors, actor-network theory (Callon 1986, Law and Callon 1992, Latour 1996) provides a useful framework. Actor-Network Theory (ANT), or the 'sociology of translations' (Latour 1991, Latour 1992, Law 1992, Latour 2005), is concerned with studying the mechanics of power as this occurs through the construction and maintenance of networks made up of both human and non-human actors (Latour 1986, Law and Callon 1988, Latour 1996). It attempts to allow for the socio-technical nature of research of this type by giving due and equal treatment to the interactions of both the human and the non-human actors that are involved in each situation and to deny that in regard to technological innovation, purely social or purely technical actions are possible (Tatnall 2000, Tatnall 2011). ANT reacts against the idea that characteristics of humans and social organisations exist which distinguish actions from the inanimate behaviour of technological and natural objects, instead offering a socio-technical approach in which neither social nor technical positions are privileged (Adam and Tatnall 2012).

The actors involved in the adoption of this technology to assist students with Special Needs were found to include: the students themselves, their parents, their teachers, school principals, school ICT specialist teachers, the School Council, the Web, microcomputers (Windows and Macintosh), laptops, iPads, software, Education Department policies, learning technology policy, the school environment, classroom environments, learning approaches and paradigms, delivery methods of instruction, engagement methods, thinking processes, technology infrastructure-bandwidth, curriculum, Internet resources, digital libraries and other related mainstream and Special Schools (Adam and Tatnall 2010).

The methods employed in this research come from those of case study. Yin (2014) regards a case study as the preferred method for examining questions that ask how or why of contemporary events, or when the relevant behaviours cannot be manipulated. He says that case studies use many of the same techniques as a history, but add direct observation and systematic interviewing. Case study evidence can come from documents, archival records, interviews, direct observation, participant-

observation or physical artefacts. In this research study key (human) actors – teachers and parents, were identified and interviewed about the use of ICT in the school. Questions to the teachers were broad and asked whether, and if so how, the use of ICT in the school had made a difference to the students' learning outcomes. Parents were asked to identify any changes in their child's attitude to learning and ability to perform educationally. The computers and software (non-human actors) were 'interviewed' by examining their operation, instruction manuals and facilities.

Following the main data collection period, contact was kept with Concord School through on-going conversations with the Principal and attendance at a Concord Conference in 2008. After completion of the initial research project, although access to these Special Schools was no longer possible (under Education Department ethics rules), follow-up discussions were also held over several years with Principals and teachers from nearby and feeder schools to see if anything had changed from their perspective. These discussions suggested that what was observed during the case studies was still continuing, and perhaps even accelerating, after this period. Contact was kept with the Concord school principal until he transferred to another school several years later.

Case Study: Sunbury and Macedon Ranges Specialist School

Sunbury and Macedon Ranges Specialist School is a purpose built school for students with learning disabilities. It has around 180 students with 70 teaching and support staff and provides a range of educational programs for students who present with special learning needs including global development delay, autism spectrum disorder, physical, social and emotional disabilities and provides an extensive curriculum consisting of: Arts, English, Technology, Health and Physical Education, Studies of Society and Environment, Science and Maths. In addition to delivering the key learning areas as part of the curriculum the school provides a broad range of programs that are designed to further enhance the independence of its students. The school motto of 'Consistency, Credibility and Continuity' is reflected in the curriculum delivered and underpins all that the school's website claims the school represents (Sunbury and Macedon Ranges Specialist School 2016).

At Sunbury, ICT was used predominantly to reinforce language and numeracy skills. An examination of the school's technology policy and curriculum showed that the use of ICT was an integral part of classroom teaching and learning (Adam 2011), but that access was rather limited due to costs.

The reported research involved a small scale project of observations and discussions with the Principal and several teachers as well as a small group of students aged around fourteen. The students were of mixed cognitive and physical disabilities and in general were keen to use computer games (AbilityNet 2013) that reinforced certain skills like language or numeracy and literacy. The researcher chatted with a few students: Ben, Barry and Teagan[1], and watched them play the Magic School Bus on Mars. This showed how puzzles were used in this setting to engage students and help them to improve their perception of space, time, age and personal attributes (Adam 2011). The students investigated were heterogeneous in LD as there were both physical and cognitive disabilities present in the group. At the school there were certain students with severe physical disabilities. Several students needed help with the CRTL-ALT and DEL keys on the keyboard and a few needed directions as to how to shut down the computer and the order that the various keys had to be pressed.

