Digital Accessibility Guide

Project Result 2

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Executive Summary

The Digital Accessibility Guide, a core result of the Map4accessibility project co-funded by Erasmus+, is a thorough resource crafted to boost your proficiency in developing digitally accessible content. The guide comprises eight distinct chapters and an additional annex, offering learning activities to enrich understanding and practical skills.

Each chapter of the guide dissects different elements of web and digital accessibility, both in a broader context and specifically within higher education environments. This resource, tailored for practitioners, allows quick, easy access to vital information, which can either be consumed in its entirety or broken down into select chapters of interest. The guide, acknowledging the complexity of digital accessibility, frequently presents similar information from varying perspectives.

Chapter I of the guide serves as an introductory roadmap, detailing the overall goal and general structure to orient the reader.

Chapter II focuses on defining disabilities, highlighting the unique needs of people with different abilities, and suggesting appropriate digital content to meet those needs.

Chapter III delves into the key aspects of digital accessibility in education, addressing target groups, fundamental concepts, and strategies for needs identification.

Chapter IV provides more detailed advice for the design and development of digital content in an educational context, including accessible iconography, online meetings, documents, and website design. This chapter also includes a case study, showing how the implementation of these principles can promote inclusivity.

Chapter V provides a broad overview of enabling technologies, standardization, and legislation concerning accessible web content. It allows readers to understand the key elements of making digital content more accessible.

Chapter VI meticulously arranges the standards and legal requirements for developing accessible web content, referencing WCAG 2.1, and relevant European standards and legislation.

Chapter VII offers a sneak peek into the Map4Accessibility project's initial findings, outlining its challenges and best practices in progressive web app development. Considering the project is only halfway through its implementation, the guide commits to regular updates to keep users informed about its future developments.

The guide concludes by consolidating all insights and providing practical web accessibility strategies for education, summarising the tips and tricks into concise, easy-to-digest one-page infographics or fact sheets. This comprehensive guide thus serves as a go-to resource for enhancing digital accessibility in education. We hope you enjoy the read and find it immensely useful!

I. Introduction

Higher education institutions (HEIs) in Europe are facing significant challenges in ensuring the accessibility of their digital content as the world rapidly shifts towards digital resources and workflows. In the age of the "new normal," meeting the digital needs of people with disabilities has become more critical than ever. The COVID-19 pandemic has accelerated this shift and made it even more urgent for HEIs to prioritise accessibility.

Yet, recent research conducted by the WebAIM organisation found that most websites are not designed to be fully accessible. In fact, the study showed that "97.8% of homepages from the one million most visited websites failed to meet Web Content Accessibility Guidelines (WCAG) 2.0 standards for web accessibility"[1]. This is particularly true concerning higher education institutions (HEIs), as digital content plays a critical role in teaching and learning, research, and administrative functions. When digital content is not designed with accessibility in mind, it can **lead to significant barriers for students and staff with disabilities and hinder their ability to fully participate in the academic community**.

While some HEIs are still struggling to meet accessibility requirements, there is a growing awareness of the importance of accessibility in higher education and the multiple resources supporting universities to navigate the digital accessibility process. The [Web Accessibility Initiative](#) provides guidelines and support to improve digital accessibility. In their efforts to address the challenge, multiple universities across Europe are finding creative ways to increase their digital accessibility accommodating a wide range of disabilities and ensuring that everyone has equal access to digital content and services.

The present digital guide provides versatile examples to address its main purpose – ensuring that HEIs design digital technologies with accessibility in mind.

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[1] WebAIM. (2020). One million homepages, year 2020 edition. Retrieved from https://webaim.org/projects/million/

II. Navigating the spectrum of disabilities

Accessible websites address the needs of users with disabilities, ensuring equal access and use of digital content and services for everyone, including those with visual, hearing, motor, and cognitive impairments. These websites provide accommodations such as alternative text for images, closed captioning for videos, keyboard navigation, and assistive technologies like screen readers, which enable users with disabilities to access and interact with digital content. In higher education, people with diverse disabilities may need to access online content, but often encounter various barriers to perceiving and processing such one. By addressing these needs and implementing accessibility features, accessible websites ensure that everyone, regardless of their abilities, can fully participate in the digital world and benefit from educational resources[2].

In this chapter, we will explore the five most recognised types of disabilities: visual, hearing, motor, cognitive, and speech impairments. By understanding these categories and the specific needs associated with each of them, we can better address accessibility issues and create inclusive digital content that accommodates everyone, regardless of their abilities.

