

# ICT to Support Inclusive Education

## – Universal Learning Design (ULD)

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**Abstract:** This short paper presents six papers discussing different features of and approaches to inclusive education, including audio access to admissions tests, accessibility and usability, the use of assistive technology to support inclusion and teacher education. They are introduced by a brief discussion of inclusive education and the role of accessibility and usability and assistive technology in supporting it.

**Keywords:** inclusive education, accessibility, usability, assistive technology, teacher education, audio access

## 1. Introduction

It has been suggested that full educational inclusion requires physical, academic and social inclusion [1]. The Convention of the Rights of Persons with Disabilities [2] recognises inclusive education as a human right. The principles of the Education for All movement [3] have been incorporated into the policies and legislation of many countries. Education is vital both for personal development and employment opportunities. People with a postsecondary education qualification are significantly more likely to get a job e.g. [4] and the correlation may be even stronger for disabled people [5]. Disabled students have comparable entry qualifications [6], but are underrepresented in further and higher education [7] and obtain poorer degree results. This considerably reduces their employment opportunities [8, 9] particularly when combined with attitudinal and other barriers [10, 11].

The value of inclusive education in mainstream schools is being increasingly recognised including through legislation e.g. for 97% of all learners to be included in mainstream schools in Denmark [12]. However moves to educating disabled students in mainstream schools are taking place at different rates in different countries.

ICT (information and communication technologies) can be used to support inclusion by providing different ways of representing information, expressing knowledge and engaging in learning, including assessment. This involves both general learning technologies and assistive technologies designed specifically for disabled people. This has the further advantages of teaching ICT skills, which are becoming increasingly important and drawing on the increasing popularity and motivating effects of using ICT, particularly amongst young people. However, ICT is

not a universal solution and its successful use requires appropriate inclusive pedagogical strategies and teacher education. It also needs to be fully accessible and usable by all students. Accessibility is the system feature which ensures it can be used in particular by disabled people, including those who rely on assistive technology [13]. Usability is based on the principles of effectiveness, efficiency and satisfaction to make the process of interaction and use of both content and functions simpler, more intuitive and satisfying. There is discussion in the literature of the value of combining accessibility and usability so that disabled people are not only able to use particular systems find it easy to do so [14]. This is illustrated by the discussion in the next section of a learning platform which is accessible to screen reader users, but not very useable.

These two principles are important for all digital resources and systems, and really crucial in the field of education. In this case, it is important that the learner can focus on learning and that the system or resource does not introduce unnecessary barriers that may distract the student or even prevent learning [15]. For these reasons, when designing and developing solutions, including those based on ICT, it is crucial to always take account of the principles of accessibility and usability in the design.

## **2. Session Papers**

Inclusive education should cover both online education/eInclusion and in person education. The papers in this session focus on eInclusion and the use of ICT to support it. This is very important, but should be considered complementary to rather than instead of in person/classroom inclusion. The six conference session papers published in this chapter are wide ranging and include audio access to admission exams, accessibility of open education resources, usability of an accessible learning platform, two papers on assistive technology and teacher education on inclusion.

All stage of education should be accessible, including admissions. In their paper ‘Simulating the answering process of dyslexic students for audio versions of the common test of university admissions’, Masashi Hatekayami and Akio Fujiyoshi from Ibaraki University in Japan propose a method for evaluating audio admissions tests. The audio tests are aimed particularly at dyslexic students and the initial university admissions test (Common Test) which is taken by over half a million students in Japan each year. The evaluation is carried out by non-disabled students due to few dyslexic students yet having sufficient qualifications to apply for university. In the audio test, the scanner on top of a Speakun reading device scans an invisible 2-dimensional code and the corresponding text is read. It can be listened to via a headphone or built-in speaker at half to twice reading speed. To prevent non-disabled students reading the text it was replaced by hard to read glyphs based on the original characters. Tests with four university students found that they could complete the test in the time allowed (one and a half times that for the regular test) and three of them did better than average. However, they found the audio test more tiring and difficult and to require more time than the standard test. Technology to support audio tests is very useful and the approach to evaluation is interesting. However, it does not consider possible differences in audio processing between dyslexic and non-disabled students and that dyslexic students may use both audio and written information.

All aspects of education systems should be accessible and usable to all students. This includes institution websites, learning management systems and resource materials. Two papers in the session consider accessibility (and usability).

In 'Gauging awareness of accessibility in open educational resources' Oriane Pierrès and Alireza Darvisha from Zurich University of Applied Sciences, Switzerland, used interviews to investigate the accessibility of open educational resources. These are educational materials that can be used by everyone free of charge and with few restrictions. 17 semi-structured interviews were carried out with university personnel in 15 countries who create, teach about or support the creation of open educational resources (OERs). 12 participants considered accessibility in terms of meeting the needs of disabled learners, whereas others had a broader definition based on meeting the needs of all users including those of 'low socioeconomic status'. 14 participants tried to make OERs accessible and nine of them tested their content for accessibility issues. The difficulties of creating accessible OERs included the time involved with accessibility involving additional work to make adjustments or learn how to make OERs accessible. Participants realised they needed more knowledge of accessibility and considered this generally lacking amongst OER developers. Knowledge about making maths formulae and tables accessible was particularly limited.

