Guidelines for educators on

eLearning accessibility

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DIRENE

Competences for the new era of user-driven digital rehabilitation

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Chapter 1 - Introduction

An EasyReading summary on “what to think about when developing technology” (Easyreading, 2022):

“It's always important to design technology so that everyone can use it. Here is some advice that it’s good to think about during the time you are developing eLearning” (Easyreading, 2022).

“The technology must be useful for the user. It must help more than it creates problems” (Easyreading, 2022).

“The technology must be possible to use for different people. Everyone has different abilities. The technology must be easy to understand” (Easyreading, 2022).

“It must be clear how you are going to do a task. It must also be clear what happens when you use it, for example when you press a button” (Easyreading, 2022).

“It's good to use buttons and symbols that users already know. That will make it easier to use. It is also good to have text together with symbols” (Easyreading, 2022).

Figure 1: Pictograms (ARASAAC, Seritium, Sclera, 2022)

ARASAAC

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1.1 Aims

This guideline aims to aid educators, their supportive tutors and web developers to create eLearning programmes that are accessible to all.

eLearning experiences should enhance learner's satisfaction, learning speed and learning effectiveness. In order to be inclusive, eLearning experiences should be personalised and adaptive to every learner's needs and characteristics (Laabidi et al., 2014).

In general, it may be beneficial for many people to explore new and unfamiliar content by having personalised, easy-to-read access.

1.2 Definitions

- **eLearning** (electronical learning) is defined as any educational intervention mediated electronically via the Internet (Vaona et al., 2018).
- **Accessibility** is concerned with ensuring that products and technologies are capable of supporting people with disabilities.
- The term **disability** is accepted in its broadest sense. All physical, mental and social accessibility must be addressed.
- User of **eLearning** is every person that learns electronically (IMS Global, 2022).

1.3 Users of Accessible eLearning

Who could be a potential user of accessible eLearning? In this guideline, the target groups for accessible eLearning are:

- people with limited reading and language skills,
- people with different types of disabilities,
- people who use digital content in various environments,
- elderly people,
- people with different mother language than the one in which the content is written,
- any people who face difficulties.

1.4 Technical Difficulties in Online Education

What technical difficulties may arise in online education? Students face difficulties and need accessible eLearning, if they (Burgstahler, 2020):

- use mobile smartphones, tablets, or other devices with a variety of screen sizes,

- use gestures, gaze or user interfaces for interacting with their devices and for accessing content,
- are deaf or hard of hearing or are in a noisy environment and therefore depend on captions or transcripts to access audio content,
- have low vision and enlarge default fonts or use screen magnification software that allows them to zoom into the screen.

1.5 Inclusive Online Education

Who needs inclusive online education? Students depend on inclusive online education, if they (Burgstahler, 2020):

- have vision disabilities and use audible (for example, screen readers),
- have motor impairments and use assistive technologies such as:
  - → speech recognition,
  - → head pointers,
  - → mouth sticks,
  - → eye-gaze tracking systems or
  - → tactile output (e.g., a refreshable braille device),
- have learning disabilities such as dyslexia and use text to speech (TTS) technologies that read aloud digital text while visually highlighting each word.

1.6 The Social Model of Disability

The approach of earlier times on disability followed the medical model which put emphasis on restoring the user's weakness. Nowadays, the approach on disability the "social model". The "social model" aims to include all learners by taking into consideration their specific needs. It gathers information about the unique preferences and needs of each person. Through this “functional approach“, physical, mental and social factors are considered in the development of appropriate (effective and efficient) programmes (Burgstahler, 2020).

Chapter 2 - General Guidelines

This chapter explains basic principles and standards for inclusive eLearning programs.

An overview on existing sources of guiding principles, which were used in this guideline (Laabidi et al., 2014), is presented through the subchapters 2.1 to 2.3.

2.1 The World Wide Web Consortium (W3C)

The W3C defined international standards for the accessibility of web content (Laabidi et al., 2014).