[1] Not their real names.

Overall though the students were familiar with their environment and were able to relate to and use technology in a comfortable manner. Parents were generally supportive for the initial ICT study and infrastructure. One technical task was setting up the infrastructure for links between different classes at the local level. In working between classes the students showed a tremendous level of enthusiasm and immediate engagement when they began to communicate via web cams. The students were provided with an opportunity to respond to the researcher's open ended questions relating to: 'My technology skills' and 'Uses of technology'. Figure 1 below shows the responses of a couple of the students.

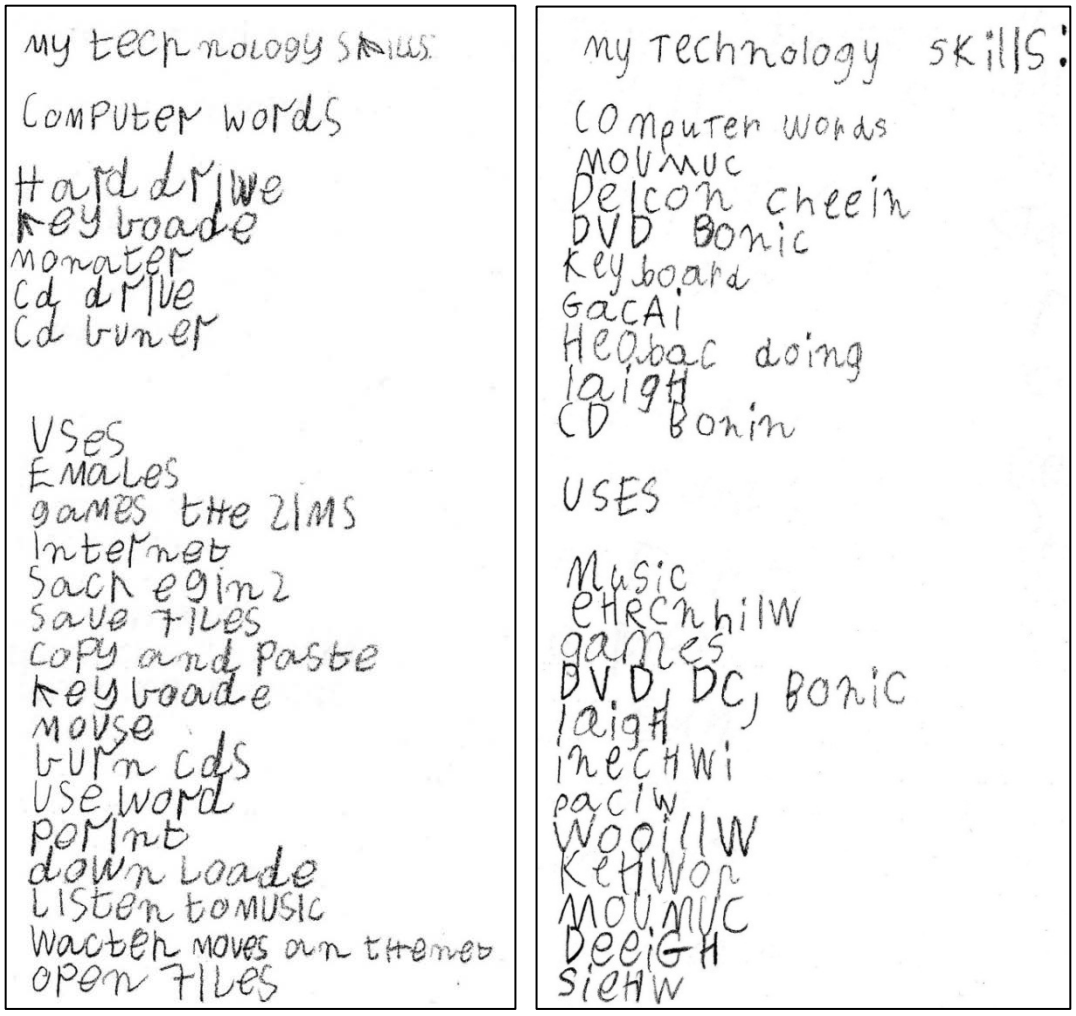

Figure 1: 'My technology skills' and 'Uses of Technology'

Sunbury and Macedon Ranges provided a gateway into this research and facilitated an investigation of the infrastructure for school ICT. The results were very significant, enabling identification of the level of support both at the local School level and from the Education Department. The school was also instrumental in identifying Concord School, where a significant part of the study was conducted.

