Adapting Learning Materials for Students with Disabilities

Laura Grindei (Technical University of Cluj-Napoca, Romania)
José-V. Benlloch-Dualde (Universitat Politècnica de Valencia, Spain)

Version 1.0
25th April 2015
Introduction

Designing education for equal access [1] means that, rather than designing for the average student, you design instruction for students who potentially have broad ranges with respect to ability, disability, age, reading level, learning style, native language, race, ethnicity, and other characteristics. It can be applied to all aspects of instruction, including class climate, interaction, physical environments and products, delivery methods, information resources and technology, feedback, and assessment.

Teachers should consider the potential variation in individual skills, learning styles and preferences, age, gender, culture, abilities, and disabilities as they select appropriate strategies for the delivery of instruction and then apply universal design to all course activities and resources. Specifically, the instructor needs to consider their potential diverse characteristics (e.g., with respect to abilities to see, hear, manipulate objects, read, and communicate). Then apply instructional strategies to all lectures, classroom discussions, group work, handouts, web-based content, labs, fieldwork, assessment instruments, and other academic activities and materials to maximize the learning of students with the wide variety of characteristics including disabilities. Monitoring the effectiveness of instruction through observation and feedback from all students, and particularly from those with disabilities, regarding their perception on assessing learning and modifying the course as appropriate, should improve the whole instruction process.

Ensure that facilities, activities, materials, and equipment are physically accessible to and usable by all students, and that all potential student characteristics are addressed in safety considerations. Ensure that course materials, notes, and other information resources are engaging, flexible, and accessible for all students. If computers or science labs are used, ensure that assistive technology for students with disabilities is available or can be readily acquired.

Using these equal access principles benefits students with disabilities but also benefits others. For example, captioning course videos [2], which provides access to deaf students, is also a benefit to students with other learning disabilities, and to those watching the video in a noisy environment. Delivering content in redundant ways can improve instruction for students with a variety of learning styles and cultural backgrounds. Letting all students have access to your class notes and assignments on a website benefits students with disabilities and everyone else. All this serves to increase the successful participation of individuals with disabilities in challenging academic programs such as those in science, engineering, mathematics, and technology.

Invisible disabilities—such as learning disabilities, attention deficits, autism spectrum disorders, psychiatric impairments, Tourette's syndrome, seizure conditions—are not easily noticed. And often, individuals with these conditions do not disclose them. Therefore, in educational and work environments, it is good for practitioners to keep in mind that some people with whom they interact may have these conditions so that they can provide education and employment situations that are welcoming and accessible to individuals from these populations [3].

In addition, if we consider that access to learning is identified as a right supported by European legislation, it seems fundamental to adapt learning materials in order to make them accessible to all, regardless the particular student needs.

Based on the studies carried out within an EU-funded accessibility project at The Open University in UK, and at three other European universities, P. McAndrew et al. [4] propose a holistic view of accessibility, based on three factors: positioning the university as a positive provider to disabled students; developing processes, systems and services to give personal help; and planning online materials which include alternatives.

Some related European projects

1. The EU4ALL project (European Unified Approach for Accessible Lifelong Learning, IST-2005-034778) is a European project under the 6th Framework Program, within the FP6-2005-IST-
2.5.11 eInclusion research objective, coordinated by the National Distance Education University (UNED), in Spain. Although in the e-Inclusion area, it fully focused on technology applied to education. In particular, it addressed the needs of Accessible Lifelong Learning at HE. EU4ALL is a 48-months (finally extended to 54, from October 2006 to March 2011) integrated project which involves major stakeholders on both the demand and supply sides [5].

2. The **ICT4IAL project** (Jan2013-Dec2015), coordinated by the European Agency for Development in Special Needs and Inclusive Education (http://www.european-agency.org/agency-projects/ict4ial), will:
- Raise awareness and increase the visibility of the issue of accessible information provision and its relevance for equitable lifelong learning opportunities;
- Support accessible information provision within organizations through the development, trialing and evaluation of guidelines that build upon already existing work in the field (notably the i-access project recommendations).

3. The **EDDA project** (*Adapting learning materials to make them accessible to learners who are blind or have visual impairments while retaining the original level of instruction*). The context for the use of ICT for Inclusion (https://www.european-agency.org/sites/default/files/Netherlands_exa-2.pdf). The EDDA Project is responsible for providing learning materials that are optimally accessible for pupils with severe visual impairments, and provides tailor-made advice, according to the pupil’s potential. ‘Optimal’ refers to materials that are technically and didactically appropriate to the pupil’s developmental age. The EDDA project will adopt guidelines for:
  - Technical adaptation of written learning materials and technical adaptation of digital learning materials.
  - Didactic adaptation of written learning materials and didactic adaptation of digital learning materials: http://www.project-edda.nl/ (in dutch).

4. The **QATRAIN** project (*Quality Assurance and Accessible Training*: http://www.qatrain.eu/). It is a Leonardo da Vinci funded project that aims to help remove barriers to participation for disabled people in mainstream Vocational Education and Training (VET). This transnational project, with partners in the UK, Bulgaria, France, Greece, and Poland, helps VET providers to develop a more inclusive approach to the design of teaching, learning and assessment strategies through the development of a web based resource that provides Strategies for Creating Inclusive Programmes of Study (SCIPS): http://www.scips.worc.ac.uk/browse.html

5. The **ETTAD** project (*Enabling teachers and trainers to improve the accessibility of adult education*, 134653-LLP-1-2007-UK-GRUNDTVIG-GMP). The project has produced a web-based resource for teachers and trainers that identifies potential challenges that disabled learners might experience in engaging with their courses. The resource also offers strategies and recommendations for adjustments to practice. Such strategies/more inclusive practices enable disabled learners to overcome these challenges and this allows them to participate more fully in adult education Best practice guide available in English, Bulgarian, Greek, Romanian, Turkish: http://uk.ettad.eu/understanding-disability

6. The **EUPD** project: European Project High education for people with disabilities, POSDRU/86/1.2./S/6395: http://eupd.ro/ . Title Development and implementation of an integrated pilot program for providing increased access to higher education for people with disabilities). Results : design of a curriculum for a mentorship educational program for training academic staff from higher education institutions to work with disabled people: http://eupd.ro/wp-content/uploads/2011/09/Curriculum.pdf (Romanian only) including definition of disabilities, national actual legislation regarding people with disabilities, examples of best

7. **STEM Learning and Teaching Reconfigured**, Maximising the potential of students with a visual impairment: [http://stem.ecs.soton.ac.uk/](http://stem.ecs.soton.ac.uk/)

**Goals**

I. To investigate into how to produce and/or **adapt learning materials using the new assistive technologies** to make them accessible to all, and to establish **guidelines** to accomplish this goal.