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[2] https://www.wordstream.com/blog/ws/2022/06/15/website-accessibility

a.   Visual Impairment

What are visual impairments?

These vary from mild / moderate vision loss in one or both eyes to substantial or complete loss of vision in both eyes. The most common visual impairments are:

- **Colour blindness** – difficulty to distinguish between colours (often between red and green; yellow and blue) and in some cases inability to discern between any colour. The most common forms of colour blindness are deuteranopia, which is a reduced sensitivity to green light, and protanopia, which is a reduced sensitivity to red light.

- **Low vision** - blurry vision, recognition of content only in the middle or the edges of the visual field.

- **Blindness** - considerable loss of vision (both eyes).

While the visual impairments discussed above are most common, please note that the list is not exhaustive and there are other less common types of visual disabilities as well.

Needs of people with visual impairments in terms of web accessible content

Depending on the type and severity of visual impairment, users may struggle to discern textual and visual content on the web. The key needs of people with visual disabilities when accessing web content include proper text formatting, accurate alternative text for images, descriptive links, and compatibility with screen readers. To meet these needs effectively, it is essential to provide multiple options for accessing content, such as audio descriptions and transcripts. Sometimes, websites are abundant in colours and visual content, making them unreadable from people with colour or low vision blindness. In case of considerable loss of vison or even some forms of low vision, users may wish/need to use Text-to-speech (TTS) software which will read out the content.

Transcript: On the left there is an image of a text-to-speech technology, visualizing a microphone and 2 screens

Text-to-speech (TTS) is software that converts written text into spoken words, allowing users to listen to the content instead of reading it. TTS software can be used on a wide range of personal digital devices, including computers, smartphones, and tablets. With it, users can have all types of text files read aloud, including online web pages. Although TTS is enhanced with artificial intelligence to accurately pronounce words, it is not able to fully understand their context. The features of TTS software vary, with the best options offering a variety of natural-sounding voices and the ability to adjust the speed of pronunciation. Many TTS tools also highlight words as they are read aloud, which can be especially helpful for individuals with other types of disabilities such as dyslexia. Most often, people with visual impairment already have installed and adjusted to their preferences TTS

which navigates through all digital content on their electronic devices. Yet, when designing your web page /app **you may wish to provide TTS feature.**

In comparison, today most free word processors also have the TTS feature – you may check your Microsoft Word (the Speak button) or Google Docs (Speak selection in your Accessibility settings). Furthermore, there are also free online TTS where text could be pasted to be read aloud. Among the most famous one is NaturalReader.

TTS vary in their type: Built-in text-to-speech - devices manufactured with TTS tools; Web-based tools - TTS tools on-site (e.g., making available a "Reading Assist" tool). Text-to-speech apps - downloadable TTS apps on smartphones and digital tablets; Browser tools - TTS tools available on the browser; Text-to-speech software programs - literacy software programs for desktop and laptop computers.

The predominance of the audience with moderate to severe visual impairment might prefer to use **braille keyboard hardware** for their enhanced experience on digital devices. The braille keyboards contain single keys that represent each of the dots in a braille cell. To type a letter in braille the user would press a combination of the keys needed to create that braille character.[3]

Recommendations for web content for people with visual impairment

- web content is displayed in a limited number of colours and in **sufficient contrast of colours and textures**. Tools (e.g., colour contrast checker) can be used to test the right combination between text colour and background, taking size into consideration. For example, when using graphs, consider adding textures or patterns as they provide an extra layer of scannability and differentiation between data points.

- include a **sidebar** on webpages that allows users to make their own adjustments to the size and colour of the content,

- use multiple visual cues, such as **underlining or bolding**, in addition to colour to highlight important information on webpages. When creating buttons with hyperlinks, using only one colour and type is preferred for optimal accessibility,

- provide **keyboard accessibility** on webpages - users should be able to navigate the site using keyboard shortcuts rather than relying on a mouse,

- use **clear and descriptive labels for links and buttons** on webpages, instead of vague phrases like "click here". This practice also enhances search engine optimization (SEO) for the website.

- present web content in a logical sequence. Text-to-speech (TTS) software reads content in a linear progression, scanning through the entire page in its plain text format, line by line, one element at a time.

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[3] https://usability.yale.edu/web-accessibility/articles/types-disabilities

- use headings to organise page content. Text-to-speech (TTS) software can skim through a page or read headings only, allowing users to gain an overall impression of the website's structure and content.