Case Study: Concord School

Concord School is a Special School located in metropolitan Melbourne that caters for Special Needs Students with mild to moderate intellectual disabilities from Primary (elementary) to Year 12 (senior secondary) levels. The students come from diverse socio-economic backgrounds and are between five and eighteen years of age (Adam and Tatnall 2003). The vision of this school community encompasses a commitment to achieving excellence in education for students with additional

learning needs through a curriculum which integrates learning technologies with best practice in teaching and learning. The values embraced by the school community are: 'Respect, Personal Best, Happiness, Cooperation, and Honesty' (Adam and Tatnall 2008a).

Concord has a teaching and educational support staff of 110 with an enrolment of about 400 students. The school's website (Concord School 2016) proclaims that "Concord School is a government P-12 specialist school for students with additional learning needs. It provides a safe and supportive learning environment where students are challenged to achieve and reach their full potential". It indicates that Individual Learning Plans are used to specifically tailor the educational pathway of each student to meet their targeted learning needs (Adam 2011). This is done through the use of good resourcing, class sizes of eight to twelve and education support staff in each classroom. There is also specialised staff consisting of a school nurse, occupational therapists, speech pathologists and student wellbeing coordinators. The school has an excellent IT Resource Centre housing the latest technological equipment for use by its staff and students. Classrooms are equipped with an electronic whiteboard and each student has access to a notebook computer and iPad. The students at Concord School are encouraged with the school motto: 'To be the best that I can be'.

For senior students in the school, the curriculum offers alternative studies such as the Victorian Certificate for Applied Learning (VCAL) and ICT was clearly seen as a driving force for students with special needs. Concord had a One-to-One (121) Information and Communications Technology initiative in its Transition Centre. In simple terms this required the school to invest in a computer (lap-top or desk-top) for each student, as well as other accompanying software and hardware (including a classroom interactive whiteboard) for VCAL students. The 121 ICT project offered opportunities for students to use technology that would improve their literacy output, access and exposure to technology as well as increasing engagement (Adam, Rigoni and Tatnall 2006) and provides evidence that scaffolding with a direct teaching approach enhances the learning outcomes of LD students.

In addition, the study further demonstrates that infrastructure is a significant factor in the successful adoption of ICT in these schools. A major part of the reported research was related to VCAL studies, where the students' daily work was aimed at completing the set tasks. In addition this program provided access to work and further study with the assistance of local organisations and programs from tertiary institutions. In terms of learning outcomes, the students were involved in activities that allowed them to become familiar with current events, national issues and disasters (Adam 2011). The ICT programs and environment were reflected in the attitude, motivation and communication skills of the actors.

Overall, observations and discussions at the school found that a strong focus on the use of technology in teaching and the curriculum can lead to stronger engagement by students and teachers. Although in some cases students faced difficulties with motor skills including writing, drawing, spatial perception and speech, it was observed over a significant time period that these handicaps were often overcome with the use of ICT. It was observed that in certain activities that required physical or motor skills, some students were able to overcome these with the use of this technology (Adam 2011). For example, folding a blank sheet of paper to make an envelope, and then writing their address on the front of the envelope was very difficult for some of the students. However, almost every student was able to use a laptop and a Word Processing program to do this. It was also apparent that some of the students demonstrated ICT skills beyond what was required in

class, and because of this, they sometimes tended to show frustration with the teacher in class. The activities appeared to be commensurate with the standard of the students and the main activities observed included Personal Development, Office Skills and ICT studies (Adam 2011).