II. To look for **best practices to adapt learning materials**, particularly from SALEIE partner institutions.

III. To study the **integration methods for the adapted learning materials in the Learning Management System (LMS)**.

IV. To collect **guidelines and standards for accessible website design**, especially for delivering online learning materials.

V. To find **other useful resources** for adapting learning materials.
I. ADAPTING LEARNING MATERIALS USING THE NEW ASSISTIVE TECHNOLOGIES

1. Defining impact and recognising disabilities:

Dyslexia [6]

Impacts: on an individual's ability to read, write, speak and remember information automatically. Symptoms vary between individuals, and their severity may fluctuate. Performance is affected by the general level of IQ and effectiveness of coping strategies, as well as the severity of dyslexia that is present. There is high comorbidity with other specific learning disabilities such as dyspraxia, dyscalculia, ADHD and Irlen Syndrome.

Recognising dyslexia

A number of the following indicators may be present:

- Poor spelling
- Incoherent prose, as a result of using incorrect alternatives from the spell-check facility
- Poor grasp of grammar, punctuation and sentence structure
- Inability to structure ideas in written work
- Difficulty with verbal expression, especially word retrieval
- Poor organisation: forgetting instructions, losing papers, missing appointments, lectures and deadlines
- Illegible handwriting
- Poor self-esteem and sensitivity to criticism
- Difficulties coping with a heavy reading load
- Inability to take notes effectively
- Lack of concentration
- Weak mathematical skills

Visual impairments [6]
Impact: The extent of the impact of the disability on a person’s life is influenced by the degree of impairment, the age at which the impairment occurs and the person’s range of experiences in early life. People who are blind from a young age may have only partial knowledge of many objects and ideas that people with normal vision take for granted. Some people may be able to improve their vision with corrective lenses, while others with low vision may rely on residual vision with the use of adaptive equipment. Reading and writing are often much slower processes for people with vision disabilities. Extra time may be needed to use the necessary aids such as magnifiers, scanners and screen readers. The causes of vision impairment are diverse and include diabetes, glaucoma, stroke, brain injury, eye infections, viruses, accidents and congenital conditions such as albinism.

Hearing impairment

Some people are born with a hearing impairment, whilst others develop it in later life. The effects of deafness and hearing loss on communication can vary depending on the extent and time of onset of the impairment.

The extent may range from mild to profound, and may involve the loss of some or many frequencies of sound. It is often possible for people to hear certain sounds (usually of low frequency, such as vowels) but not others. Some sounds may be distorted or grossly amplified. Also, hearing levels may fluctuate and a student who hears quite well one day may have considerable difficulty the next. A “mild” loss may still make it difficult or impossible for the person to understand a lecturer’s voice eight metres away even when a hearing aide can assist at closer distances. Students who have been deaf from birth, or prelingually, may have varying degrees of speech. For those who choose to speak, feedback is limited, so vocal control, volume and articulation may be affected. This can result in the student's voice sounding different. Depending on the nature of the impairment, students may use a combination of lip reading, sign language interpreters and specialised equipment (such as hearing aids or radio transmitters) to augment their hearing loss.

For a student who has been deaf from birth speech may be minimal, and there will be a resulting difficulty in grasping language and vocabulary. Students who have lost hearing after birth may have varying degrees of speech, depending on the time of loss.

Mobility impairment

Mobility impairments can stem from a wide range of causes and be permanent, intermittent or temporary.

Mobility difficulties can arise from congenital conditions such as cerebral palsy or can onset in later life through injury or conditions such as muscular dystrophy, certain types of arthritis, or multiple sclerosis. ‘Hidden’ conditions such as chronic fatigue syndrome and cystic fibrosis may also impair mobility. Any of these conditions impair the strength, speed and endurance of the person, and may possibly affect manual dexterity and coordination as well as the ability to walk.
Impact: The effects of mobility disabilities may be visible in that the person makes use of aids such as wheelchairs, crutches and walking sticks. The individual may use a Personal Assistant to help with personal care or make use of a Disability Support Worker to help with notetaking, photocopying and retrieving library materials.

However, there are also less obvious effects. In the case of head injury, fine motor control, balance and sometimes orientation may be affected, and fatigue is a common problem. Similarly, chronic illness may not be obvious but can cause fatigue during movement about the campus. All mobility impairments increase the time and effort which students expend performing day-to-day activities. Using facilities which others take for granted, such as toilets, canteens, libraries and lecture rooms can be a major undertaking. Physical access to university buildings is a key concern and those who use wheelchairs, crutches, canes, or who tire easily, may find it difficult moving about, especially within the time restraints imposed by lecture timetables. Absence or lateness may be caused by transportation problems, inclement weather, waiting for lifts, lift or wheelchair breakdown. Getting out of lecture rooms may pose problems as well, especially in emergencies.

Report any physical access problems in the department so that modifications can be made, eg ramps on kerbs to allow wheelchair access.

Other medical conditions: chronic fatigue syndrome, diabetes etc.

There are a number of disabilities and medical conditions that may interfere with students' academic work, their ability to attend lectures, concentrate, finish assignments or complete examinations. Many of these conditions are 'hidden' disabilities and their effects may not be immediately apparent. However, the symptoms of some of these, such as limited mobility or impaired vision, and the types of adjustments required, may resemble those covered in guides for other disabilities. The same general teaching principles apply to teaching all students with disabilities, particularly the need to identify the disability and to discuss with the student both its effects and any necessary considerations regarding course work. This should be a continuous process since the student's needs may change as their degree program continues. Brief descriptions of some of the more prevalent disabilities among students are given below.

Chronic fatigue syndrome (CFS), or myalgic encephalomyelitis (ME) is believed to be caused by an abnormal response to a virus or some other trigger factor. CFS is a chronic condition lasting months or even years. People with CFS are prone to relapse if they exceed the limits of physical or mental exertion which their illness imposes. Symptoms may vary in severity from day to day, even from hour to hour, and include:

- Profound physical and mental exhaustion
- Persistent pain in muscles and joints
- Headaches varying from dull to intense
- Dizziness, nausea, fainting
- Poor concentration and memory
- Pallor or flushing of face
- An inability to tolerate extremes of heat, light or sound (for example a noisy lecture room)
- A sensitivity to various agents and chemicals
Students will need to avoid prolonged standing, extremes of heat and cold, exposure to fumes from science laboratories, and mental or physical exertion beyond the limits imposed by their condition.