Learning content and technologies need to be easy to use as well as accessible. In 'Usability of an accessible learning platform – lessons learnt', Leev Wilkens and Christian Bühler from TU Dortmund, Germany evaluate the usability of the Degree 4.0 learning platform with nine disabled and non-disabled students. Accessibility features of this platform include the ability to operate all functions including the video player and editor via a keyboard and to switch audio descriptions and subtitles on and off. One usability test with a visually impaired student was carried out in person with the others carried out on zoom with screen sharing to allow observation by researchers who were present for one of the six usability tests and not for the five others. Participants were asked to 'think aloud'. The usability task involved editing a video sequence. All participants completed the task, but the time required varied by a factor of five. All participants found the platform accessible. Screen reader users were able to access everything with a keyboard, but experienced problems due to inaccurate or incorrect labelling. There were also problems due to lack of knowledge of how codes worked. Three participants had usability scores below 70, which is considered a problem. A visually impaired participant had the lowest score of 17.5. This indicates the importance of considering usability as well as accessibility. There is a risk that users will abandon systems with poor usability e.g. which take too long to use even if they are theoretically fully accessible.

Two papers consider the use of assistive technology to support inclusion. 'Requirements for assistive technology by disabled students in higher education' by Inguna Griskevica, Dace Stiegle and Dina Bithere from the University of Liepaja, Latvia presents the results of a study to support the development of an evaluation tool for the requirements of disabled students in higher education. This involved analysing policy documents and research on inclusive education. This led to the choice of inclusive education, universal design and universal design for research approaches to tool development. Data was collected on a random basis from students in any level of education in Cyprus, Greece, Latvia and Slovenia. 65% of participants

were found to require assistive technology to some extent. This is a very high percentage and its implications require further investigation. The main types of assistive technologies required were found to be mentor (42%), psychologist (31%) and assistant (16%). However, this refers to types of support generally provided by people rather than technology.

‘Video screen commentary system supporting online learning of visually impaired students’ by Dong-Yeon Park and Soon-Bum Lin of Sookmyung Women University, Korea presents a system for automatically adding audio commentary to a video screen to improve the understanding of visually impaired students. This involves identifying the start of new slides, adding commentary files for each slide and merging the commentary video with the original video. The commentary file includes all text from the slide in an appropriate reading order, captions for graphics, either provided on the slide (or created using Microsoft’s Azure Cognitive Services Computer Vision), and structural information for tables. The commentary files are inserted when the screen changes in the original video and the commentary and videos merged to form a single video. Eight blind and blindfolded non-disabled students evaluated the system. The use of video commentary was found to improve understanding to a statistically significant extent.

Teachers need appropriate education and training to apply inclusive approaches. ‘How to overcome eInclusion – Inclusive education going digital: the education of “digital scouts”’ by Claudia Mertens of the University of Bielefeld, Germany presents a two-phase approach to educating students in teacher education (‘digital scouts’) on inclusion. The first theoretical phase involved the presentation of inclusive digital teaching materials and concepts. In the second practical phase 14 digital scouts worked in pairs with students with learning disabilities or cognitive impairments in inclusive settings in seven mainstream schools. The aim was to support the disabled students using digital media to learn to teach them about media. The materials used were developed using universal design for learning principles. Group interviews with these students were used to investigate their experiences and found that they had both learnt to use media and learnt about them and enjoyed the involvement of the digital scouts. E-portfolios of self-reflection were used to investigate the digital scouts’ experiences and found that they had increased their competence in digital teaching and sensitivity to universal design for learning.

This conference session also includes seven scientific contributions which are part of in the Open Access Compendium (OAC) and one in the Inclusion Forum. The OAC paper are:

- ‘Accessibility Standards and Laws: Implementation for Successful Digital Education within the Eurozone’,
- ‘Digi-ID: co-creating accessible digital skills education to enhance health, well being and social inclusion for people with accessibility needs’,
- ‘Information Technologies in Teaching to Play the Piano for Children with Disabilities’,
- ‘Polygraf Online – video-conferencing system for accessible remote and hybrid teaching’,
- ‘Training to implement inclusive distance higher education’, and
- ‘Universal Design of Inquiry-Based Mathematics Education in Universities’.

Many of these papers discuss the use of technology and accessibility features which should be part of good practice when designing and developing technologies to support inclusive education. A substantial proportion of the papers deal with the more topical issue of the accessibility of distance education and communication systems. There is a need for research to start now to prepare for the possible future use of these systems in remote or blended learning to contribute to ensuring full access for all.

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