Figure 2: The WWC Logo (2022)

The W3C standards are (Laabidi et al., 2014):

a. **Perceivable content**, regardless of the used device or configuration:
   - Information and user interface components must be presentable to users in ways they can perceive.

b. **Operable** user interface components and navigation:
   - Users must be able to operate the controls, buttons, sliders, menus, etc., regardless of the device they're using.

c. **Understandable** information and operation of the user interface.

d. **Robust** content that can be interpreted reliably by a wide variety of user agents, including assistive technologies.

2.2 The Web Accessibility Initiative (WAI)

The Web Accessibility Initiative (WAI) is a W3C key solution and it focuses specifically on people with cognitive disabilities. Disabilities of vision, hearing, speech, moving hands and generally physical disabilities are included (Laabidi et al., 2014).

Concerning cognitive accessibility, three principles are considered (Henry, 2021):

- **Language** should be in a way in which content is readable and understandable.
- **Text format** is related to font face, how big the text is, the spacing etc. All of these impact readability.

- **Interface** addresses how websites and applications are designed, how they are laid out and how things are labeled.

In detail, an interface should be (Henry, 2021):

a. **Adaptable:** Use content that can be presented in different ways,

b. **Distinguishable:** Make it easier for users to hear and see the content,

c. **Navigatable:** Help users to navigate, find the content and determine where they are,

d. **Predictable:** Make websites appear and operate in predictable ways,

e. **Providing enough time:** Time to use and read the content is needed,

f. **Providing input assistance:** Help users to avoid and correct mistakes.

2.3 Web Content Accessibility Guidelines (WCAG)

The WAI developed Web Content Accessibility Guidelines (WCAG) are often referred to in international policies and other standards, as for example ISO/IEC 40500, European EN 301549. They are used for websites, mobile apps, documents and software (Laabidi et al., 2014).

For the inclusive design of an online learning program, 3 principles emerge from the W3C standards (Laabidi et al., 2014):

a. Provide **multiple ways** for participants to **learn** and to demonstrate what they have learned.

b. Provide multiple ways **to engage**.

c. Ensure all technologies, facilities, services, resources, and strategies are accessible to individuals with a wide variety of disabilities.

Guidance on proactive design practices is provided by the following subchapters (2.4 to 2.5):

2.4 Universal Design for Learning (UDL)

The following 3 proactive design practices shall make online courses accessible for all students (CAST, 2018):

- **Engagement**: For purposeful, motivated learners, stimulate interest and motivation (in) for learning.
- **Representation**: For resourceful, knowledgeable learners, present information and content in different ways.
- **Action and expression**: For strategic, goal-directed learners, differentiate the ways that students can express what they know.

2.5 Universal Design Principles (UDP)

7 further proactive design practices exist, which may reduce the need of accommodation adjusts (National Disability Authority, 2020):

a. **Equitable use:** The design is useful and marketable to people with diverse abilities.

b. **Flexibility in use**: The design accommodates a wide range of individual preferences and abilities.

c. **Simple and intuitive use:** The use of the design is easy to understand, regardless of the user's experience, knowledge, language skills, or current concentration level.

d. **Perceptible information:** The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

e. **Tolerance for error:** The design minimises hazards and the adverse consequences of accidental or unintended actions.

f. **Low physical effort:** The design can be used efficiently, comfortably, and with a minimum of fatigue.

g. **Size and space for approach and use:** Appropriate size and space is provided for approach, reach, manipulation and use regardless of the user's body size, posture, or mobility.

Further, guidance on assistive technologies is provided on the final subchapter (2.6).

2.6 IMS Global Learning Consortium

The Consortium aims to advance technology that can affordably scale and improve educational participation and attainment of people with cognitive disabilities. Every educator or web developer should follow their principles, when producing accessible software and content for online distributed

learning (IMS Global, 2020). These sources of guiding principles are described in detail on the following pages.

There are 6 principles for developing accessible learning:

a. **Allow for customisation based on user preference (IMS Global, 2015):**

- Enable users to change settings about presentation style, size or timing.
- An application is accessible to many users, if the information can be presented in many different ways.