As a consequence of this illness, the student may feel a great sense of isolation and loneliness with a serious loss of self-confidence. It is important that the student be trusted and treated sympathetically. As the condition fluctuates, sometimes drastically, difficulties should be discussed as they arise. Good communication between the staff member and the student is essential and the student's ability to cope will be assisted by such empathy.

**Diabetes** means that there is too much sugar (or glucose) in the blood and is caused by a lack of insulin, a substance the body needs to use sugar. People with diabetes are usually treated with insulin injections, as well as some modification to their diet and exercise. In order to balance the injected insulin with sugar levels, meals need to be evenly spaced throughout the day, with extra food taken before exercise.

**Hypoglycaemia**: Sometimes the blood sugar level will fall below normal and the person may experience a 'hypo' or hypoglycaemic reaction. A hypo can occur if a student misses a meal entirely; runs late for a meal; fails to eat extra carbohydrate before exercise or inadvertently takes too much insulin. The symptoms of hypoglycaemia vary from one person to another but commonly include sweating, pallor, day dreaming, slurred speech, shakiness, crying, confusion and bad temper. Hypoglycaemia can occur within minutes of a person seeming to be well and is potentially serious. If you suspect a person is hypoglycaemic, encourage them to ingest sugar. A temporary excess of sugar is not harmful, but if sugar levels fall very low it may lead to a loss of consciousness or a seizure. If the person is unconscious, do not attempt to give food or drink but seek medical attention immediately.

**Hyperglycaemia**: Sometimes high blood sugar levels can result when a person with diabetes eats too much, eats the wrong food, or does not have enough insulin to meet body requirements such as during examinations or other times of stress. The classic symptoms of hyperglycaemia are increased thirst, increased urination, increased appetite and signs of dehydration (cracked lips, dry skin, sunken eyes). Most students with diabetes are able to manage the condition without assistance. Small accommodations from teaching staff may be required at certain times (eg permission to eat small amounts of food in lectures or examinations).

It would be helpful to provide students with a basic outline of the teaching module's structure. This can help students with limited energy or sensory impairments know when to focus on certain aspects of the subject and mean they are better prepared for lectures and seminars. Considered good practice, the provision of a course structure is encouraged wherever possible.
2. Academic staff GUIDELINES TO ADAPT TEACHING MATERIALS for students with disabilities and learning difficulties:

