Proceedings of the Second International Conference on the Use of New Technologies for Inclusive Learning

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This project has been funded with support from the European Commission. This publication reflects the views only of the author, and the Commission cannot be held responsible for any use which may be made of the information contained therein.

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Welcome

The second ENABLE International Conference on Using New Technologies for Inclusive Learning was held on 18 & 19 June 2014 in York. Jisc TechDis were thrilled to play host and honoured to be asked to organise this prestigious event.

Jisc TechDis is a leading UK advisory service on technologies for accessibility and inclusion for disabled staff and students. We provide resources and advice for learning and teaching in UK higher education, further education & skills, and independent specialist colleges.

We are one of the partners involved in the ENABLE project which is investigating how ICT is currently used to support lifelong learning by disabled adults and how it could best be used to overcome barriers and increase opportunities. Jisc TechDis's aims are closely aligned with the three year project which began in November 2011.

The conference had an exciting programme with 23 different presentations and papers from across the world. Here you will find the conference proceedings. We have included all the full papers available and abstracts for those sessions without full papers.

- Sal Cooke, Director, Jisc TechDis

Assistive ICT Project: formative vocational assessments tests for disabled adults.

Julija Astrauskiene (RTVMC Lithuania).

Abstract

In 2006-8, a series of assessment tests for disabled students in six sectors (cookery, interior decorating, metal work, hotel work, tailoring and carpentry) were created by the Radviliskis Technology and Business Teaching Centre (RTVMC - formerly the Lithuanian Rehabilitation Vocational Training Centre). These tests were developed within the ESF project, Adapting of Methodical Tools for Vocational Training for Disabled People (http://rtvmc.lt/news.php?extend.23.2), and made available in Lithuanian, issued on CD and online. The tests are written in plain language and include a large number of images.

RTVMC is a vocational training centre for students with learning difficulties, established in 1993 by the Lithuanian Republic government. It is situated in Radviliskis in Siauliai County, in the centre of Lithuania. All students in the RTVMC Radviliskis department (about 300) have special needs including hearing, vision, and mobility issues. Many students also have some degree of intellectual disability (diagnosed by the Pedagogical Psychological Bureau). RTVMC students are aged from 15 to 25. Some graduated after 10 grades of special school, others learned in primary school in special or adapted programs. All the students are disadvantaged youths. Young people learn a specialist trade in RTVMC over a three year period.

The Centre offers 23 vocational rehabilitation programs for unemployed disabled adults. The adults have become disabled due to illness, car accidents or heart attack for example. As a result they are not able to work in their previous job and must change occupation. They are also in a group most at risk of social exclusion. The disabled adults are referred to a vocational rehabilitation program from the Lithuanian labour exchange. They learn a new specialist trade in RTVMC over a nine month period.

The formative vocational assessment tools (http://www.lrprc.lt/testai) have the name “tests”, but they are used not for examination, rather they are used for learning or formative assessment. Initially it was the idea that only young people would use these specialised assessment tests. Later, during the learning process, we discovered that these online tests were also suitable for disabled adults in their rehabilitation programs. The teachers of vocational subjects use these tests for initial vocational training students and for disabled adults.

The tests enrich the teachers' work since the tool enables them to use a new methodical approach. Aside from books, material examples, practical work and theory lessons, a teacher can use the tests as a tool to improve the students' retention of key knowledge, or for formative assessment.

For learners these tests are very useful - for example if there are difficulties in choosing the correct answer, a student can repeat the test procedure. This is particularly useful since one of the main learning methods for students with learning difficulties and minor intellectual disability is repetition.

Keynote: Not Comprehensible = Not Accessible! The importance of comprehensibility in our digitised world.

Ulla Bohman (The Centre for Easy-to-Read, Sweden)

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25 per cent of Swedish adults can´t use a computer to find information, according to PIAAC, the OECD Survey “Programme for the International Assessment of Adult Competences”, 2013.

13 per cent can only read simple text and 40 per cent are below the level “good readers”. These skills are needed for individuals to participate in society and for economies to prosper.

Reading problems may be caused by many things. A disability, for example, might impair the ability to read, interpret and understand texts and pictures. Intellectual disabilities, dementia, dyslexia or aphasia may make reading, interpreting and comprehension of texts more difficult.

People who are untrained readers, are poorly educated, have social problems, concentration problems or are newly arrived immigrants also often have a need for easy-to-read texts.

In the year of 2000 the Swedish Parliament decided upon a strategy how people with disabilities are to enjoy the same rights and obligations as others. This strategy includes the rights to information and communication. In order to make information more accessible for all, the different Swedish National Agencies focused on improving their web sites and the development of various e-services.

This progress was very positive for people with good reading skills, but for people with reading problems this increased accessibility was not a reality. Finding and reading information on internet is difficult and requires good reading skills.
To comprehend how to use the information technology - what button to press, where to look on the screen and then understand the content when finding the information - was too difficult for too many people.

Therefor the Centre for Easy-to-Read started working with how to make internet more comprehensible and easy-to-read for people with reading problems.

About Comprehension on the Internet

Accessible information on internet is definitely not only about technical matters. In order to make internet accessible for all, including people with reading problems, you also need to focus on structure, navigation, language and the presentation of the information.

Generally we can say that for a large number of people:

1. To find information on a web site is difficult
2. It is easy to get lost on a web site
3. If you find the information you are looking for, the information is not always understandable.

There for, the web sites must be easy to navigate and the structure must be simple to grasp. The text itself must be written simply and understandable, but at the same time in an adult and varied manner. To achieve this you have to take into consideration the content, language, pictures and the graphic layout.

When working with new technology, you need to include the comprehension aspect - easy to find, easy to use, easy to understand.
If it is comprehensible in all aspects, it is accessible!

Centrum för lättläst – The Centre for Easy-to-Read

The Centre for Easy-to-Read is a resource and competence centre. The Centre can provide easy-to-read material or offer assistance in various questions relating to easy-to-read material. The Centre publish books and a newspaper "8 PAGES" under the slogan: "Easy to read and easy to understand".

Don’t disable people with disabilities. How to make accessibility software available everywhere.

Nick Brown (nick.brown@rnc.ac.uk) (The Royal National College for the Blind, on behalf of Software2, UK)

Accessibility software for people who are blind or partially sighted (such as JAWS and SuperNova) is expensive to buy and time consuming to install. As a result, many institutions only install it on specific computers, asking their users to use only these.

Why should people with disabilities be disadvantaged in this way? Most people would agree that were it possible, such enabling software should be available on *every* computer. In fact, it *is* now possible. This session will demonstrate the work done by the Royal National College for the Blind in a recent Association of Colleges project, making virtualisation of enabling software a reality.

We’ll show you how:

- It’s easy for the user and they don’t need special rights.
- You can still keep control over software use if you need to.
- Virtualisation might actually reduce licensing costs.
- Enabling software can be updated and patched centrally, saving technician visits.
- Your technical team “packages” an application.
- Or you could even get a “ready to go” solution from the cloud.

You’ll discover that there’s now little to stop you making all of your computers accessible.

Teaching Deaf and Hearing Impaired Students in South Africa.

Neil Butcher (NBA, South Africa).

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Abstract

This paper reports on a pilot project conducted for the National Institute for the Deaf (NID), a registered Further Education and Training College in South Africa. The project involved the development and piloting of a blended learning programme called Links4Life. Links4Life is a one year orientation programme aimed at building the skills of young Deaf adults in preparation for post-school study and for finding employment. The pilot project is described and the results of the research conducted are presented. The paper demonstrates the potential of blended learning, student-driven and activity-centered educational programmes to address the vocational learning needs of the Deaf.

Keywords

Deaf education, blended learning, South Africa, vocational education and training

Introduction

Thousands of Deaf and persons with hearing loss in South Africa have little or no access to education. For those who do access education, quality is often questionable. For Deaf children who grow up with sign language as a first language the literacy challenge has an added component: English is tackled as a second language using the resources of their first (which has no written form) alongside varying degrees of phonetic awareness (Young & Hunt, 2011; El Ghoul & Jemni, 2009; Long et al, 2007). Education provision for the Deaf in South Africa has had a complex history, and many challenges remain, particularly with respect to quality. Many of the teachers in schools catering for Deaf learners are poorly trained in South African Sign Language (SASL). Research has shown that it is common for teachers in schools for Deaf learners to cover only the elements of the school curriculum that they are comfortable in signing (Storbeck, Magongwa & Parkin, 2009). As a result, the average Deaf school leaver in South Africa has the same written language comprehension as an average 8-year old hearing child. Further, 90% leave school at 16 years or younger, with little or no exposure to meaningful education and training (Moloi & Motaung, 2014). At present, there are only twelve schools for the Deaf in South Africa that offer education and training up the Grade 12 levels and there has been much debate within the Deaf education community about whether or not Deaf learners should write the national school leaving examination (Storbeck et al, 2009). The National Institute for the Deaf (NID)[1], founded in 1881, is the only educational institution in the country that provides vocational and occupational training for the Deaf. NID is registered as a private Further and Education Training (FET) College.

As part of its work in striving to improve the lives of young Deaf adults, NID embarked on a project to develop an orientation programme – Links4Life – aimed at building the skills of

[1] www.nid.org.za

young Deaf adults. Links4Life is a one-year certificate programme with a focus on critical skills such as Numeracy, Communications and ICT, which are covered in three courses. Funding is provided by the South African National Skills Fund. This paper reports the results of the Links4Life pilot project that took place in 2013. Following a brief outline of the programme, the pilot design and research methodology is summarized. The bulk of the paper is focused on presenting the results of the pilot and reflecting on lessons learned to inform practice going forward and to contribute to broader debates about the role that blended learning models such as this can play in providing access for students who are commonly excluded from formal learning opportunities.

Introducing Links4Life

Links4Life is a one-year bridging programme offered by NID College to help young Deaf adults strengthen and build skills in critical social and academic areas. The learning design includes 120 credits to enable students to recover time lost in schooling. Links4Life integrates workplace experiences and weaves in life skills throughout. The purpose of the programme is to prepare students for successful participation in occupational programmes of their choice and to enter the world of work and participate in the hearing world. The learning approach centres on providing a stimulating and flexible learning environment in which the students are encouraged to become critical thinkers and problem solvers, and grow as self-directed learners who have the necessary skills to continue their lifelong learning journey and participate meaningfully in society. The Links4Life Programme employs a blended learning pedagogy that combines the effectiveness and socialization opportunities of face-to-face interaction with technologically enhanced active learning possibilities of the digital environment (Diaz & Brown, 2010).

The curriculum design is activity-based. Contact activities create learning spaces and opportunities for students to collaborate with each other and with learning facilitators. A range of self-study activities is also included, with some being facilitator-supported, others computer-based and some project-based. Vocabulary activities are included throughout using a mobile and computer-based tool for recording words, sentences and signs. Students compile a portfolio of their individual online as well as offline learning. Both formative and summative assessments are incorporated and make use of a range of techniques, such as quizzes, online games, face to face, video assignments and project-based individual and team work.

Links4Life is offered via a specially developed technological platform built using the Canvas Learning Management System[2] (LMS). The LMS includes comprehensive learner tracking, as well as providing a platform via which students can access resources, complete quizzes, participate in forums and chats, and use various other tools. Online video is an important component of the programme, which includes both interpreter and caption supported video content. Students access the platform using their mobile phones and laptops. The college provides college-wide wireless access, including internet access. Classrooms in which face-to-face facilitation takes place were equipped with data projectors.

[2] See http://www.instructure.com/B/ for details

The Pilot Project

The objectives of the pilot were to assess:

- The appropriateness and effectiveness of a sample of the materials and content, and the mix of teaching and learning methods used to deliver the content.
- The effectiveness of the student-driven instructional model.
- The appropriateness of the activity-based design using a combination of contact, self-study, and assessment activities.
- The effectiveness of technology integration in the Programme, including the technology infrastructure and the use of available technology.

A comprehensive series of 31 indicators for success was defined, and used to guide the research process. The pilot project took place from 10-17 May 2013. Twelve students who were enrolled at NID College at the time were selected to participate in the pilot. Eleven were female, and one male, and their ages ranged from 19 to 25 years. Ten students were South African citizens, and two from Botswana. This is important since Botswana Sign Language differs from SASL. The students represented a wide range of home languages, including Afrikaans (1), English (4), Afrikaans and English (1), IsiXhosa (1), IsiZulu (2), Sepedi (1), Sesotho (1) and Setswana, (1). Only three of the twelve participating students had used a laptop prior to the project. Each student was provided with a laptop[3] for which they were responsible for the duration of the pilot. The students received their laptops five days before the pilot began and received two hours per day (over five days) induction to the laptops, the Windows interface, the LMS and the pilot in general. Three of the Links4Life courses were included in the pilot. These were: Communication, Numeracy and ICT. In addition to selecting the twelve participating students, NID also provided three facilitators (one per course area). Due to time constraints, it was only possible to pilot one theme within one module per course.

In preparation for the pilot, facilitators were provided with Facilitator Guides and learning materials three weeks before the pilot. A three-hour induction session was held for facilitators. On-going email support was also provided. The 12 students were divided into two groups of six students each. One group completed the Communication theme and the other group the Numeracy theme. The two groups came together and both (i.e. all 12 students) completed the ICT theme. The Numeracy and Communications groups completed the whole theme over the five day pilot, but the ICT group did not complete everything due to technical problems at the outset of the pilot.

Research methodology

In order to meet the four pilot project objectives listed above, the following research methods were used:

- All contact sessions were observed and observations recorded using a standard observation sheet;
- Students completed short questionnaires at the start of each day reflecting on their experiences of the previous day;

[3] Three different laptops were used during the pilot: Toshiba, Acer, and Lenovo.

- *Employee Monitor* software was used to track the use of each laptop (when the laptop was used, which programmes were used, which websites were visited and so on);
- Interviews were conducted with the three facilitators, the interpreter and the NID programme manager;
- A focus group discussion was conducted with each of the student groups; and
- Student's completed work was reviewed.

Drawing on multiple methods is essential to collect quality data and allows for methodological triangulation (Creswell, 2009). Data triangulation strengthens data if used in a research design that includes observation in addition to collecting individual perceptions. The data collection methods were carefully designed taking into account the specific requirements for conducting research with the Deaf (Young & Hunt, 2011). These methods of data collection resulted in a large amount of mostly (but not exclusively) qualitative data that was analysed according to the indicators of success identified for the Programme.

Results

For the purposes of this paper, the pilot results are reported in three sections:

- Information about how the students used their laptops;
- Students' experiences; and
- Facilitators' experiences.

Students' laptop use

The majority of students (nine out of twelve) used a laptop computer for the first time during the pilot. In the focus groups, some students indicated that they initially experienced some difficulty with knowing how to operate a computer and use a touchpad mouse, but on the whole all were able to use the technology with relatively little support.

There were two main technical problems. The first was that some laptops had Windows 8 and others Windows 7, and the machines used by the facilitators had Windows 7 installed. Students found it difficult to use Windows 8, especially when the guidance provided by the facilitator was done using Windows 7. The second technical problem was related to internet connectivity. The wireless connection was fine in the classrooms, but at the hostel the signal was poor and erratic. Students explained how they needed to move around the hostel to try to find a spot with a signal and then sit there to work. It was also noted that the signal seemed stronger between 10pm and 11pm.

As part of the observation notes, observers were asked to complete a technology checklist focused on the extent to which students were able to use technology. The results are summarised in Table 1 below and show that, on the whole, students were able to effectively use the laptops most of the time. The differences across the courses is significant as it points to the importance of the facilitator being sufficiently equipped to support students with technology use, as well as facilitate online content learning. This was not always the case – as is seen in the responses for Communications. It is important to note though that as the project is being rolled out fully a lot more facilitator training is provided prior to the course so that facilitators are better able to support students with the technology.

Table 1: Observers' technology checklist

Item	% observers selecting "Yes"		
Students are able to:	**Communications**	**ICT**	**Numeracy**
a) Switch the laptops on and off.	100%	100%	100%
b) Use the mouse and keyboard on the laptops.	83%	100%	100%
c) Navigate from one program to another on their laptops.	67%	100%	88%
d) Access the LMS from their laptops.	83%	100%	100%
e) Login to the LMS.	83%	100%	100%
f) Access appropriate programmes and/or appropriate resources on LMS.	83%	100%	100%
g) Are students caring for their laptops effectively? (For example, do they carry their laptops in a bag, do not eat/drink near laptop etc.)	100%	100%	100%

The students took excellent care of their laptops – as reported by the students themselves, the observers, and the facilitators. Laptops were always neatly and carefully packed into the laptop bags when not in use and students reported that they locked the laptops in their cupboards when not in use at the hostel.

Analysis of the data captured about actual laptop use (using Employee Monitor software) showed the following trends. On average, students switched on their laptops about 38 times (ranging between 22 times to 58 times) during the pilot. The shortest login time was less than one second and the longest was nine hours and eight minutes. In the latter case, though, the computer appears to have been left on overnight. The second longest session recorded lasted six hours and 48 minutes. On average (including all students), the laptops were used for a total of one hour and fifteen minutes per session. All twelve students made use of their laptops outside of class time, i.e. after hours in the hostel. While one student only used the laptop once after hours, most students made regular use of the laptops after hours. The average number of times that students used the laptops after hours was 14, with one student logging in 37 times outside of the classroom. The length of each session was also tracked, and this analysis showed that on average per student (taking all students into account) laptops were used for 19 hours and 30 minutes outside of class time over the course of the five day pilot. Thus, it seems that most students were actively using their laptops both within and outside the classroom. This is an important finding and highlights the potential for blended learning to provide additional learning time and opportunity outside of contact time.

Figure 1 provides an indication of the different windows applications that students made use of, and the average time that each was used.

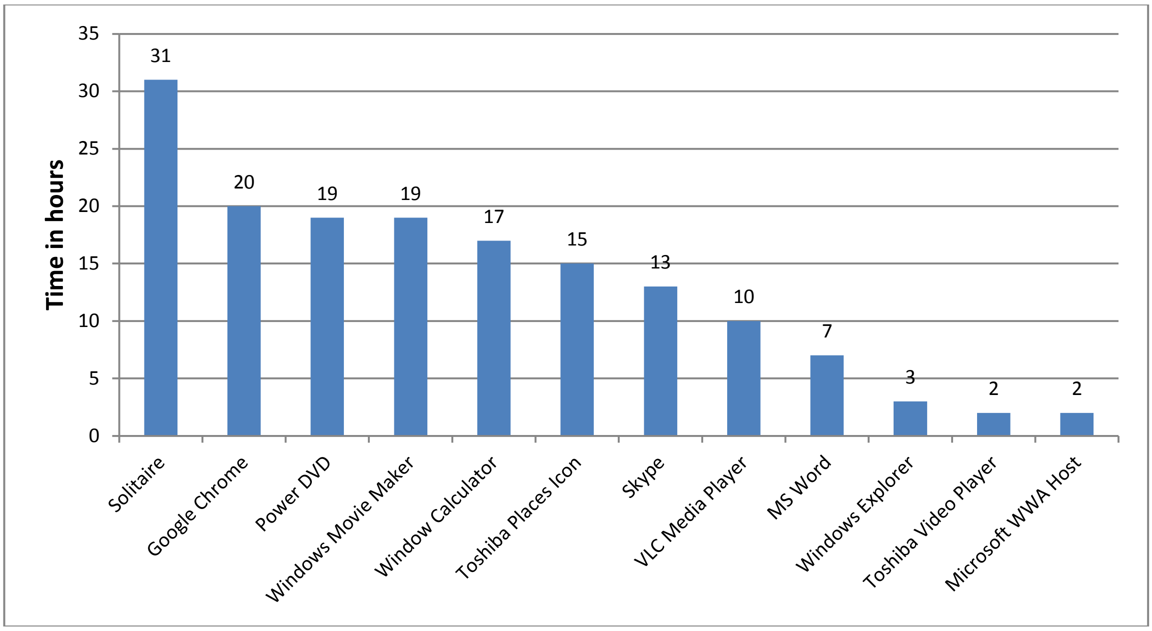

Figure 1: Windows applications used

As is seen from Figure 1, the application that students used the most was solitaire. We can speculate that much of the use of the laptops after hours was to play solitaire. Students also spent a relatively large amount of time searching the internet (Google Chrome). Students spent an average of seven hours over five days using MS Word since most of the worksheets were used in Word and the course was focused on teaching Word. The windows calculator was the fifth most commonly used application, which is attributed to the use of this application in the numeracy theme. The use of programmes such as Power DVD, Windows Movie Maker, and VCL Media Player is promising as it shows that students are exploring the range of tasks that can be done using a computer.

Student experiences

Information about the experiences of the twelve participating students was sourced from the short questionnaires that students completed each day, student focus groups, and observation data about how students were responding during the contact sessions. Overall, the response of students was very positive – based on formal data, anecdotal and photographic evidence.

On the daily questionnaires that students completed they were asked to respond to a series of statements about the Programme – with either: “yes ☺”, “sort of 😐”, or “no ☹”. The results are shown in Figure 2.

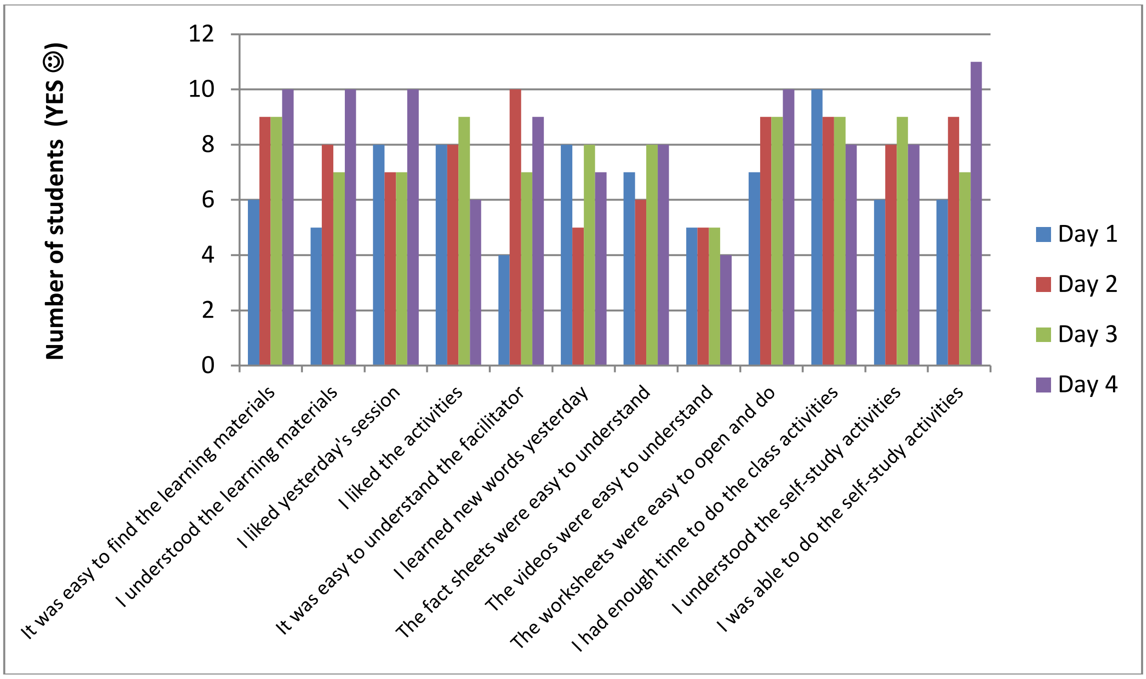

Figure 2: Students' self-reported experiences days 1-4

Figure 2 highlights some useful findings. On the whole, students responded positively to the pilot in the questionnaires they completed each day. The use of videos is the area that was generally rated the lowest. This is not unexpected since the videos were only used in some classes, and some difficulties were also experienced with slow download times. Most of the videos have been produced for use outside of the classroom and there is likely to more use of videos when the full Programme is offered. Of particular interest from Figure 2 is how students' ratings improved from day one to day four. This provides initial evidence that the Programme was sufficiently scaffolded for most students to be able to respond positively after four days of participation. For example, after day one only six students reported that it was easy to find the learning materials. By day four, this increased to ten students.

The observation notes also provide important information about students experiences, in particular from a learning and facilitation perspective. Across the board, the importance of having facilitators who can use sign language was noted. The dynamic in the classroom was markedly different when an interpreter is used, and the communicative relationship between the facilitator and students is much more effective when the facilitator is signing. Lack of understanding between students and facilitators also limits the learning impact. Several examples were provided where students were confused or behind and this was not picked up by the facilitator. It also appears, from the observation notes, that vocabulary ("new words") was more effectively acquired when the facilitator was signing and could more explicitly make note of new words and their meanings. This was also echoed in the student focus groups, where students reported feeling more comfortable to ask questions when the facilitator could sign.

The activity-based curriculum was well-received by the students. Students themselves, facilitators and observers noted that students tend to lose interest if the facilitator talks for too long. This makes the incorporation of practical activities where students are actively involved of particular value. Observation notes provide evidence that students responded well and enthusiastically to learning activities. Students themselves also noted this in the focus groups. Also important is to ensure opportunities for students to work with each other as this was noted by students as something positive. The value of students working together was also raised by facilitators during their interviews. One of the facilitators also emphasised that students do not like to read, and tend to be afraid of reading. For this reason, students do not read their instructions, but tend to rely on the facilitator to interpret the instructions for them.

Students made the following suggestions for improvements to the Programme:

- Better Wi-fi connectivity at the hostel for self-study.
- The content should not be too basic, it needs to challenge students.
- Consider incorporating different activities for different levels of ability and provide space for students who are ready to engage in more challenging activities.
- More time should be spent on computer/laptop training prior to starting with the actual courses.
- Dynamic facilitators who are good with sign language are needed.
- Incorporation of a video chat facility so that students can chat using sign language.

Facilitator experiences

In a blended learning programme such as this, the role of facilitators is particularly important. Thus, this section focuses on the process of facilitation and the experiences of the three facilitators. The facilitators provided a lot of useful feedback during their interviews at the end of the pilot.

All three facilitators found the facilitator guides useful for planning their sessions and for the sessions themselves. One recommendation for improvement of the facilitator guides was the inclusion of more concrete examples. Despite the usefulness of the guides, it is important that sufficient time is spent with facilitators (especially those new to the LMS and technology more broadly) to ensure that they are sufficiently prepared to use technology as required for successful blended learning. One facilitator reported feeling that she was thrown in the deep end due to insufficient preparation, and this experience created uncertainty and frustration. The importance of adequate preparation was further emphasised by the fact that the two facilitators who had been involved in the development of the materials (and so were better prepared for the pilot) felt much more at ease with both the content, methodology and the technology. Facilitators reported preparing between one and two hours for each session. One facilitator reported that working with the LMS was a very positive experience because the system completes the administrative work.

In addition to adequate preparation, it was also noted by facilitators in their interviews that ongoing support for facilitators should be built in to the Programme when being implemented fully. This might include, for example, opportunities for facilitators to periodically share and reflect on their experiences, what is working well and what is not.

The observers completed a facilitation checklist as a means of keeping record of the way in which facilitation took place. The results further support the students' reports that it was more difficult where the facilitator was not able to sign (see Swift, 2012 for more on the complexities of interpreting in educational contexts). From a pedagogic perspective, the results of this pilot project highlight the importance of identifying facilitators who are able to communicate directly with the students using sign language (as was also noted by Storbeck et al, 2009), and also, who are dynamic and animated and so are better able to engage the students in their learning.