  Items fall into two categories:

  → **Customisable display elements** (for example, font color / size / style, size of text / pictures etc.)

  → **Customisable interface features** (for example, time of events, keyboard settings)

b. **Provide equivalent access to auditory and visual content (IMS Global, 2015):**

Recommendations for users with hearing impairments:

- Caption all auditory content.
- Provide a text transcription of auditory content.

Recommendations for users with visual impairments:

- Add text descriptions to all static images (e.g. pictures, charts, logos etc.). Thus, the text can be read by a screen reader or output to a Braille display.
- Utilise the "longdesc" attribute for images that have useful content and require lengthier descriptions.
- Provide audio description tracks for multimedia, by describing visual aspects of the content.

c. **Provide compatibility with assistive technologies and include complete keyboard access (IMS Global, 2015):**

We cannot take it for granted that all the users can use and operate a computer mouse. As a result, a complete keyboard access to all elements of an application and its content (as for example, menus, toolbars, help directories and dialog boxes) should be provided. Furthermore, screen readers/ magnifiers, adaptive keyboards, voice recognition software and single switches are to be considered essential parts of applications and software.

d. **Provide context and orientation information (IMS Global, 2015):**

Applications and software are made more useable when developers provide context and orientation information to users:

- Teach users how to navigate.
- Inform users about the length of the document.
- Provide a way for users to skip standard page headers and navigation links.
- Maintain a consistent layout between pages.
- Make the presentation of content consistent.
- Provide alerts/text warning whenever a new browser window will be opened automatically.

e. **Follow IMS Global (2022) specifications and other relevant specifications, standards, and/or guidelines (IMS Global, 2015):**

IMS standards are:

- **Build a foundation**: Build equity with a trusted, seamless plug-and-play digital ecosystem.
- **Enhance learning:** Increase equity with personalise learning and build learner agency with actionable data.
- **Recognise achievement:** Add even more equity by recognising learner mastery and accomplishments, tracking competences and providing for flexible pathways.

f. **Consider the use of Extensible Markup Language (XML) (IMS Global, 2015):**

- Data is stored and transported by XML.
- This language was designed to be self-descriptive.
- It is recommended by W3C.

Chapter 3 - Specific Guidelines

This chapter is based on the Easy-to-Read Checklist (Inclusion Europe, 2020). The checklist was developed by the non-profit organisation Inclusion Europe. This organisation aims to include adult people with intellectual (or cognitive) disabilities and their families in all aspects of society. Its logo shall inform users that easy to read information is provided.

Figure 3: Logo (Inclusion Europe, 2020)

The following checklist provides standards to make information easy to read and to understand, by focusing on documents. The checklist is organised - based on four different formats of information (Inclusion Europe, 2020):

a. **Written information:** These are e.g., leaflets, brochures and reports.

b. **Electronic information:** This is written information on websites, computers, disks or CD-rom.

c. **Audio information:** This can be listened to, e.g., on a CD or on the radio.

d. **Videos:** These can be watched on TV or on a computer.

3.1 Written Information

Before you start producing the information (Inclusion Europe, 2020):

- Find as much as you can about the people, who will use your information, and their needs.
- Use the best format for your information (e.g. sometimes audio may be better choice than written info).
- Explain your subject clearly and explain any difficult words that have to do with the subject.
- Use the right language for the people your information is for.
- Involve people with intellectual disabilities when making and checking the information.

Design and format (Inclusion Europe, 2020):

- Use a format that is easy to read, follow and photocopy.
- Think about the size of your document.
- Make sure that the design or layout do not make your document hard to read or understand.
- Do not use a background that makes it hard to read the text (e.g. picture or pattern).
- Be careful when using a dark background. When you do that, make sure the background is dark enough and the writing clear enough for you to read it.