The School Principal fully supported the research and felt that the school could only benefit from an independent examination of the way ICT was used and how it could be further used to support the 121 project. He was a key actor who displayed very strong leadership, and this was recognised and respected by the school staff, students and other stakeholders. He, himself, was an early adopter of the technology and held the belief that students with LD could be assisted by the use of technology or ICT in the classroom. He saw the strength of the school in the strong bonds that it has with its students. Everyone in this school community – teachers, parents, assistants, students and ancillary staff all have access to the Principal who was active and involved in the affairs of the school and very keen to see the 121 ICT project implemented. He was enthusiastic about innovation with technology and organised work on the infrastructure to get the classrooms ready. His interview comments included the following (Adam 2011):

- *"I want to see the students be active participants in their own learning that leads to specialisation in technology"*
- *"This empowers students (disabled or not) to control and self-manage their own learning at school and at home and hence become lifelong learners with access to technology and skills"*
- *"Technology provides skills so that they can be seen as normal workers and have gained an understanding to take on the role beyond school"*
- *"The focus is on collaborative learning with students becoming social and collaborative learners."*

A number of teachers were observed and interviewed on a regular basis by the researcher and all demonstrated full support for the school leadership and vision in regard to ICT. They were all very strong users of ICT, having their own laptop, using email, and also accessing the school's internal resources through a shared medium. They worked well with the students and implemented school policy, agreeing that ICT was an enabler for their students and that it would improve their learning outcomes, particularly since it was integrated into the curriculum. They showed adequate technical skills and willingness to adopt new technologies. Their comments included:

- *"This is an exciting step for students, teachers and classrooms as it is social and collaborative technology – it is never boring",*
- *"Yes and they are growing in an environment where the world is at their fingertips",*
- *"It is a whole new classroom that is not constrained to that physical building of the school",*
- *"It's not just about playing with a new toy - it's exciting because it connects you with others".*

Parents of students from several classes were asked to respond to a questionnaire, and the response rate was very high and showed a positive attitude for the use of ICT in the classroom. Several parents indicated a good awareness of the use of ICT in the curriculum by the school but their responses showed that they felt there were still gaps in how technology could assist their child in both school and life. However, they indicated that they had identified a positive gain from ICT and acceptance of the school's work and curriculum. Parent responses included (Adam 2011):

- *"Provides confidence, very useful information, spelling, solving problems, skills for the job, and skills for the home",*
- *"Ability to use laptops and programs not at home",*

- *“Gain independence in writing, and money skills”,*
- *“Have good understanding of various computer programs, source information, look up bus tables, concert tickets, movies, starting times etc. independently”,*
- *"My daughter’s limitations reduce the degree to which she can use ICT, great learning tools as she is a very visual child, and she likes to be alone often.”*

Concord School, Transition Centre

The Transition Centre caters for approximately 60 to 70 students from Years 10, 11 and 12 with the aim of facilitating their transition from school to further education or to work, through learning programs that offer an applied learning curriculum. This could be followed up though courses at a local training organisation. The practical and pragmatic approach adopted by Concord is that its Transition Students are provided with a curriculum with a strong focus on ICT. In Year 10, students complete the pre-transition learning program designed to prepare them for their post-compulsory schooling. In Years 11 and 12 students complete either their VCAL or a Special Needs Learning Framework program designed by the school. This ensures that learning continues during and after the transition process, and is recognised for employment and educational purposes. It also provides a safety net for school leavers.

The practical and pragmatic approach adopted by Concord is that its Transition Students are provided with a curriculum with a strong focus on ICT. And this subsequently, can be seen as a vehicle that allows the students to build lifelong skills. From the USA, the ‘Individuals with Disabilities Education Improvement Act’ (Wright 2004) mandates equity, accountability and excellence in education for children with disabilities and provides recommendations in regards to the assessment of standards of LD students in the preparation and continuity beyond college. Concord’s Transition Centre echoes these ideals. ICT is embedded in the curriculum and the beliefs of staff and school community at Concord. It is a strong vehicle and enabler for good pedagogy as it reinforced communication skills, engagement and is a clear indicator and facilitator for school to work transition (Seymour 2005, Adam 2011).