- use descriptive titles for every page to significantly enhance the comprehension of web content. These provide important context and allow users to identify the content of a particular page quickly and easily.

- include descriptions of non-text content on webpages. This can be achieved by providing an HTML transcript of an image or graphic, which allows the user to better imagine the textual content.

b.   Hearing Impairment

Click on this link to access a visualized on the left image of modern representation of hearing impairment

What are hearing impairments?

These vary from mild to moderate hearing impairment in one or both ears. The most common hearing impairment are:

- **Hard of hearing** - mild to moderate hearing impairment in at least one ear. These are cases of:

- conductive hearing loss in which the sound perception is muffled,

- perceptive deafness in which the sound perception is distorted,

- crackling tinnitus, where there is a crackling noise in addition to the sound coming from an external source,

- whistling tinnitus, where there is a whistling noise in addition to the sound they hear from an external source.

- **Deafness** - profound hearing loss, which implies very little or no hearing[4].

While the hearing impairments discussed above are among the most prevalent, it's important to note that this list is not exhaustive, and there are other, less common types of hearing impairments as well.

Needs of people with hearing impairments in terms of web accessible content

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[4] https://www.who.int/news-room/fact-sheets/detail/deafness-and-hearing-loss

As the severity of auditory impairment vary, people facing hearing challenges choose between options enhancing their perception. Some may use hearing aids, or electronic devices which amplify sounds in the case of partial hearing loss. Others may use sign language to communicate. Yet, it is a matter of personal choice and above all, the opportunity to learn sign language is sometimes hindered.

In fact, providing web content that is accessible for people with auditory impairment may be a bit challenging as hearing perceptions vary. For example, individuals who experience high-tone hearing loss tend to understand harder women's voices, whereas those with low-tone hearing loss comprehend worse men's voices. Furthermore, with the advancement of age, individuals tend to be experiencing some hearing loss.

To enhance information accessibility for individuals with hearing impairments, we suggest widespread installation of QR codes, facilitating instant access to concise and easy-to-understand information. Further, integration of AI-based tools such as ChatGPT and Quillbot can aid in producing precise and clear texts, ensuring the information is easily comprehendible. Explore more at https://quillbot.com/co-writer.

Very often the convenient option to **perceive web content is through visual and textual representation**. Today, the web consists of information not only presented as graphics and text but also as video, audio, animation which are increasingly used. In the case of sound materials closed transcripts are most likely preferable and in the case of multimedia content, e.g., video with audio, both captions and transcripts are used.

Transcripts include descriptions of important audio information (like laughter) and visual information (such as someone entering the room) for users who can neither hear the audio nor see the video. *A piece of advice would be to use as profound description of the action and sounds as possible for the users to grasp the concept of the multimedia offered on the web.*

In parallel, hearing loss could impede voice production which results in various social, educational and speech limitations. In these cases, web users facing the challenge may prefer to use **TTS tools** in their online communication. Supporting people with auditory impairment when videoconferencing or audio chat is offered on webpage or web platform may require planning and adjustments to accommodations so that services such as **CART** and **captioning** can be provided effectively.

CART (Communication Access Realtime Translation) is a tool that enables real-time text to be provided during a video call, lecture, training session, or meeting. This technology offers live transcription of spoken content, making it accessible for individuals with hearing impairments or those who may benefit from additional language support.

Captions are words produced on an electronic device display, providing the speech / sound portion via text. Captions allow users to follow the communication and action of a program simultaneously. In other words, it makes the spoken words easier to understand.

Providing sign language presentation of audio information is another way to make content accessible to individuals with hearing impairment. A universally compatible way to do so is to embed a video of the sign language interpreter in the video stream.

Recommendations for web content for people with hearing impairments

- provide **transcripts and captions** for audio and multimedia content. These captions should be synchronized with video content and may include live captions or cues, in addition to sound, in apps. An excellent example of meeting accessibility needs for hearing impairment is the presentations from TED Talks. All videos include a highlighted transcript that corresponds to the words spoken by the presenter, making it easy for individuals with hearing impairments to fully comprehend the content,

- use a **combination of sound and visual elements** to ensure that the content can be comprehended by a wider range of individuals and that the message is conveyed in a way that is both effective and engaging,

- provide **support over email and/or text chat** rather than phone call alone,

- provide **two-factor authentication** which gives the choice between a phone call and a message for initial setup, reset or validation,

- **exclude background sounds** or provide the user the option to turn them off,

- provide **sign language interpretation** during the transmission of live content, such as news websites.

c.   Physical Disabilities

What are physical disabilities?