Discussion

As is evident from the detailed results presented above, the piloting of Links4Life indicated that the programme was successful. The rating of performance against the 31 indicators of success showed full or partial achievement of all. Overall, it was concluded that the material/content and the mix of teaching and learning methods used were both appropriate and effective. Although specific areas for improvement were identified, the approach generally worked well. The student-driven instructional model was found to be effective, but the pilot also highlighted the critical importance of providing good quality facilitation as well as some technical support for students for this model to achieve its potential. The activity-driven design was found to be one of the most effective elements of the programme. Students thoroughly enjoyed the learning activities, especially those where they were actively involved, and engaged with enthusiasm. On the whole, students were excited about the use of technology and also reported learning new technological skills.

Taking it forward

Given the successful results of the pilot project in 2013, full development of the programme was completed, taking into account and incorporating the lessons learned in the pilot. The first cohort of 58 students enrolled for Links4Life in 2014. Although it is too early to report on the success of the full programme, the initial results look promising. At present, similar programmes for Deaf Carers and Deaf Educators are being developed in order to expand the range of options available beyond the current Technical and Vocational Programme offerings which do not take specific account of the unique contexts of the Deaf. In addition, the entire programme, once completed, will be released under a Create Commons licence so that it is available for use across the South African schooling system. In this way, the programme will potentially reach hearing impaired students who are attending mainstream schools and will also be available as an important learning resource for schools that specifically target the Deaf. The Links4Life programme is thus a good example of the potential of technology to enable learning for young people who are commonly excluded from quality educational opportunities.

Acknowledgements

The authors would like to thank the National Institute for the Deaf for their support of this research. The development of the Links4Life programme was made possible with funding from the South African National Skills Fund.

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Augmentative and Alternative Communication Technology Therapy for Disabled Children.

Tamara Cierpialowska (CRIS, Poland).

Abstract

Communication is the basis for development of every child and their acquisition of skills. The primary goal during the therapy of nonverbal children is to teach them to communicate with the environment and help them to express their own thoughts, emotions and experiences. In addition, the child should be taught how to plan their activities, work within a schedule and make choices. It can occur when the interaction between two people takes place. Communication comes in different forms, such as alternative communication (one person sends a message, and the other one receives and gives feedback). These communications do not have to be verbal. When children communicate by pointing their finger or making another appropriate gesture (head movement, eyelid, finger or foot movement for example) they can make a choice such as indicating which fruit on a tray they want to eat. Once this base level of communication is possible with a child, then we introduce our communication system.

Every activity should be interesting for the child and give them a sense of self-agency. It should be planned such that the child knows what will happen and is aware time has passed and some activities have been completed, but there are still some which need to be done. When all tasks have been completed there is the satisfaction of time being used well, achieving the task, and as a result high self-esteem.

Nowadays using and applying alternative communication can be facilitated by Information and Communication Technology (messengers, computers, tablets equipped with appropriate software). More and more popular are specialized peripherals (different keyboards, switches, trackballs) allowing severely disabled people to operate ICT and use it to aid their communication. There are available supporting computer programs for children, youngsters and adults with speech problems. We have utilised Bliss for Windows with Bliss symbols, Boardmaker using PCS, and also Clicker which makes it possible to use both of those programs as well as many others via graphic signs.
The Clicker program also has other applications. Tables made in this program can involve letters, words, sentences, pictures, pictograms, and symbols, for example, to best utilise and extend the child's current level of communication.

Clicker can be used both as a communication device and for editing text. The application (program) has a built-in speech synthesizer and works with other speech synthesizers allowing the contents of specially created tables, plus content selected or recorded by the user of the program, to be read out loud. The great advantage of this program is the ability to adapt it to the individual needs of the user. We can control the number and size of signs (symbols) that are recorded in interactive tables and presented to the user in the form of a communication electronic book on a computer screen (tablet or other device acting as a messenger). We can also control the method and scanning speed of the content contained in the tables. The user can operate it using standard peripherals such as a mouse or keyboard, or by using specially selected switches (one or two) depending on the type of physical disability.

In addition the Clicker programme can be adjusted to the individual needs of the user. Using this program gives children a sense of self-agency and self-esteem which directly influences their overall functioning. The only drawback may be that the AAC users must always have the right equipment and communication tables with them.

All of the programs are important in shaping students' non-verbal communication skills, giving them many opportunities to communicate and checking the skills acquired by the children during their education.

eSafety Alarm –protecting vulnerable learners online.

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Abstract

This paper discusses an application which can both store and email 'alarmed' content but which, despite its intention to safeguard learners, may contravene legislation regarding the storage of illegal material (The Protection of Children Act 1978; The Criminal Justice and Immigration Act 2008). The 'eSafety Alarm', which is a robust system to navigate users away from 'upsetting' content, can be network deployed and managed through group policies, or individually installed onto a range of personal devices. It runs independently of Internet connectivity with alerts notified on Internet reconnection. The program automatically saves a time-stamped screenshot and locks the computer, immediately removing content from the student. However, storing and emailing such content risks breaking the law relating to the storage of illegal material and, to date, the program has not been implemented because of a lack of clarity and assurance regarding this legislation.

Keywords

esafety, alarm, safeguarding, application, legislation, vulnerable, learners

Background

As part of a focus on e-responsibility, Henshaws College (HC http://henshaws.org.uk/), in discussion with the Jisc RSC, (Yorkshire Humber http://www.jiscrsc.ac.uk/yh) developed a robust system to navigate users away from 'upsetting' content. The National Star College (NSC http://www.natstar.ac.uk/), who face similar difficulties regarding the eSafeguarding of students, were keen to adopt and adapt this prototype system. This paper discusses an application which can both store and email 'alarmed' content but which, despite its intention to safeguard learners, may contravene legislation regarding the storage of illegal material (The Protection of Children Act 1978; The Criminal Justice and Immigration Act 2008).

Responsibility for Safeguarding Vulnerable Learners

Whilst both NSC and HC do block certain categories of sites, the blocking mechanisms are not totally effective, nor do they account for content which is deemed appropriate, but which may be found upsetting by an individual. It is important to emphasise that whilst the material deemed to be 'upsetting' might, for example, be pornographic or racist, it could equally well be something which is inoffensive in the eyes of all except the user – this is the strength of the panic-button system. The requirement for a 'panic button' system arose from a discussion which concluded that, provided a safe e-environment could be ensured, rather than decide on behalf of students what constituted 'inappropriate content', the onus of responsibility could be ceded to them, facilitating the autonomous elimination of content they found upsetting.

The application was intended for use primarily, though not exclusively, within Henshaws College and National Star College. Students at these colleges have visual impairments, a range of physical disabilities and/or acquired brain injuries, alongside associated learning, behavioural, sensory and medical difficulties. Many have complex learning difficulties and disabilities, with high personal care, therapy, emotional and medical support needs. Both colleges employ innovative uses of Information Learning Technology (ILT) which has supported learners to become more autonomous in their learning, living and work. It seemed timely to extend this focus on autonomy to include learner control of their own electronic environments, driving further development and achievement and, crucially, providing them with a means to inhabit an e-environment which suits them. These highly relevant life skills, which are supported by the system, will be of central importance when students leave college and no such eSafety provision is available to them, so the implementation of the 'panic button' offers a significant contribution to a student's overall development.

Colleges are obliged to use a risk management approach to ensure the provision of a duty of care to ensure the safety of both learners and staff. The Children Act (1989) provides for learners up to nineteen years old and has been extended to incorporate the safety of 'vulnerable adults' which is defined by Section 115(4) of the Police Act 1997 as follows:

"a person can be considered vulnerable if they are 'substantially dependent upon others in performing basic functions, or their ability to communicate with those providing services, or to communicate with others is severely impaired". This may mean that they have a reduced ability to protect themselves from assault, abuse or neglect. This can be as a result of a learning or physical disability (not normally to include dyslexia; a physical or mental illness chronic or otherwise (including an addiction to alcohol or drugs); or a reduction in physical or mental capacity."

In accordance with the Data Protection Act 1998, it is essential to ensure that all personal data is accurately processed, in accordance with the data subject's rights, and for limited purposes; that it is adequate, relevant and not excessive; that it is securely, fairly and lawfully recorded, transferred and made available, but kept no longer than is necessary and only transferred to others with adequate protection. Unsuitable and inappropriate activity includes, but is not limited to, that which relates to racism or discrimination of any form, pornography, or breaches the Obscene Publications Act (1959). Additionally, the Criminal Justice and Public Order Act (1994) makes the storage and electronic transmission of pornographic material arrestable offences. In the light of this, the ability to make use of the panic-button system is limited by an inability to automatically store the offending content because of the risk that it may contain material which would contravene the Act.

*"Please note; it is against the law to actively seek out such images and doing so in order to report to the IWF would not be a defence in court. (*https://www.iwf.org.uk/hotline/the-laws/child-sexual-abuse-content/protection-of-children-act-1978"

Yet this Act also states that a defence is available where a person "making" such a photograph or pseudo-photograph can prove that it was necessary to do so for the purposes of the prevention, detection or investigation of crime, or for the purposes of criminal proceedings, permitting those who need to be able to identify and act to deal with such images to do so.

Application Description

HC's system provided an accessible and simple to use solution which is activated by pressing the 'esc' function on the keyboard. This turns the monitor black, mutes the speakers, automatically saves a time-stamped screenshot and locks the computer, immediately removing content from the student. The National Star College, who face similar difficulties regarding the eSafeguarding of students, were keen to adopt and adapt the prototype system developed by Henshaws College as it offers learners greater control of their e-environment, encouraging critical thinking and decision making skills. NSC became aware of HC's solution for their students via Twitter, which the program's initial developer had used to share good practice. The work was also distributed on his blog (http://accesstechnology.org.uk/blog/the-open-sourcing-adventure) where a video demonstrates the program in action, and the code was open-sourced (http://mikethrussell.github.io/panic-button) so that it was widely available for implementation and adaptation.

NSC further developed this system ensuring ease of administration, and customisation so that installation does not require IT expertise. The 'eSafety Alarm' can be network deployed and managed through group policies, or individually installed onto a range of personal devices. It runs independently of Internet connectivity with alerts notified on Internet reconnection. Options for unlocking the screen and remove offending content are: (i) entering a password set by, for example, a parent, or (ii) an authorised member of staff entering their own details. As using only one password across a network creates a security risk, Active Directory is used so that authorised staff members, using their own login details, can unlock the screen and take remedial action, bypassing any requirement for further student involvement.

The program options allow for a nominated hot key to be selected to trigger the alarm; additionally, an optional onscreen virtual button can be displayed over other programs and scaled according to user preferences. When the alarm is triggered, the sound is muted and the screen is 'locked'. Other options include email notification, screenshot to be taken, screenshot save location, how to unlock once triggered, update notifications, and wording of the lock message. These options are standard across a network, but on individual devices they can be specific to requirements. It was intended that future developments would include support of switch access and a full range of accessibility features, such as provision of audio via text to speech of displayed message.

Using free software AutoHotKey and Nircmd, the system allowed, for example, the setting up of a switch to trigger the esc key, making it accessible to switch users. Because a screenshot is saved, the exact nature of the problem can be seen and addressed accordingly. This may include discussion of the offending material with the learner concerned as part of a greater learning process.

Discussion

Esafety is a focus in all areas of the curriculum and students are taught to be critically aware of the materials and content they access on-line. It is more difficult to ensure that learners are able to quickly move away from either inappropriate, or upsetting, content. Given the range of disabilities experienced by learners, it is not helpful to teach them to simply turn off a monitor or mute the speakers. A non-sighted person, whilst immune to offensive visual content, needs an exit strategy from audio content (either from video content or text that a screen-reader is speaking) and, conversely, a sighted person needs a method to exit both visual and audio content. There is also a need for something highly usable for learners with cognitive difficulties to exit unpleasant content. We can reasonably assume that during times of stress and panic, their difficulties will be exacerbated.   But it is also helpful for staff supporting these learners to have a quick exit strategy. The program's initial designer had an unfortunate incident whilst searching images to support a student's understanding of the weather. He googled 'hot' and was presented with inappropriate content. Often staff will realise before the learner that their search term is likely to produce results containing offensive content and, with a quick exit strategy, are able to take remedial action.

Given this background, the 'panic button' is an important step forward in the esafety landscape because notions of 'appropriateness' (generally decided by others), cannot encompass materials found to be 'upsetting', as this will be specific to individuals. One example of where this might arise is YouTube videos where, on completion of selected content, YouTube suggests further viewing, but the search term becomes diluted, where the content on offer may be completely unrelated to the original search term, increasing the risk of content offensive to the user. Whilst many users can simply navigate away from such content, it can be challenging for students using a large variety of access methods and range of assistive technologies to use ICT, or for those with learning difficulties, who might not have the physical capability or the mental capacity to calmly close a browser window or stop a video. The 'panic button' was intended to provide an instant, accessible, method of doing so, facilitating a move from e-safety to e-responsibility.

Excited about this product, and its affordances for learners, NSC first shared this product at a Jisc RSC Southwest (http://www.jiscrsc.ac.uk/southwest) Forum in November 2013; however, addressees suggested that storing and emailing content risked contravening legislation pertaining to the storage of illegal material. Whilst NSC contacted the Jisc Legal Team for clarification, this is a complex matter and investigations are ongoing, with a resultant delay in implementing the application at NSC. It was also hoped that discussion at the Second International Conference on Using New Technologies for Inclusive Learning might have provided guidance as to ways in which this solution could be moved forwards but, unfortunately, this was not the case as no one seems to be aware of any way to implement the program whilst guaranteeing that doing so remains within the law. This is to the detriment of students for whom this kind of protection is essential. However, JISC's view was that to implement the program would put the College at risk. This view was reiterated by The Child Exploitation and Online Protection Centre (CEOP). These are the two bodies that colleges would expect to be guided by in this regard, yet the law remains insufficiently clear for anyone to assume the responsibility of providing a distinct assurance on the matter. This highlights two current difficulties: (i) the still embryonic nature of the law within cyberspace and (ii) the vulnerability of educators, without a background in law, when trying to provide solutions for emergent problems faced by vulnerable learners.

Acknowledgements

Henshaws College, Harrogate, North Yorkshire; Jisc RSC Southwest and Yorkshire Humber

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SiS-builder: A Tool to Support Sign Synthesis.

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Abstract
In this paper we discuss accessibility issues related to the use of sign language in Deaf and Hard of hearing communication in general and in the framework of Education more specifically. We further present SiS-Builder, a tool for creation and maintenance of sign language resources appropriate for use in dynamic synthetic signing. The aim is to provide learners and teachers who use sign language as their main communication means, with an environment that allows for sign language “texts” generation, enabling storage, editing and reuse of previously created signed texts. Under this light, the learning process in the framework of Deaf education radically changes, enabling a completely novel model of learner-teacher communication. The paper crucially considers initial evaluation aspects of the proposed technology, which address GUI and functionalities issues, as well as acceptance by end users of the signing avatar performance, necessary for the display of the synthetic signed text, where acceptance refers mainly to the degree of understandability and naturalness of the synthetic signing. The pilot implementation of the tool in Greek mainstream education, planned to start next year, will provide a more concrete view of the potentials of sign synthesis in the framework of Deaf and Hard of hearing education.

Keywords
Sign synthesis, sign language resources creation and maintenance, sign language editor, education of the Deaf and Hard of Hearing

1. Introduction
Sign Languages (SL) are natural visual-spatial languages that use the three-dimensional space to articulate linguistic utterances instead of vocal sounds used in oral languages. SLs simultaneously exploit handshape, orientation and movement of the hands, arms, upper body and the head, as well as facial expressions to express the linguistic message.

SLs are natural language systems which exhibit all properties of the biological basis of human language. In linguistic terms, sign languages are as rich and complex as any oral language, despite the common misconception for the opposite. Linguistic analysis of a number of SLs has proven that they exhibit all characteristics and grammar components required to classify them as natural language systems. They have rich vocabulary and complex grammar, and can be used to convey any type of linguistic message from the most simple and concrete to the lofty and abstract ones.

Partially due to their 3D nature, sign languages are not written. However, there have been several attempts to develop “scripts” for sign language. These, among other approaches, include “phonetic” systems, such as HamNoSys (the Hamburg Notational System) (Prillwitz, Leven, Zienert, Hanke and Henning, 1989) and the Stokoe notation system for American Sign Language (ASL) (Stokoe, 1978), both introducing transcription symbols applicable for the transcription of any sign language, while research effort towards the goal of developing effective notation systems for signed text is dominant in the last decade. Indicative work in this direction is also provided in the framework of SignStream™ (Neidle, 2001) in respect to ASL (on similar research questions see also (Pizzuto and Pietrandrea 2001)).

The possibility of phonetic decomposition of signs and the association of each component of sign articulation with a set of possible features enabled experimentation on synthetic signing performed by signing avatars. This emerging technology opens new perspectives in respect to Deaf education, since it provides the learner and the teacher who uses sign language with the option of creating, saving, modifying and reusing signed “text” whenever she/he needs to.

In the next sections, we present SiS-Builder, a tool especially designed for the creation and maintenance of huge sign language resources exploited in synthetic signing, the emphasis being placed on the end user perspective in respect to both usability and intuitiveness of the proposed system.

2. User Demographics and Educational Legislation in Greece

Considering the state-of–the-art in Greece, the Greek Sign Language (GSL) is used by 1% of the 10 million people of the overall Greek population (Facts about Greek Deaf Population 2002), with several thousands of native and non-native signers.

In 2000 GSL was approved by the Ministry of Education, as the official language for schooling of deaf persons, following recognition of GSL by the Greek Parliament as one of the official national languages of the Greek State (Legislative Act 2817/2000).

The lack of a standard written form and the existence of several transcription systems, which however, fail to capture intuitive properties of the language, have put a barrier in Deaf education for decades.

In particular, in Greek schools of Special Education there exists a significant lack of educational material to be offered in Greek Sign Language (GSL) in contrast with the richness of the foreseen official curriculum.

Furthermore, deaf persons confront significant problems in learning the written form of the Greek language given the lack of any systematic method of teaching the written form of oral Greek to deaf pupils. In parallel, there is neither support for learning any sign language transcription/notation system.

As a result, deaf pupils are obliged to learn a transcription system (the written form of their respective oral language) as an artificial language, since born deaf have no experience of sound perception.

The latter also explains why the argument that deaf people can read since they can see and, thus, they overcome the accessibility barrier to written text, is a widely believed misconception. Against such statements, it must be acknowledged that deaf individuals rarely develop reading skills similar to hearing ones with direct consequences in respect to higher education perspectives of born deaf populations and the consequent exclusion from high level occupation potentials.

3. Deaf accessibility: true potentials and wide misconceptions

When discussing ways of making content accessible to deaf individuals, either in the framework of education or in respect to any other human activity involving exchange of linguistic messages, the immediate reaction is to think of an inter-personal communication in a given sign language, although W3C/WAI and WCAG 2.0 do not make any explicit statement as to which technology is more effective for content accessibility by deaf and hard of hearing persons. Furthermore, in the case of asynchronous or non-live communication the most widely accepted -and in a sense, expected- technology to be exploited is by far video. This preference is easily understood on the basis of objective reasons, with most prevalent among them the high degree of naturalness in signing representation and fidelity of the conveyed message.

However, if carefully observed, the use of video per se raises a number of significant obstacles in deaf individuals' accessibility in respect to linguistic content, with direct consequences especially in the domain of education.

The most prevalent of these obstacles are relating to the following parameters:

1. Video, although easily available nowadays, is still far from providing reusable or easily modified content. In this sense, the dynamic interaction of teacher-student, which forms an integral part of the educational process, cannot be succeeded by the use of video alone. More specifically, a video file cannot be easily handled in order to change parts of its content in view of i.e. creating a batch of exercises with slots to be field by the student or slight structural modifications, or when from the side of the student, some correction is needed to be made.
2. Unlike creating a text document, the creator of a video file cannot remain anonymous or avoid exhibiting his/her face.
3. Sign language video cannot be always available for any kind of activity which needs to be attended by deaf individuals, as in the case of i.e. college lectures and scientific presentations (for example by an invited expert or during a conference), addressing an audience with specific educational/scientific interest.
4. A video camera may cover only a specific angle of the signer's performance, leaving a number of issues like various occlusions (mostly of the face) and depth related information out of capturing capacity. This situation becomes especially significant when teaching sign language grammar, since the major characteristic of sign languages is their three-dimensional articulation on the signer's body and in the signing space in front of him/her, along with the multichannel articulation of the linguistic message within a single time period involving parallel activity from the hands, the upper body, the head and eye gaze.

This situation exhibits the acute need for technologies which will enable sign language users to treat sign language "documents" the same way, text files are treated by means of any common text editor. In this direction, research currently focuses on two major enabling, and also highly demanding technologies in respect to sign language support: a) sign video recognition and b) sign language synthesis and animation.

The lack of mature technologies and educational material in sign language(s) has led to solutions which are partially dictated by the existing needs and partially based on the widely spread misconception relating to deaf persons' ability to see, thus, it is considered natural for them to be able to read as well.

This assumption sets the issue of born or early deaf persons' accessibility rights on a completely wrong basis, although it is true that at some point deaf individuals who receive education, develop a specific bilingualism which involves their sign language (as mother language) and the written form of the dominant language of their hearing societal environment (as second language). And it is on this basis that subtitling has been considered a useful method for making lecture or spectacle linguistic content accessible to the Deaf and Hard of Hearing.

However, the truth is that in most cases, born and early deaf persons very rarely may reach a level of reading capability that extends the level of early to middle classes of Primary Education. This can be easily understood, if one realizes that the writing systems assigned to oral languages are composed of conventions on the representation of vocal sounds or sound clusters.

In the case of hearing loss or heavy impairment, the association between a sound and some symbol for its representation cannot be conceptualized, and what remains is the option of photographic association of a string of symbols (letters) with a specific concept. In this line, information conveyed via declination morphology of an oral language adds another level of difficulty in decoding the meaning of a written text.

Against all odds, and complementary to the still open research questions, a number of technological solutions targeting more efficient support than ever before, to accessibility by Deaf and Hard of Hearing individuals, are already available. Discussion of one such system that combines experience from the language technologies domain for the creation and maintenance of huge electronic lexical resources and the domain of avatar technologies for the presentation of signed content follows in the next section.

4. The SiS-Builder Editing Environment for Creation and Maintenance of Sign Synthesis Resources

Video is widely acknowledged as the only option for transferring signed linguistic meaning. However, although video is the only means for SL messages transmission that preserves naturalness of expression, it poses a number of serious restrictions as regards on-the-fly composition of new "texts" or modification of previously created text, actions which are crucially common in educational practice, when we only think of how an editor for written text is used in relation to classroom activities.

SiS-Builder is an online tool initially developed to serve needs of the DICTA-SIGN (http://www.dictasign.eu) project for the creation of Sign Language (SL) lexical resources for sign synthesis and animation (Goulas, Fotinea, Efthimiou and Pissaris, 2010). The tool is based on open source internet technologies to allow for easy access and platform compatibility, mostly exploiting “php” and “java script”, and is accessible through the following URL: http://speech.ilsp.gr/sl/.

The most prominent need that led to the design and implementation of SiS-Builder was the requirement to code SL lexical resources via an environment which offers an easy way to assign manual and non manual features to lexical entries due to feed sign synthesis.

In more technical terms, SiS-Builder was so developed in order to be able to generate SiGML transcriptions (Elliott, Glauert, Jennings and Kennaway, 2004), (Glauert and Elliott, 2011) of HamNoSys strings representing sign language lexical items (Hanke, 2004) or signed phrases in order to feed the avatar specifically developed by the University of East Anglia (UEA) (http://vh.cmp.uea.ac.uk) for synthetic signing presentation.

In the course of its implementation, SiS-Builder was enriched with a number of functionalities that have provided a complete environment for creating, editing, maintaining and testing lexical resources of sign languages, appropriately annotated for sign synthesis and animation, while the tool may serve both expert and naïve end user needs in creating and maintaining SL lexical resources and composition of new signed utterances.

The main components and functionalities of SiS-Builder are briefly sketched next.

SiS-Builder enables multiple users to create and test their own data sets. It may accommodate video files of sign language lemmas and associate them with a complex structure of data which include lemma coding for manual and non manual articulation elements, visualisation of the coded items via sign performance by an avatar and conversion of HamNoSys to SiGML files and the vice versa for ease of coding corrections and modifications where necessary,

When used by non expert users, SiS-Builder allows viewing of the lexical resources available in the associated repository, according to the degree of access permission assigned to each user. It also allows for composition of new synthetic signed phrases by selection of the wished phrase components from an available list of properly annotated items which the user may freely use but is unable to modify with regard to their associated codings.

The new signed phrases are presented by a signing avatar and the user may select to save, modify of delete each phrase she/he has built. Users may reuse the whole or part of the phrases they save according to their communication needs.

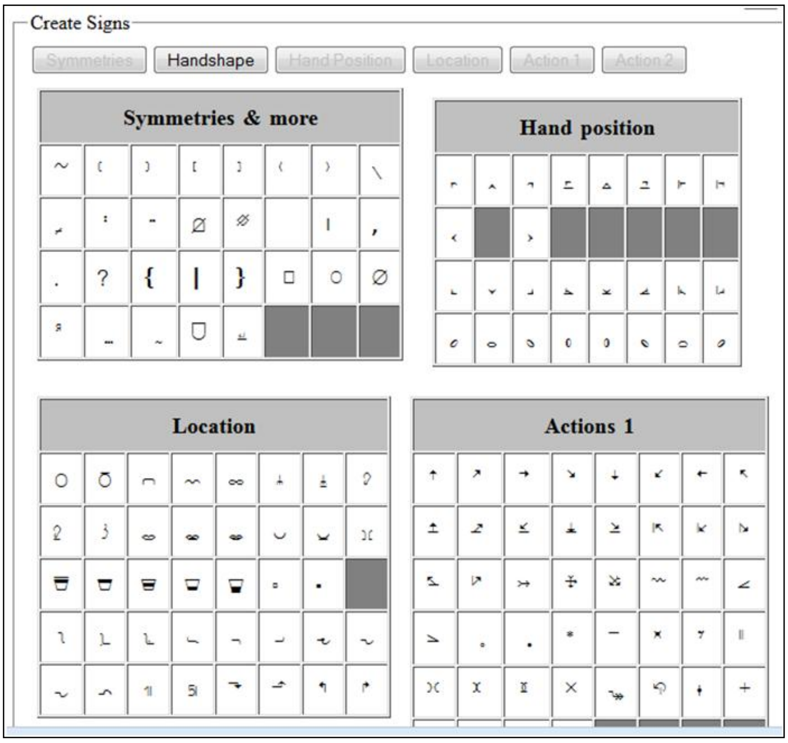

Figure 1 SiS-Builder's virtual keyboard for the assignment of HamNoSys annotations corresponding to the manual features of signs

Sign language authoring tools, in general, belong to rising technologies that are still subject to basic research efforts and thus not directly available to end users. An overview of the current state of research worldwide was offered during the 3rd International Symposium on Sign Language Translation and Avatar Technology (SLTAT), held at DePaul University in Chicago, Illinois, USA on October 18-19, 2013 (http://sltat.cs.depaul.edu/Dropbox/ASL/sltat_2013/sltat_v2/default.htm), while a volume of selected papers from this event, currently under review for publication as a dedicated special issue of the UAIS Journal (http://www.springer.com/computer/hci/journal/10209) will provide a solid reference to the state-of-the-art in the field (expected to be published within 2014).