This research provided strong evidence that ICT can equip LD students with adequate skills which allow them to continue with further study through pathways to higher education at a local polytechnic or university. This subsequently can be seen as a vehicle that allows the students to build lifelong skills. The research also showed that LD students can increase their job opportunities as the ICT skills they learn can minimise the impact of their disability or learning difficulty and thus enable them to attain a normal work environment. For example, some of the students were supported by government partners such as Jobs West and Match Works. Job opportunities were higher where students were able to display and apply ICT skills.

At an academic conference in 2007 the ICT Coordinator described how Concord School had recently introduced and trialled the use of social software and networked learning activities and practices (Adam, Tatnall and Olsen 2007). He described the use of software such as: Lumil, WordPressMU, ccHost, Urdit, Gregarius, Scuttle and Firefox by the students at all levels in the school. Table 1 below gives a summary of the activities undertaken and what they achieved during the early phase of the program.

	Junior	Middle	Secondary	Transition
Using photo sharing social software to locate suitable photos for use in other work by searching with tags.	X	X	X	X
Using photo focussed social software (tagging and comments) to share			X	X

artwork created with GIMP.				
Using photo focussed social software to annotate photos to identify key information and demonstrate learning about horticulture.				X
Using photo focussed social software to share sound notes recorded at when the photo was taken to demonstrate learning and understanding.				X
Using photo focussed social software to create albums to identify and celebrate a range of learning activities and experiences.		X	X	X
Using photo focussed social software to comment on successful learning.				X
Using photo focussed social software to easily locate photos for student blogs (digital portfolios).			X	
Using blogs to celebrate and reflect on student learning.			X	X
Using ccHost to share scratch sprites, backgrounds and projects to encourage remixes and collaborative work.				X
Importing Scratch sprites, reusing and modifying the work of others.	X			X
Using ccHost to share audio samples to encourage networked and collaborative learning.				X
Using music focussed social software to develop social software skills and activities and create an online presence			X	
Searching music focussed social software using tags to find suitable music for use in other work.		X	X	X
Using a web-based feed reader to read aggregated student blog content to facilitate interaction.			X	X
Using social bookmarking software to share web resources and encourage networked learning.			X	X
Using shared scripts to scaffold use of social software and other Internet sites.				X

Table 1: Trialled Social Media activities undertaken at each section of the school

An Actor-Network Analysis of the Use of ICT for Students with LD in these Schools

Any analysis using ANT deals not so much with the actors themselves as with the interactions between actors – their networks, so ICT is only important here in its interactions with the LD students, and also indirectly with their teachers and parents. Both schools only had significant ICT programs and provided good ICT facilities and student encouragement due to the interactions of their Principals with teachers, parents and the Education Department. The classroom computers are only able to interact with students due to their prior interactions with the school ICT coordinators to prepare workstations, software and Internet connections. The most important interaction here though is between the students and ICT facilities. We will discuss the data, primarily from Concord School as this was most significant, in accordance with ANT innovation concepts namely problematisation, interessement, enrolment and mobilisation of actors (Callon 1986) similar to Shaddock et. al. (2007).

The leadership of key actors including the Principal, ICT Coordinator and several leading team teachers who worked in the 121 ICT project, all problematised[2] (Callon 1986) the vision of integrating ICT in the curriculum. The most important actors examined and their interactions were:

[2] Problematisation: an actor attempts to define the nature of the problem and the roles of other actors to fit the proposed solution (Callon, 1986).

- Ten students, of mixed cognitive and physical disabilities at Concord were observed working and interacting with teachers and assistants from the senior class in the 121 pilot project. Their main interactions were with their teacher and the school computers, and they were all keen to use educational computer games. These acted to reinforced skills like language, numeracy and literacy. They were also able to exchange email with the Principal.
- Parents, as actors have their own voice and networks and problematise their own way via the School Council and support funding.
- The Principal is very much a leadership actor, gate keeper, strong voice and power in the school council. He insists protocols are followed, has very strong view on the technology, users and the role of technology in learning.
- The ICT Coordinator is another leading actor who is recognised for his skills and knowledge. He was assigned the task to enrol other actors and extend the 121 ICT pilot to the rest of the school. He is an innovator who introduced Web 2.0 technologies and is very highly regarded by other actors. He problematised ICT curriculum by applying his ICT skills. He also possessed previous experience from working with specific Education Department projects to train others.
- Leading Teacher (1) was a key instigator for the 121 project in 2005 and a willing user of ICT in classrooms. She problematised the 121 ICT project and the necessary infrastructure for its delivery. She has high communication skills and is very capable in mobilising other actors.
- Leading Teacher (2) is highly trained in special needs work and in engaging an ICT user. She problematised curriculum studies by integrating ICT in General VCAL studies.
- Computers and other technical objects (in ANT, known as immutable mobiles) and their interactions with students were highly significant. For instance, it was amazing to notice the students' reaction to the Tablet PC when they saw it for the first time.