2.1 Lectures: teaching materials, on line learning and assistive technologies for lectures [1] [7] [8] [9]

<table>
<thead>
<tr>
<th>Type of disability or SpLD*</th>
<th>Lectures</th>
<th>on line learning</th>
<th>Assistive technologies for lectures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dyslexia</td>
<td>• flow charts are ideal for explaining procedures.</td>
<td>• on line navigation through teaching materials should be easy &amp; site map is helpful.</td>
<td>• assistive technologies for dyslexic people including reading devices and software since reading is the area in which students with dyslexia struggle the most: Learning Ally, Read2Go, iBooks, Kindle, Audiobooks from Audible, ZoomReader, ClaroSpeak US including an option for OpenDyslexic font, Speak it!, Balabolka, Natural Reader.</td>
</tr>
<tr>
<td></td>
<td>• pictograms&amp; graphics help to locate information.</td>
<td>• use graphics, images, and pictures to break up text.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• avoid abbreviations if possible or provide a glossary of abbreviations and jargon.</td>
<td>• offer alternate download pages in a text reader friendly style.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• use short, simple sentences in a direct style and give instructions clearly.</td>
<td>• avoid using white backgrounds for web resources.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• avoid long sentences explanations, be concise.</td>
<td>• Web Reader.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• avoid text in block capitals because this is much harder to read and white backgrounds.</td>
<td>• The users of e-learning materials should be able to change:</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• provide handouts giving an overview of main points, well in advance of lectures. This enables a student to prepare effectively, and provides an outline which can be annotated during the lecture.</td>
<td>• font, font style &amp;size, font colour</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• vary styles of delivery. Present information visually wherever possible and consider using alternative media: videos, tapes, CD ROMs.</td>
<td>• cursor size, style and blink rate;</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• dyslexic students often need points repeating, to ensure that information passes into their long term memory. Give summaries at beginning and end of lectures and revisit points of learning at intervals.</td>
<td>• size of text and images;</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• screen layout, colours and backgrounds.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• learning objects must have control options for timing of events, multimedia elements, including video, and navigation – allowing the user to skip a section or return to a section.</td>
<td></td>
</tr>
<tr>
<td>Visual Impairment</td>
<td>In-class access to a computer/laptop with screen-reading software or assistive technology for taking notes and communicate during classes: Transcriptions – Panopto with Synote <a href="http://linkeddata.synote.org">http://linkeddata.synote.org</a> offering synchronised annotations.</td>
<td>Use of visual assistive technologies that provides enlarged text: ZoomReader; voice: ClaroSpeak US, Speak it!, Balabolka, Natural Reader, LiveScribe, or Braille output, FingerReader <a href="http://fluid.media.mit.edu/projects/fingerreader">http://fluid.media.mit.edu/projects/fingerreader</a></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>• materials in large print or Braille.</td>
<td>• in-line audio materials.</td>
<td>• use of note taking apps, image capture and OCR – ex. Evernote + Prizmo <a href="https://itunes.apple.com/gb/app/prizmo-scanning-ocr-speech/id366791896?mt=8">https://itunes.apple.com/gb/app/prizmo-scanning-ocr-speech/id366791896?mt=8</a></td>
<td></td>
</tr>
<tr>
<td>• audio materials recorded on tape, DVD, etc or via computer.</td>
<td>• e-books.</td>
<td>• Braille translation software and embossing equipment.</td>
<td></td>
</tr>
<tr>
<td>• captioning course videos.</td>
<td>• access to on line assistive technology that provides enlarged text, voice recordings.</td>
<td>Software based tools such as screen readers, screen magnifiers such as hand held magnifiers: SenseView, text to speech software &amp; screen tinters. Hardware based tools such as refreshable braille, CCTV magnifiers or portable magnifiers, talking tools (ex measuring jugs, rulers etc).</td>
<td></td>
</tr>
<tr>
<td>• enlarged or tactile drawings.</td>
<td>• suggest students to use: Web Reader, Firefox – Fire Vox for web page reading aloud</td>
<td>• suggest students to use NVDA screen reader Virtual Magnifying Glass, SumatraPDF, WebbIE, and free software for print to audio conversion, ex: Create&amp;Convert – JISC RSC Scotland SE, TAMS – Techadap, Save as Daisy and Pipeline – Office 2010 – Daisy Consortium, Robobraille [9]</td>
<td></td>
</tr>
<tr>
<td>• tactile demonstrations incorporated into instruction for understanding concepts.</td>
<td>• tactile demonstrations incorporated into instruction for understanding concepts.</td>
<td>• suggest students to use mobile phone apps, for Android phones ex. eyes free, talkback &amp; Digital Talking Timer, for iPhone the built in accessibility features ex. VoiceOver and Zoom or Eye Reader and Voice of Daisy [9]</td>
<td></td>
</tr>
<tr>
<td>• electronic dictionaries (e.g. languages or science-based dictionaries) with audio.</td>
<td>• use email for class notes and other teaching materials instead of printed documents for blind students (they can be converted in audio information through screen reading software).</td>
<td>• suggest students to use mobile phone apps, for Android phones ex. eyes free, talkback &amp; Digital Talking Timer, for iPhone the built in accessibility features ex. VoiceOver and Zoom or Eye Reader and Voice of Daisy [9]</td>
<td></td>
</tr>
<tr>
<td>• use email for class notes and other teaching materials instead of printed documents for blind students (they can be converted in audio information through screen reading software).</td>
<td>• e-books.</td>
<td>• e-books.</td>
<td></td>
</tr>
<tr>
<td>• on line audio materials.</td>
<td>• use of visual assistive technologies that provides enlarged text: ZoomReader; voice: ClaroSpeak US, Speak it!, Balabolka, Natural Reader, LiveScribe, or Braille output, FingerReader <a href="http://fluid.media.mit.edu/projects/fingerreader">http://fluid.media.mit.edu/projects/fingerreader</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• access to on line assistive technology that provides enlarged text, voice recordings.</td>
<td>• suggest students to use: Web Reader, Firefox – Fire Vox for web page reading aloud</td>
<td>• use of note taking apps, image capture and OCR – ex. Evernote + Prizmo <a href="https://itunes.apple.com/gb/app/prizmo-scanning-ocr-speech/id366791896?mt=8">https://itunes.apple.com/gb/app/prizmo-scanning-ocr-speech/id366791896?mt=8</a></td>
<td></td>
</tr>
<tr>
<td>• suggest students to use: Web Reader, Firefox – Fire Vox for web page reading aloud</td>
<td>• tactile demonstrations incorporated into instruction for understanding concepts.</td>
<td>• use of note taking apps, image capture and OCR – ex. Evernote + Prizmo <a href="https://itunes.apple.com/gb/app/prizmo-scanning-ocr-speech/id366791896?mt=8">https://itunes.apple.com/gb/app/prizmo-scanning-ocr-speech/id366791896?mt=8</a></td>
<td></td>
</tr>
<tr>
<td>• use email for class notes and other teaching materials instead of printed documents for blind students (they can be converted in audio information through screen reading software).</td>
<td>• e-books.</td>
<td>• Braille translation software and embossing equipment.</td>
<td></td>
</tr>
<tr>
<td>• on line audio materials.</td>
<td>• use of visual assistive technologies that provides enlarged text: ZoomReader; voice: ClaroSpeak US, Speak it!, Balabolka, Natural Reader, LiveScribe, or Braille output, FingerReader <a href="http://fluid.media.mit.edu/projects/fingerreader">http://fluid.media.mit.edu/projects/fingerreader</a></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• access to on line assistive technology that provides enlarged text, voice recordings.</td>
<td>• tactile demonstrations incorporated into instruction for understanding concepts.</td>
<td>• use of note taking apps, image capture and OCR – ex. Evernote + Prizmo <a href="https://itunes.apple.com/gb/app/prizmo-scanning-ocr-speech/id366791896?mt=8">https://itunes.apple.com/gb/app/prizmo-scanning-ocr-speech/id366791896?mt=8</a></td>
<td></td>
</tr>
<tr>
<td>• suggest students to use: Web Reader, Firefox – Fire Vox for web page reading aloud</td>
<td>• tactile demonstrations incorporated into instruction for understanding concepts.</td>
<td>• use of note taking apps, image capture and OCR – ex. Evernote + Prizmo <a href="https://itunes.apple.com/gb/app/prizmo-scanning-ocr-speech/id366791896?mt=8">https://itunes.apple.com/gb/app/prizmo-scanning-ocr-speech/id366791896?mt=8</a></td>
<td></td>
</tr>
<tr>
<td>• tactile demonstrations incorporated into instruction for understanding concepts.</td>
<td>• use email for class notes and other teaching materials instead of printed documents for blind students (they can be converted in audio information through screen reading software).</td>
<td>• use of note taking apps, image capture and OCR – ex. Evernote + Prizmo <a href="https://itunes.apple.com/gb/app/prizmo-scanning-ocr-speech/id366791896?mt=8">https://itunes.apple.com/gb/app/prizmo-scanning-ocr-speech/id366791896?mt=8</a></td>
<td></td>
</tr>
<tr>
<td>• electronic dictionaries (e.g. languages or science-based dictionaries) with audio.</td>
<td>• on line audio materials.</td>
<td>• Braille translation software and embossing equipment.</td>
<td></td>
</tr>
<tr>
<td>• use email for class notes and other teaching materials instead of printed documents for blind students (they can be converted in audio information through screen reading software).</td>
<td>• access to on line assistive technology that provides enlarged text, voice recordings.</td>
<td>Software based tools such as screen readers, screen magnifiers such as hand held magnifiers: SenseView, text to speech software &amp; screen tinters. Hardware based tools such as refreshable braille, CCTV magnifiers or portable magnifiers, talking tools (ex measuring jugs, rulers etc).</td>
<td></td>
</tr>
<tr>
<td>• on line audio materials.</td>
<td>• suggest students to use: Web Reader, Firefox – Fire Vox for web page reading aloud</td>
<td>• suggest students to use mobile phone apps, for Android phones ex. eyes free, talkback &amp; Digital Talking Timer, for iPhone the built in accessibility features ex. VoiceOver and Zoom or Eye Reader and Voice of Daisy [9]</td>
<td></td>
</tr>
<tr>
<td>• access to on line assistive technology that provides enlarged text, voice recordings.</td>
<td>• tactile demonstrations incorporated into instruction for understanding concepts.</td>
<td>• suggest students to use mobile phone apps, for Android phones ex. eyes free, talkback &amp; Digital Talking Timer, for iPhone the built in accessibility features ex. VoiceOver and Zoom or Eye Reader and Voice of Daisy [9]</td>
<td></td>
</tr>
<tr>
<td>• tactile demonstrations incorporated into instruction for understanding concepts.</td>
<td>• use email for class notes and other teaching materials instead of printed documents for blind students (they can be converted in audio information through screen reading software).</td>
<td>• use of note taking apps, image capture and OCR – ex. Evernote + Prizmo <a href="https://itunes.apple.com/gb/app/prizmo-scanning-ocr-speech/id366791896?mt=8">https://itunes.apple.com/gb/app/prizmo-scanning-ocr-speech/id366791896?mt=8</a></td>
<td></td>
</tr>
<tr>
<td>• electronic dictionaries (e.g. languages or science-based dictionaries) with audio.</td>
<td>• on line audio materials.</td>
<td>• Braille translation software and embossing equipment.</td>
<td></td>
</tr>
<tr>
<td>• use email for class notes and other teaching materials instead of printed documents for blind students (they can be converted in audio information through screen reading software).</td>
<td>• access to on line assistive technology that provides enlarged text, voice recordings.</td>
<td>Software based tools such as screen readers, screen magnifiers such as hand held magnifiers: SenseView, text to speech software &amp; screen tinters. Hardware based tools such as refreshable braille, CCTV magnifiers or portable magnifiers, talking tools (ex measuring jugs, rulers etc).</td>
<td></td>
</tr>
<tr>
<td>• on line audio materials.</td>
<td>• suggest students to use: Web Reader, Firefox – Fire Vox for web page reading aloud</td>
<td>• suggest students to use mobile phone apps, for Android phones ex. eyes free, talkback &amp; Digital Talking Timer, for iPhone the built in accessibility features ex. VoiceOver and Zoom or Eye Reader and Voice of Daisy [9]</td>
<td></td>
</tr>
<tr>
<td>• access to on line assistive technology that provides enlarged text, voice recordings.</td>
<td>• tactile demonstrations incorporated into instruction for understanding concepts.</td>
<td>• suggest students to use mobile phone apps, for Android phones ex. eyes free, talkback &amp; Digital Talking Timer, for iPhone the built in accessibility features ex. VoiceOver and Zoom or Eye Reader and Voice of Daisy [9]</td>
<td></td>
</tr>
<tr>
<td>• suggest students to use: Web Reader, Firefox – Fire Vox for web page reading aloud</td>
<td>• tactile demonstrations incorporated into instruction for understanding concepts.</td>
<td>• suggest students to use mobile phone apps, for Android phones ex. eyes free, talkback &amp; Digital Talking Timer, for iPhone the built in accessibility features ex. VoiceOver and Zoom or Eye Reader and Voice of Daisy [9]</td>
<td></td>
</tr>
<tr>
<td>• tactile demonstrations incorporated into instruction for understanding concepts.</td>
<td>• electronic dictionaries (e.g. languages or science-based dictionaries) with audio.</td>
<td>• use email for class notes and other teaching materials instead of printed documents for blind students (they can be converted in audio information through screen reading software).</td>
<td></td>
</tr>
<tr>
<td>• use email for class notes and other teaching materials instead of printed documents for blind students (they can be converted in audio information through screen reading software).</td>
<td>• on line audio materials.</td>
<td>• Braille translation software and embossing equipment.</td>
<td></td>
</tr>
<tr>
<td>• on line audio materials.</td>
<td>• access to on line assistive technology that provides enlarged text, voice recordings.</td>
<td>Software based tools such as screen readers, screen magnifiers such as hand held magnifiers: SenseView, text to speech software &amp; screen tinters. Hardware based tools such as refreshable braille, CCTV magnifiers or portable magnifiers, talking tools (ex measuring jugs, rulers etc).</td>
<td></td>
</tr>
<tr>
<td>• suggest students to use: Web Reader, Firefox – Fire Vox for web page reading aloud</td>
<td>• tactile demonstrations incorporated into instruction for understanding concepts.</td>
<td>• suggest students to use mobile phone apps, for Android phones ex. eyes free, talkback &amp; Digital Talking Timer, for iPhone the built in accessibility features ex. VoiceOver and Zoom or Eye Reader and Voice of Daisy [9]</td>
<td></td>
</tr>
<tr>
<td>• tactile demonstrations incorporated into instruction for understanding concepts.</td>
<td>• electronic dictionaries (e.g. languages or science-based dictionaries) with audio.</td>
<td>• use email for class notes and other teaching materials instead of printed documents for blind students (they can be converted in audio information through screen reading software).</td>
<td></td>
</tr>
<tr>
<td>• use email for class notes and other teaching materials instead of printed documents for blind students (they can be converted in audio information through screen reading software).</td>
<td>• on line audio materials.</td>
<td>• Braille translation software and embossing equipment.</td>
<td></td>
</tr>
<tr>
<td>• tactile demonstrations incorporated into instruction for understanding concepts.</td>
<td>• access to on line assistive technology that provides enlarged text, voice recordings.</td>
<td>Software based tools such as screen readers, screen magnifiers such as hand held magnifiers: SenseView, text to speech software &amp; screen tinters. Hardware based tools such as refreshable braille, CCTV magnifiers or portable magnifiers, talking tools (ex measuring jugs, rulers etc).</td>
<td></td>
</tr>
<tr>
<td>• electronic dictionaries (e.g. languages or science-based dictionaries) with audio.</td>
<td>• suggest students to use: Web Reader, Firefox – Fire Vox for web page reading aloud</td>
<td>• suggest students to use mobile phone apps, for Android phones ex. eyes free, talkback &amp; Digital Talking Timer, for iPhone the built in accessibility features ex. VoiceOver and Zoom or Eye Reader and Voice of Daisy [9]</td>
<td></td>
</tr>
<tr>
<td>• use email for class notes and other teaching materials instead of printed documents for blind students (they can be converted in audio information through screen reading software).</td>
<td>• on line audio materials.</td>
<td>• Braille translation software and embossing equipment.</td>
<td></td>
</tr>
<tr>
<td>• tactile demonstrations incorporated into instruction for understanding concepts.</td>
<td>• access to on line assistive technology that provides enlarged text, voice recordings.</td>
<td>Software based tools such as screen readers, screen magnifiers such as hand held magnifiers: SenseView, text to speech software &amp; screen tinters. Hardware based tools such as refreshable braille, CCTV magnifiers or portable magnifiers, talking tools (ex measuring jugs, rulers etc).</td>
<td></td>
</tr>
<tr>
<td>• electronic dictionaries (e.g. languages or science-based dictionaries) with audio.</td>
<td>• suggest students to use: Web Reader, Firefox – Fire Vox for web page reading aloud</td>
<td>• suggest students to use mobile phone apps, for Android phones ex. eyes free, talkback &amp; Digital Talking Timer, for iPhone the built in accessibility features ex. VoiceOver and Zoom or Eye Reader and Voice of Daisy [9]</td>
<td></td>
</tr>
<tr>
<td>• use email for class notes and other teaching materials instead of printed documents for blind students (they can be converted in audio information through screen reading software).</td>
<td>• on line audio materials.</td>
<td>• Braille translation software and embossing equipment.</td>
<td></td>
</tr>
<tr>
<td>Hearing Impairment</td>
<td>Mobility Impairment (inc wheelchair users)</td>
<td>Dyspraxia</td>
<td></td>
</tr>
<tr>
<td>--------------------</td>
<td>-------------------------------------------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>• printed and video materials offered before classes with captioning (involves synchronizing text with audio content of a video presentation);</td>
<td>• Account for the time and fatigue factors which may arise as the student moves between lectures.</td>
<td>• visual, aural, and tactile demonstrations incorporated into instruction</td>
<td></td>
</tr>
<tr>
<td>• facing student for lip reading;</td>
<td>• Consider supplementary video or multimedia presentations as options to field trips</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• reinforce spoken information with visual aids (e.g. writing on the board, slides, OHPs)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• A student who has been deaf from birth may require the use of a thesaurus, dictionary or sign language interpreter during lectures and exams.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• When possible, provide the student with class outlines, lecture notes, lists of new technical terms and printed transcripts of audio and audio-visual materials.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Do not hesitate to communicate with the student in writing when conveying important information such as assignments, scheduling, deadlines etc</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• on line video materials with subtitles</td>
<td>• advise students to use more on line resources rather than library resources that involve more time and efforts</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• on line multimedia presentations with subtitles</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• learning objects must have control options for timing of events, multimedia elements, including video, and navigation – allowing the user to skip a section or return to a section.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• use of hearing assistive technologies (ex. FM systems).</td>
<td>• wheelchair access to classrooms.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• use of overhead projector or blackboard.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• portable computer with speech output for participating in class discussions due to hearing or speech impairment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>• mini-disc recorder.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Special Learning Difficulty
## 2.2 Laboratories: Software and hardware, On line/Virtual labs and assistive technologies for laboratories [1] [7] [8]