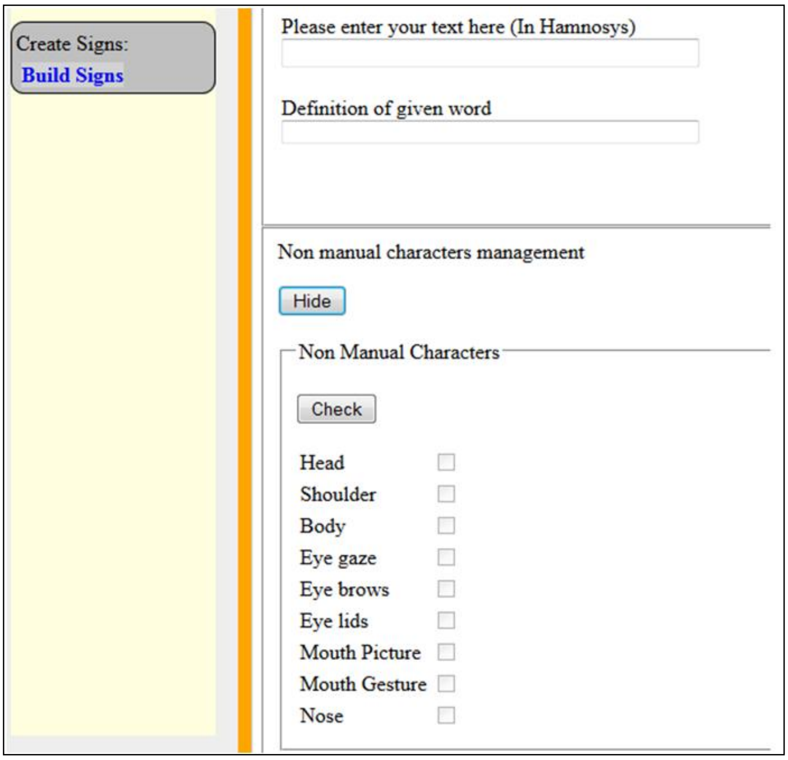

Figure 2 The SiS-Builder drop-down menu for the assignment of non manual features to sign lemmas coding

SiS-Builder being very close to entering experimental use in real schooling conditions has undergone both classification and initial evaluation in respect to its accessibility features and use in educational environment, while extensive evaluation of the signing avatar performance by end users has taken place in the framework of the DICTA-SIGN project (DICTA-SIGN Deliverable D7.4, 2011).

Avatar performance evaluation and acceptance by end users is a significant factor for further exploitation of synthetic signing technologies, since signing avatar performance relates may find further applications relevant to Deaf education, as in the case of presentation of Machine Translation results (Kouremenos, Fotinea, Efthimiou and Ntalianis, 2010).

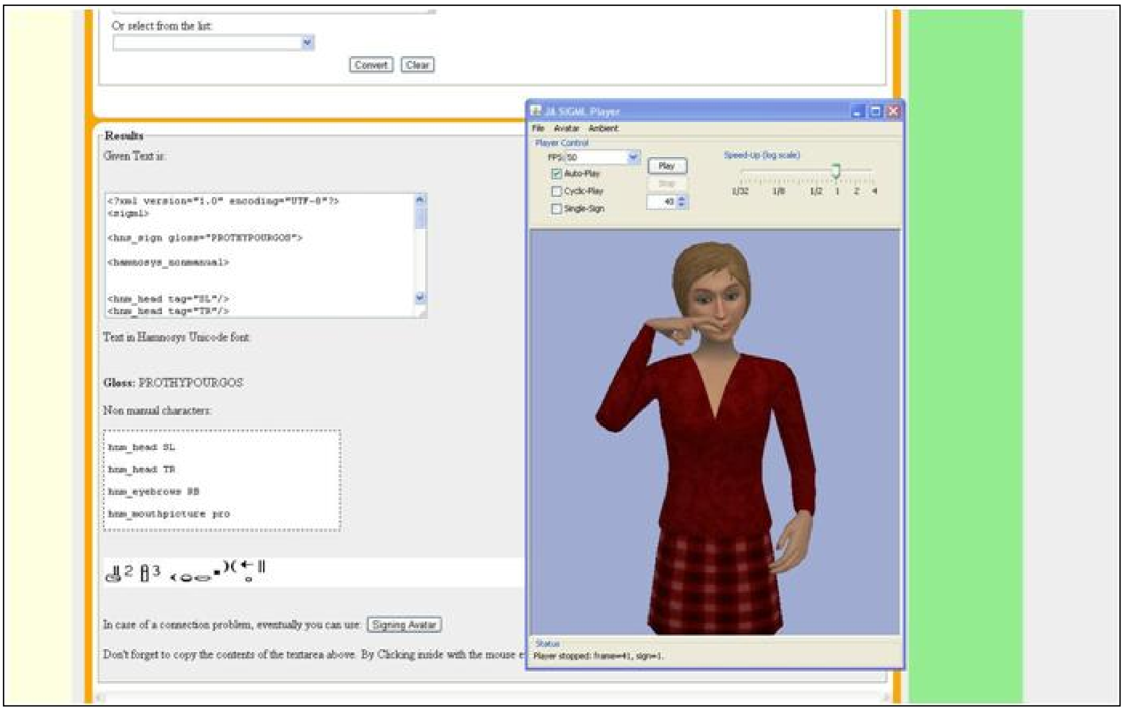

Figure 3 The UEA avatar performing synthetic signing by exploiting SiS-builder resources and interface

Classification of the tool as to its specific accessibility and education supporting features that address the needs of Deaf/Hard of Hearing end users was conducted in the framework of the ENABLE project (http://www.i-enable.eu) (Hersh, 2013a), (Hersh, 2013b).

Initial small scale evaluation of the tool was also conducted in the same framework and was incorporated in the project's deliverable D3.3. "*Categorisation and Evaluation of Existing ICT to Support Lifelong Learning by Disabled People*". The reported evaluation was user centred and focused on the demands deriving from the end user profile and needs. Since the ENABLE project aims at spotting ICT support solutions to lifelong learning of people with disabilities, the evaluation of SiS-Builder within this specific framework has focused on those aspects of the tool's use as a sign language editor that can directly link to Deaf/Hard of Hearing individuals' support in learning.

The key-features of the SiS-Builder editor have been classified in line with the ENABLE methodology in respect to five major classification clusters: A. Disabled learner or end-user, B. Learning Technology, C. Context, D. Learning Activities, and E. Additional personal and contextual factors to support choice of a specific learning technology. Each of the above clusters incorporates a set of criteria which allow for identification of the tool's properties in respect to its targeted end user group.

As regards cluster *A) Disabled Learner*, the entailed criteria incorporate:

1. Accessibility features provided, where SiS-Builder is characterised as WCAG 2.0 compliant.
2. Skills/education level/knowledge, a criterion that can be satisfied across the board, since the tool can be exploited in different ways and for different educational levels.

3. Personal characteristics, a criterion addressing issues such as age/gender independent use and GUI friendliness.

As regards cluster *B) Learning Technology*, the entailed criteria incorporate:

1. Type of technology offered, a criterion focusing on whether the tool is platform independent, suitable for stationary use (PC) and/or mobile use etc.
2. Interface, which focuses on the HCI characteristics of the tool under consideration,
3. Use/availability factors, referring to whether the tool is free of charge or not, it makes use of open source technologies, it is available on line etc.
4. Technical factors

As regards cluster *C) Context*, the entailed criteria incorporate:

1. Requirements, is a criterion related to ease of use, time needed to get familiar with the environment, versions of hardware/software supporting the tool etc. and
2. Learning context

Finally, cluster *D) Learning Activity/ies*, entailed criteria i) Type of Activity and ii) Other, which target use of the tool in educational context.

The ENABLE evaluation methodology is based on the same five major clusters of criteria listed above when discussing the adopted classification mechanism. As regards the evaluation protocol, three main evaluation domains/strategies where incorporated in the questionnaire presented to end users with respect to the evaluated tool or technology:

a) Simple Mainly Qualitative Evaluation Methodology
b) Simple Quantitative and Qualitative Evaluation Methodology, and
c) Detailed Evaluation Methodology

SiS-builder evaluators were presented with a questionnaire where they had to provide scores from zero (0) to five (5), Yes/No answers or “short comment” answers on sets of questions distributed under the three evaluation methodologies composing the evaluation suite.

5. Conclusions

Following the initial small scale evaluation referred to above, a wider scale end user evaluation has been designed in order to collect a possibly wide range of feedback regarding both the technologies entailed in the SiS-Builder environment and the functional/interaction aspects of the tool. Such an evaluation is becoming necessary in the perspective of introducing the tool for experimental use in support of educational and communication needs of Deaf/Hard of Hearing individuals with non signers (learners and/or teachers) in the environment of mainstream education in Greece, which is planned to start within the next school year.

Moreover, evaluation results will provide significant feedback on user acceptance of synthetic signing for short “written” communications exchange within the Deaf/Hard of Hearing communities.

Furthermore, extensive user feedback is valuable to designing the graphical user interface (GUI) of the tool in the most effective way in respect to user preferences in order to achieve their optimal support.

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Acknowledgements

Work reported herein has initially received funding from the European Community's Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 231135, DICTA-SIGN project, and it is currently on going in the framework of POLYTROPON Project (GSRT-KRIPIS, MIS: 448306), while the here reported user evaluation and tool classification has been conducted in the framework of ENABLE project (GRUNDTVIG Lifelong Learning Programme).

Keynote: E-Learning – a boon or too much bother for people with disabilities?

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Previous generations held the viewpoint that the educational process started at the age of about 4, and continued until the child left school. Very few people had the opportunity (or indeed the need) to progress to third level education. It is only in very recent times that the realisation that formalised education can be a lifelong process. One of the major contributors to this change in perception has been the growth of distance-learning courses, and the acceptance by those managing third level institutions that there exists a need to provide more flexible learning opportunities. E learning has greatly enhanced the educational possibilities for people. however the question should be asked: Has the ubiquity and increased availability had the same positive impact on persons with disabilities?

Let us look at those involved in the learning process. It should be noted that a high-level view is being taken here. At one end we have students who must access content, and on the other there are those who must create the content, and make it available through E learning portals such as Mooodle, Blackboard or others. However, there is, in this author's view, a third constituent which is the designers and developers of such portals.

When viewed from the student perspective, there can be nothing more frustrating than finding a third level institution who are amenable to solving the issues that arise for a student with disabilities, only to discover that in reality the content provided consists of scanned Pdf documents with no recourse to alternatives. This, from experience, rarely occurs out of malice but is certainly commonplace. Another consideration is the nature of the course undertaken. How does a student with certain disabilities (such as blindness or vision impairment) access certain forms of STEM content remotely?

A group which is often overlooked in discussions pertaining to the accessibility (or otherwise) of E Learning is the constituency who, being both academics and have some form of disability, must attempt to create content for use by students. It is fair to say that in this author's experience, effort from developers is primarily directed towards making the front-ends of their systems accessible however little or no attention is paid to the bak-ends of systems or those features usually accessed by the content providers. This results in academics who are obliged to provide materials online, resorting to using systems divorced from the main E Learning portal employed by the institution in which they work, and simply providing external links to their content from the portal.

This leads to the third constituency which are those designers and developers alluded to in the previous paragraph. Effort must be directed to three things:
1. is the underlying infrastructure of the E Learning portal itself accessible?
2. Is the facility to provide content in alternative formats (or forms) available?
3.Is there facility to add extra metadata or descriptive text to Learning Objects?

4.In the case of MultiMedia objects, are all players used accessible?

In this talk, it is proposed to discuss these topics and to highlight examples of issues that arise because, in this author’s opinion, E Learning can be a boon for people with disabilities, but it is far too often just too much bother to interact with the portals and the inaccessible content thus raising the possibility that students simply give up, and academics with disabilities simply do not bother making use of E Learning portals.

Design requirements for touch screen control panels as assistive learning technologies for people with intellectual disabilities working with computer-numeric-controlled machines

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The project „iBaMs" – Barrier-Reduced Machines In Innovative Interaction" aims to develop new assistive learning technologies for disabled adults and is funded by the German Federal Ministry of Research and Technology (BMBF). It examines the preconditions and requirements for the development of accessible touch screen control panels for computer-numeric-controlled (CNC)1 units/ machines in facilities for the disabled.

Our overall goal is better support, empowerment and workflow control for mentally disabled persons who work with technology. Simultaneously, we try to improve the value creation of facilities for the disabled. Practically, that means the joining of two methodological approaches – one that aims at the user-centric perspective of mentally disabled persons, and another that deals with the modernization and economic requirements of facilities for the disabled.

As the use of technology facilitates and influences new forms of social rules and interactions and hence the possibilities for increased integration or isolation of mentally disabled persons, technological innovation in that field requires special attention to the user-centric perspective. Therefore, we have tried to identify the special skills as well as the weaknesses of mentally disabled persons who work with technology.

Although the limitations of some mentally disabled persons (e.g. small degrees of self-government, limited scope of understanding, reflection and action) should not be neglected, it is possible to capitalise on their skills (such as reliability, empathy and positive attitudes towards work) in developing human-technology-interactions. Research and experience also show that mentally disabled persons do not generally have difficulty with CNC units and machines, because fine motor skills are not relevant here. This is why we took the pre-existance of CNC machines in selected facilities for the disabled as our empirical starting point.

It is important to reflect from both of our methodological points how flexible and adaptable touch screen control panels for CNC units need to be, adapted for fields like metal processing, carpentry or semi-automatic large-scale catering establishments. Our project thus addresses the development of accessible touch screen control panels, enabling the different requirements and user-perspectives for the preparation, starting and controlling of CNC machines. This can be considered as part of a lifelong learning strategy, because the touch screen control panels are intended to improve subjective working conditions, enhance the spectrum of tasks achievable and delegate more responsibility towards the disabled individual. As many facilities for disabled people work in similar fields, we see strong perspectives for the proliferation as well as the adaptation of these touch screen control panels.

Our practical partner is the CVJM-Sozialwerk Wesermarsch e.V., a well-established organization that employs over 360 persons with disabilities and more than 70 qualified staff members on a large site at the German North Sea coast. Together with a highly qualified team, including production and factory leaders as well as selected employees, we analyse the user-centric and economic perspectives for the development of disabled accessible touch screen control panels, using methods like expert interviews, participative observation and workshops. With these methods, the following research questions are addressed:

- What shop floor experiences exist with human-technology-interactions in different practical fields?
- How could these interactions be improved?
- How do we have to compose a user interface as assistive learning technology in order to open it up for the experiences, capacities and limitations of mentally disabled persons?
- How many symbols, knobs, colours, pictures, gesture control elements or acoustic signals should a touch screen control panel possess?
- How are these elements perceived by the mentally disabled?
- How can these perceptions be used for the shaping of new assistive learning technology?
- What kind of technological/pedagogical help is required for the maintaining of workflows and the handling of problems that arise?

While answering these questions, the project iBaMs marks the first step towards a more encompassing 3-year research project that will add more partners and realize the concrete shaping of the specified technology.

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Enable – Classification and Evaluation of ICT Learning Technologies to Support Disabled Adults

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This paper presents the first systematic approach to the classification and evaluation of inclusive ICT-based learning technologies and ICT-based learning technologies for disabled people.

The aims of the classification and evaluation frameworks can be summarised as follows:

Classification

Providing a framework based on a technology description to determine and evaluate what is available, how this changes over time and identify gaps in provision, develop new technologies and modify existing technologies to improve accessibility.
Supporting learners, teachers and tutors in choosing appropriate technologies for themselves or a particular learner or group of learners in a given context.

Evaluation

Evaluating various features of existing technologies from the perspectives of disabled learners and other stakeholders, comparing technologies and identifying gaps in technology provision.
Evaluating the impact of technology use on user outcomes, including barriers to learning, self-confidence, motivation, increasing participation in learning activities and achievement of desired learning outcomes.

The evaluation framework is based on the following three main components:

Aims which specify the purpose(s) of the evaluation or what it is intended to achieve.

Principles which provide a framework and context in which the evaluation should be carried out and, in particular, specify the constraints, rules and factors to be taken into account.

Methodologies which specify the approaches used to carry out the evaluation taking account of the principles in order to achieve the aims.

Development of both the frameworks took place as part of the Enable network project and involved a multi-stage process, including cycles of discussion, comment and validation using ICT based learning technologies used in the 16 partner countries. The results have a number of important applications. In particular they have established for the first time clear classification and evaluation frameworks which can be used to discuss and evaluate existing ICT-based learning technologies for disabled people, identify gaps in provision or the need for modifications and support the design and development process for new technologies.

Versions of this material have been or will be presented at the following conferences:

- Enable, Glasgow, Scotland, August 2013

* ALT, Nottingham, England, September, 2013
* AAATE, Vilamoura, Portugal, September 2013
* RAate, University of Warwick, England, November 2013
* ICCHP, Paris, France, July 2014

The evaluation methodology will be published under the following title Evaluation Framework for ICT-Based Learning Technologies for Disabled People in Computers and Education. The classification methodology has also been submitted for journal publication under the title Classification Framework for ICT-Based Learning Technologies for Disabled People.

I would like to thank the partners of the Enable Network for their input and support in developing the classification and evaluation frameworks; the members of the End-User Advisory Committees and all the other people from out with the project who provided information and/or answered questionnaires; and the anonymous reviewers of the various versions for their useful comments.

I would like to thank the Lifelong Learning Programme of the European Union for funding, but to note that the funders have no responsibility for the content of this work.

Speech support for Maths and Science.

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Abstract
Many learners with print disabilities, such as dyslexia, dyscalculia and visual impairment face barriers when reading and comprehending mathematical notation. One strategy that can help is the ability to hear and see symbols together in order to enhance comprehension and reduce cognitive load as provided by text-to-speech and screen reading tools. So far development of such tools to read aloud maths notation has been limited by both technological and lexical barriers. This paper considers these barriers and the current technological tools for reading mathematical notation. The authors go on to review how STEMReader a 6 month project to produce a proof-of-concept text-to-speech tool for maths notation) has attempted to remove these barriers and presents feedback from potential users of the STEMReader tool.

Keywords
Accessibility, maths,, science, e-text, text-to-speech, ,

1. Introduction
In the UK It is estimated that up to 10 million individuals are affected by print disabilities. Those of this group who are learners with print disabilities, dyscalculia and learning difficulties will encounter barriers when reading and comprehending Science, Technology, Engineering and Mathematics (STEM) subjects. Some of these individuals will always struggle despite support from good teachers who may have a toolkit of remedial strategies. Nevertheless, research shows that there are particular coping strategies that can help. One example is the ability to hear and see symbols together in order to enhance comprehension and reduce cognitive load (Mousavi et al, 1995). These connections are important whether learning the numbers 1 to 10, dealing with calculations in the workplace or understanding maths at degree level.

Synchronising computer generated speech with the highlighting of the text has been used to assist print disabled learners with accessing text.. Similarly, those who are unable to read due to a physical or sensory impairment – whether due to poor visual acuity, difficulty with concentration or actually holding printed material – can be facilitated through the use of text-to-speech or screen reader tools. However, the lack of accessibility in mathematical notation and technology to read aloud maths has compromised the use of these strategies within STEM fields. While learning strategies and assessment accommodations are increasingly focussing on enabling students to demonstrate their skills independently through the use of assistive technologies, learners studying at all levels remain reliant on human readers for accessing maths notation.

Creating and then accessing maths notation through assistive technology presents a multi-faceted and inter-disciplinary challenge. This paper sets out the first steps taken to develop a multi-sensory tool – STEMReader – a tool for reading aloud and navigating within mathematical notation which could ameliorate many of the difficulties print impaired learners experience when manipulating mathematical concepts. This paper also includes a review of the issues of reading aloud maths that require further study.

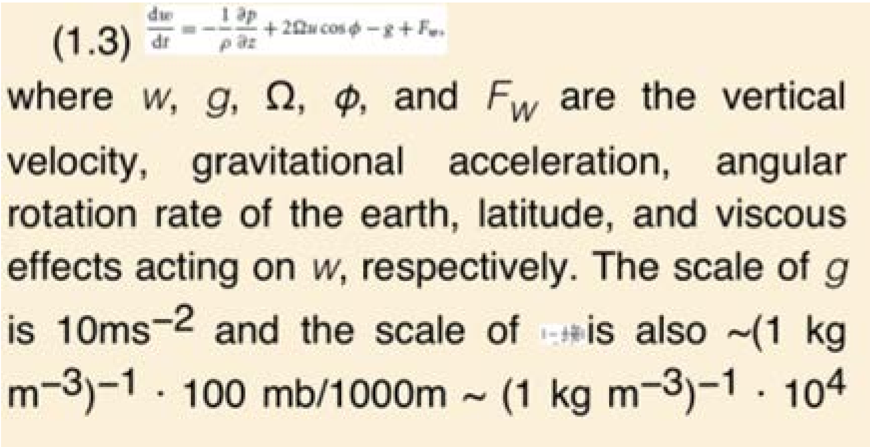
2. Accessibility Barriers to maths notation

While the need to provide accessible maths notation and compatible assistive tools has been recognised for a number of years development of such tools has been piecemeal due to the multi-facetted nature of the problem.

2.1 Issues with accessible rendering of maths notation.

Most digitised representations of maths appear as images. These are embedded within web-pages, PDFs or other materials. Alt-tags (alternative text tags) may be used to describe the content of images to a print-impaired reader but this offers a number of challenges:

- There is no consistent approach to representing maths within alt-tags which needs to take into account the likely audience and their difficulties (National Centre on Accessible Instructional Materials, 2014).
- Images replicating text are often not re-scaled when font size is increased. Figure 1 shows an example of an e-textbook containing inline equations created with images that have not resized. Use of scalable vector graphics (SVG) can resolve this problem (Fine, 2008).
- It is not possible to chunk or navigate through content when an alt-tag is used in a mathematical sense as information is provided as a linear text description.


(1.3) $\frac{dw}{dt} = -\frac{1}{\rho}\frac{\partial p}{\partial z} + 2\Omega u \cos\phi - g + F_w,$

where w, g, Ω, ϕ, and F_W are the vertical velocity, gravitational acceleration, angular rotation rate of the earth, latitude, and viscous effects acting on w, respectively. The scale of g is $10ms^{-2}$ and the scale of is also ~$(1\ kg\ m^{-3})^{-1} \cdot 100\ mb/1000m \sim (1\ kg\ m^{-3})^{-1} \cdot 10^4$

Figure 1: a screenshot of an e-textbook containing maths equations as images.

In 1998 MathML was released by the Worldwide Web Consortium (W3C) recommendation as a standardised mark-up for mathematical notation and has since been revised to version 3.0 (Ausbrooks et al, 2009). Unlike existing mathematical mark-up formats, such as LaTeX, MathML was developed with regard to the requirements for accessibility and assistive technology users. MathML enables math notation to be rendered correctly whilst also maintaining the semantic structure of the notation and forms part of the HTML5 specification. As the line between offline content and online content has blurred, MathML has also been adopted into document formats such as the ePub3 standard for ebooks and OpenOffice. However, MathML adoption has been hampered by the lack of support for rendering MathML in internet browsers and the limited range of tools for creating MathML. In particularly both Internet Explorer and Chrome (accounting for over 70% of internet users in 2014, (GlobalStats, 2014)) do not natively support MathML. Therefore it is possible to create a webpage containing maths content using MathML that will not be displayed correctly to the majority of users. And without the guarantee of maths equations being displayed correctly, developers have tended to revert to the fail-safe route of providing maths equations as images. Furthermore the only significant attempt to establish compatibility between mainstream screen-readers and text-to-speech tools using the MathPlayer plug-in for Internet Explorer has halted due to MathPlayer no longer being compatible with recent versions of Internet Explorer (Design Science, 2013).

It has only been in the last few years, driven by the impetus to provide re-flowable ebook and web content for mobile devices that a solution to the lack of MathML support in browsers has emerged, namely MathJax. This is an open source JavaScript display engine for mathematics that works in all browsers. It enables equations entered within webpages as MathML or LaTeX to be rendered in any browser. If the browser does not support MathML, then an SVG image is presented and includes an option to zoom for those requiring a larger font (Cervone, 2012). Utilising the MathJax API it is now possible to retrieve the MathML code for equations even in browsers that do not use support MathML rendering. This provides the content of maths notation and its semantic structure that would be necessary to read aloud the notation (Sorge et al 2014).

2.2 Audio Rendering of Maths

In order for maths notation to be read aloud, there needs to be a system of rules that links the symbols to the words that will be spoken. For example, a rule for the symbol "≤" would link it to the text "less than or equal to" that could be converted into speech by text to speech engine. However, there are a number of issues with converting maths symbols into linear text:

A. Maths is a 2-dimensional notation and the location of a symbol affects its meaning. This needs to be represented in the speech output. For example, for $4x$ and 4^x without some information indicating the location of the "x", a text to speech engine would say "four x four x".
B. When maths is spoken some information may not be verbalised that may be vital to interpreting the structure of the notation. Without this information it can be possible to interpret the audio rendering of the maths notation into different structures. For example, "a plus b over 2" could mean:

$$a+\frac{b}{2}$$

or

$$\frac{a+b}{2}$$

Without further audio information (for non-sighted individuals) or a visual link through synchronised highlighting (for sighted individuals), users may be provided with an ambiguous reading of the maths notation and misinterpret the contents.

C. The audio rendering of maths can be dependent on the context of the notation and the requirements of the audience. For example:

$$p > q$$

usually represents "p is greater q" but the same notation could be used in logic theory to represent or "p only if q".

In essence, a mathematical expression or equation is like a sentence. It has a grammar and semantic structure. Simple expressions are like simple sentences:

“I can run” …… $x+2$
Complex expressions can contain sub-clauses and conjugates

"I can run like the wind if the grizzly bear chases after me“… $\frac{(x+2)^2}{x+2}$
If readers can drill down into the semantics of an equation then audio representation of the notation may be more valuable, and the amount of audio information being presented at any one time can be controlled.

One of the first comprehensive maths reading rules sets was developed by Chang et al, (1983) for individuals reading aloud maths for blind individuals. While this provides comprehensive guidance, it exemplifies the number of options available when reading the maths providing many alternatives for reading aloud a single expression. During the early 1990’s two sets of computer-based maths reading rules were developed for use by blind users. The Nemath MathSpeak rules (MathSpeak, 2005) were based on Nemath Maths braille. Nemath matches the Braille set rules, in that each change in script level is spoken. While removing ambiguity for the listener, this leads to long and verbose descriptions. For example:

$$\frac{20}{5}\times\frac{1}{100}=\frac{1}{25}$$

would be read aloud as “StartFraction 20 Over 5 EndFraction times StartFraction 1 Over 100 EndFraction equals one-twenty-fifth”.