The interactions between the students and computers indicated their considerable interest in ICT and showed that their teachers were able to help them in catching up with school work, looking up words in the dictionary, preparing oral presentations, working on the computer, working out things together and similar activities. They were clear and accurate about who managed the school and the class they belonged to, and clearly identified with their home group teacher. In some classes, they were given responsibility to check the attendance roll, organise orders for the store and lunches. They also collected and distributed laptops and trolleys between classrooms in an orderly manner and appeared happy to go from one class to the next and participate in the activities on hand.

The school learning model developed and changed in response to need and the availability and type of resources. It was proactive and its focus was on addressing the current needs of students, parents and teachers. For example inclusion of social-networking concepts like blogs were introduced in 2007. This enhanced the way ICT was used in the classroom with students engaging and producing work of higher standard and displaying stronger skills. All this curriculum development was done within the frame of Education Department policy.

Conclusion

In this article we have argued that whatever the OECD says about the value of ICT in schools in terms of PISA results, research has shown that ICT use can be of significant benefit to the education of students with Learning Difficulties. Our research involved just two schools and a small number of students and so we make no claim to generalisation, but from discussions with other schools and

from other studies reported in the literature we suspect that what we have found would apply in many other cases (National Council on Disability 2011).

Our research showed that use of ICT enhances LD students' independence and equips them with adequate skills which should allow them to continue with further study through various pathways and to move into a normal work environment (Finn 1991). A number of other authors discuss the issue of empowering persons with disabilities through ICT and e-learning methodologies by fostering technological innovation to address the needs of these people in daily life training and the work environment (Finn 1999, ILO 2016, JobAccess 2016).

The study also demonstrated the importance that key actors, such as the Concord School Principal, have in facilitating the adoption and use of ICT with these students. It was observed that in certain activities that required physical or motor skills, some students were able to overcome these with the use of ICT (Crook and Harrison 2008).

Although Concord did use some performance indicators internally and externally through the number of students completing VCAL, in this article it has not been argued that test results and better educational outcomes in the commonly used sense of the term, were necessarily improved. It has been argued, however, that ICT can be seen to be an enabler for good pedagogy with these students (Blamires 1999, Hardy 2000).

The research found that the most effective manner for teachers to implement programs using computer-based technology is to integrate the technology into the curriculum. In doing so, the special needs students gain lifelong skills and enhance their self-esteem and communication skills. These views or findings are also supported by the literature (Caldwell 2005, Harris 2005, Moyle 2005, Williams, Jamali and Nicholas 2006b). ICT is shown to be an enabler for good pedagogy that can also set a pathway for the transition from school to work or further study for these LD students (Stendal 2012). It does not change the nature of a teaching subject but has the capacity to integrate and consolidate several areas from the field of study or curriculum. This study found that ICT was applied to teach image refinements, certificate designs or artefacts in Office Skills at Concord (Fischer and Scharff 1998).

The research data from the case studies demonstrate the power of both human and non-human aspects of the socio-technical network that staff and students construct around LD, and the benefit of using ICT in their education. The study provides evidence that for LD students, a significant attainment in skills and academic knowledge is facilitated by the adoption of ICT. This data showed that a strong focus on the use of technology in teaching and the curriculum can lead to stronger engagement by students and teachers. The study strongly supports that ICT increases the motivation, independence, self-esteem and communication skills of LD students and aids in facilitating transition to work. At least in this respect producing a different result to that reported in the OECD study. ICT clearly has the power to interest, enthuse and inspire these students. This is illustrated by the comment of one student who proudly said: *"We were the first to use a laptop and a smart whiteboard in the school".*

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