<table>
<thead>
<tr>
<th>Type of disability or SpLD</th>
<th>Laboratories</th>
<th>Assistive technologies for labs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>teaching materials</td>
<td>virtual labs</td>
</tr>
</tbody>
</table>
| **Dyslexia**               | • similar adapting principles for laboratory printed and visual teaching materials as for classes including flow charts, pictograms and graphics, avoiding white background.  
• allow a student to prepare in advance for any texts which will be discussed in a laboratory or seminar session, to compensate for slow reading speed. It can cause frustration and embarrassment if a slow, inaccurate reader is asked to give immediate feedback on a previously unseen text.  
• Verbal instructions may need to be repeated.  
|                            | [Web Reader]  
|                            | • access to Virtual Lab applications, as ex. [Virtual Experiments @ Southampton University] | [assistive technologies for dyslexic people] including reading devices and software since reading is the area in which students with dyslexia struggle the most: [Learning Ally], [Read2Go], [iBooks], [Kindle], [Audiobooks from Audible], [ZoomReader], [ClaroSpeak US including an option for OpenDyslexic font], [Speak it!], [Balabolka], [Natural Reader].  
|                            | • audio, video equipment. | |
| **Visual Impairment**      | • materials in large print or Braille.  
• audio materials recorded on tape, DVD, etc or via computer.  
• enlarged or tactile drawings.  
• tactile demonstrations incorporated into lab applications for understanding concepts.  
• transcripts on presentations or captioning experiments videos also provide access for people who are deaf blind. | [Web Reader]  
|                            | • on line audio materials.  
• access to on line assistive technology that provides enlarged text, voice recordings.  
• [Web Reader].  
• access to Virtual Lab applications, as ex. [Virtual Experiments @ Southampton University] | [use for Chemistry, Biology, and Physics labs the talking [LabQuest] (Vernier) interface which is a sensor interface for blind or low vision students, in connection with Sci-Voice Access software  
|                            | • use [LabPro] (Vernier) software which includes over 1,000 experiment files supported by its library of lab books  
|                            | • in-class access to a computer/laptop with screen-reading software or assistive technology for taking notes and communicate during classes.  
|                            | • use of [visual assistive technologies] that provides enlarged text: [ZoomReader], voice: [ClaroSpeak US], [Speak it!], [Balabolka], [Natural Reader], or Braille output.  
|                            | • 3D printers, portable magnification, image capture for note taking – OneNote and the Cloud, printer for printing out assignments, scanner for scanning printed text, to then emboss into Braille.  
|                            | • Braille translation software and embossing equipment, Braille indications on equipments.  
|                            | • use email for laboratory instead of printed. | |
Hearing Impairment
- printed and video materials.
- facing student for lip reading.
- reinforce spoken information with visual aids (e.g. writing on the board, slides, OHPs).
- if videos are used as teaching aids, the student will need subtitles or a copy of the video well in advance of the lecture.