Raman’s (1994) AsTeR system was designed for screen reader use and introduced the use of prosody and pitch to indicate levels and structures within the notation. However, too much auditory information puts a strain on the users working memory and requires users to learn an intricate system of auditory cues, similar to learning a new language. Stevens et al (1997), Fitzpatrick (2006), Bates & Fitzpatrick (2010), Murphy et al (2010) have explored other auditory methods for reducing the memory load and verbosity of spoken maths but none has been widely adopted. Recently Frankel et al (2014) have started to examine the use of familiar vocabulary and prosodic cues as methods to improve the reading of maths equations for students in classroom settings using ClearSpeak. In evaluation trials they found learners were more confident in understanding the maths they were hearing and scored higher in correct responses to maths equation compared to using the previously available rule sets. However, limited information is available regarding the age and mathematical ability for which these rules are suitable for as they are still in development. Providing a consistent and unambiguous approach to reading aloud maths has become increasingly important in order to offer equal access to all students in assessments or examinations whether undertaken on a computer or handwritten. Examination arrangements or accommodations often enable print disabled students to have the content of the questions read aloud. Although studies in this area are limited, a few have shown that when candidates use computer readers they often repeatedly listen to the content which is not something they requested when supported by human readers (Laitusis et al, 2012).
Assessment consortia in the US have published extensive guidelines on how mathematical notation should be read aloud (PARCC, 2014; Smarter Balanced Assessment Consortium, 2012). In the UK, where over 50 000 candidates per annum are eligible for reading support,

no such guidelines exist and readers are instructed to ensure symbols are not read aloud due to the risk of impacting the assessment criteria.

2.3 Existing software tools for reading aloud maths

Recently software developers have developed a few tools to enhance accessibility to maths notation. MathPlayer (Soiffer, 2009) for Internet Explorer focussed on rendering and reading MathML within web browsers. Mathplayer allows users to switch between reading rules but is no longer compatible with the latest versions of the browser. Holder et. al., 2014 have produced a stand-alone reading application called Central Access Reader which opens Microsoft Word or html files and supports reading maths. It also gives the users options to switch between different maths reading rules. However, the program fails to enable users to navigate within equations or offer guidance on their semantic structure. A recent addition to ChromeVox, the speech plug-in for the Chrome web browse has enabled maths equations to be read aloud and to navigate within an equation using the keyboard using the MathJax engine (Sorge et al, 2014). While other software developers are looking to build on this approach, the focus remains on reading aloud web content.

3. STEMReader project

In March 2014, the UK Department for Business Innovation and Skills (BIS) and the Technology Strategy Board funded ECS Partners (a subsidiary of the University of Southampton), for a 6 month proof-of-concept project to create a tool that will support users of all mathematical abilities. The STEMReader project aimed to create an application to read aloud accessible maths content from Word documents, ebooks and other learning materials as well as web content. The project created a platform independent tool that enabled users to hear maths equations read aloud with synchronised highlighting. During the project feedback was gathered on the proof-of-concept tool to guide future development and assess the potential of the features offered to assist learners. The project undertook individual interviews and held focus groups with 13 students and 6 tutors. The students were studying maths and STEM subjects at a range of levels from Functional Skills Level 1 to degree level. The students were struggling with reading or comprehending maths due to:

- a specific learning difficulty (dyslexia or dyscalculia),
- visual impairment,
- cognitive disability,
- English as a second language.

In addition interviews took place with tutors who were supporting learners in post-16 education and on work placements.

The STEMReader tool was built to be platform independent to run on mobile and desktop operating systems and independent of internet connectivity. During the project STEMReader was developed as an online tool and as a standalone application for Windows. Users copied MathML notation into the STEMReader web page or application, which then rendered it on the screen and read aloud the result with synchronised highlighting. Maths notation from Word documents, presentations as well as web pages was comatible with STEMReader as long as they were created or converted to MathML. The web version was accessible on smartphones and tablet devices and a demo with limited functionality was made available to all participants and stakeholders in the project (ECS Partners, 2014).

3.1 Feedback on audio rendering of Maths with STEMReader

The STEMReader concept enabled users to select different reading rules for reading aloud maths which could be used to alter a number of attributes of how maths was read aloud. User feedback identified that it was particularly important to have reading rules that were appropriate and understandable to the learner. For example, the colloquial form of fractions was requested for learners at functional skill levels who were still developing their conceptual understanding of fractions – for example $\frac{1}{5}$ read as "a fifth". However, learners working at higher levels wanted the fractions read as numbers to aid their calculations. Therefore alternative reading rules could be selected within STEMReader. During the proof of concept phase reading rule options demonstrated 3 different reading criteria:

- Choosing how much of the symbolic representations are read aloud e.g. whether brackets were vocalised.
- Using the colloquial (or "soft") fraction reading rules vs. read aloud in full.
- Selecting different maths vocabulary; for example "multiplied by" or "times".

In addition learners and tutors requested that reading rules should be added that would be suitable for use in assessments. The students all read aloud the maths to check their understanding and would often re-read items multiple times. In examinations they tended to find the reading support very different and unhelpful. In order to develop such rules it would need the involvement of the assessment authorities.

"I have to read things 3 or 4 times. I read it so many times that I forget what the question actually said. Hearing it on the computer makes it easier. " Visually impaired functional skills student

"This could be used in exams to make students more independent. As a support worker it is difficult to distance yourself and provide unbiased support." Tutor

It was also noted that as learners developed their maths skills they often wanted to check the meanings of symbols and terms. In particular, students for whom English was a second language liked the fact that they could use STEMReader to learn the English pronunciation and order for equations.

"As a PhD student it is important that I can explain equations. STEMReader helped me learn the reading order of equations in English as it is different to my native language."

Learners and tutors reported that often terminology confused the learner and that mathematical glossaries and dictionaries currently available were often difficult to understand for those with specific learning difficulties. In response to this feedback a "Define" button was added to the STEMReader proof-of-concept tool with a few mock-up definitions to demonstrate how a dictionary could be integrated into the tool. However, writing suitable dictionary content was beyond the scope of this phase of the project.
"with algebra I can't remember what the symbols are" dyslexic student studying Maths GCSE

3.2 Feedback on navigation within the equation using STEMReader

In order to assist with understanding the semantic structure of an equation, it is important to allow readers the opportunity to focus in on part of an equation or re-listen to it. While the browser tools MathPlayer and ChromeVox allow for keyboard navigation to drill down into an equation, this places a burden on the users working memory and processing to recall their location and level within the equation. For sighted users a simpler navigation system may be possible through the use of the mouse or other visualisation methods. To enable improved navigation, the STEMReader proof-of-concept tool exposed the semantic structure of the mathematical equation in a tree view. This provided a multi-sensory view for displaying and enables user to navigate within an equation using keyboard commands, on-screen arrow keys or through use of the mouse. Highlighting within the tree diagram and rendering of the equation enabled users to track their location (see figure 2). By observing individuals using STEMReader it was found that they were able to move through and within the equation to aid their understanding. Learners and tutors also noted that seeing the semantic structure of an equation as a tree structure could be used to support concepts or highlight errors. For example, a tutor identified that the tree structure could be used to reinforce the order for operations within calculation

“The added advantage to the STEMReader is that a visual representation of the equation is given and this provides a valuable additional tool to enable the student to better understand the equation on a conceptual level. “ Tutor working with dyslexic and dyscalculic students in Higher Education

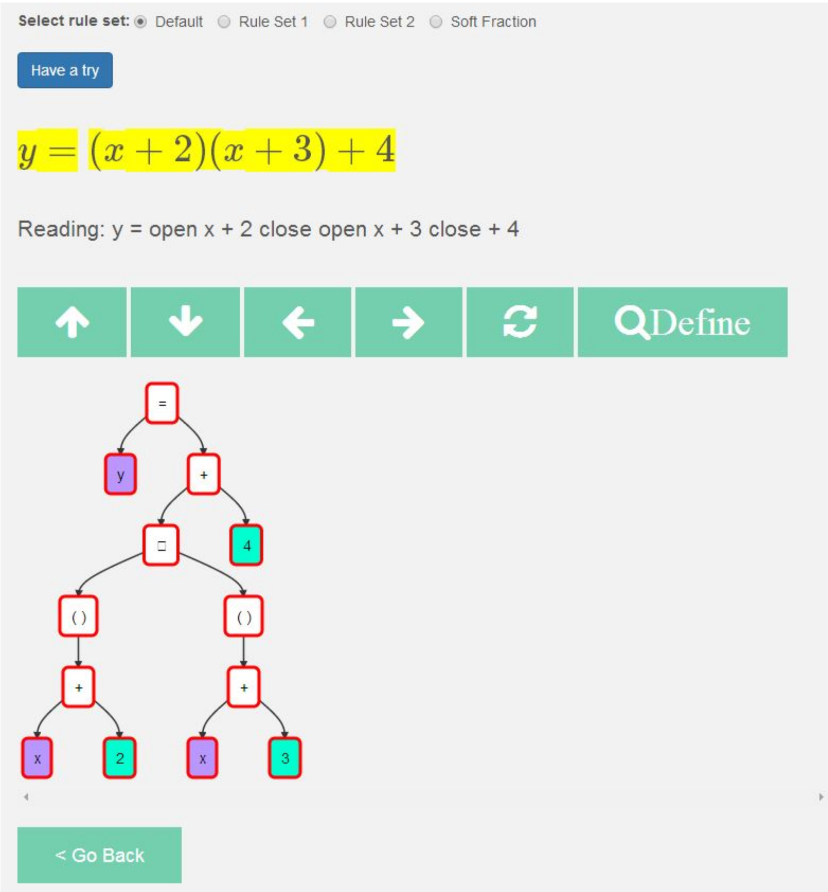


Figure 2: Screenshot of the STEMReader tree view of an equation

However, it was noted that in order for learners to get the most out of the tree diagrams, both tutors and learners would need training and guidance. Some learners who preferred a more visual way of working also noted that the tree view could assist with identifying errors within their calculation as similar equations would produce similar tree structures.

"with the tree I could see where I've gone wrong" dyslexic student studying Maths GCSE
Many learners and tutors wanted to have the ability to alter the look and shape of the tree. As no consistent views of the design of the tree were gathered, it was concluded that enabling users to alter the look of the tree diagram to suit their personal preferences could engage them further with the use of the STEMReader tool.

4.0 Future work

The STEMReader project demonstrated it was possible to build a platform independent tool for reading aloud accessible mathematical notation. Removing reliance on internet browsers means that learners could now hear maths read aloud within their own documents, worksheets, presentations and assessments as well from online resources. Through the innovative approach of exposing the semantic tree, learners could explore mathematical equations using different interfaces and navigation techniques. Initial user feedback indicates that these tree visualisation may assist learners in understanding mathematical concepts and checking maths. In addition by engaging with learners and stakeholders at an early stage of a proof of concept, the following user requirements for future development were identified:

- adding options to personalise and alter the semantic tree layout;
- a screen-reader / text-only mode for use by those who do not wish to see symbolic notation or use a screen reader
- reading rules specific to assessment environments and the ability to personalise maths reading rules
- collating definitions appropriate for learners with SpLDs or those who struggle with Maths and English;

It is hoped that future funding will be available to include these features with the view to making STEMReader available for use within the education and workplace sector.

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Barriers to inclusion: ICT use by Serbian adults with disabilities.

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Abstract

This paper focuses on the barriers to application of ICT (Information and Communications Technology) as a tool that provides opportunities for people with disabilities to get a quality education that would provide them with skills competitive enough to get and keep a job in Serbia. In recent year's digital literacy, information society, and inclusion have become a high priority in the EU (e.g. Digital Agenda for Europe, 2010; Granada Ministerial Declaration on the European Digital Agenda, 2010). These had a major influence on the development of a Serbian legal framework aimed to support all the abovementioned EU priorities (e.g. National strategy for information society development, 2006; Serbian Digital Agenda, 2010).

Although the developed legal framework is adequate, there is no support for its implementation, and because of political and economic circumstances, investments in the IT sector in Serbia are insufficient. For example, statistics show that in Serbia 50.4% households have a computer and 39% have an internet connection (RSZ, 2010), while in EU this number is significantly higher – 80% of households have a computer and 65% have internet connections (Eurostat, 2010).

As for the labor market, the general unemployment rate in Serbia was 19.2% in 2010 (RSZ, 2010) compared to 9.6% in EU (Eurostat, 2010). In Serbia, as elsewhere, computer skills become common prerequisite in many job advertisements. Nowadays, 97.8% of companies in Serbia use computers in doing business and the vast majority of the companies (96.8%) have access to the Internet (Mijačić, Kappenmann & Sredojević, 2011). Therefore, it is even more concerning that persons with a disability represent the group at highest risk of experiencing information inequalities and, consequently, employment inequalities. For example, in Žuvela's (2013) study as many as one third of the blind participants said that they have low or no computer skills as a consequence of inadequate curricula for information technologies in schools. Also, we shall discuss issues of accessibility of information technologies to people with disabilities and initial training in their use and maintenance, and their relation to equality and self-advocacy issues.

Integrating universal design at an institutional level.

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Keywords
Universal Design, Universal Design for Learning, Education, Learning, Teaching, Students with disabilities, equity, access.

1 Introduction
In Australia, supporting the learning experience of university students with a disability relies on a system of referrals, accommodations, and academic adjustments. To gain access to this support in our institution, students are first required to disclose their disability to a Disability Support Officer. This presents a problem in itself, as some students may be reluctant to disclose through fear of being labelled and discriminated against even further, and, in turn, miss out on the support they might otherwise be entitled to, putting them at greater risk of not completing their degree.

Another barrier to learning for some students is the unavailability of accessible content, due, in part, to inconsistent approaches to content creation within departments across the campus. While existing remedies for this are available for individual students who have been offered support, the necessary delay in the conversion of learning materials to formats they can access means that they are disadvantaged in terms of timely access to the content of the courses they have enrolled in.

The aim of adopting a Universal Design (UD) approach in the creation of curriculum materials is to try to:

- decrease the time taken for academic adjustments, particularly where learning materials need to be re-formatted to suit the learning requirements of specific students;
- improve student retention and progression;
- reduce the burden on academic and professional staff by providing learning design tools such as checklists and frameworks ;
- encourage more students with disabilities to come to university, and
- provide all students with alternative means of access to content, thus reducing referrals to support services for students with a disability, declared or otherwise.

2 Background
In 2012 Macquarie University released its first Disability Action Plan (DAP), which is designed to protect students with a disability "against discrimination in education in the following areas: admissions, access, and harassment." (DAP, 2012). By applying UD principles to learning design, the university can provide broad access to course content that may, in some cases, remove the need for disclosure of a disability, as the content has been

designed from the ground up with accessibility in mind. The current UD implementation team was formed as a response to the release of the DAP, and to develop a program designed to meet the University's strategic aim (Office of the Vice-Chancellor, Macquarie University, 2014) of implementing inclusive learning practices.

The current procedure for meeting the needs of students with disabilities is to refer them to the services offered by the University Library's conversion team, which offers conversion of texts and other learning materials to formats which best suit the students' preferred learning style. This is inevitably a costly and work-intensive process that may also result in significant delays in obtaining access to the materials produced. As mentioned above, UD approaches used at the early design stage have the potential to reduce the number of student referrals for support services, as well as reducing conversion times and costs where specific formats are required.

3 Principles of Universal Design

The UD implementation plan that is currently in development at our institution is informed by the nine principles that define universal design in practice. The first seven principles came from architectural practices in the 1980s (Mace, Hardy and Place, 1991) and were a response to a general lack of equitable and inclusive access to landscapes, buildings, artefacts and physical tools at that time. They are designed to offer a framework for accessible design and are listed as follows:

1. Equitable Use. The design is useful and marketable to people with diverse abilities.
2. Flexibility in Use. The design accommodates a wide range of individual preferences and abilities.
3. Simple and Intuitive. Use. Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.
4. Perceptible Information. The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.
5. Tolerance for Error. The design minimizes hazards and the adverse consequences of accidental or unintended actions.
6. Low Physical Effort. The design can be used efficiently and comfortably and with a minimum of fatigue.
7. Size and Space for Approach and Use. Appropriate size and space is provided for approach, reach, manipulation, and use regardless of user's body size, posture, or mobility. (The Center for Universal Design, 1997)

Principles 8 and 9 focus on instructional environments, and derive from the Universal Design for Instruction (UDI) model. They are:

8. A community of learners. The instructional environment promotes interaction and communication among students and between students and faculty.
9. Instructional climate. Instruction is designed to be welcoming and inclusive. High expectations are espoused for all students. (Scott, McGuire and Foley, 2003)

Universal Design approaches encourage the building of flexible learning systems and artefacts that allow for multiple abilities and learning styles, and give learners wider choices in the way they access content. Rather than designing for learning or physical disability, UD is an approach that addresses the access needs of any learner.

3.1 Three Universal Design Models for Education

The three major models that have evolved from the application of UD to educational settings are Universal Design for Learning (UDL), Universal Design in Education (UDE) and Universal Design for Instruction (UDI). Our review of the literature so far reveals that there is a significant amount of overlap between models, and that each offers a different perspective on how to develop accessible content for learners. It has also become obvious that the design field lacks a clear taxonomy of model relationships that maps out shared principles and the specific learning contexts that models can be applied to. The three key UD models are described below.

3.1.1 Universal Design for Learning

Universal Design for Learning appears to be the most ubiquitous of the three principal UD models applied to educational settings. UDL takes the view that meeting the needs of learners first requires an understanding of how the brain represents knowledge and information. The model proposes that knowledge is represented as a series of neurological networks that deal with declarative knowledge ("what"), planning ('how"), and emotional responses to new information ('why"), or as integrated component networks that might involve any or all of the three types of representation. The proponents of UDL (Meyer, Rose & Gordon, 2014) suggest that UD can assist in the creation of accessible and inclusive learning by offering:

- multiple means of representation of learning content;
- opportunities for multiple means of action and expression, and
- multiple means of engaging with knowledge.

3.1.2 Universal Design in Education

"Universal Design in Education" is a model that provides a framework for making changes at the curriculum level in order to provide wider access to learning materials. The model was first described by Bowe (2000: p. 2), who describes its principle aim as maximizing the usability of learning materials. Bowe also asserts that UD design approaches are cheaper to implement than conventional approaches to learning design. Our team believes that this assertion needs to be tested, so we have included costing as a criterion in the evaluation plan for UD implementation. The application of UDE principles at the curriculum level allows accommodation of the learning requirements of a broad range of learners, including students with first languages other than English, students from different ethnic or cultural backgrounds, and students with physical, psychological, or learning disabilities.

3.1.3 Universal Design for Instruction

Universal Design for Instruction (UDI) applies UD principles at the instructional level (Scott, McGuire & Foley, 2003). By taking a holistic approach to learning design, the model promotes communities of learners and inclusive practice, as indicated by its contribution of Universal Design Principles 8 and 9 to the original list of seven.

4 Development of a Program for Implementing UD in Tertiary Education

The UD Implementation team is currently at the early planning stage for the dissemination of a UD program across the institution with the initial goal of encouraging the uptake of UD practices in all new learning materials developed at the university. Our longer-term plan is encourage the use of UD principles as a mainstream practice within the next five years. We will also be instituting a retrospective design program so that existing or legacy programs can be re-designed with UD principles in mind.

A first step in achieving these developmental goals has been to design a program that addresses the equitable access needs of both students and staff on two levels:

1. From a practical and educational point of view we want to clearly explain to key organisational groups how UD principles can be easily applied to educational settings, while introducing staff to the tools, methods and resources that will provide the widest possible access to learning materials for all students and staff. An example of a built-for-purpose tool based on UD principles is MQAS Orange, which is designed to assist teaching staff in the creation of accessible learning units by suggesting strategies that can enhance accessibility and through the provision of a curriculum checklist that acts as a quality control measure when UD is used in the creation of learning materials.
2. From a conceptual point of view we plan to initiate a broadly-based discussion with key stakeholders, educational developers and students that looks at the practicalities of implementing UD as a design practice from pedagogical, economic and equity points of view. The initial framework for the discussion has been the formation of a widely sourced reference group that includes representatives from key groups such as the university Library, the Equity and Diversity unit, Campus Wellbeing, and faculty staff, all of which are directly concerned with inclusive learning practices. We anticipate that input from the reference group will provide the implementation team with highly relevant feedback on key issues involved in implementation of the UD development program from key stakeholder and end-user points of view.

5 Future Challenges

Some of the challenges we will be facing during the UD implementation are already apparent. We are acutely aware, for example, that the program is as much about winning “hearts and minds” as it is about instilling good design practices at our university. To some degree, success will depend on our ability to bring about cultural and attitudinal changes regarding creation of course content and associated activities. While we certainly expect resistance to some of the approaches we want to encourage, we believe that UD practices make such good sense that the majority of academic and professional staff involved in learning design will realise the broad benefits that will result from their adoption at this institution and beyond.

Another challenge we are facing is securing adequate funding for the UD implementation. Our organisational unit has already committed significant in-kind funding by creating two designated Educational Developer positions tasked with developing and delivering the UD implementation plan. Other anticipated program costs include:

- the funding required to develop tools and interfaces for implementing UD, that may involve significant programming and graphic design input;
- transcription, subtitling and captioning costs that will accumulate as we test different approaches to learning design that enhance graphic and video components;
- publishing costs associated with the creation of accessible guides, eBooks and conference proceedings. and
- costs associated with hosting one planned conference, various seminars, and colloquia on universal design practice.

We plan to attract significant grants-based funding that will support the UD implementation over the planned five-year period, supplemented by institutional backing and any locally available support from groups advocating equity in educational access. Our immediate funding challenge is gaining a sufficient level of institutional support for the proposed UD program so that we can proceed along the development path with confidence.
Finally, a critical challenge for the implementation team is to ascertain the existing level of design-based expertise and understanding of UD principles at Macquarie. We need to establish a baseline of current skill-levels in knowledge of UD in order to design a program that will best meet the needs of all staff involved in learning design. Our plan is to conduct a representative survey of staff that will provide qualitative and quantitative data that can be used in the program design process.

6 Conclusion

Universal Design makes good sense as a learning design approach from an intuitive point of view, but any design approach needs to be tested and evaluated before it become truly useful to a learning organisation. We believe the strength in our approach to UD implementation lies in adequate pre-planning that includes wide consultation within the institution, continuous evaluation of the process, and adherence to our long-term aims for the program overall.

True integration of UD principles into learning design at our institution will be achieved when the use of UD is seen as a mainstream practice. Hopefully we will have moved well beyond the need to raise awareness about disability and accessibility to a position where the use of inclusive practices generally are not only accepted but are expected.

We foresee many challenges along the way to achieving this overall program goal, but we also expect to learn unforeseen lessons about how those challenges can be met. Universal Design in learning contexts, by definition, applies to all users, learners or participants in education, so we see ourselves in the role of potential end-users as much as in the role of promoting UD practices at Macquarie University.

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Developing a test for touchscreen usability for blind learners.

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Abstract

One major trend in research and development of ICT learning tools is universal design for learning. Although universal design theory posits that every learner should have equal access to learning, its focus is on general access rather than ease of use for people with particular needs. Many ICT tools for disabled people are targeted to support the needs of learners with specific disabilities, which calls for validated usability evaluation criteria for those tools, reflecting opinions of all the related parties such as learners, parents, teachers, developers and researchers.

The purpose of this study is to develop a usability evaluation tool that specifically considers the characteristics of the difficulties that blind people will face when learning with ICT learning tools in practice. To carry out this task, researchers proposed a framework for analyzing various dimensions representing ICT learning tools. The basis of the framework consists of three dimensions: Interface (screen layout, menu design, etc.), learning (support for various learning tasks, interaction, etc.), and technology (compatibility, error prevention, stability, etc.). Each dimension was categorized into efficiency, efficacy, and satisfaction. Overall, test items were derived for each of the 9 sub categories based on previous usability evaluation tools, and research on software development for the vision disabled as well as educational technology.

The theoretically constructed initial version of the usability evaluation test items was iteratively evaluated and revised through a needs analysis and a Delphi study which were carried out with a group of 9 panels including ICT tool developers, learners, teachers and researchers. The final version was qualitatively and quantitatively validated by a group of field professionals and limited cases of implementations. Implications of the added and deleted items on designing learning tools were discussed along with limitations of the study and future research recommendations.

Keywords

usability evaluation instrument; ICT learning tools; the visually disabled

Using Asynchronous Video to Enhance Engagement with Learning, Assessment and Feedback for Learners Affected by Dyslexia.

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Abstract

While asynchronous text-based approaches dominated much early technology-enhanced learning research into blended learning in higher education, there is broad recognition that text-based learning, assessment and feedback can act as a barrier for learners affected by dyslexia.

This paper presents the findings emerging from practice-based research undertaken in the Computing department of a north of England HEI which has explored the potential for asynchronous video to facilitate greater inclusivity for learners affected by dyslexia. The research saw the introduction of both instructional tutorial videos and formative video-feedback situated within a dialogic framework, and the substitution of documentation tasks with video-enhanced assessment activities. Illustrative cases highlight the influence of these video-based interventions on the experience of three participants affected by dyslexia, and the research concludes that an integrated model of asynchronous video-enhancement can afford greater inclusivity for students affected by dyslexia through the promotion of engagement with learning, assessment and feedback.

Keywords

video, dyslexia, blended learning, engagement, higher education

1. Background and Context

Dyslexia is a ‘learning difficulty’, frequently referred to as a specific learning difficulty (SpLD), which affects ‘phonological awareness, verbal memory and verbal processing speed’, and which ‘primarily affects the skills involved in accurate and fluent word reading and spelling’ (British Dyslexia Association, 2014a). It may also ‘co-occur’ with ‘aspects of language, motor co-ordination, mental calculation, concentration and personal organisation’ (British Dyslexia Association, 2014a). Importantly, particularly in a pedagogical context, it occurs across the ‘ability range’ and ‘mainly affects the development of literacy and language related skills’ (British Dyslexia Association, 2014a). A further complexity is that dyslexia is said to be ‘unique’ to an ‘individual’ in that it can vary in degree, ‘from person to person’ and even from ‘day-to-day’ in those individuals having the condition (Lockley, 2001).

According to the British Dyslexia Association, ten per cent of the British population is dyslexic with four per cent ‘severely so’ (British Dyslexia Association, 2014b) while two studies have suggested that a ‘genetic predisposition to dyslexia may be present in 15.5%

of the population' (Malpas, 2012, p.6). In higher education, figures for entrants into British universities indicate that nearly 4.70 per cent of new students starting the 2012-2013 academic year declared a specific learning difficulty, representing just under half of those declaring a disability (HESA, 2014). There is also a complication resulting from the fact that many students do not declare a specific learning difficulty or this remains undiagnosed for some time after entry. A study from 1999 suggested that only 57 per cent of students with the condition are known 'on entry' into higher education (Haslum & Kiziewicz, 2007, p.8) with others declaring or being diagnosed after entry, or remaining undiagnosed or undeclared for the duration of their studies. This tends to suggest that the percentage of students in the British higher education system with dyslexia is nearer or perhaps greater than ten per cent of all students and is more closely aligned to the putative occurrence of dyslexia in the general population.

Students with dyslexia in higher education clearly face challenges in learning and studying. A study conducted across 17 UK universities suggested that challenges had already manifested themselves amongst students with dyslexia while in 'primary' and 'secondary' education, with some specific tasks representing an increased challenge at university, such as 'time keeping'; 'note taking' ;'organisation' ''organising essays' and 'expressing ideas in writing' (Mortimore & Crozier, 2006, p.243). These do not appear to significantly differ between types of institutions such as traditional universities and the post-1992 former polytechnics (Mortimore & Crozier, 2010, p.247), albeit that 'expressing ideas in writing', 'concentration', 'spelling' and 'note taking' present more of a challenge to students with dyslexia in post-1992 universities. As Mortimore and Crozier note, there is more to dyslexia than an issue with 'reading and spelling' (Mortimore and Crozier, 2010,p.250), as this affects 'a wide range of study skills and learning tasks'(Mortimore & Crozier, 2010, p,250), although it is with writing and what might be called 'associated skills', which students with dyslexia struggle most at university.