Writing (Inclusion Europe, 2020):

- Use a font (=type of writing) that is clear and easy to read. Prefer Arial and Tahoma and avoid serif fonts.
- Avoid using italics, special writing design and writing that is too close together or too light and does not print off well.
- Do not write whole words in capitals. Lower letters are easier to read.
- Try to use only one type of writing in your text.
- Use underlying with caution, because it may make the reading harder for some people with intellectual disabilities.
- Avoid writing in colours because some people cannot tell the differences between colours.

Words (Inclusion Europe, 2020):

- Do not use difficult words and if, you have to explain them at the time, when you are using them and in the end of the document.
- Be careful when you use pronouns. Make sure that is always clear who or what the pronoun is talking about, otherwise use the proper name.
- Never use footnotes. Provide needed detail information in the text.
- Avoid special characters (for example “&”).
- Keep the punctuation simple.

Sentences (Inclusion Europe, 2020):

- Always start a new sentence on a new line.
- Never split one word in two lines.
- Keep your sentences short.
- You could write one idea per sentence.
- Where possible, one sentence should fit in one line. If you have to write 1 sentence in 2 lines, cut the sentence where people would pause when reading out loud.

Writing text (Inclusion Europe, 2020):

- Use headings that are clear and easy to understand.
- Give people all the information they need, but only the important.
- Make sure the important information is easy to find. To do this, you could:
  - → put this information at the beginning of the document,
  - → highlight the important information in bold,
  - → or put the important information in a box.
- Try not to use too many layers of subtitles or bullet points.

- When you use graphs or tables, make them simple and explain them well.

What your text should look like (Inclusion Europe, 2020):

- Use bullet points to list things, instead of commas.
- Do not write in columns.
- Align your text to the left of the page.
- Do not put too much text on your page.
- Leave space between paragraphs.
- Do not indent your text. This means the first line of each paragraph should be aligned with the rest of the text.
- Try to avoid narrow margins (= spaces between the words and the edges of the page).
- Where possible, number the pages of your document.

Images (Inclusion Europe, 2020):

- Put images and next to them describe in text what they are about, in order to help people understand them better.
- To illustrate your text, you can use: photographs, drawings, or symbols.
- Always use images that are designed for the people you are writing for.
- Always choose images that are clear, easy to understand and go well with the piece of text they are helping to explain.
- Use the same image to explain the same thing throughout your document.

Standards for the English language (Inclusion Europe, 2020):

- Be careful with numbers like “7th” meeting. Instead, write: “The meeting we have had 6 times before”.
- Be careful with numbers. Write numbers as digits, not as words. Never use Roman numerals.
- Where possible, use the present tense rather than the past tense.
- Avoid words like doesn’t, wasn’t, couldn’t. Instead, write them in full.
- Where possible, write dates out in full.

Design of online courses (Burgstahler, 2020):

- Use clear, consistent layouts and organisation schemes for presenting content.
- Structure headings and lists, by using design layouts or style features.
- Use large bold, sans serif fonts on uncluttered pages with plain backgrounds.
- Avoid creating PDF documents.
- Post instructor-created course content within learning management system pages and if a PDF is desired, link to it only as a secondary source of information.

- Address a wide range of language skills as you write content (for example, spell acronyms, define terms, avoid or define jargon).

3.2 Electronic Information

Creating an accessible website (Inclusion Europe, 2020):

- Always ask people with intellectual disabilities to test the website.
- Add to the website things that will make the information easier to understand (e.g. screen-reader).
- To make sure that people can easily find the website, you could add the words “easy-to-read” in the “meta tag” of your homepage.
- "Pop-up" pages should be avoided on websites, because it is difficult for some people to follow and it can be confusing.
- Be careful with special programs, because some of them are heavy and make the access harder.
- Do not use any program or pictures that will make your website very slow to use, as some people have old computers.
- Try to have a way for people to find things easily on your website. This is usually called a “search tool”.

The homepage (start website) (Inclusion Europe, 2020):

- Make sure that the homepage clearly shows what the website is about.
- Put on the homepage a telephone number, a postal address, an e-mail address of someone to contact.
- Provide big and clear buttons to change the size of the writing,for people who prefer bigger writing.