Mobility Impairment (inc wheelchair users)
- Consider supplementary laboratory practicals as options to field trips.
- Students may need extensions to deadlines for assignments that involves locating and using library resources.

Dyspraxia
- visual, aural, and tactile demonstrations incorporated into instruction.

2.3 Exam adjustments [1][8]

<table>
<thead>
<tr>
<th>Type of disability or SpLD</th>
<th>Exams</th>
<th>Assistive technologies for exams</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>evaluation</td>
<td>on line tests</td>
</tr>
<tr>
<td>Dyslexia</td>
<td>- It is usual practice for 25% extra time to be awarded in closed examinations for those diagnosed with dyslexia, to allow for slower speeds of reading and writing [6].&lt;br&gt;- alternate different evaluation methods: multiple choice, essay, etc.&lt;br&gt;- Students may be using mind mapping and text to speech software which assists in the identification of errors in written work&lt;br&gt;- Increasingly, requests are being made for alternative forms of non-written assessment to be considered, acknowledging that many dyslexic students have excellent verbal skills.</td>
<td>- on line evaluation tests with extra time provided.</td>
</tr>
<tr>
<td>Visual Impairment</td>
<td>- provide extra time in examinations (aprox. 25%-50%)</td>
<td>- access to on line evaluation</td>
</tr>
<tr>
<td>Disability</td>
<td>Measures</td>
<td></td>
</tr>
<tr>
<td>-----------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------</td>
<td></td>
</tr>
<tr>
<td>Hearing Impairment</td>
<td>• provide extra time in examinations (aprox. 25%-50% additional time) for students who need to listen the evaluation tests.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• use visual aids in evaluation tests (e.g. writing on the board, slides, OHPs).</td>
<td></td>
</tr>
<tr>
<td>Mobility Impairment</td>
<td>• a reader or an oral examination (either presenting answers on tape or participating in a viva) are alternatives to the conventional written paper.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• alternate different evaluation methods: multiple choice, essay, on line evaluation etc.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• for an oral examination allow extra time for the student to listen to and refine or edit responses.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• in your assessment, allowance should be made for the fact that spoken answers are likely to be less coherent than written answers.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• for some students the combination of written and oral examination will be most appropriate.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• some students with a mobility disability may need rest breaks.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• on line evaluation tests with extra time provided.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• students may need to use a personal computer/laptop or a personal assistant in an examination. If so it may be necessary to provide extra space for equipment, or a separate examination venue if the noise from equipment (for example a voice synthesizer) is likely to be distracting for other students.</td>
<td></td>
</tr>
<tr>
<td>Dyspraxia</td>
<td>• provide extra time in examinations (aprox. 25%-50% additional time) for students who have reduced writing speed</td>
<td></td>
</tr>
</tbody>
</table>
### 2.4 Projects: Working in groups [1] [7] [8].