While there is evidence of the challenges faced by students with dyslexia, it also clear that there is a shortfall of achievement by this these students. In terms of academic performance, a study by Richardson & Wydell (2003) found that while students with dyslexia are at increased risk of withdrawing from their course or not completing it (Richardson & Wydell, 2003, pp.499-500), they are able to perform as well as students with a learning disability if they are 'appropriately supported' (Richardson & Wydell, 2003, p.500). As Richardson and Wydell note:

"dyslexia is by no means incompatible with a successful outcome in higher education, given an appropriate level of commitment on the part of the students and an appropriate level of resources on the part of their institution."
(Richardson & Wydell, 2003, p.500)

This has fundamental implications for universities and for the academic and support staff who work with students with dyslexia. The issue for academic staff becomes one of how they are able to effect appropriate solutions to ensure that the academic success of students with dyslexia is maximised. One way that this can be achieved is by seeking to work with media other than text and to create opportunities for student interaction through a multiplicity of mediums. The use of multi-media interventions is most apposite as there are indications that students with dyslexia might be stronger with visual material and respond better to 'multi-sensory learning techniques' (Ott, 1999, pp.289-290). A study by Beacham and Alty (2006) concluded that the use of 'different combinations of media' are linked to 'learning performance' and that 'significant differences in understanding' and 'differences between dyslexic and non-dyslexic students' result (Beacham & Alty, 2006, pp.87-88).

Adopting effective solutions for students with dyslexia need not be either challenging or onerous for academic staff. In fact, most only involve 'matters of good teaching practice' (Swain, 2008) which might benefit all students not exclusive to those with learning disabilities based around the notion that students have different 'learning styles' and will respond appropriately to different medium (Swain, 2008). Similarly, in this context dyslexia practitioners express a desire for student interactions through a variety of mediums including 'Videos, podcasts, talking books' (Swain, 2008). This desire is also matched by students with dyslexia. As Fuller, Bradley & Healey (2004) discovered, students with disabilities 'made a conscious choice about their course of study on the basis of what types of assessment they perceived would be used in that course' (Fuller et al, 2004, p.462). Further, it was also found that 'students made informed choices about the individual modules they would study, based on the published form of assessment' (Fuller et al, 2004, p.462).These findings highlight the 'importance of negotiating an alternative form of assessment which is appropriate to individual students' (Fuller et al, 2004, p.463). By the same token, the principles attaching to assessment for students with disabilities can also be applied to feedback based on a demand for diversity in modes of feedback other than text made available to students where 'mistakes' can be identified, explained and acted upon by the student (Fuller et al, 2004, p.464). Indeed, the concept of diversity in assessment and feedback should be central to the management of the curriculum for students with dyslexia for academic and support staff in higher education.

The notion that students 'should be provided with a variety of assessment methods' and 'should be given a choice of format for feedback' (National Union of Students, 2014) is now a generally accepted principle in higher education for all students irrespective of disability and there is a growing expectation from students that alternative assessment methods and choice of feedback will be implemented by higher education institutions (National Union of Students, 2014). Although practice varies between institutions it is at least evident that a dialogue about alternative forms of assessment and feedback for students with learning disabilities is taking place and it is interesting to note that a number of British universities are currently encouraging academic staff to discuss alternative possibilities for their students (e.g. Edinburgh Napier University, 2014).

Rather than seeking to identify viable alternatives to text, early studies tended to explore how technology might be leveraged to improve the accessibility of text for learners affected by dyslexia, such as work examining the impact of screen-reader and spellchecking technologies (e.g. Raskind & Higgins, 1998; Engstrom, 2005), while later studies began to examine how text-only, text-plus-audio and text-plus-graphic formats (Beacham & Alty, 2006) might affect information retention. Despite their continued focus on what might be described as 'text-plus' approaches, Beacham and Alty proposed that problems for dyslexic students caused by issues connected with working memory might be explored against the backdrop of a theoretical framework including Dual Coding Theory (Paivio, 1990) and the Cognitive Theory of Multimedia Learning (Mayer, 2001).

Paivio's (1990) Dual Coding Theory is underpinned by the assumption that working memory is subject to finite capacity, and that two distinct channels process information received as visual and audio form. These channels can be overloaded where a high volume of visual or audio information requires processing, but as textual information can be presented in both written (processed by the visual channel) and spoken (processed by the audio channel) forms, there is an opportunity to remove barriers for dyslexic students associated with printed text by presenting words as audio rather than as visual information. This is taken further in Mayer's (2001) Cognitive Theory of Multimedia Learning, which provides key principles of direct relevance for learners affected by dyslexia, and informing the presentation of information using video explored in this study: "students learner better from animation and narration than from animation and on-screen text", and also "when words in a multimedia message are presented as spoken text rather than printed text" (Mayer, 2001, p. 134).

While it is has been recognised that an audio-only approach might yield benefits for dyslexic students (e.g. Rotherham, 2009), the processing of audio-only information is necessarily restricted to the auditory channel, and misses the opportunity to take advantage of dual channel processing. By contrast, audio-enabled video provides a vehicle through which to present two streams of information which can be processed by both the auditory and visual channels, thereby leading to the formation and consolidation of stronger mental representations of learning materials requiring visual presentation. Notably, specific research into the use of video as a tool to support this learner group in the learning, assessment and feedback process appears absent from the literature, inviting exploration.

2. Design and Implementation of the Intervention

Employing a design-based research methodology, three specific interventions were designed to integrate asynchronous forms of video into learning, feedback and assessment for undergraduate students studying computer games design and programming: video-enhanced learning was facilitated through the production of instructional tutorial videos (ITVs); the introduction of video-enhanced feedback (VEF) sought to encourage learners to engage in dialogue around feedback using screencasting techniques deployed within a conversational framework (Laurillard, 2002); the introduction of a video-enhanced assessment (VEA) strategy (using similar techniques to those used to produce video-enhanced feedback) enabled students to produce video-based reflective, summative self-assessment of the development of key skills during the first design-based research cycle, while the production of regular video diary entries to document the development of practical work evolved in the subsequent cycle.

Following an initial trial of video-enhanced assessment in the form of a summative, self-assessment exercise, early positive feedback led to the design of a subsequent intervention that enabled learners to engage in more frequent use of video through the substitution of textual documentation with regular video diary entries documenting their development work. This evolution of the approach afforded closer integration of the three video-based activities, as the week-by-week series of ITVs provided a clear focus for the weekly activities on which students reported their progress, an on which they received weekly formative video-feedback.

3. Discussion of Findings

As an investigation that aimed to improve engagement with learning, assessment and feedback of students affected by dyslexia, sources of data used to evaluate the effectiveness of the intervention included both qualitative and quantitative data. Qualitative data was collected through a combination of semi-structured and dialogic interviews with students (Knight & Saunders, 1999; Denzin, 2001), while academic performance informed a process of data triangulation through analysis of participants' summative results. The findings are presented through three illustrative cases that highlight the impact of asynchronous video on three students whose dyslexia ranged from mild to severe; all names used here are pseudonyms.

3.1 Illustrative Case 1: Robert

'Robert', a 21 year-old male student from a BTEC background, found that his dyslexia left him struggling to achieve his potential in secondary education, but when the opportunity arose to engage in dialogue using video he researched cost-free options that he shared with his classmates. Robert went on to negotiate the use of video as a medium for assessment in other modules, and later gained a Second Class Honours degree.

Quotes from Robert:
On VEA: "... better for me. It's much easier to explain what you've done, and better than using screenshots ... a much easier way of documenting your work."

On VEF: "... more relaxing - you know exactly what's going on, and you can re-play it to double-check you're sorting out everything you need to."

3.2 Illustrative Case 2: Keith

'Keith', a 19 year-old male student from an A-level Mathematics and ICT background, produced a competition-winning video in which he reflected on the development of skills over the course of an academic year, interlinking demonstrations of his game development work with a screencast which highlighted his use of the course e-portfolio system. Keith went to achieve a First Class Honours degree.

Quotes from Keith:
On VEF: "… absolutely amazing to get feedback like that - a lot more detailed than what I'm used to. Seems to work really well because of the detail. Very difficult to get that if just text."

On VEA: "A lot easier, felt more dynamic and exciting - using Camtasia was also fun as I was learning how to use that as well ... Made me think about how I'd done things, had to plan out what I was going to say; good to go back and look at how my work's progressed."

3.3 Illustrative Case 3: Neil

The impact of dyslexia on 'Neil', a 19 year-old male student from a BTEC Art and Design background, was particularly severe, and he too had struggled to achieve his potential in secondary education. In the first year of his undergraduate studies, Neil leapt at the opportunity to engage in dialogue around feedback on his work, later reporting the 'massive improvement' for him of being allowed to use video to document his work. Neil graduated with a Second Class Honours degree.

Quotes from Neil:
On VEF: "I liked getting feedback in that format. I wouldn't have understood if it was a PDF, even with circles around the errors I still wouldn't get it. Because you showed exactly where the error was, while explaining it, I knew where to go."

On VEA: “If I had to write up my progress, I'd spend a week writing what I'd done the previous week. Pointless. Video is a massive improvement, and video blogs means you're more likely to do it on a weekly basis; with text version, you’re tempted to do it at the end.”

On the Impact of Video: “… there’s no way I would have passed this module without video. I would have failed programming for sure, and it would have taken weeks to explain my work if I’d had to do it as text.”

4. Conclusions

This paper has outlined the problems faced by university students affected by dyslexia, presenting a case for the exploration of alternatives to the traditional text-based paradigm, and highlighting opportunities for the adoption of asynchronous video-based approaches in learning, assessment and feedback. The findings emerging from a series of case studies saw students’ self-reporting benefits in both engagement and the attainment of final outcomes that they attributed directly to opportunities to use video as the primary medium for engagement.

Video-enhanced learning, feedback and assessment made a significant positive impact on the experience of students affected by dyslexia, levelling the playing field for students to compete with peers, and to become more self-aware and autonomous as learners. In separate work, video-enhanced techniques have been found to be transferable to areas outside the Computing discipline, and the processes and techniques are readily adaptable for use with smartphones and tablets, thereby enabling learners to benefit from opportunities offered by mobile learning. While video-enhanced assessment and feedback has been found to be optimised within models of assessment for learning which employ high frequency formative feedback, its use can also afford efficiencies in academic administrative processes including internal moderation and external examination of students’ work.

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Bring Your Own Accessibility.

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Abstract

The growing Bring Your Own Device agenda and the general rise of tablet usage in education have a significant impact on those with additional support needs. To ensure these devices do not present a barrier to users, the accessibility of the tablets should be taken into account by institutions and staff who may be supporting students.

The main tablet operating systems have accessibility settings built-in which assist access for individuals with physical and cognitive impairments.

An overview is given of the accessibility options provided on the main tablet operating systems – iOS, Android and Windows 8. These include options to support visually impaired and blind users, those with literacy difficulties and users with physical disabilities.
Also discussed are the advantages and disadvantages of the various hardware formats available for each of the main tablet operating systems. For example the advantages given by an operating system may be countered by it only being available on certain hardware platforms.

Keywords

Accessibility, tablet computing, tablets, assistive technology, AT, iOS, iPad, Android, Windows

1. Introduction

Apple, who were the forerunner in producing a tablet computer which appealed to the mass market, has also long been the leader in tablet accessibility. Many of the tools were developed to allow access to the iPhone and have proved just as useful in a larger format. Apple have continued to develop these tools with each new release of the iOS operating system and have seemed to respond to uses of the iPad by users with limited physical dexterity and learning difficulties.

Android, the tablet operating system developed by Google has improved its accessibility with every version. It still lags behind iOS and the accessibility seems to be tailored more to visually impaired and blind users, rather than a wider constituency of users with additional support needs.

Windows 8 is the newest of the three main tablet operating systems. Windows 8 is designed to work on tablets and desktop PCs. In the first version of Windows 8, the accessibility options for tablets were mostly the desktop options, with a few accessibility settings available in the tablet interface. However in Windows 8.1 the Ease of Access Centre has been redesigned so that the settings are more configurable when in the tablet interface.

The accessibility settings of each of the three systems are described individually below, this is not an exhaustive guide to how the options work, but rather an overview of settings available. These are followed by a summary of other factors which may influence tablet purchasing decisions.

2. Accessibility Settings on iOS (Apple)

The settings are described for iOS 7, released in September 2013.

2.1 Vision

VoiceOver is a screenreader which uses the technology developed for the Apple Mac operating system, but with some redesign so that it suits the tablet format. Any text on the screen can be read aloud, any menu item or icon which has text associated with it (e.g. app icons on the home screen) is also voiced. Navigation is achieved by dragging a finger around the screen whereupon VoiceOver will read out any item under the user's finger. Alternatively a swipe left or right will cycle through any objects on the screen. A double tap will select the item. To scroll, two fingers must be used.
The Rotor tool gives control over the VoiceOver settings without having to navigate to the Settings application every time a change is required.

Zoom enables the entire screen to be magnified to a level suitable for the user. The zoom level can be adjusted as and when needed by using a three finger tap double-tap and drag. The zoom feature is noticeably improved when using the iPad 3 or above as these have the "Retina" screen which has a much higher resolution than previous models. This difference is critical when zooming in.
Instead of zooming the entire screen a zom window cna be moved around the screen.

Invert Colours changes the standard white background to black. Text shows as white, with other colours showing as a high contrast version e.g. blue shows as orange, green as pink. If this is not suitable then Grayscale Screen can be selected.

Speak selection is not only a useful tool for users with a visual impairment it works well for users with literacy difficulties. Once text (e.g. in a document) has been highlighted an option to "Speak" appears, touching this will voice the selected text.

Larger Type provides a choice of type size preferences. In addition to this Bold Text can increase the legibility of all text on the iPad.

2.2 Hearing

Subtitles & Captioning can be selected, but this is obviously dependent on whether captions are available on any media.

Mono Audio can be an advantage for anyone with unilateral hearing loss as stereo sound can all be placed in the left or right channel.

2.3 Guided Access

Designed as a response to iPad use in Special Education and by younger users, Guided Access locks the iPad into a single app. It can also block off various areas of the screen so that for example adverts cannot be clicked on or a user cannot access a back button. The home button, sleep/wake button and volume controls can also be disabled.

Time limits on how long a user is locked into an app can be set.

2.4 Assistive Touch
Many apps on the iPad can require gestures which require finger and hand dexterity e.g. pinch to zoom, tapping with multiple fingers, shaking the device. Assistive touch places a button on the screen via which the user can select one of these gestures and then activate it with one finger. It also allows control of the hardware buttons in case they are inaccessible to the user.

2.5 Switch Control
Switch control has previously been available in iOS by switch interface manufacturers exploiting the swipe feature available in VoiceOver. This was always less than satisfactory as the speech output and other settings were not as controllable as switch users might require, or may have been accustomed to. With the release of iOS7, Apple built switch access into the device, meaning that any app should be controllable via single switch or two switch scanning. Visual settings, scanning speed and other typical switch scanning options are all adjustable.

2.6 Keyboard
The onscreen keyboard can be used as a standard QWERTY layout, or split so that it can be accessed with two thumbs while holding the iPad in two hands. Speech input can also be used by tapping the microphone icon. Speech input requires an internet connection as the speech to text processing is performed on Apple's servers. Handwriting input is available which may be faster than using Voiceover with the standard keyboard.

The latest version of iOS (iOS8) includes word prediction, to cut down on key presses and support for third-party keyboards, so users can choose keyboards such as Swype or Fleksy which may better meet their needs.

2.7 Reading
When text has been highlighted an option will allow that text to be read to the user. This is not on by default though and must be enabled through General> Accessibility> Speak Selection. A new feature in iOS8 is Speak Screen which will read through all the text currently on the screen.

3. Accessibility Settings on Android
The settings are described for Android 4.3 (AKA Jelly Bean) Some

3.1 Vision
Talkback is Android's screenreader for blind or visually impaired users. As with iOS it voices any element under the user's finger, which they then double-tap to select. A left or right swipe will cycle through all elements on the screen. Scrolling is achieved with two fingers.
In addition Talkback incorporates a range of gestures with which actions can be activated e.g. swipe up and left to go to home screen, swipe down then left for the back button.

Magnification Gestures enables the user to zoom in by triple tapping the screen. The zoom level is adjusted by pinching the screen and the user moves around the screen by dragging with two fingers. A temporary zoom can be achieved by triple tapping and holding anywhere on the screen. Once the finger is lifted the screen returns to normal.

In the accessibility options, text size can be selected from Normal or Large text. A more nuanced control of text size can be achieved in Settings> Display where four sizes can be chosen from – Small, Normal, Large, Huge.

3.2 Keyboard

The Android on-screen keyboard can be accessed by a standard method, or by gesture typing; dragging across letters to form the words. Even the spacebar can be incorporated, meaning that a user could type a whole sentence without needing to lift their finger from the screen.

Voice input can be used by tapping the microphone icon on the keyboard. This requires an internet connection as it accesses Google's servers to provide the speech to text conversion.

3.3 Log-in

A log in to Android can be achieved by the standard 4 digit code, or by a pattern which may be more memorable for some users. Another method is Face Unlock which uses the forward facing camera to recognise a user's face. This is not the most reliable method as it depends on lighting and positioning being similar to when the original image was taken.

4. Accessibility Settings on Windows 8

The settings are described for Windows 8.1 released in October 2013. As noted previously Windows 8 has been designed to function on desktop and touchscreen devices. The settings detailed here are in the Ease of Access Centre on the tablet interface (also known as Tiles or Metro).

4.1 Vision

Narrator is a screen reader, designed to give access to Blind or Visually Impaired users. Any text or element moon the screen can be read aloud. Basic navigation is identical to iOS: dragging a finger around the screen will cause any element under the finger to be voiced. Double tap will select the most recent item voiced. A swipe left or right will cycle through all elements on the screen. Two fingers must be used to scroll.
There is no control tool similar to Rotor in iOS, to make any changes the user must return to the Ease of Access Centre.

Magnifier has been available for many past iterations of the Windows operating system. This version though has been optimised for table use. When you turn Magnifier on + and – symbols appear in the corners of the screen to control the level of zoom. To move around the magnified screen the user must drag from the 'tramlines' at the edge of the screen. This gives the ability to scroll (e.g. in menus) in the central section.
The invert colours setting is also under the Magnifier option, providing one high contrast option.

High contrast enables the user to choose from a range of four pre-set visual themes. Individual elements of these themes – colours for text, selected text, background etc. can then be modified to suit the user's requirements.

Keyboard and Mouse

Settings are available for changing the accessibility of keyboards and mice when plugged into a Windows 8 device; these are described further in Section 5.
The on screen keyboard for Windows 8 has configuration options which may make it more accessible. It can be used as a standard on-screen QWERTY layout, or split so that it is easier to access by typing with thumbs when holding a tablet in two hands. Alternatively handwriting recognition can be used with a finger or stylus.

5. Form Factor and Connectivity as Accessibility Influencers

5.1 Form Factor

One major accessibility consideration for tablet device use is that of size and weight. Some users may prefer to hold in one hand, others two. Some may wish to place their device on a table or wheelchair tray. Choice of device size is dependent on which operating system is running it. iOS only runs on Apple devices, therefore the user only has the choice between an iPad, an iPad mini or an iPod touch/iPhone. Android is installed by a multitude of hardware manufacturers and this has led to a much wider range of device sizes being available from a watch right up to an interactive table. This gives a much wider choice of hardware. Windows 8 is currently mostly available on 10" widescreen tablets. However some 7" tablets are starting to appear and as Windows 8 can be utilised by any hardware manufacturer there should in future be a wider range of size options.

5.2 Connectivity

The design of a tablet is that it is a standalone, portable device. However for accessibility reasons many users may wish to connect external keyboards, mice and other control peripherals. With Windows 8 this is straightforward and most Windows devices have a standard USB port. If not they will have a mini-USB port which can be adapted. Once connected the mouse and keyboard settings can be adjusted to suit the user – speed, pointer size, key repeat, sticky keys etc. As it is Windows and other pointing device will function – head pointer or eye-gaze for example.
For Android most USB keyboards and mice can be plugged in and Android will recognise them. The mouse pointer size cannot be adjusted, but the speed of the pointer can. Bluetooth mice and keyboards can also be connected.
iOS has not been designed to connect hardware with wires. The Camera Connection Kit has a USB socket which will accept some keyboards, but generally a Bluetooth keyboard is more reliable. iOS is not designed to work with a mouse and has no pointer to display.

6. Other Factors Which May Influence Tablet device Choice

6.1 Freedom

Many educational institutions are implementing a Bring Your Own Device strategy. This means the institution has no influence of which operating system a user will choose. Therefore the most accessible device for that user will not necessarily be what they arrive with.

6.2 Fashion

Fashion and peer pressure can be a far more powerful driving force than accessibility.

6.3 Finance
Many users may not be able to afford the device which most suits their needs. A Kindle Fire is an Android tablet which costs just over £100. However the accessibility options on the Kindle Fire are much more limited than those described above as Amazon (the manufacturer) have provided a bespoke version of Android which does not contain all the features. A full sized iPad may be the ideal size for a user, but costs around £400. An iPad mini costs about £250.

7. Conclusion
It would be straightforward and uncontroversial to state that, based on the evidence above, iOS is the most accessible operating system. It certainly has many more accessibility options and goes beyond the basics of access for people with visual or physical impairment. However, as noted above, software is not the only factor and hardware and connectivity should also be taken into account when assessing suitability.

Even when only examining the operating system, it may be certain features steer a user away from iOS. For example the High contrast settings in Windows 8 are a far more configurable than in either of the other two systems. Also (in the author's opinion) the Magnification tool in Windows 8 is far more intuitive to use than Zoom in iOS.

Another key advantage iOS has is that (apart from iPad 1 and early iPod Touch) all Apple tablets can be updated to the latest operating system as soon as it is released. The same is true of Windows 8 devices, as the updates are controlled by Microsoft.

The disadvantage of multiple manufacturers of Android devices is that the version of the operating system on a device is decided by the hardware manufacturer. This is known as fragmentation. A manufacturer may (and often does) refuse to update Android on a particular model of tablet, leaving that user without accessibility updates which may be in the latest version.

The tablet computer adds a great deal to the area of accessible computing, mainly due to touchscreen access and portability. As one person's accessibility tool, can be another person's barrier it is hoped that consideration is given to the operating system and tablet hardware which most suits the user. It is also hoped that other options – for example a laptop computer - are not discarded if they prove to be more suitable than the dominant technology in an institution.

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iOS Accessibility Guide https://www.apple.com/uk/accessibility/ios/.

Android Accessibility Guide https://www.google.co.uk/accessibility/products/.

Windows 8 Accessibility Guide http://www.microsoft.com/enable/products/windows8/.

Using In-Folio in Supported Learning Programmes.

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Keywords
e-Portfolios, inclusion, empowerment, learner voice.

Abstract
e-Portfolio tools offer an online personal space or repository of digital items combined with a means of presenting selected items to others (Jisc 2012). They have been described as a set of resources and tools owned by the student. These tools can be of particular benefit for learners who need to maintain a record of their learning over a period of time, and within a varying number of institutions. In some instances however, 'mainstream' e-Portfolio platforms are difficult for some learners to use. Stefano et al. (2007) highlighted the fact that e-Portfolios cannot serve their intended purpose if students require a high level of support every time they need to access/modify their e-Portfolios.

In a bid to address these issues, staff from various Independent Specialist Colleges in collaboration with The Rix Centre and Jisc Techdis created In-Folio in 2008. This e-Portfolio system was designed to support students with learning disabilities. This bespoke application allows learners to record material in a range of formats (mp3, video and text) and to demonstrate their skills, knowledge and achievements in a more multi-sensory way.

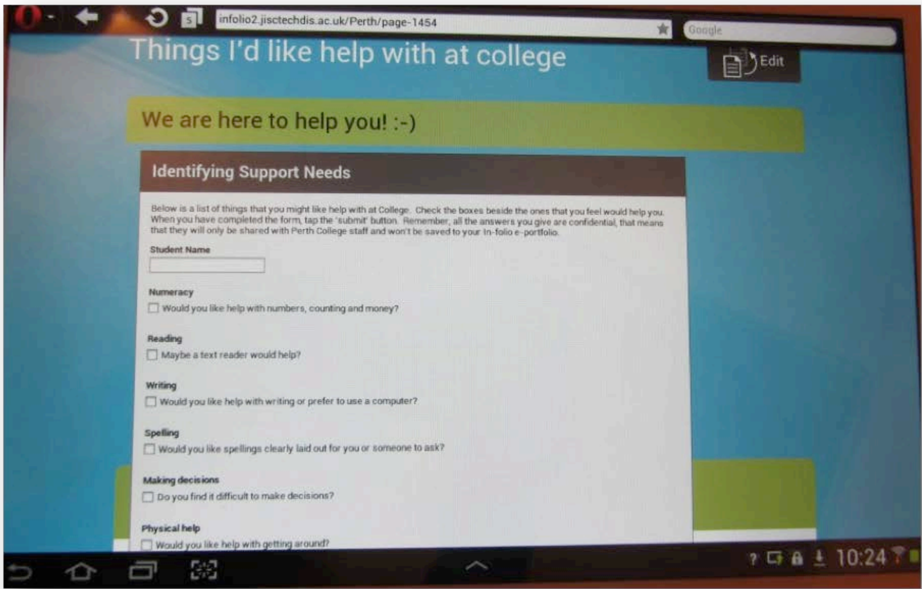

Figure 3: Using In-Folio to provide information about the College

Since academic year 2011 Jisc RSC Scotland have worked with Further Education colleges across Scotland to develop their use of In-Folio. Following an initial ‘proof of concept’ trial, a number of Scottish Further Education (FE) colleges decided to use In-Folio within their supported learning programmes. Jisc Techdis helped create accounts for staff and students, and together with Jisc RSC Scotland they delivered discrete training for staff who would be implementing the use of In-Folio with learners. In addition, RSC Scotland provided a team teaching model of support within the lecture room environment to assist staff in introducing In-Folio to their learners for the first time.

In-Folio was used in a number of unique ways in each college:

- To record learner progress on an Expressive Arts course,
- To support learners record achievement on a Moving to Independence course,
- To document learners journey on a Skill Start course,
- To add value to a New Skills Link school transition course,
- To provide evidence for validation as part of a Life Skills City and Guilds Course.

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Recording Student Progress on an Expressive Arts Course at New College Lanarkshire (Cumbernauld College): http://tiny.cc/NCL-infolio.

Scottish FE Colleges In-Folio Trail: http://tiny.cc/ScottishInFolioTrial.

Using Tablet Devices and Accessible e-Portfolios to Support Successful Transition at Perth (UHI) College: http://tiny.cc/Tablet-Perth.

Keynote: Accessible learning – the new vegetarian

Alistair McNaught (Jisc TechDis, UK)

Accessibility is, fundamentally, about culture change. Only by changing the way people think can you hope to change the way they act. In this presentation some of the key ingredients required for culture change in education are explored by comparing them with the cultural changes that have taken place in the food industry since the presenter decided to become a vegetarian (at the tender age of seven). The presentation explores the power of innocent questions, the significance of labelling, the need for creativity and compromise, the importance of stating your case and the dynamism of swapped ideas in a community of practice. The session includes practical pointers to improving your own practice and inspiring a curiosity driven approach to accessibility.

How technology links to learning: enhancing technology teacher education to support adults with learning difficulties.