Moving between the different pages of a website (Inclusion Europe, 2020):

- It should always be easy for people to see which part of the website they are on.
- People should not have to click more than once to get back to the home page.
- Always put the same navigation bar in the same place throughout the website.
- It must be easy for people to move from one page to another (e.g., put clear and big buttons on every page).
- If you choose to have a second navigation bar, make sure it does not stand out as the main one.
- Your main navigation bar should not have more than 7 or 8 main headings, which should be clear and easy to understand.

Links on websites (Equal Opportunity and Access, 2022):

- If you decide to underline link so people will find them easily, do not underline headings or words which are not links. It may be confusing.
- When you create links to other pages, make sure it is clear what information people will find on these new pages.
- Avoid links that are difficult to read.
- Users should know if they have already clicked on the link or not. This could be facilitated by using colours.
- Use descriptive links, by providing users with the proper context of where clicking the link will take them. Avoid link text as „click here“, „more“, „link“ or „website“.

What your screen should look like (Equal Opportunity and Access, 2022):

- Do not put too much information on the screen.
- Fit all information on the screen so people do not have to scroll down. Otherwise, put a text menu at the top.
- People should not have to move the page from left to right to read the text.
- Leave space between each paragraph on the screen.
- Do not have animations on the screen.

Online courses (Burgstahler, 2020):

- Use a small number of information technology tools. They shall present content and navigation that require use of the keyboard alone. Otherwise employ accessible practices.
- Assume students have a wide range of technology skills. Provide options for gaining the skills needed for course participation.
- Provide options for learning by presenting content in multiple ways (for example a combination of text, video, audio, and/or image format).
- Provide options for communicating and collaborating, that are accessible to individuals with a variety of disabilities.
- Offer outlines, scaffolding tools and opportunities to practice.
- Allow adequate time for activities, projects and test (for example, details of assignment so that students can start working on them early).
- Provide feedback in between and offer corrective opportunities.

3.3 Audio Information

Audio content (Inclusion Europe, 2020):

- Do not hesitate to repeat your information several times.
- Messages given in audio format should always be polite and courteous.
- Do not interrupt audio information, for example by advertising.
- Use words which are easy to understand.

Sound quality (Inclusion Europe, 2020):

- Make sure that the sound has a good volume, not too loud, not too quiet.
- Interference or background noise is important to be avoided.
- A special sound could announce that the following information is in an accessible format.

Speaker (Inclusion Europe, 2020):

- When it is appropriate, the voice should match the character.
- The person speaking should have good pronunciation and articulate clearly.
- The person speaking should not have an accent which is too strong.
- The voice of the person speaking should be clear, meaning not too low, not too high.
- Read the text in a way that emotions can be perceived.
- The person speaking should speak slowly.
- It is essential to leave pauses at sensible points.
- Give enough time for people to understand the information.
- Always speak one at a time.

3.4 Video Information

General advice for creating videos (Inclusion Europe, 2020):

- Your video must be clear and simple. It should make difficult ideas easy to understand.
- Do not be in a hurry or speak too fast. People must have enough time to understand what you are telling them.
- Avoid confusing things, like slow or fast motion.

The content (Guo et al., 2014):

- Follow the standards for an easy-to-understand information.
- Stick as much as possible to reality.
- Videos presenting information should not be too long.
- The length should be no more than 20 or 30 minutes.
- In online courses, the optimal video length should be under 6 minutes.

- When you change the place of filming, explain where the new place is so people do not get confused.

Background voice (Guo et al., 2014):

- Background voice should be slow and very clear.
- It can be helpful to present the person first, before he or she starts talking in the background.
- The voice should only be speaking about things that people can see on the screen.

The screen (Guo et al., 2014):

- The screen should not be too light or too dark.
- Video and sound must be high quality and clear.
- For videos to be played on a computer, buttons for sound and full screen should be easy to find.