Group work is a form of cooperative learning which aims to develop student’s knowledge, generic skills, (e.g. communication skills, collaborative skills, critical thinking skills) and attitudes. The ability to participate effectively in group work or team work is seen as a desirable employability skill and should be considered to be part of every learner’s educational experience.

<table>
<thead>
<tr>
<th>Type of disability or SpLD</th>
<th>Projects</th>
<th>Assistive technologies for working in groups</th>
</tr>
</thead>
</table>
| **Dyslexia**               | - It is essential that the teacher works with the group and the disabled learner to identify the best method for communicating; this may be as simple as waiting patiently for the person with the speech impediment to make themselves understood, or it may be more appropriate to use a note book and pen, email or text, for example.  
- give students good guidelines and give them clear rules and criteria by which they’ll be assessed e.g. PDF files, Poster presentations, PowerPoint presentations, etc.  
- for written assignment it is helpful to provide different examples of good practice. Students often benefit from being given a model to use, when compiling bibliographies.  
- use on line communication technologies: ‘chat’, ‘blogs’, SMS texting and  
- assistive technologies for dyslexic people including reading devices and software. |                                                                                  |
| **Visual Impairment**      | - Group Tasks or Assignments, Discussions, role play, problem based learning adapted to students with visual impairment needs  
- It is helpful to provide any textual material, in an accessible format, in advance of the meetings  
- Web Reader,  
- assistive technologies for visual impairment students |                                                                                  |
| **Hearing Impairment**     | - identify the best method for communicating  
- choose the appropriate way to communicate in groups using a note book and pen, email, text, SMS.  
- If someone with a hearing impairment needs the speaker to use a microphone, ensure that you establish a system for passing this around the group.  
- use on line communication technologies: ‘chat’, ‘blogs’, SMS texting and email  
- assistive technologies for hearing impairment incl. microphones, overhead projector or blackboard.  
- portable computer with speech output for participating in class discussions |                                                                                  |
| **Mobility Impairment (inc wheelchair users)** | **Physical environment:** arrange the room so that all learners can see each other including students using wheelchairs;  
• give students good guidelines and give them clear rules and criteria by which they’ll be assessed e.g. Poster presentations; PowerPoint presentations, etc  
• allow extensions to assignment deadlines if extensive research involving physical activity (for example, frequent trips to the library or collection of data from dispersed locations) is required. | **use on line communication technologies:** ‘chat’, ‘blogs’, SMS texting and email | **students may need to use a personal computer/laptop or a personal** |
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dyspraxia</strong></td>
<td><strong>Some people with Specific Learning Difficulties such as dyslexia or dyspraxia can exhibit poor self organisation skills and/or difficulties organising their learning materials; helping the group to indentify pragmatic ways to organise themselves and their workload, could lead to improvement of their self organisation skills</strong></td>
<td><strong>use on line communication technologies:</strong> ‘chat’, ‘blogs’, SMS texting and email</td>
<td></td>
</tr>
<tr>
<td><strong>Unlisted Disability</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

2.5 Internships:

**Example of reasonable adjustments for international students with disabilities exchanges (Erasmus, etc) [6]**

Some examples of reasonable adjustment we can make:
- Handouts and lecture presentations in advance if available
- Access to campus-based computers with assistive technology (including, text-to-speech, mind-mapping and magnification software)
- Equipment loan, if available
- Adapted accommodation, if available
- Modified examination arrangements where appropriate
- Extended library loans
- One-to-one learning support
- Transcription for visually impaired students
- Sign Language interpreters
- Note-takers
- Readers
II. BEST PRACTICE EXAMPLES FROM SALEIE PARTNER INSTITUTIONS:

2.1. York, UK

2.2. Bordeaux, France

2.3. Limerick, Ireland

III. INTEGRATING THE ADAPTED LEARNING MATERIALS IN THE LMS

Nowadays, there are multiple efforts in different universities to make accessible their web sites and e-learning platforms. However, most of these initiatives have been focused on Web accessibility. In the next subsection we will describe an experience implemented at the Universitat Politècnica de València (UPV) in order to adapt its e-learning platform to make accessible its contents and resources.

This experience has been developed in the context of the EU4ALL project mentioned before. The preparation of this experience was supervised by CEDAT, the unit at the UPV that assists people having disabilities and special needs.

The e-learning platform called PoliformaT has been used as the institutional LMS at UPV since 2005. It is based on the Sakai environment and is being used every year by about 40,000 students and 2,600 members of teaching and research staff, in a hundred of undergraduate and Master degrees. Sakai is a consortium of universities, colleges and commercial affiliates working in open partnership with standards organizations and other open-source initiatives to develop "community-source enterprise-scale software applications to enhance collaboration, research and teaching within HE" [10]. Moreover, thanks to its extensible service-oriented architecture, Sakai components can be easily extended to improve or modify current component features.

In order to adapt the platform, the first modification was to extend the service of the framework in charge of managing User Preferences. At the end user side, a new tab into the Sakai preferences tool was also added to handle accessibility information. Additionally, the Resources tool was also modified, so that instructors can specify accessibility constraints for the resources they are about to upload to the site content area, and students can only see resources matching their accessibility preferences. In this case, a first action was to incorporate in the Sakai Resource tool a new form to allow instructors input content attributes. These attributes were related to accessibility issues such as alternative media for text, audio or image contents, and their values were stored in the Metadata Repository component. In a second step, the Resource tool was connected to the Content Personalisation component in order to register the content alternatives depending on the user accessibility preferences.