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Abstract
The aim of this article is to describe how learning technology is demonstrated to support adults with learning difficulties in a technology teacher education programme in Finland. Technology teachers are usually teaching in the upper stage of comprehensive school but they often are teaching also in adult education. The outcomes of the teacher training are collected using the 'Digital Portfolio Constructional Circle' (DPCC) model. The student teachers can use the portfolio for documenting and developing his or her main study processes for their future teaching. These study processes develop the students' competencies to teach technology skills to adults with learning difficulties. The DPCC model comprises four phases: orientation, visioning, checking and presentation.

Currently knowledge of the support of learning difficulties in student teachers is developed through separate study of special education and knowledge of technologies. The way the student teachers are taught about technologies focuses on product planning and manufacturing rather than their use in learning support. Hence special education and technology have been quite separate study modules in terms of the ICT learning content in teacher education programmes. This comprises the first 'orientation' phase of the DPCC model i.e. how the content is presented most appropriately to enable the student teachers to learn about supporting adults with learning difficulties.

To investigate this problem the main learning concepts of three study modules (Metsärinne 2003) are explored using the TPCK Model (Technological Pedagogical Content Knowledge (Koehler & Mishra 2008). Secondly these learning concepts of the three modules using the TPCK Model are developed by using digital portfolios to enhance creative thinking (Barak & Doppelt 2000). Thirdly the conceptual layout of portfolio system processing checkpoints is introduced (Luesher & Sinn 2003). The students’ actual portfolio is the fourth phase (presentation) at the end of the studies for lifelong learning and the teacher training.

The DPCC model and its four constituent phases demonstrate one way to develop student teachers' technology education for teaching adults with learning difficulties, and to help the student teachers understand how to enhance their knowledge management and knowledge production.

Keywords
Technology teacher education, learning difficulties, technology pedagogy content knowledge, digital portfolio

Adaptive eLearning and Learners with Special Needs.

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Abstract
It has long been recognised that, by matching educational approaches to individual requirements, learning outcomes can be improved. Traditionally, learning style was measured using questionnaires (paper-based or online) which had to be completed before learning commenced. The results were then used to tailor features of learning delivery. In recent years, a number of systems have been developed that determine certain aspects of learning style automatically, removing the need for prior completion of questionnaires, and then adapt delivery of learning materials to suit.
A number of studies have shown links between certain learning disabilities and learning style. This raises the possibility of developing learning systems that can adapt to the needs of those with learning disabilities. In this paper we review previous work on learning style, and its application to users with special needs. We then describe a study involving ten learners, five mainstream and five with special needs, in which the learning style of each subject was assessed both manually and automatically (based on gaze-path analysis). A Brain-Computer Interface (BCI) was used to assess applied effort, etc., during both processes. Finally, we consider the implications of our findings and discuss possible future work in this field.

Keywords
Learning Styles, Adaptive eLearning, Learners with Special Needs

1. Introduction
Individuals vary in many respects, including the way they learn. Research shows that, depending upon their learning styles, individuals are influenced in different ways and to varying degrees by factors such as:

- Presentation modality – whether learning material is presented visually or verbally, and if visually, whether in 2D or 3D.
- Ordering and structure of material - some people learn better when given a 'top-down' presentation, in which they receive an overview first, then progressively greater levels of detail; others learn best when given a 'bottom-up' presentation, in which the details are presented first and gradually assembled to form the whole.
- The perceived opinions of teachers and peers - some learners place great store on the opinions of others, and may be discouraged if they feel that teachers and/or peers have a negative view of their progress; others are little influenced by the opinions of others.
- Time pressure / competitive pressure - some learners perform better when under pressure of time or competition, but others are negatively affected by these factors.

- Testing: some people perform less well in written tests than in other forms of assessment.

Some learning-style models use a large number of scales. For example, Dunn & Dunn's model (1974) has 24 elements, each having a number of possible values, giving over 40,000 possible combinations. Other models seek to categorise users into a smaller number of types. While this necessarily offers coarser assessment, it is much easier to use in designing a learning programme or tool.

2.The Felder-Silverman Model

2.1 The Felder-Silverman Learner-Style Model (FSLSM)

The FSLSM (Felder & Silverman, 1988) is widely used for inferring learner characteristics in the area of adaptive eLearning. For example, the model is used in the CS383 System (Carver, Howard and Lane 1999) and by Graf and Kinshuk (2006) in their adaptive LMS system.
The FSLSM was developed to help instructors in the field of engineering identify the most effective way to deliver educational content. It is designed to capture the most significant learning-style differences among students to enable the delivery of content in a manner that suits each individual. Felder and Silverman's work was based on the belief that the matching of a student's learning-style with the teaching style of their professor would lead to better learning-outcomes for students. Where a mismatch occurs, Felder & Spurlin (2005) suggest that students are likely to lose interest, leading to an inferior educational outcome.

Dimension	Learning-Style	Description
Active/Reflective	*Active*	Learn by doing
	Reflective	Think about information before using it
Sensitive/Intuitive	*Sensitive*	Learn facts
	Intuitive	Discover possibilities / relationships from data
Global/Sequential	*Global*	Learn in large leaps and bounds
	Sequential	Learn in incremental steps of complexity
Visual/Verbal	*Visual*	Learn through images and diagrams
	Verbal	Learn from text and spoken explanations

Table 1. FSLSM Dimensions

The current version of the FSLSM has four dimensions yielding 16 learning-styles. The dimensions are: Active / Reflective, Sensing / Intuitive, Visual / Verbal, and Sequential / Global. These dimensions are intended to reflect the ways in which students process, perceive, understand and stress inputs. "Learners are characterised by values on the four dimensions. These dimensions are based on major dimensions in the field of learning-styles and can be viewed independently from each other" (Graf et.al., 2007). Students may show balance within a particular dimension, having no tendency toward either end of the scale, or they may display a moderate or strong tendency towards one end of the scale.

To enable teachers to reach all students in a single session, Felder & Silverman also propose a teaching model for use in parallel with the learning-style model. The model aims to classify instructional methods according to their corresponding learning-style.

2.2. The Felder-Solomon Index of Learning Style Questionnaire (FSILS)

The Felder-Solomon Index of Learning Styles (Felder & Solomon, 1994) is the instrument used to measure the learning-style of an individual user in relation to the FSLSM. It was originally published in 1991 and updated in 1994 after further analysis based on responses. The online version became available for use as a non-commercial instrument in 1997 (Felder & Spurlin, 2005).

The online FSILS questionnaire contains 44 questions which rate a student on each of the four dimensions of the FSLSM. A total of 11 questions are posed for each dimension. Each question offers two potential answers to the user. For example, each question is answered either with a value +1 (where answer ‘A’ is selected by the user) or -1 (where answer ‘B’ is selected). These values are totalled in respect of the dimension score. Preferences are expressed for students as between values +11 and -11 to indicate the total score achieved on either side of the dimension scale.

- A learner placed between a score of 1 and 3 on a single dimension of the results screen is deemed to be balanced on that particular dimension.
- A learner placed between 5 and 7 on one side of a dimension will be deemed to have a moderate leaning in favour of the relevant side of that dimension scale.
- A learner placed between 9 and 11 on a dimension scale will be deemed to have a high leaning toward the relevant side of the dimension scale.

```
ACT                      X                                 REF
      11   9    7    5   3    1    1    3    5    7    9   11
                             <--  -->

SEN                                X                       INT
      11   9    7    5   3    1    1    3    5    7    9   11
                             <--  -->

VIS             X                                          VRB
      11   9    7    5   3    1    1    3    5    7    9   11
                             <--  -->

SEQ        X                                               GLO
      11   9    7    5   3    1    1    3    5    7    9   11
                             <--  -->
```

Figure 1 Example of results from an FSILS questionnaire

A sample results screen from the online questionnaire is shown in Figure 1
The learner whose questionnaire result is presented is balanced on the Active / Reflective dimension with a score of +3. This balanced score implies that the learner is equally Active and Reflective, and does not show a leaning toward one extreme of the scale over the other. He is also balanced on the Sensitive / Intuitive dimension with a score of +1. The student is moderately Visual on the Visual / Verbal dimension with a score of +7. The student shown is highly Sequential, scoring +9 on the Sequential side of the Global / Sequential dimension scale.

The FSILS is currently the only validated instrument for the FSLSM (Graf and Kinshuk 2006). The validity and reliability of the FSILS has been tested by Felder and Spurlin (2005), Seery et al (2003), Livesay et al (2002) and Zywno (2003). Four different measures including test-retest, internal consistency, inter- scale reliability and construct validity were examined across a number of studies, and the results demonstrated the validity and reliability of the model.

3. Determination of Learning-Style

Traditionally, learning-style has been assessed using questionnaires. Examples of adaptive systems using this approach include MASPLAG (Pena et al. 2004), LSAS (Bajraktarevic et al. 2003) and TANGOW (Carro et al. 2001). Learners would be asked to complete the questionnaire before receiving instruction, and the results would be analysed and used to determine the content and form of the instruction. This is cumbersome and time-consuming: it is adequate for laboratory studies and occasional use, but not for regular delivery of tailored learning, particularly where classes may be large. It is not easy to use this approach in distance learning.

In recent years, a number of researchers have looked at ways to automate the process of assessing learning style. Maple (Mobile Adaptive Personalised Learning Environment, Mehigan & Pitt, 2013) is designed to support fully automatic detection of learning-style and consequent adaptation of content delivery to suit the individual learner. The model is suitable for use with any electronic or mobile learning environment and can be implemented for any platform and any device category including, for example, Apple's IOS, Google's Android OS and web-based applications.

Detection of user learning-style is based on analysis of biometric interaction data. This can include mouse-movement data, accelerometer data (e.g., in a hand-held device) and eye-tracking data. Spada et.al. (2008) found a strong correlation between mouse-acceleration and users' measured scores on the Global-Sequential dimension of the FSLSM. Mehigan et.al. (2009) showed that a similar correlation exists for movement of hand-held devices as measured using data from an in-built accelerometer. They also showed that eye-tracking data can be analysed to yield figures which correlate strongly with users' measured scores on the Visual-Verbal dimension of the FSLSM (Mehigan et.al., 2011) , and that scores on this dimension can also be estimated by analysing interaction data (scrolling, pointing, etc.) and comparing time spent navigating visual and textual elements.

4. Learning-Style and Learners with Special Needs

While considerable work has been conducted on learning styles, relatively little has focussed on learners with special needs. In part this is because there is little evidence of a direct link: blind people do not necessarily preform less well than sighted people on tasks involving visual and spatial processing, nor do deaf people necessarily perform less well than those with hearing on tasks involving auditory processing.
What work has been done has tended to focus on 'twice exceptional' learners - those who are deemed to be gifted whilst also exhibiting a learning disability. Lohman (1994) considered the issue of verbal fluency as a measure of ability, and noted that some leaners were 'spatially gifted but verbally inconvenience'. He concluded that the lack of verbal fluency did not reflect a lack of verbal ability, merely a difficulty in fluid retrieval of verbal information under certain conditions. Silverman (1989) found that gifted learners who were assessed as having a learning disability were more likely than other gifted learners to exhibit a visual-spatial learning style. She concluded that their poor auditory sequencing skills underpinned their learning disabilities. She also noted that whilst gifted auditory-sequential learners are easily identified, gifted visual-spatial learners are often not identified as gifted and are more likely to be labelled as academic under-achievers. This suggests that assessment of learning-style may help in the identification of learners whose learning-disability may mask strengths in other areas. However, little work has been done in this area.

Before we can begin to assess the learning-style of those with a learning disability, there are several issues that should be addressed. First, can we be sure that existing models of learning-style apply to learners with special needs as well as to mainstream learners? Most of the previous work cited above has focussed on gifted learners who may be atypical, and we are not aware of any large-scale attempts to assess the learning-style of others labelled as having a learning disability.
There is also a potential problem in using traditional assessment tools: research shows that many people with learning-disabilities have difficulty with written forms of assessment (Silverman, 1989). Therefore, using a measurement tool such as the FSILS may not yield useful results. However, the automatic assessment methods we have developed for MAPLE have been shown to produce measurements of learning-style that correlate closely with those obtained using questionnaires. These methods may provide a more effective way of assessing those with certain learning disabilities than traditional questionnaires.

5. Pilot Study

Attempting to answer these questions definitively would require a major study involving many subjects. As a first step, we conducted a pilot study using just two subjects, one a mainstream learner and one with a learning disability, and focussing on just one aspect of the problem, the stress and effort involved in completing a learning-style questionnaire.

5.1 Methodology

The paper-based assessment involved completion of an FSILS questionnaire. The analysis of applied effort, etc., was based around measurements taken with a NeuroSky Brain-Computer Interface (BCI). The NeuroSky comprises a lightweight headset that collects EEG data, and an associated signal-analysis package. Using the NeuroSky, it is possible to obtain raw EEG data. However, the system also outputs data on attention and meditation levels. Previous studies (e.g., Crowley & Pitt, 2013) have shown that these signals can be used to gauge the effort a subject devotes to a task (attention) and the extent to which the subject is stressed by the task (meditation - high levels indicate low stress and *vice versa*).
The process involved two stages: playing a game on a PC and then completing a learning-style questionnaire. Subjects were first shown how to use the NeuroSky headsets and given instruction in the game NeuroBoy, which is designed for use with the NeuroSky. They were then asked to play the game for 10 minutes whilst wearing the headset. They were also video recorded whilst completing the questionnaire. The subjects received no further help or instruction once the task had begun.

On completion of the task they were asked to complete a paper-based FSILS questionnaire. No time-limit was imposed for completion of the questionnaire.

The aim in asking subjects to complete the game-based task was not to assess their performance at the task but to obtain reliable baseline EEG scores using the NeuroSky. Having established a baseline, the signals obtained from the headset during completion of the questionnaire were gathered and stored for analysis. The video recordings were made so as to provide back-up information that could be used to resolve any anomalies in the results.

5.2 Results

Subject A, a dyslexic student, was assessed as being balanced on the Active/Reflective dimension (with a score of 3), highly Sensitive (with a score of 11 on the Sensitive side of

the Sensitive/Intuitive dimension), highly Verbal (with a score of 9 on the Verbal side of the Visual/Verbal dimension), and moderately Sequential (with a score of 5 on the Sequential side of the Sequential/Global dimension).
Subject B, a mainstream student, was assessed as being balanced on both the Active/Reflective and Sensitive/Intuitive dimensions, moderately Visual (with a score of 5 on the Visual side of the Visual/Verbal dimension), and moderately Sequential (with a score of 7 on the Sequential side of the Sequential/Global dimension).

The categorisation of the dyslexic learner as verbal-sequential is unexpected since it has been found that most people diagnosed with dyslexia are visual learners (see, e.g., Scarborough, 1998). However, since only one dyslexic subject is involved there is no reason to doubt the validity of the assessment.

The dyslexic subject recorded much higher average attention figures than the mainstream learner - 85/85% compared with 66/67% - and also took significantly longer to complete the questionnaire - 7:47 minutes compared with 4.45 minutes. This may be due to individual differences, but it may also be a reflection of the demand the task represents for someone with dyslexia. It's also interesting to note that the dyslexic subject remained relaxed throughout both the baseline and questionnaire tasks while the mainstream subject was relaxed during the baseline task but showed some periods of reduced relaxation/increased stress whilst completing the questionnaire.

Full details of the study and of the results obtained can be found in Pitt, Mehigan & Crowley (2013).

6. Extended Study

The pilot study focussed on a single issue - the stress and cognitive effort involved in completing a learning-style questionnaire for two subjects, one dyslexic and one not. The small size of the sample makes it impossible to draw reliable conclusions.
Having completed this preliminary study we conducted a larger-scale study in which learning style was assessed using both traditional questionnaires and the automated assessment techniques supported by MAPLE. The aim was compare the assessments obtained using both methods, and thus to determine whether automated assessment works as well for learners with special needs as for mainstream learners. By monitoring the attention and meditation levels during the tasks, as in the pilot study, we hoped to gain some insight into the relative cognitive demands of each assessment method, both for learners with special needs and mainstream learners.

6.1 Methodology

The extended study involved ten subjects, five mainstream learners and five dyslexic learners. The process involved two stages:

- completing a paper-based learning-style questionnaire whilst wearing a BCI headset;
- studying two screens of learning material whilst wearing a BCI headset and being monitored by an eye-tracker.

As in the pilot-study, the paper-based assessment involved completion of an FSILS questionnaire, whilst BCI the analysis of applied effort, etc., was based around measurements taken with a NeuroSky BCI. The eye-tracking system used for the second task was a Tobii T120.

Subjects were first shown how to use the NeuroSky headsets. They were encouraged to put the headsets on themselves and position them for maximum comfort, but the experimenter also monitored the signal levels and made adjustments where necessary to ensure correct performance. Subjects then completed the FSILS questionnaire.
For the second stage, subjects were asked to sit in front of the Tobii eye-tracker and undertake a calibration task. This involved focussing on a red spot as it moved around the screen until the system indicated that it was reliably tracking the subject's eye-movements. The subjects were then asked to view two screens of learning material, containing both text and images. Subjects were allowed as much time as they wished to view each screen.

6.2 Results

The subjects' learning style data, as determined from analysis of the FSILS questionnaires, is summarised in Table 2.

Subject	Group	Active / Reflective		Sensitive / Intuitive		Visual / Verbal		Sequential / Global	
1	Mainstream		3	7		9			1
2	Mainstream	7			1	5			5
3	Mainstream		3		3	5			1
4	Mainstream		3		11		3		5
5	Mainstream	1			3	11			1
1	Dyslexic		3	7		9			1
2	Dyslexic	1		3			5		1
3	Dyslexic		5		9		7		7
4	Dyslexic	7			3	11			9
5	Dyslexic		1	3		9		5	

Table 2. The Learning Styles of the ten subjects, based on their responses to the FSILS Questionnaire

The results show that the Dyslexic subjects tend to be visual rather than verbal. Three of the dyslexic subjects are highly visual and two are moderately verbal. This is in line with previous findings. However, the mainstream students show a similar distribution of styles – two are highly visual, two are moderately visual, one is balanced on the scale with a slight leaning toward the verbal side. In short, there is no clear distinction between the learning-styles of the two groups.

Interestingly, the automatic analysis of learning style based on eye-tracking data does not correlate well with the questionnaire data. Several of the subjects identified as highly visual from analysis of their FSILS questionnaire results spent more time looking at the text of the learning material than the images.

The timing and BCI data are summarised in Table 3.

	Questionnaire			Learning task		
	time taken	attention	meditation	time taken	attention	meditation

Mainstream	2.25	62.2	54.6	1.45	55.4	62.8
Dyslexic	8.21	60.8	60.8	6.04	60.2	63.4

Table 3. The Learning Styles of the ten subjects, based on their responses to the FSILS Questionnaire

It can be seen that there is a considerable difference between the time taken for the two tasks by the dyslexic and mainstream students. The dyslexic subjects took around 3-4 times longer to complete both tasks than the mainstream students. The BCI data shows that the dyslexic students were, on average, more attentive than the mainstream students, suggesting they found the task more difficult. However, the data also shows that they were more relaxed.

6.3 Discussion

These findings raise a number of issues.

One is the poor correlation between the questionnaire-based and automated (eye-tracking-based) identification of learning styles. Previous work (Mehigan et.al. 2011) found a strong correlation between the visual/verbal dimension of learning-style (as identified through completion of an FSILS questionnaire) and the relative amount of time spent fixating on text or images.

There are several possible reasons for the lack of agreement found here. One is that the result has been affected by the inclusion of dyslexic learners, compared with the earlier studies which included only mainstream learners. If this were the case, it would suggest that automatic detection of learning style does not work as well with dyslexic learners as with mainstream learners. However, the small size of the sample and the consequent amount of scatter in the data makes it difficult to distinguish clearly between mainstream and dyslexic learners - automatic detection of learner style based on eye-tracking data does not correlate well with questionnaire-based analysis for either mainstream or dyslexic learners in this study.

Another possibility is that the learning task here is different in some crucial respect to that employed in the earlier study. However, while the topic covered is different, the amount of material and the screen layout is very similar. The only significant difference is that subjects in the earlier study expected to be tested on the material they had learned, whereas in this study the only requirement was to read it. Perhaps this has implications for motivation and the way in which the subjects approached the material.

Another issue raised by these results concerns relative amount of time and effort devoted by the two groups to the tasks. The dyslexic subjects spent longer on both tasks and also recorded higher attention levels. This is in line with previous data which suggests that dyslexic subjects have more difficulty with reading and writing tasks than mainstream students. However, the higher average meditation levels recorded by the dyslexic students is unexpected. This suggests that they were less stressed by the task than the mainstream students. As noted earlier, this was also the case in the pilot study. It would be interesting to know if this holds for other tasks and in other situations.

6.4 Conclusions and Future Work

The aim of this study was to determine if automated assessment of learning style, which has been shown to work well for mainstream students, can also be employed with dyslexic students, and if so, how it compares in terms of the effort, etc., required on the part of the student.

The results are mixed. As expected, completing a learning-style questionnaire took the dyslexic students longer than the mainstream students and required more mental effort (attention). However, the dyslexic students appeared less stressed by the task than the mainstream students, and this was observed in both the pilot study and the extended study. This merits further study.

The other significant finding is that the automated assessments of learning style did not correlate well with the questionnaire results. Thus, on the basis of this study, there is little benefit in automating learning-style assessment for dyslexic students. However, these findings conflict with those obtained in earlier studies. This also merits further research.
It should be borne in mind that this study involves a small sample and therefore it is difficult to draw firm conclusions. Ideally, a large-scale study is needed to provide definitive answers to the questions raised by these findings.

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Positive Risk Taking in E-Safety Practices.

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Abstract

The focus of this paper is adults with learning disabilities. In this paper I will examine the role that supporters play in facilitating their access to and use of technologies and the extent to which this role is influenced by perceptions of and responses to risk. Whilst e-safety is an important issue, there are examples where issues of safety dominate the decision-making processes of support workers and are not balanced against the potential benefits of taking a risk. This can result in safe but potentially restrictive approaches to facilitating access to technologies:

His centre manager would be happier to know the service users were 'looked after and kept safe' rather than going and taking digital photographs for a website' (P.Williams 2011, 9).

This is in contrast to approaches that appear to want to strive for something potentially more risky, but empowering:

We need to get better at empowering indiv's with id to take the risks and dare to dream of what is possible for them (Zhang-Farrelly 2011, 45 [sic]).

Balancing risk and potential benefits is a central component of positive risk-taking which is generally understood as enabling people with learning disabilities (among others) to have greater control over the way they live their lives, which may bring benefits in independence and well-being, but may also involve an element of risk either in terms of health and safety or in a potential failure to achieve the intended goal Positive risk-taking stresses managing risk not avoiding or ignoring it; taking positive risks because the potential benefits outweigh the potential harm. The UK strategy document, 'Valuing People Now' referred to services getting the balance wrong between protecting vulnerable people and helping people have a life and argues that 'positive risk taking should be a part of everyone's life' (Department of Health 2007, 77).

In this paper I will draw on research literature to discuss how positive risk taking might be a useful conceptual framework to aid in the exploration and development of e-safety practices. I will use examples from the research literature to show how a positive risk taking framework can suggest questions that would enable a rigorous and insightful interrogation of the nature and quality of support provided to people with learning disabilities to enable them to benefit from the use of technologies.

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The DART Project - Improving Technology Provision In Further Education.

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Abstract: This paper provides a brief overview of the JISC Advance FE and Skills Programme funded project DART2 (Disseminating Assistive Roles and Technology). The DART project is a sector improvement project intended to improve Assistive Technology practice in the general further education and independent specialist college sectors based on the knowledge and experience of three independent specialist colleges. This paper will describe the project background, the consortium that have run the project and the project activity, which has included the provision of a deep support element to 10 providers and a three workshop series that has run twice in England and Scotland. Feedback from participants has been positive and details of this feedback will be provided. The project included the undertaking of a Natspec research project intended to inform the design and delivery of the workshop series, but in reality went further than this and has made a number of findings. The main finding from the research project is that cooperation between teams in colleges is vital to the successful delivery of an assistive technology service, in particular the cooperation and support of IT support / technical staff is vital.

The aims of the DART project are to:

- Improve AT practice in the sector through sharing resources and providing assistive technology related CPD opportunities
- Enable the replication of the innovative Assistive Technologist role
- Produce AT case studies for the sector

1. Introduction

DART2 was a JISC Advance FE and Skills Programme funded project that followed on from the 2010-12 LSIS funded DART project. DART is run by a consortium of Specialist Colleges led by Beaumont College, National Star College and Henshaws College. The project is also supported by Natspec (The Association of National Specialist Colleges) and by Colleges Scotland / Colleges Development Network.

It should be noted that this project follows on from work done at Scope's Beaumont College as part of a wider partnership between BT and Scope. BT has resourced the development of an assistive technology service, including the development of the Assistive Technologist role at Beaumont in order to deliver two projects, Wheeltop (2007-10) and Connect to Control (2011-2014).

2. Methodology / Project Activity

This project has provided:

'Deep Support' for 10 providers (mainstream general further education colleges and independent specialist colleges) who are getting assistance with:
Staff training
Implementation of AT solutions

Assistance with the development of assistive technologist style roles, including recruitment assistance or re-training
Access to assessment kits that have been purchased by the project
A total of four days contact time allocated to each provider, plus work shadowing opportunities at the provider colleges, and access to telephone support
The design and delivery of three workshop days -open access to all, not just the providers who received ‘deep-support’. All workshops were run twice, once in central England and once in central Scotland:

‘Assessment for assistive technology’. The details, including a powerpoint are here:

- Scotland: http://goo.gl/2pZvNM
- England: http://goo.gl/usih18

‘Developing an Assistive Technology focused role and its integration into the College structure’

- Scotland: http://goo.gl/9PnNE8
- England: http://goo.gl/UWI2FB

‘Learning more about specific Assistive Technology software packages’

- Scotland: http://goo.gl/732XNY
- England: http://goo.gl/I0IpvM

A research project, carried out by Natspec (http://find.jorum.ac.uk/resources/18808), that was conducted via online questionnaire / telephone follow up, and sought to:

- Inform the content of the workshops (give the sector what it required in terms of AT related CPD).
- Define key themes around what is working well (or what is not working well) with respect to Assistive Technology in all types of FE College.

A summative DART2 project presentation took place at the JISC RSC NW annual conference on 26th June 2013: http://www.jiscrsc.ac.uk/northwest/news/2013/february/jisc-rsc-northwest-annual-event.aspx

3. Survey Results

The research project which was conducted by Natspec’s Liz Maudslay with support from Beaumont College produced 6 key points:

- Over half of the providers who responded to the questionnaire had a person (either full or part time) in a designated ‘assistive technology’ role. This was positive, although there were also indications that the level of awareness about assistive technology was very mixed with some college’s way ahead of others. Very often positive developments had occurred as a result of one particularly committed individual.
- Respondents felt overwhelmingly that a co-ordinated approach which brought together different college departments was a key to successful assistive technology support. Most providers felt there were good relationships between those providing assistive technology and learning support departments, but worryingly many felt that their relationships with IT departments were less good.

- Assistive technology was funded in different ways in different organisations. Some students were funded through an individual allocation of money. While this was positive in that it allowed for an individual to receive the hardware and software he or she required, respondents were concerned that this restriction to a specific individual made it difficult for them to try out possible creative solutions for their full range of disabled students. It also could prevent them from ensuring that assistive technology is available across the college for all students.
- There were very mixed responses to the question about whether students owned and could retain their specialist equipment when they left college which indicated that this is a complex issue which deserves further exploration both at local and national level.
- On the whole providers felt most confident about the assistive technology support they were giving to students with dyslexia and to students with a visual impairment. They were less confident that they were providing the most appropriate assistive technology support to other groups of students, particularly those with more complex learning difficulties.
- Respondents recognised the need for ongoing training and support and for easier ways to keep abreast of new developments in the area of assistive technology.