Subtitles (Guo et al., 2014):

- Subtitles should follow the standards for written information (see subchapter 3.1).
- Viewers should have enough time to read the subtitles.
- There must be a strong contrast between subtitles and the background. A dark line at the bottom may be helpful, on which the subtitles appear.
- Subtitles should be in the same position on the screen throughout the whole video.
- To make it even clearer you could also make a document with all the text. This way, people can print the text and read it before or after watching your video.

Chapter 4 - Assistive Technologies and Tools

There are many ways to facilitate access to content. Technologies that assist or enable accessibility to eLearning content may be (Laabidi et al., 2014; Texthelp, 2022):

- **Devices** (e.g., alternative input or pointing devices, such as screen keyboard, foot operated mice, head mounts or eye tracking systems)
- **Tools** (e.g., keyboard enhancements, accelerators or shortcut keys)
- **Hardware** (e.g., braille display)
- **Software** (e.g., screen reading software, that speaks displayed text and allows simulating mouse actions with the keyboard)
- **Web content** (e.g., accessibility metadata that informs about the transformative ability of content or available equivalent resources)

To make eLearning fully accessible, educators should be aware that (Burgstahler, 2020):

- Assistive technologies usually emulate the keyboard, but not the operate mouse. Websites and software should be **operated only with a keyboard.**
- Not all images content can be read with assistive technologies. As a result, **provide alternative text.**
- Assistive technologies may skip from heading to heading. Structure with **hierarchicals headings.**
- Assistive technologies may not transcribe audio accurately. Thus, the guidelines recommend **video caption** and to **transcribe audio.**

The following subchapters (4.1 to 4.4) contain examples that will give insight in relevant functions of assistive technologies.

4.1 The EasyReading Project

The purpose of the EasyReading project was to enable people with cognitive disabilities to better read, understand and use websites. Given that many websites are inadequate for people with mental disabilities, the project developed a software framework on how to make the access to any existing website possible for all users (Easyreading, 2022; Heumader, 2018).

The project applied a participative approach (Easyreading, 2022; Heumader, 2018):

- People with cognitive disabilities were part of the peer researchers team.
- Their opinions were included in all phases of the project.

As a result, web content can be adjusted in real time according to individual users' needs. In other words, the user is able to have a personalised version of the website. Whether they see or not the original website or a personalised version is up to them (Easyreading, 2022; Heumader, 2018).

The software framework consists of three features (Easyreading, 2022; Heumader, 2018):

- **Adjustment of layout** and structure of websites
- **Explanation of web content** with symbols, pictures and videos
- **Translation** of content into a different language level (for example, plain language or easy-to-read, symbol writing systems).

The provided (semi-)automated support features allow the users to remain and work within the original digital document. The EasyReading Logo is moving with the user and is thus ever present. By clicking on it, a toolbar opens. The EasyReading Logo is a chameleon. As a chameleon adapts to its environment, in the same way EasyReading adapts to user's needs. The different support features adapt to every user due to sensor-based tracking. The support features reason on the level of preferences, mood, attention, context, performance, understanding and individual learning curve (Easyreading, 2022; Heumader, 2018).

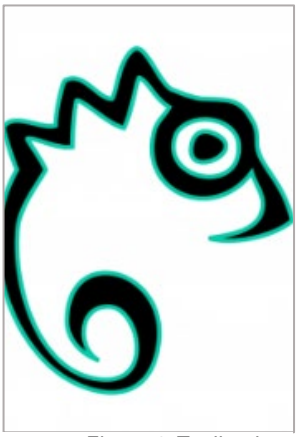

Figure 4: Toolbar logo (Easyreading, 2022)

For this, the following human computer interaction techniques are included (Easyreading, 2022; Heumader, 2018):

- pop-ups,
- text-to-speech,
- captions through mouse-over or eye-tracking.

4.2 IMS Accessible Learner Information Package

The Accessibility for Learning Information Package (ACCLIP) by IMS, provides information on how users can interact with an online learning environment. This information has a considerable impact on the user interface of learning delivery, tools, management and how content is selected. The aim

of ACCLIP is that user's interface and content can be appropriately adapted to their preferences and needs (Laabidi et al., 2014).