In order to assess the experience, participants were divided in two main groups: i) instructors who provided course materials to be adapted and ii) disabled students who were enrolled in different UPV courses. One of the main problems to face was the diversity and heterogeneity of student profiles and courses.
The experience was focused on two main areas: i) Computing courses and ii) Business courses. These courses were face-to-face and they provided a set of instructional materials mainly based on text documents (PDF in most cases), and MS PowerPoint presentations. However, they also included video or other multimedia formats. For instance, in Computing courses, audio versions were produced for PDF documents for describing lab instructions or adding additional information in graphical presentations (e.g. electronic diagram), which were difficult to read for visually impaired people. In the case of Business courses, some deployed materials were screencasts, lecture recordings and podcasts, which were captioned, or the corresponding transcripts included, in order to support students with hearing impairment.

A first version of the Poliformat prototype was developed including the Preference form displayed on Figure 1 that allows students to state their needs and preferences about the content features, for example to select text or audio contents.

![Figure 1.- Student Preference form.](image-url)

Once students select a specific course, they can access the Resources provided by such course adapted to their stated preferences. Figure 2 shows part of the resources available for the Marketing course students. In this case, there is an introductory video to Marketing concepts based on a lecturer interview and a transcription of a podcast about a Marketing on-line topic.

![Figure 2.- Resources in a Marketing course.](image-url)
In a similar way, instructors who were involved in the experience checked the introduction and review of resources. Figure 3 shows a screenshot that displays the different options available for a specific resource and the types of adaptation features which can be selected. These information items are then stored in the Metadata Repository component and used by the Content Personalization module.

The results of the evaluation [11] showed, on the one hand, the interest of students about the availability of alternative accessible resources when accessing an e-learning platform. On the other hand, lecturers who were in charge of developing such resources manifested the difficulty and effort to generate accessible versions of them.

IV. GUIDELINES AND STANDARDS FOR ACCESSIBLE WEBSITE DESIGN

The following Internet resources presented in the table below could be very useful for academic staff members who are willing to design accessible websites including online teaching materials,

<table>
<thead>
<tr>
<th>Consideration</th>
<th>Reference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility W3C consortium.</td>
<td><a href="http://www.w3.org/standards/webdesign/accessibility">http://www.w3.org/standards/webdesign/accessibility</a></td>
</tr>
<tr>
<td>Centre of Excellence in Universal Design</td>
<td><a href="http://list.universaldesign.ie/mailman/listinfo/ceud-ict">http://list.universaldesign.ie/mailman/listinfo/ceud-ict</a></td>
</tr>
</tbody>
</table>
Accessibility

A1E80256F8600431030?OpenDocument

United Kingdom – Gov.UK: Accessibility Help

https://www.gov.uk/help/accessibility

Web accessibility checking tools

WAVE
http://wave.webaim.org/
AChecker
http://achecker.ca/checker/index.php
W3C – list of web accessibility checker tools
http://www.w3.org/WAI/ER/tools/complete

Using cookies: EU Europa


British Dyslexia Association

Dyslexia Style Guide
[generally applicable guidelines]
http://www.bdadyslexia.org.uk/about-dyslexia/further-information/dyslexia-style-guide.html

WAI Guidelines and Techniques
http://www.w3.org/WAI/guid-tech.html

Planning and Implementing Web Accessibility
http://www.w3.org/WAI/managing.html

Improving the Accessibility of Your Website
http://www.w3.org/WAI/impl/improving.html

Selecting and Using Authoring Tools for Web Accessibility
http://www.w3.org/WAI/impl/software

V. OTHER USEFUL RESOURCES ON TEACHING STUDENTS WITH DISABILITIES FROM OTHER INSTITUTIONS

JISC TechDIS

- Toolkit for creating accessible learning materials:
  http://www.jisctechdis.ac.uk/techdis/resources/createcontent
- Accessible Word Documents:
  http://www.jisctechdis.ac.uk/techdis/resources/word
- Accessible PDFs: http://www.jisctechdis.ac.uk/techdis/resources/pdfs
- Accessible PPT presentations:
  http://www.jisctechdis.ac.uk/techdis/resources/presentations

Royal Holloway, University of London

- Advice for staff:
  https://www.royalholloway.ac.uk/ecampus/welfare/disabledstudents/adviceforstaff.aspx

Cardiff University

- Information for Specific Disabilities:
  http://www.cardiff.ac.uk/dyslx/disabilityguides/index.html
University of Washington, DO-IT (Disabilities, Opportunities, Internetworking, and Technology) Center

- Disability Resources: http://www.washington.edu/doit/Student/disability_resources.html
- Making Science Labs Accessible to Students with Disabilities: http://www.washington.edu/doit/Brochures/Academics/science_lab.html

Australian Disability Clearinghouse on Education and Training (ADCET)

- Teaching students with a disability: http://www.adcet.edu.au/AdcetResources/Teaching_students_with_a_disability.chpx

W3C

- Web Accessibility Initiative’s, WAI guidelines: http://www.w3.org/WAI/
- How People with Disabilities Use the Web: Overview: http://www.w3.org/WAI/intro/people-use-web/

DnA

- Disabled Students Allowance (DSA) software: http://www.dnamatters.co.uk/dsa/dsa.html
- Open Source Software & Freeware: http://www.dnamatters.co.uk/oss/oss.html

National Center for Learning Disabilities

- Types of Learning Disabilities: http://ncld.org/types-learning-disabilities
- Assistive Technology: http://ncld.org/students-disabilities/assistive-technology-education

The European Agency for Special Needs and Inclusive Education


Video content:

University of Washington. DO-IT (Disabilities, Opportunities, Internetworking, and Technology) Center:

Equal Access: Universal Design of Computer Labs:

Working Together: Computers and People with Learning Disabilities:

Invisible Disabilities and Postsecondary Education:

The National Center for Learning Disabilities:
https://www.youtube.com/channel/UCcnTqU_6gHKWGIlg5TX7JimQ.

- What Is Dyslexia?
  https://www.youtube.com/watch?v=yKsjfnCMuYY&list=TLWzmXXDduBoDfzSULdHFcaCDP3QrPqve8

- Learning Disabilities, What Are the Different Types?:
  https://www.youtube.com/watch?v=yG_xSBsFMPQ&list=TLdjW1KmEWuVfVDy4B_cTr1gYIDqNWkX

Assistive Technology: Opening Doors to Independence:
https://www.youtube.com/watch?v=x2G1U6U3zh8.

References

http://www.washington.edu/doit/Brochures/Academics/equal_access_udi.html


http://www.washington.edu/doit/Resources/invisible.html


https://www.york.ac.uk/staff/supporting-students/issues/disability/


[8] Royal Holloway, University of London:
https://www.royalholloway.ac.uk/ecampus/welfare/disabledstudents/adviceforstaff.aspx

[9] STEM Learning and Teaching Reconfigured, Maximising the potential of students with a visual impairment


Example for Student Support centre website