4. Deep Support

The Deep Support program has been very successful. Only one of the ten Colleges did not engage with the nominated supporting College, and all took up most or all of the offered deep support days that took place at the premises of the supported Colleges and many took up the additional work shadowing option. Telephone support has been provided to each of the supported Colleges. Many deep support colleges also allowed staff members to attend one or all of the workshop days. Providers were matched together based on a combination of skills analysis (to ensure a good match between the supporting and supported provider) and geography, which is why Beaumont (due to its location in Lancaster) worked with the two Scottish Colleges who took part in the deep support program.

The assessment kits that were purchased for each of the core partners to use during deep support were well used by the supported providers to both ascertain the need for some solutions or to gain a wider awareness of what is available. Each kit contained a range of access devices, including access switches and interfaces, alternative keyboards and pointing devices along with an Apple iPad, Windows 7 tablet PC and a Windows 7 Ultrabook. The computers were loaded with a range of AT software that the core partners had found useful in their contexts.

5. Workshops

The workshop series was highly successful with most days being run at full capacity. Good feedback on the workshop series has been received both formally and informally by members of the project board. The workshop presentations and other supporting materials may be of use to other providers who wish to develop their practice in these areas, the materials are available on the Jorum system.

5.1 Workshop 1: 'Assessment for assistive technology'

The first workshop days in Stirling and Birmingham went well. 8 people attended in Scotland, and 27 in England. The high level of merger activity was cited by Jisc RSC Scotland as a likely reason as to why the first workshop in Scotland was less well attended.

Some feedback from workshop 1:

"We attended your rather excellent DART training last week"
"Refreshing to see someone so passionate about what they do and believe in."
"Thanks for a great day"

5.2 Workshop 2: 'Developing an Assistive Technology focused role and its integration into the College structure'

The second workshop days in Stirling and Birmingham were successful and were well attended. 19 people attended the Birmingham event and 17 people attended the Stirling workshop. We noted that whilst we were unable to attract college principals / vice principals to these events, we did have good attendance from middle managers such as program area managers and perhaps these staff members are in a good place to influence organisational change. It is interesting to note that staff who attended did note that whilst they were not all in a position to directly influence the creation of a Technologist role, they did wish in many cases to lobby for this.

It was noteworthy that Richard Maclachlan, a Technologist who was appointed at Runshaw College as a result of the original DART project, gave presentations about his role in both venues. We greatly appreciate Runshaw releasing him to take part in delivering the workshops.

5.3 Workshop 3: 'Learning more about specific Assistive Technology software packages'

The third workshop days at Beaumont College (6th June) and Colleges Scotland's base in Stirling (12th June) were successful and well attended. 19 people attended the Beaumont College workshop and 16 people attended the Stirling workshop. In addition to staff from the DART core partner Colleges the event in England was supported by both Kevin Hickey from Jisc RSC Northwest and Mags McKay from Jisc RSC Scotland. The Scottish event was supported by Mags McKay and by Fil McIntyre from Brite. The events covered specific Assistive Technology software and hardware training, including 'hands-on' sessions.

Fil has also provided some interesting feedback on all three DART2 workshop events that took place in Scotland. Fil felt that all three events were generally very good, and he himself had no issue with the content, he felt it was great that "People can skill themselves up to make a better environment if these students were to come into College". Fil noted that two people fed back to him that they felt there was too much emphasis on access solutions for 'PMLD', although Fil noted that both of these people did not attend Day2 which had input from HE and general FE based assistive technologists. Fil noted that he had good feedback from many workshop attendees and that they provided 'a day's' worth of immersive training, especially those who were not in the deep support". Fil concluded with noting that several colleges (notably Cardonald College) are looking at creating the AT role and are using the DART materials and workshop attendance 'as a springboard' to realising this.

6. Other Outcomes

It is fair to say that a network of assistive technologists who have worked on the DART project has now formed around the project. This includes people who work at core partner providers of the project (Beaumont, National Star and Henshaws) as well as staff members at each of the supported colleges, along with people who have attended the workshop series and members of Jisc services as well. This network has focussed around twitter, with the @dartproject account being used to channel some activity. It has also been interesting to see that as members of this group have gotten to know each other that they can now post questions on twitter or via email and have an answer from a member of the group or a wider community member on AT and other matters, and often find responses in a fairly short timescale. This has been an unplanned outcome of the project, but is a most welcome one.

7. Conclusions

7.1 Lessons Learned

The project board management system worked well. This efficient approach enabled all stakeholders, including Jisc, to comment on project progress and ensured that the project activity remained focussed.

The workshop series was really well received and ensured that the project had a much wider impact that working with the deep support providers alone.

The application process has been revised for the follow up Dart 2.1 project, to enable providers at the start of their AT development journey that need 'front loaded' or more general support to begin to build an effective AT service and also providers who are well into their AT journey and need specific support in order to excel in their provision of AT to apply. Providers who had previously received deep support through Dart were eligible for the latter category if they identified a specific project which would benefit from the expertise and input of the Dart partners.

A further research project will be undertaken, again sponsored by NATSPEC (with similar goals to the original report, including similar questions in order to gain a 'longitudinal view'). There is a possibility for widening the scope here under the 'addressing barriers to adoption and utilisation' strand of 'current thinking'. A specific effort will be made to engage more GFE providers in the responses to this new survey.

7.2 Sustainability

Sustainability of the project has been addressed through a continued relationship with the Jisc FE and Skills project, and we have been successful in obtaining funding for a follow up Dart 2.1 project which is now underway. Again deep support will be provided to 10 colleges, and there will be an open access workshop series. A follow up survey will be undertaken by Natspec to obtain a longitudinal view of AT provision in the FE sector.

An additional element of Dart 2.1 is further engagement with Jisc in order to train the Access and Inclusion advisors in the JISC RSC's who wish to learn more about AT through active participation in the Deep Support provision. The RSC's A&I advisors will be invited to all deep support events in the regions they support in order to both be up skilled by DART core partner's staff members and to provide local knowledge and context. An additional workshop will be provided for all A&I advisors from the RSC's in consultation with their role group / JISC TechDis in order to promote sustainability of the projects outcomes. This workshop will be open to all interested Jisc staff.

7.3 Project Support

Staff at the Jisc RSC's and TechDIS were consulted at the design stage of this project. It cannot be emphasised enough that without this early input the project would have been much more difficult to design and manage. A special mention for Lisa Featherstone from Jisc TechDIS is essential, and her input to the deep support shortlisting procedure has been vital. It is also important to identify both Kevin Hickey of Jisc RSC NW and Mags McKay from Jisc RSC Scotland who as members of the project board have helped guide the project and have attended a number of deep support events at various colleges. Both Mags and Kevin have also contributed to the delivery and design of the workshop series and have collected case study / video feedback from the deep support providers in their regions. Jisc Advance staff including Nigel Ecclesfield and Dan McCaffery have also provided excellent support and guidance to the project board.

8. Final Thoughts

Based on the experiences of the core partners who have delivered the support, the input from the colleges who completed the questionnaire and the feedback from attendees at the workshop series we feel that we can determine that the assistive technology strategy in a College stands or falls based on relationships between teams. The college structure may help or hinder the formation of these relationships. The relationship of the IT/Technology team with Teachers, Therapists (where present), Supporting staff (such as Learning Support Workers / Assistants) and people who are in the AT role is the most important element in the successful assessment, provisioning and on-going support of assistive technology in a College environment.

We feel that based on the excellent feedback and the content of the Deep Support case studies that the DART2 project has been a great success and has delivered on all the objectives and outcomes as laid out in the original bid document. The project board also looks forward to the development of the Dart 2.1 follow on project (now underway).

We also feel that the project had demonstrated a truly collaborative approach between the three core partners (Beaumont, National Star and Henshaws), two sector membership bodies (Colleges Scotland and Natspec) and the Jisc services. We feel that the early and sustained input from the Jisc RSC's and TechDIS have helped this project succeed.

We also feel that the response from the providers who have taken part in the workshops or deep support programme has proven that there is an on-going need for Assistive Technology support within the education sector.

For more information please see http://dart.beaumontcollege.ac.uk/.

Think. Write. Go. WordQ & SpeakQ

Russell Smith (russ@carepair.co.uk) (Assistive Solutions, UK)

WordQ and SpeakQ is an innovative software package supplied by Assistive Solutions, primarily to students with DSA funding.

Although primarily is it used with students in Higher Education it has been designed to support anyone with a literacy impairment, including users with Dyslexia, Dyspraxia, ADD and ADHA, and anyone else that comes under the umbrella of 'Literacy Impairments'.

The software works across both the Mac and PC platforms and is compatible with all Microsoft Office and Mac iWorks software titles. It is also able to be used in a wide range of Mac and PC browsers, including Firefox, Safari, Internet Explorer and Google Chrome. The same applies to numerous email clients which act seamlessly, including the most common email clients Outlook, Mail and Thunderbird.

WordQ includes the ability to type, hear and choose predicative words, then insert them with keystrokes or by using the mouse. These multiple input methods really speed up the use of the software and make it very intuitive for users.

WordQ also allows you to hear words and definitions read back to you, and can echo back combinations of characters, words and sentences as your write. It also has the ability to read back pre typed text in Microsoft Word, and other text editing programmes, using simple shortcut keys.

WordQ is very simple to learn and easy to use on a day to day basis, it has just three buttons with an additional options button, allowing you to customise the software to individual needs. SpeakQ is just one button, with the options button allowing you to set up a user profile, train a profile and have access to the customisation options.

The newest features of WordQ are the medical and legal word lists which allow you to have access to over 3500 specialist terms from the medical and legal world at the touch of a button.

What kind of data to expect from educators in e-portal on learning technology for special needs?

Andreja Starcic and Maja Lebeničnik (University of Primorska) and Denis Starčič (Arhinet d.o.o.).

Abstract

ENABLE e-portal, which is one of the outputs of ENABLE project, will be an information point about available learning tools for learners with special needs. On the portal end-users contribution is also expected. A qualitative survey was made about the use of ICT for learning in institutions that provide some form of learning for adults with special needs. By carrying out telephone interviews, we researched how employees understand their actual use of ICT for teaching and learning, but also how they verbally express it. 15 employees from 12 different institutions participated in the survey. Given answers were categorized firstly, for different kinds of ICT used and secondly, for different functions of ICT in segregated educational environments. Results showed more general and basic use of ICT in Slovenian special needs institutions, consisting mostly of assistive technology, general software and Internet applications. There were, however, some noticeable differences between different disabilities, types of institutions and personnel involved. Following these results, we argue that the portal needs to provide broad spectrum of the complexity. If focus only on information of more advanced learning technology, which completely exceeds people or institution's capacity for use, it may result in lower perceived usefulness of the portal.

Keywords

E-portal, learning technology, special needs, perceived usefulness

1. Introduction

In the design phase of e-portal, where end-user contribution of information is expected, it is important to realize, what kind and range of information can be gained from different type of users. ENABLE e-portal is conceived as an information point about available learning tools for a wide range of target groups with special needs. From the perspective of usability it is essential to engage end-users to perceive new portal as useful and as easy to use in order to accept and start using it (Davis, 1989).

According to the response to the initial survey it is difficult to estimate how many users will use the portal and eventually decide to contribute new information. Understanding end-users' actual use of ICT for teaching and learning, but also how they verbally express it, can be beneficial for developers of the portal. One of the groups, expected to add information on a portal, are employees in disability related institutions that provide formal or informal education for adults with special needs. Disability institutions often face various factors when struggling with implementation: from lack of funds to illiteracy or unwillingness of their staff and clients. Lack of ICT knowledge and skills among personnel were actually indicated as main barrier in implementing ICT in Slovenian institutions for vocational rehabilitation (URI, 2010). Also scholars researching the use of ICT in special needs environments show that ICT is, especially in case of people with severe cognitive impairments, often used on more basic level (Williams, 2005; Parsons et al., 2006). It was discovered that basic ICT activities (e.g. writing exercises, lesson-related information searching), settings accommodation and innovative use of generic technology were more pervasive than the use of technology designed for specific user groups in diverse educational settings (Seale, 2006; Parsons et al., 2006).

2. Methodology

For the purpose of the survey telephone interviews were made with 15 employees (educators, representatives, IT personnel and professional staff) from 12 different Slovenian institutions providing some form of learning (formal, informal, lifelong) for adults with special needs. We categorized given answers in different functions of ICT in segregated educational environments as proposed by Lewis and Neill (2001):

- Access to normal curriculum,
- Interaction/communication,
- Physical control,
- Subject-linked learning,
- Reward/motivation,
- Developing ICT skills,
- Assessment,
- Record keeping,
- Teacher support.

Further, we categorized the answers about type of mentioned ICT:

- Assistive technology,
- General software,
- Tools designed for specific groups of users,
- Technology for communication/interaction,
- Educational material,
- Technology for monitoring/management of learning,
- Educational games.

3. Results and interpretation

Results showed that function of using ICT for developing basic ICT skills (n=4) was pervasive, especially for population with severe cognitive impairments. Also ICT use for gaining physical control and assessment/rehabilitation functions were very common (both n=4). 2 institutions reported they do not use ICT in their interaction with learners.
The use of ICT in Slovenian disability institutions consists mostly of use of general software (n=7) and (Internet) applications for communication and interaction (e.g. social networks, Skype) (n=5). General software, such as word processing, spreadsheet, creativity, presentation and graphical software (n=7), was reported in all types of institutions, except for rehabilitation institutions. Only professional workers reported to use specific tools (n=4), all for assessment and training/rehabilitation purposes. Assistive technology was also widely reported (n=4), especially for learners with sensory and physical impairments in formal education institutions.

There were some noticeable differences in use, regarding different disabilities or types of institutions. In rehabilitation and life-support institutions most diverse use of ICT was reported (n=2). In institutions, providing formal education for adults with disabilities, the function of ICT for access to normal curriculum and information was pervasive (n=2). In life-support institutions use of ICT for developing ICT literacy, gaining physical control and for reward/motivation was used. Educational games, used in life-support institutions, were originally designed for children. There were no data on using ICT for some functions such as social skills and metacognitive skills learning that were discovered in previous researches (Hartley, 2007).

To summarize, the use of ICT in Slovenian disability institutions is, as expected, more general and basic, consist mostly of use of assistive technology and general software and Internet applications. Only professional workers, who presented most detailed description of certain technologies, reported to use specific tools. Maybe telephone interviews were not as suitable for this purpose, because we were mainly connected to IT personnel or representatives of organizations, who may not have knowledge on actual use in learning situation.

At the next stage, we tested few possible designs of the Enable portal from basic classification to very detailed technical stratification of available tools.
Depending on the end user response, we decided to separate main entrance point to three fields. First field is intended for the tools that are more learners oriented and there is available only simple classification. The second field is intended for teachers and other professionals involved with disabled persons with more detailed technical description. The third field is intended for description of good practice where users can get idea how to blend use of different IT tool not necessarily designed for disabled users to cover their needs. After testing period final decision on the design will be accepted among partnership.

4. Conclusion

It can be concluded that most educators do not see use of ICT in learning situation as something special, but use it in everyday context in accordance with their skills. Another important aspect is apparent little experience with more advanced ICT activities; this may result in unfamiliarity with technological expressions and classification of the tools. That is why the portal needs to provide a broad spectrum of the complexity. If focus only on information of more advanced learning technology, which completely exceeds people or institution’s capacity for use, it may result in lower perceived usefulness of the portal. Is to be expected also much more information and useful tips to be submitted from end users to the portal, if it will allow description of more general technologies and practises, even though not specifically designed for special needs. Description of good practices of using combined IT tools could be significant added value to Enable portal providing especially institutions possible scenarios, how to cover more complex educational situations.

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Empowering Struggling Adult Learners: an online approach.

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Abstract

This document features practical lessons learned by a USA charity about why some clients are seemingly unable to learn and why so many educational outreach efforts may flounder. It offers proven insights into what you can do about it; i.e. how to affordably and effectively work around some common learning barriers which can trip up many adult learners from time to time – even mainstream adult learners who are not considered to be disabled. It is a blueprint of the design considerations for the charity's own training program, shared with the Enable conference in the hopes that it may lead to educational institutions elsewhere joining with us to create our vision of a "classroom in the cloud" job skills building community sandbox: A global, network of similarly structured classrooms where our clients would be able to exchange ideas with and interact with other learners in other organization's cloud based classrooms [assuming that our respective countries' laws allow for this.] It 1.) Explains why a client's prior educational success does not necessarily guarantee future educational results; 2.) Examines how these learning barriers can develop gradually to trap struggling clients; plus it 3.) Presents many, easy-to-deliver assists and course planning strategies which the charity uses on a daily basis to empower struggling adult learners.

Keywords

educational empowerment, online trainings, e-learning tips, instructor guidelines

1. Introduction to the charity and its program services

The Contractor Training Coalition, Inc. is a newly re-organized 501(c)3 charity based just outside of Buffalo, New York that a.) Educates newbie business owners and self-employed individuals about their legal employer responsibilities; b.) Facilitates welfare-to-work job creation efforts; c.) Works with human slavery and other fraud victims to quietly help them rebuild their shattered lives; and lastly D.) Intervenes to provide corrective re-training to misbehaving building owners and/or employers who have unsafe workplaces in the upstate New York region. It is actually a non-profit coalition; a group of USA business owners who are interested in furthering financial literacy as a routine part of their own business' operations and the coordinating charity at the heart of it all has a staff of 1 – just me. The two main things the charity's clients all have in common are: they desire to improve their economic situation; and they usually cannot obtain a loan. The charity utilizes an online educational outreach effort that combines private tutoring appointments with self-study, hands-on learning labs and tutor facilitated, job skills group practice sessions. Its program services are all focused upon encouraging the learners' rapid understanding and lasting retention of the training concepts taught. We are able to train a struggling adult for just mere pennies on the dollar utilizing distance learning techniques, emerging cloud technology, and tutoring sessions provided by the individual coalition member firms (who are our peer tutors).

1.1 Empowerment history: about the now defunct predecessor charity

8 business management graduate students from State University of New York – University at Buffalo, including myself, decided to found a non-profit agency in 2002. Our university had just yanked its research sponsorship of some community empowerment research that we had been involved in for my masters' theses research, and we and our mentors in business wanted a way to continue forward with it. I got elected to volunteer as its Executive Director since I owned a little tax practice and I had the most experience working with micro sized firms (fewer than 10 employees). That charity opened up a self-help clinic for entrepreneurs in 2006 – our Employer Assistance Center. The predecessor charity originally just focused its program services upon helping entrepreneurs to implement accounting internal controls within their firms and teaching them budgeting how-to's. Everyone who came to the new clinic seeking help was within 120 days of total business failure or else was trying to start up a new business without any funding available to them to start it with. But even with we founding team's strong financial backgrounds, we could not adequately help them figure out how to stay in business operations and pretty much all of our clinic's client firms still failed. So I again started coordinating business mentored, group homework assignments where ever I could find a willing teacher to have his or her students study community empowerment to help me figure out how the charity might better counsel the charity's clientele. Hundreds of students attending five different universities in two states as well as two grammar school districts contributed to the informal student research effort. The result was a powerful, business empowerment curriculum, our Business Survival 101 course which I authored.

With it, some clients started succeeding. [My husband and I were later able to utilize the profit coaxing and business empowerment insights gained from that Students Building America research project to figure out how to operate and grow his specialty pressure washer firm on less than half of the operating capital that it took our competitor firms to survive on. We grew it to the point that we completely eliminated his firm's advertising budget and were still turning away want to be clients obtained solely from word of mouth referrals before he decided to shut it down in 2011 and do something other than restaurant hood cleaning and kitchen exhaust ventilation system repairs.] Unfortunately, too many of the charity's clients at the Employer Assistance Center were not able to grasp nor apply the concepts in the new business survival training and their firms still kept on failing left and right; which caused all of my charity's founding team mates except me to lose interest and stop volunteering. Eventually, the predecessor charity's board of directors voted to permanently close down my non-performing charity too. That predecessor charity's closure was a serious emotional blow to me. Its 2008 shut down also sparked an ongoing research passion for me: Why didn't most of the charity's clients learn? Many of them were college graduates with successful careers before they decided to start or purchase their firms that failed. So what happened to seemingly shut down their ability to learn, and what could be done to help them better learn; apply and later remember the empowerment and profit coaxing concepts now?

1.2 Empowerment history: studied academically challenged learners at Job Corps

Afterwards, I set out to figure out for myself why the original charity's clients couldn't seem to retain nor apply my training effort. In 2009, I went to work full time as a tutor at a nearby Job Corps Center. USA Job Corps Centers are federally funded vocational training institutions that train high school dropouts aged 16-24 who are also economically disadvantaged. I wanted to observe the students there and to learn first-hand how the Job Corps Center faculty succeeded in teaching special needs learners. While there, I developed my own methodology to coach academically struggling adult learners, assist them to prepare for vocational or high school equivalency diploma exams, and to successfully pass these exams. It was awesome watching so many of my tutoring students pass their exams via my strategy!

1.3 Empowerment history: asked by local governments in NY to rebuild my charity

I later determined to rebuild the charity from scratch at the request of several local municipal governments' code enforcement officials (building safety inspectors located in upstate New York). They were familiar with my high profile public safety advocacy work in connection with my husband's former hood cleaning business and who also knew of the program services for cash-strapped entrepreneurs which the predecessor charity I directed used to provide in the past and begged me to resume the badly needed small business coaching services. I now knew that traditional classroom learning probably wouldn't work for my target clients so I investigated cloud based, distance learning techniques and other possible program alternatives for almost another 4 years. I was delighted that several of my own consulting firm's vendors took an interest in my project and were most helpful in mentoring me to rebuild and finance my charity without grant funding. Happily, in 2014, I was finally able to organize a replacement charity that does all of its work activities online. It quickly became a performing charity itself using these tips which I had discovered at Job Corps as well as things that a fellow faculty colleague taught me when I was an adjunct business management faculty member at a local college. Only after I found out about these common learning barriers and then began delivering some teacher "assists" to help the client entrepreneurs work around them was I able to help the new charity's clients to stay in business operations and regain their financial independence (with the help of the other coalition member firms).

2. Recap of lessons learned: why the predecessor charity's clients didn't learn

- Economic distress will often cause the client to exhibit symptoms and learning barriers mimicking a person who has a true cognitive learning disorder or handicap.
- No matter how or why a struggling adult learner or the micro sized firm that he or she owns got into economic distress in the first place, chances are that this person is now effectively trapped behind seemingly impossible learning barriers which may in essence render him or her unable to benefit from traditional classroom environments.
- People who are experiencing heavy stress in their lives and/or who are struggling hard economically either within their own personal life or else within their firm, will tend to temporarily acquire a print impairment and manifest reading comprehension problems due to their current cash-flow distress levels and the resulting combination of information overload and mental burnout factors.

- Many other “mainstreamed” adults may eventually just mentally shut down their ability to learn as the result of numerous, previous educational fails and/or being victimized in bullying incidents. They simply cease to believe that academic success is possible for them. They must then learn to change their entire thinking paradigm in this case. There are precious few adults who truly cannot learn [due to physical handicaps].
- The weird part about it, is that these mental barriers to learning as well as fiscal recovery are often self-created and are temporary in nature: assuming that the clients are given the right teacher “assists” and taught to better manage their stress levels.
- The good news is that almost all of the successor charity’s clients respond positively to the teacher “assists” created for special needs teaching and these adults make the greatest amount of forward progress when their learning hiccups and academic or strategic business planning “wall thumps” are proactively taken into account.

Let us now examine what factors most likely contributed to these client’s inability to learn and the instructor “assists” that can help your client to overcome the accompanying obstacles:

3. The most common culprit that creates barriers: the time crunch factor

Problem: Time crunched learning is both physically and mentally exhausting. So is undertaking fiscal recovery intervention within a firm. Both will lead into a print impairment.

3.1 Explanation: what is a print impairment and why is it a problem?

A print impairment is the inability to focus on large amounts of printed text. The affected person is often unable to comprehend what was just read and cannot pick key ideas out of the text. Learners describe it to me as, “The words just seem to blur together” (for him or her). Time crunched learning is a huge problem for my charity’s clients. A common rule of thumb for my charity is that most of its new clients will come in with an urgent need for fiscal stability intervention services. Even if they were among the small minority who do not suffer from these learning barriers discussed within this paper, they mostly tend to have neither the time nor the resources nor the desire to enrol in a formal educational program. They need to find relief and they insist they need it now. Most of them are within 120 days of total business failure and/or homelessness when they first walk into the charity’s door seeking our help. They usually come in discouraged, somewhat resistant to authority, often feeling that all hope is lost, but are unwilling to accept ultimate defeat and they prefer deeply not to either be forced to remain on or else start on public assistance. We (the coalition members and mentoring universities who advise me and other the coalition members) have to cram a whole lot of information into their heads in as short a timeframe as possible. It is actually physically painful to try to study or analyse operational problems under intense pressure for long periods of time. It causes physical tension headaches that can really throb. It is also nerve-racking and sometimes downright embarrassing to learn new job skills, and/or work to change a firm’s internal operations so that it can ethically coax profits. Therefore, I always tell my clients that it’s not for the faint of heart. “We can most likely help you”, I tell them. “But, it’s going to be a bunch of work for you, you might feel uncomfortable, and it’s going to take some time, cooperation between a number of people and patience to do so.”

3.2 Assists for a print impairment

3.2.1 Assist #1 – Visualize Success:

The first step to academic intervention and the first teacher "assist" I strive to give the charity's clients is to individually help each client to visualize the value of putting up with some personal discomfort and a fair amount of work now in order to realize the promised goal and outcome in their future – a much better economic outlook for themselves. Once a client can internally visualize how a bit of present discomfort will most likely lead to future success and financial self-reliance, he or she becomes more willing to overcome a temporary print impairment. Sometimes, the person needs some coaching in the value of getting adequate rest and proper nutrition as well.

3.2.2 Assist # 2 – Break information down into tiny little chunks:

This technique seems to be a bit hard for people to grasp just by me talking about how to do it. I like to use Microsoft® PowerPoint® and the Xerte Online Toolkit to chunk the lecture material into little tidbits of information. An example presentation that demonstrates the assists for cognitive impaired learners is included in my supplemental PowerPoint® slideshow. Checklists also help greatly. I'm often amazed at how empowering just seeing a completed item's checkmark is for the charity's struggling clients.

4. The biggest culprit that causes barriers: unmanaged "learning hiccups"

I taught accounting, human resource management and business law classes as an adjunct faculty member at Bryant and Stratton College in Lackawanna, New York. I was doing well there as a teacher, until my employer asked me to fill in to teach a foundation math class. That mathematics class become so difficult for me to teach. My remedial math students just couldn't seem to understand me no matter how hard I tried. They and I became increasingly more miserable. By midterm exam time, my entire math class was failing. One evening after class, I cried the blues to a fellow faculty colleague, who listened intently to me. Then he asked me if I was teaching around my students' learning hiccups. I'd never heard of learning hiccups before so I questioned him further. He explained to me that learning hiccups were little areas or hiccup points where the student experienced some type of a get-me-out-of-here response, and where learning might hit a sort of pothole or a bump in the road. Once I started looking for and teaching around their learning hiccups, the entire classroom atmosphere turned around. They started learning. By the time final exams rolled around, 2/3 of the class had improved to an A grade. They'd each earned it. Only 2 members of that math class got Fs. I was so proud of my math students. I also became a firm believer in the value of closely monitoring my learners for outward signs of learning hiccups because of this.