4.3 IMS Accessibility Metadata Description

IMS Accessibility Metadata Description is an extension of ACCLIP. This tool is able to identify the primary resource and suggest an alternative to the users. The alternative is more suitable to their needs, based on their ACCLIP profiles. Furthermore, it provides an interoperable framework. This supports the substitution and augmentation of a resource. The resource is equivalent or supplementary, as required by the accessibility needs and preferences of a user's ACCLIP profile (Laabidi et al., 2014).

4.4 MoodleAcc+

MoodleAcc+ is a platform that allow users to evaluate the given eLearning environment according to:

a. display,

b. control and

c. content.

As a result, students and educators are well informed about the limitations of each course. Recommendations for a better eLearning experience are welcomed (Laabidi et al., 2014).

Chapter 5 - Portland Partnership Project and its Virtual Environment

In this chapter, an example of an inclusive eLearning project is provided. The Portland partnership project and its virtual environment aimed to develop a prototype software and curriculum content, that responded to the needs of adult students with physical and mental disabilities (Harisson et al, 2008).

5.1 Target Group of the Project

Students from 16 years and upwards at pre-entry level were targeted.

The range of disabilities and associated learning difficulties included (Harisson et al, 2008):

- physical disabilities,
- limited or no sight,
- limited or no verbal communication,
- being “capable of learning, but … profound intellectual impairments and will require very specialised teaching”.

The two main barriers that these students have to deal with, are (Harisson et al, 2008):

- limited access to resources (operate mouse, keyboard),
- age-inapproriated programs.

5.2 Participative, Learner-centred Approach

All learners in the project expressed their willingness to be equal with their peers without disabilities. They felt that they had a fundamental right to access information and communication technology-based resources and tools. Educators and learners worked together at every stage of project development. By doing so, they aimed to meet learners’ needs and to tailor learning resources. Learners’ barriers were taken into account, e.g., to log on to a computer independently. Specific tools allowed educators complete control over what and how learners had access to (Harisson et al, 2008).

5.3 Virtual Learning Environment

A virtual learning environment (VLE) was developed with the following aims (Harisson et al, 2008):

- every student would have access anytime, anywhere,

- roaming profiles should ensure that user's preference would automatically be loaded upon login.

The VLE was designed in accordance with the following four functionalities and examples (Harisson et al, 2008):

a. **Appropriate language (e.g., options of symbols, text and symbols, text only):**

- For learners with low literacy level (who recognise individual letters), there were symbol-supported text and speech output.
- Furthermore, a symbol-based e-mail system was provided in order to help learners to communicate with their peers and educators.
- Learners were enabled to send pre-determined sentences from a range of subject/topics categories via e-mail.

b. **Compatibility with adaptive technologies (for those unable to use a mouse or keyboard):**

- Learners with motor disabilities were able to operate in all environment and content by using one or two switches as an alternative to keyboard or mouse.
- A scanning mechanism for switch users was developed. It was ensured that the design was compatible with touch screens and most other assistive input devices.

c. **Built-in audio and visual clues were provided:**

- Pictorial symbols were used (an example is displayed in the EasyReading summary, chapter 1).
- Even if these symbols did not consist of a universal language, they aided learners to give context to a word, phase or scenario.

d. **An adaptable interface in terms of screen layout was provided:**

- accessible login screen,
- provision for font and colour adjustments for those with visual impairments,
- information about a timetable was displayed in small, absorbable sections,
- as for some learners the time was difficult to read, symbols were used,
- activities were illustrated by an appropriate symbol, supported by text and audio.

Abbreviations

Abbreviation	Meaning
ACCLIP	Accessibility for Learning Information Package
TTS	Text to speech
UDP	Universal Design Principles
UDL	Universal Design for Learning
VLE	Virtual Learning Environment
W3C	World Wide Web Consortium
WAI	Web Accessibility Initiative
WCAG	Web Content Accessibility Guidelines

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