4.1 More lessons learned about how economic distress impacts learning hiccups

I leveraged the notion of learning hiccups successfully to help many high school dropouts aged 16-24 to prepare for and pass their GED (high school diploma equivalency) exams when I worked as the GED tutor at the Iroquois Job Corps Center. Academically weak-skilled clients tend to struggle a whole lot more with learning hiccups than other learners do. That is, until the entrepreneur or a fraud victim client temporarily acquires the print impairment barrier to learning and then the number of learning hiccups that he or she encounters will drastically increase. Once the temporary print impairment kicks in, everyone whom I've personally worked with starts to mimic the symptoms of one having a true cognitive learning disability, no matter how much education they've had in the past. At least this is what I've noticed among my tax clients, my Citrix® Authorized Learning Center provider partner clients and also in my own students. The GED-prep kids at Job Corps displayed an average of 15-20 learning hiccups an hour. It was fascinating for me to observe them whenever I substitute taught in their GED classrooms (1/3 of my job duties was to substitute teach in the full time GED prep classrooms whenever one of the teachers took a personal leave day). Too many unmanaged learning hiccups will lead up to an internal mental encounter akin to one running headlong into a brick wall and getting knocked down flat on your back by your physical encounter with that wall. But let's first start with how to identify hiccup points and help an adult student to manage his or her own learning hiccups.

4.1.1 Student behaviours that may indicate an encounter with a learning hiccup:

It's fairly easy to discern when your learner has bumped into a learning hiccup. The most common reaction is the blank stare. He or she may nod the head in agreement but it's clear to you from looking into your learner's eyes that he or she has absolutely no idea what you are talking about. Other indicators of a learning hiccup include:

- A yawn or a frown or a furrowed eyebrow (puzzled expression)
- Looking about the classroom or gazing at a clock or their watch
- Touching their hair or playing with their clothes, removing lint, etc.
- Doodling – drawing cartoons, etc. on their paper
- Changing the subject abruptly
- Tapping one's foot or tapping a pencil on their paper

4.1.2 The lucky horse shoe teaching methodology used by the charity:

The most effective approach I've found for helping clients to overcome their temporary barriers to success that are caused by too many unmanaged learning hiccups and/or the client's sheer mental fatigue is to employ a variety of mind cool down periods and mental distractions in much the same way as the blacksmiths of old used to build iron horse shoes. Just in case you are not familiar with the blacksmith's of centuries past build process, here it is:

- Step 1: Heat up the iron ore in the fire until it is red hot.
- Step 2: Remove the ore from the heat, lay it on the table in front of you, and give it a few, good hard whacks with your hammer to shape it
- Step 3: Dunk the metal you are working on / shaping into a pail of cold water for 3-5 seconds. (NOTE: this interim step is hugely important – it hardens and strengthens the iron plus the cold water dunk keeps it from cracking or flaking or from getting too soft)
- Step 4: Return the partially shaped metal to the fire and heat it up again until it is red hot
- Repeat steps # 1 through # 4 until you have a finished, iron horse shoe to tack onto a horse's foot.

I first used it in my own life as I was struggling to pass the difficult AICPA's certified public accountant exam. Traditional study methods failed me for that exam. Despite my best efforts to prepare, I failed that exam twice. Then I found out about learning hiccups and decided to apply the assists (namely offering an immediate topic jump or a 1-2 minute mental distraction learning activity) to my own studying. The 3rd time I attempted the CPA exam (2 day, 16 hours of brutal accounting knowledge testing) I passed it. I also used it to pass the US Internal Revenue Service' difficult Enrolled Agent exam (nationally licensed, approved tax practitioner license). My GED prep students at Job Corps, told me it was the only study method that had ever worked for them. The topic jumps and distraction learning activities / games allow one to focus clearly and be able to study intently for many hours longer than the same person can without them.

4.1.3 Lessons learned on how to teach around a learning hiccup:

If you can, you as an instructor or the (vendor sourcing introduction) peer tutor, need to stop and immediately manage your student's learning hiccup at the exact moment when it occurs. First you must help the learner to try to figure out why it occurred. The next step is to jump topics with a one or two minute mind break or mental diversion before you circle back around to the point where you were in the teacher's lecture when your student's learning hiccup occurred. The biggest empowerment capability from a fiscal stability intervention and business empowerment perspective comes from the topic jumps, the mental diversion, and from follow-up, one-on-one appointments with a coach / counsellor where you analyse the person's learning hiccups together. There are six main causes of learning hiccups and each one has a different management technique to teach around it:

4.1.4 Cause # 1 and how to deal with it or manage it as an instructor:

- Cause # 1: The person has recently come across a word that they didn't understand or else they picked up an incorrect contextual meaning of that word. Nothing from that point forward will make sense to him or her now. Contextual meanings are a big problem within the English language, more-so for the American English dialect than with the British dialect. For example: The word credit can have any one of seven different meanings, depending on your financial background and your career. The student and the teacher may even be on two totally different pages as far as contextual meanings go, and yet neither one of you realizes it.
- Work-around # 1: Stop and go back and help the learner to define that word in its correct context. The concern here is that this is an indicator that they may not be able to read well. If you are teaching in a group setting, you need to get this person into an appointment one-on-one with a tutor just as soon as possible to have them read aloud to the tutor and build up their reading vocabulary if needed. 48% of the kids at Job Corps came in unable to read English at the 5th grade level. 15%-20% of them came in unable to read at all. [per a 2009 Pace Learning Systems® study. Pace Learning Systems® is the GED® curriculum publisher that Iroquois Job Corps Center utilizes and these statistics I'm quoting were used by the vendor within their in-service teacher training workshops to the center's academic staff – references not available.] You absolutely can't hide an inability to read when you have to read out loud to someone else and in a number of cases, making them read out loud to a trained tutor is the only way to accurately identify illiteracy or weaker academic skills.
- Discussion: Some of the charity's clients are expert at hiding the fact that they actually can't read. Those who can't read are also usually greatly ashamed of this

fact. Hence this concern needs to be addressed delicately and privately. I noted while I worked at Job Corps that it takes an average of 2500-3000 instructor hours to bring an extremely weak academically skilled client's reading and math skills up to the point where their business can make money without turning the firm into a human slavery / forced labor debt bondage situation. Much of that learning also needs to take place at the person's own pace. It if doesn't, it takes much longer to boost the client's academic skill level. I use Moodle® and Xerte Online Toolkits learning modules to embed an on-demand virtual tutor within all of the self-study learning labs that I program/develop for the charity. The Enable conference sponsors also have links to some good, open source dictionaries and other teaching tools on their website(s).

4.1.5 Cause # 2 and how to deal with it or manage it as an instructor:

- Cause # 2: The person just side tracked into recalling an annoyance at the job or regarding a personal matter.
- Work-around # 2: Help him or her to create a to-do task item, by allowing a moment to write it down. I have my charity's clients enter it as a Citrix® Podio® task where it can easily be reviewed online by their tutor or coaches or other partnering non-profit agency staff members. This cause is something that I have a keen interest in further exploring in my charity's role as a fiscal recovery intervention counsellor. I especially want to know where the client's learning hiccups and wall thumps occur. My tutors and I can gain all kinds of insights into a firm's financial health and it's possible budget busters and fiscal recovery intervention leverage points from doing some further investigative probing into this type of learning hiccup. Often, the only indicator of a nearly-hidden budget buster and a costs magnifier is somebody's gripe about it and/or a negative emotional reaction whenever the topic is recalled.

4.1.6 Cause # 3 and how to deal with it or manage it as an instructor:

- Cause # 3: The person's body is signalling that it needs a rest break to stretch.
- Work-around # 3: Give the learner(s) a 1 – 5 minute stretch break to get up and physically move around. There are detailed instructions in my Moodle training classroom at my website for how to create a count-down time slideshow. Sometimes, you just grow weary of trying to learn or trying to concentrate, and your body simply needs to physically move. I see it a lot as a small business coach. FYI: There are also some simple, seated stretch exercises that I have my students do to ease the tension in their forehead, neck and shoulders. You can even do these simple stretches during the middle of an exam to help yourself regain composure and focus after experiencing a panicky feeling when you don't know the answer to something.

4.1.7 Cause # 4 and how to deal with it or manage it as an instructor:

- Cause # 4: In distance learning settings, the learning hiccup may mean that there is someone or something in the background who is interrupting the entrepreneur or client. One of the hallmark characteristics of a firm in severe economic distress is that there is a sharp increase in the number of production floor headaches and issues which arise because the firm's workers are unable to obtain the raw materials and supplies that they need at the exact time when it is needed. All of this translates to extreme demands made upon the owner or management's time, and their work flow interruptions are also constant. This is why it is so dang hard for an

entrepreneur or a manager whose firm is in cash-flow trouble to get into a regular classroom setting.
- Work-around # 4: Give them a 3 – 5 minute small break to deal with the interruption so that they can give you their full attention again. If it will take longer than 5 minutes to deal with, set up a new appointment with them to continue whatever you were doing in your online meeting with them. Recap: Cash starved = super busy owner and office manager.

4.1.8 Cause # 5 and how to deal with it or manage it as an instructor:
- Cause # 5: The client already knows how to do this task or skill and feels bored.
- Work-around # 5: Jump topics altogether and move onto to something else. We staff at the charity do not want our client wasting time on studying something that he or she already knows. Time is of the essence! Each client needs to find feasible solutions and needs it now so we can't afford to waste any valuable learning time.

4.1.9 Cause # 6 and how to deal with it or manage it as an instructor:
- Cause # 6: The client just figured out how much work is going to be involved in this particular project, and what follows is a mind balk or involuntary knee jerk reaction.
- Work-around # 6: Give the client a quiet moment to complete the knee jerk reaction. All learning progress has already stopped at this point anyways. The best you can do now is to try to regain the person's permission for you to teach them. (Hint: Adult learners must voluntarily give you their consent to learn from you before you can make any forward progress with them.) Then give the person a totally different learning activity to complete. Simple learning games are usually best here. I like the vocabulary and concept review games found at ContentGenerator.net. Before you come back to the original teaching topic, remind them to daydream or visualize the benefits that will be obtained from going through all the grief to complete the work and how much better off they will be at the end of it. I.e. If I do this then I can obtain that which I want more (mentally picture the car or apartment that they want, picture them taking their kids to an amusement park etc. Sometimes I have the client actually draw out a floor plan of their dream job or clip out a picture of their desired car before they can visualize the benefits to be obtained from doing the work involved.)

5. Online training considerations
In prior sections, we've discussed the time savings value which can be achieved using learn at your own pace learning labs and live sessions that are mentored by the business community and by universities. When combined with remote telecommute, private tutoring sessions with a live tutor, it becomes exponentially more effective. There are also some drawbacks; the most bothersome being that you lose a lot of the ability to observe when your client or student has encountered a learning hiccup. Citrix® online workforce collaboration product, GoToMeeting with HDFaces®, restores this ability to a large extent. Plus, it is cheap to acquire / use, and cheap is preferred by our clients. Here are some programming design techniques to facilitate the learning process:

5.1 General instructions
Prepare a few simple, instructor tools before initiating a GoToMeeting® session; such as a couple of countdown timers using Microsoft® PowerPoint® along with a vocabulary game or

two using ContentGenerator.net programs. Step-by-step instructions for how to create them can be found in the free, second course at the charity's project website, http://hopeforstartups.com/moodle

5.2 Use the video conferencing feature

The learners like to see a moving, waving human being at the beginning of the tutoring session or private product demo. Consider turning off the instructor's camera after the first couple of minutes, but leaving the student's camera still recording. This way you can watch for learning hiccups as you teach while not distracting your learner with the live video feed of you during the online meeting / tutoring session.

5.3 Use the comments box to communicate with each other

Agree beforehand on a couple of letters that the learner can type into their comments box to alert you that they have encountered a learning hiccup. For example, I can mean "I have an interruption I need to address right now." H can mean "I just bumped into a learning hiccup". And T can mean, "I want a 1 minute break so that I can write down a To Do item that I just thought of." Then write this item directly into the comments box, so that they don't have to click away from the session itself.

5.4 Use learning diamonds and "introductions" to potential vendors (peer tutors)

Turn over mouse and keyboard control to the student as soon as it is feasible to do so. In other words, make the student the presenter and then watch him or her actually do the tasks on his or her computer screen as you talk through how to do each task. This forces the learner to take an active learning participant role, and makes learning retention a whole lot more likely to occur. If all of the peer tutors and faculty members are also potential strategic business alliance partners, the client is a whole lot more likely to pay close attention / learn.

5.5 Teach clients how to capture a screenshot:

Clients are strongly encouraged to watch other firms' webinars and marketing presentation in order to help them better promote their own firms and products plus understand how firms in the USA communicate with potential buyers and supply chain partners. Before I start a person on watching webinars, or participating in private product demos, I will make sure that he or she knows how to capture a screenshot of the presenter's screen using Microsoft® OneNote®. Each client is encouraged to capture screenshots and keep a running log of everywhere during a webinar that they experience a learning hiccup. This task is so that we can talk about it and analyse their learning hiccup log events during a later small business coaching / mentoring appointment.

6. The most frustrating culprit: Wall thumps

Whenever too many learning hiccups and/or unpleasant educational experiences go unmanaged, the student may then do what I call a wall thump. A wall thump is something that happens completely within one's own mind, but this mental obstacle can prove to be super daunting and debilitating for an academically struggling adult and is equally as frustrating to the instructor. The person literally reacts as if he or she got knocked flat onto their back after encountering "the wall". All learning stops after a wall thump episode; usually because the learner's self-esteem is at an all-time low and the person stops believing that they can. The difference between a wall thump and a learning hiccup is that with the wall thump, you have no choice but to pursue a different training topic. You can't go back to the original one, not in this session. Lastly, we conclude the paper with a discussion on: What is the wall?

6.1 "The Wall" in high school sports – outdoor track competitions

Most of the track participant's parents don't sit in the crowd grandstands to cheer their child on during a race. They stand at a location commonly referred to as the wall, at the third bend in the track. This is the hardest point of the race and it is where their child needs their cheering the most. It is the point where your back is to the finish line, the end is nowhere in sight, you haven't yet started burning deep muscle fat energy but your muscles have used up all the readily available sugar reserves. You only see it in high school events because by the time an athlete reaches the college or professional level, "the wall" no longer exists for them. It takes a high speed camera to capture an athlete's wall thump during a race, because one usually only lasts for a split second, but there is no mistaking the pain and sheer will power needed to power through "the wall" in order to complete the race. The charity's project website has a number of pictures of wall encounters and wall thumps that were taken at a regional track championship meet.

6.2 "The Wall" in academics and in strategic business planning

Just as there is a wall in high school track meet competitions, there is also a wall within academics as well as one within fiscal stability intervention efforts for small firms that are in severe economic distress. However, while the sports mental wall is a combination of both physical exhaustion and mental feelings of inadequacy, the latter two walls are entirely mentally constructed by the learner. A wall thump produces one of the following four reactions: 1.) distraction – the person does something to distract the teacher's and classmates' attention. 2.) deflect – the person engages in bullying behaviour so that no one realizes that he or she doesn't know this answer. (this is why the peer tutors and the presence of facilitators in the job skills group practice sessions are so important) 3.) disappear – the person goes to sleep, walks out of the room, or turns his or her attention away entirely from the learning activity and 4.) deal with it and overcome the wall – one brick at a time. The extreme challenge with a wall thump is that you must somehow steer the person towards dealing with and overcoming the present obstacle. That is something easier said than done, especially when they tend towards the first three non-productive responses.

7. Conclusions

In this paper we discussed common barriers to learning. Once you understand wall thumps, learning hiccups, and the time constraints that hamper entrepreneurs, you can teach around their barriers. Doing so empowers struggling adult learners in an educational outreach to the community setting and forward progress becomes a whole lot more achievable.

LectureMonkey – Universal Lecture Capture Supporting Lifelong Learning by Disabled and Elderly Adults.

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LectureMonkey is a platform combining mobile, cloud and social computing enabling students to record the content of a lecture in a very compact format, putting students in charge of classroom lecture capture and collaborative lecture notes. Requiring only a mobile phone, students can automatically combine lecture capture (high quality audio, board images and presentation capture) together with comments from class into a social, group-sourced multimedia summary of a lecture which effectively becomes their lecture notes. LectureMonkey's learning centric social platform enables students to help each other succeed, and supports lecture review anytime, anywhere – on a mobile or on the web. LectureMonkey is freely available on the in the appstore and web at www.lecturemonkey.com. The mobile version is currently available only for the Apple iPhone™ and iPad™.

Most adult education is presented in the form of frontal lectures. It well known that quality lecture notes are crucial for student understanding and knowledge retention from lectures (Boon 1989). Without notes, approximately 80% of what is not noted is forgotten after two weeks (Boon 1989).
Quality note-taking is hard for disabled, older and second language students, generally noting less than 50% of the critical ideas (Hartley and Cameron 1967; Kiewra 1985) - but they are the group that benefits most from the ability to review lecture content at their own pace (Mahal 2012).

LectureMonkey enables students to capture “perfect” notes from which they can easily review the parts of lecture they missed or didn't understand as many times as needed. An added benefit is that lectures can be easily shared with the rest of the class, so all that is needed is a single student recorder for any class. The end result is a high quality "slide show" of all the images (presentations and whiteboards) along with synchronized audio, bookmarks and comments. You can go back to any image or point-in-time and see the board and hear exactly what was said.

Universal lecture capture would greatly benefit disabled and elderly students, providing recorded access to lectures they attend for later review at their own pace. However the technology needed for today's lecture capture systems doesn't exist in most classrooms, and the cost and complexity of these systems requires a level of equipment and IT support out of reach of most facilities. Because of these limitations, commercial lecture system have less than 10% classroom penetration in higher education (Frost&Sullivan 2014).

LectureMonkey is the only system that enables universal lecture capture by putting students in charge of capture, and requiring only a mobile phone.

LectureMonkey Modes

LectureMonkey enables students to capture lectures in two modes – *Record* and *Capture*. Record mode provides fully automated capture of the presentation content, boards and audio. All that is needed is simple setup and a convenient location to place a mobile with the camera facing the front of the room. Once set LectureMonkey automatically captures all classroom content until the application is closed.

Capture mode is semi-automatic. LectureMonkey automatically records audio, but images are manually captured by students while the audio is being recorded by picking up the phone and pointing it towards the front of the room. LectureMonkey then takes an image and automatically adds it to the captured lecture.

All images taken by LectureMonkey users in class are combined to enable true group sourcing of the captured lecture. Also the audio track combines the audio recorded by all the LectureMonkey users in class ensuring that the recording starts when the first user starts LectureMonkey and continues until the last user stops recording.

In both modes students can easily add comments using the app, or on the web by logging in and linking to the lecture at www.lecturemonkey.com. Comments are collated and added to lecture in the appropriate location as subtitles to the captured images.

Students can decide how the lectures are shared with their classmates. Lectures can be made public (anyone can view the lecture), private (no one can see the lecture except if specifically invited, and “university” – the lecture is available to any student registered in the same University, but not to anyone else.

Students can watch captured lecture from beginning to end – increasing or decreasing the speed of playback according to their needs. They can also skip through images or comments to quickly find and focus on the areas of interest. Students can view the lectures on their mobile, tablet or on the Web.

Recording a Lecture Using Record Mode

Touch the Record button 

on the main screen. After that LectureMonkey will ask for details describing the lecture you are about to record.

If you leave the details blank, LectureMonkey will name the lecture using the current date and time. You can always change the details by editing the lecture later, after you have finished recording and saved the lecture.

Set down the mobile with the camera pointed at the front of the classroom, making sure that you can see everything you want to capture on the screen. You can have completely automated setup by just leaving your phone sit - LectureMonkey will beep and start recording the whole screen automatically in about a minute. This is a little less optimal then if you calibrated LectureMonkey for the presentations and boards.

To calibrate LectureMonkey, touch the screen anywhere to take a calibration image. When calibration is complete you will see a green rectangle in the center of the screen. You can then pick up the phone to mark the capture areas.

Figure 4 Mark capture areas

Use the highlighted rectangle to mark presentation (or board) capture area by touching the rectangle (it will turn red) and moving and re-sizing as needed   Add as many areas as you need using the "New Presentation" New Presentation or "New Board" New Board buttons. When you are done adding capture areas, touch "Next"

Figure 5 Mark capture areas

The areas you marked show up in green for presentations and blue for boards. Use the rectangles as a guide to place the mobile back in the correct position. Don't worry about being exact - just get the rectangles in about the same location - the capture process is forgiving and you can always to fix the images when you are done recording.

Figure 6 Put mobile back in position

LectureMonkey will start recording automatically a few seconds after you have set it down (or you can press next if you are in a hurry). It will flash a "Recording" notification when recording starts.

You can also add comments while recording. Just pick up the phone (LectureMonkey will continue to record audio, but stop taking images), press the “add comment” button and type in your comment. Recording of images will resume when the mobile is placed back into position.

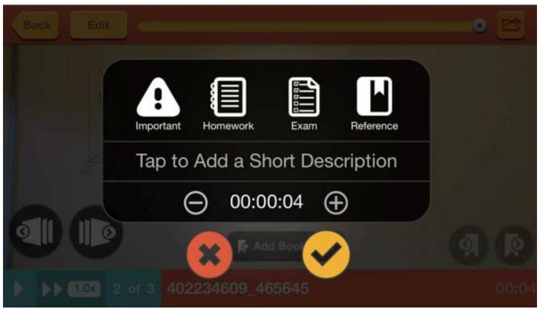

Figure 7 Add comments while recording

Recording a Lecture Using Capture Mode

Recording isn't always the way to go - sometimes you may not have a seat with visibility to the front of the room or maybe there is no where to set down the phone. For those cases and more there is "capture mode". To start capturing, press the Capture button on the top left of the main screen.

The first thing that happens is that LectureMonkey checks if anyone has already started capturing or recording. If so, it will offer you the choice of joining that recording or starting a new capture.

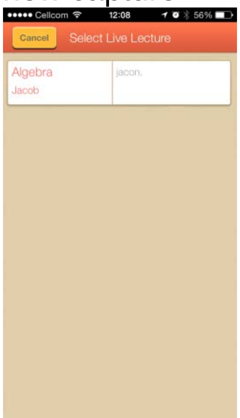

Figure 8 Choose lecture for comments

If you start a new capture, LectureMonkey will ask you to fill in a few details about the lecture so you can find it later. If you decide to join an ongoing recording - LectureMonkey will use the info provided by the first recording and start recording audio. You can now set LectureMonkey down and it will continue recording audio until you press done. You can even leave the app (put it in background) and it will continue recording.

Figure 9 Type in comments

While the audio is being recorded you can add comments, images and video. To add an image touch the camera icon (or just pick up the phone in landscape mode and point the camera forward). Pushing the video icon will start recording a 30 second video snippet. To add a comment just text and press send.

When you press done you have a recording of class with your comments, images and video.

The magic happens once class is over and everyone has finished recording. LectureMonkey collates the audio, images, video and comments from all the participants and creates a new merged lecture that starts when the first user started recording and ends when the last user stops. LectureMonkey the shares the enhanced, merged lecture with all participants so everyone has their own recording and a version of the joint effort.

Adding Bookmarks and Comments During a Lecture

If there is anyone in class recording a lecture using LectureMonkey - other LectureMonkey users can join in and add bookmarks and comments (or you can use your laptop or iPad to enter comments to a lecture you are recording yourself). Just use the press the 

button on the top left of the main screen.

As in capture mode, just choose the lecture you are attending (the list won't be long, since only lectures near you are shown). Now you can enter your bookmarks and comments, and see everyone else's. These comments are collated and added to the lecture so that they are available to everyone.

Registration, Viewing and Sharing Lectures

There is no requirement to register to use LectureMonkey, but there are quite a few benefits to registration. When you register using your school email account (e.g. Albert.Einstein@yourschool.edu) LectureMonkey adds you to your school's domain. Once part of a domain, you can see other lectures recorded in that domain (i.e. at your school), and your lectures are automatically shared with other schoolmates. This of course doesn't work if you use a generic email domain like gmail or yahoomail. That is why we recommend using your school's email – so that you share with your schoolmates, and benefit from their recordings as well? LectureMonkey also automatically enhances the audio of registered user recordings using sophisticated audio enhancement algorithms – ensuring the best audio quality possible for recorded lectures.

You can also manually share a lecture by selecting the lectures "share" icon and then selecting the email addresses, or lecturemonkey names of the classmates you wish to share with.

Lectures recorded with LectureMonkey can be viewed on an mobile or tablet using the LectureMonkey app, or on the web at http://www.lecturemonkey.com. There are a number of functions available to users to make sure lecture viewing is as efficient and enjoyable as possible:

Play: Play back the lecture continuing from the last viewing.

Share (with colleagues): Send an invitation to a colleague to view the lecture. You need this only if the colleague isn't registered for LectureMonkey using their school email address. It will send them instructions on how to access the lecture for viewing.

(Upload to) Dropbox: LectureMonkey tries to upload your lecture to your Dropbox as soon as recording is complete (assuming you have a Wifi connection), or the next time you open LectureMonkey in a Wifi zone. The icons describe where the lecture is located - an orange mobile icon means it is local on your mobile and a blue Dropbox icon means the lecture is on Dropbox - a lecture can be on either, or both. Sometimes you'll want to "force" an upload of a lecture to Dropbox, use this icon to achieve that.

Edit: This allows you modify the recorded lecture - change lecture information (e.g. name), delete images and videos. If you are the owner (i.e. you recorded the video) you can also change the location of the boards and presentations.

Delete: Delete a lecture from the mobile, Dropbox or both. Be careful, if you delete it from both it may be difficult to restore.

Skipping and direct access: LectureMonkey synchronizes playback between the slides and the audio. As you watch the lecture, the audio and slides will advance in unison. If you want to skip to the next (or previous) slide during playback you can use the standard left-right swipe gesture, or use the next\prev slide icons.

You can also skip to the next (or previous book mark) using the next\prev bookmark icons.

Image enhancement: If you are having trouble viewing a captured image, you can increase\decrease the contrast and brightness of an image during playback. The + will increase brightness, while the – decreases it. The B&W changes the image to a gray scale black and white image.

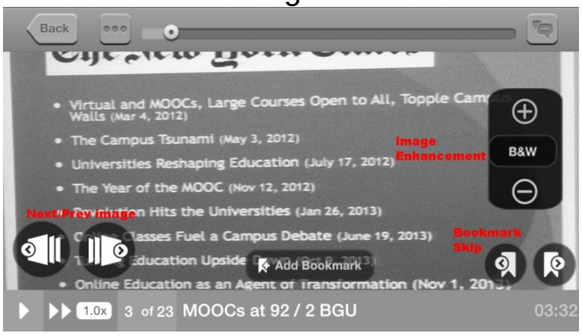

Figure 10 Viewing features

Summary

LectureMonkey aims to help all students learn better by democratizing access to lecture capture. Through pervasive crowd-sourced lecture capture, shared social comments and ubiquitous access to recorded lectures, LectureMonkey will fundamentally change the way all students learn and will especially benefit disabled, older and second language students.

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