Motor or physical disabilities relate to weakness and/or limitations of muscular control, including involuntary movements e.g., tremors, lack of coordination, paralysis, limitations of sensation, joint disorders (arthritis), pain that impedes movement, missing limbs. The most common disabilities related to digital accessibility are:

- **Amputation** - missing digits, limbs, or other parts of the human body,

- **Arthritis** - inflammation and damage to the joints,

- **Paralysis** - loss of control over a limb or other part of the body,

- **Repetitive stress injury** - injuries in the muscles, bones, joints due to repetitive motion.

While the physical disabilities discussed above are some of the most common, it's important to note that this list is not exhaustive, and there are other less frequently encountered types of physical disabilities as well.

Needs of people visual disabilities in terms of web accessible content

Physical disabilities can impact an individual's ability to use their hands and fingers to interact with digital content since fine motor skills are often required for these activities. To address this issue, assistive technologies are being developed at a rapid pace to improve accessibility and ensure that individuals with physical disabilities can effectively engage with digital content.

Such assistive technologies can be:

- **alternative keyboards** – they have an ergonomic design to support hands and wrists, larger keys with greater space between them, high-contrast features, and separate numeric keypads. These keyboards enable individuals with a range of physical impairments to effectively engage with digital content, while also reducing the risk of physical strain or discomfort.

- **head wand** - a thin, long device that attached to a headpiece which often has a rubber tip to prevent slipping on keys. This tool is designed to help individuals with physical disabilities to write and interact with digital content using very little movement of the head. This makes it an ideal option for individuals who may not have full use of their hands or fingers, but still need to engage with digital technology on a regular basis.

- **trackball mouse** – a mouse with ergonomic design which allows for smooth thumb control of the cursor instead of moving the wrist and the arm.

- **mouth stick** – a device that can be controlled by the mouth, providing typing aid, page turning, browsing, and other forms of digital interaction.

- **single switch device** – a switch used to navigate through web content, relying on a focus indicator which moves automatically across the different objects, where the user clicks to activate it. Some users have multiple switches and can use one to move the cursor forward and another for clicking;

- **speech/voice recognition or dictation software** - type of software that utilizes speech recognition algorithms to identify spoken languages, analyses sound, and converts it into text via voice dictation. This technology is available across a range of devices, including Windows, Mac, Android, iOS, and Windows Phone. Additionally, speech recognition can be used as a voice command to control electronic devices, without the need for a keyboard or mouse.

- **puff and sip device (SNP)** – a small stick that uses air pressure to send a signal to a device and execute certain commands, like a keyboard or mouse. Depending on the type of SNP, a puff can allow navigation through elements on a webpage, while a sip can be used to open links and activate buttons. This tool is particularly useful for individuals with physical disabilities that may prevent them from using traditional keyboards or mice to interact with digital content.

- **eye-tracking technology** – it measures eye movements, eye positions, and points of gaze through various technological processes to enable navigating through digital content.

Regardless of the type of assistive technology that an individual may use, it is essential to consider tab order for proper navigation through a keyboard interface when developing web accessible content. Individuals with mild physical disabilities commonly use the keyboard to access web content, making it important that the keyboard tab order is coordinated with the structure of the webpage. The tab order should be logical and intuitive, following the visual flow of the page, explicitly: from left to right (for most languages) and top to bottom, starting with the header, followed by the main navigation, then page navigation (if present), and finally the footer. The [CSUN/Universal Design Center web page](#) offers more information on how to program the tab order.

Recommendations for web content for people with physical disability

- ensure that **all functions are accessible and easy to use via the keyboard** - users should be able to navigate the site, activate links, and access all functions without the need for a mouse.

- it's important to make sure that the data entered in forms is accurate. However, using a mouse and keyboard to enter data can be difficult for some people. To help with this, web developers can **provide a clear indication of any errors in the form**, such as highlighting the incorrect field or showing an error message. This makes it easier for individuals with physical disabilities to accurately fill out forms and submit data online.

- enable effective navigation through web content using voice commands. To do so, it is important **to include appropriate labels for controls**. These labels should be clear and

common, enabling users to easily understand the function of each control and navigate the content effectively.

- ensure that **the TAB key can be used to navigate through the content in a logical and intuitive order** - the order in which users move between elements on the page using the TAB key should be easy to understand and follow a clear structure.

- when a website uses time-based media or requires users to react to elements within a certain time frame, it's important to **provide non-timed alternatives**. This ensures that individuals with disabilities, who may require more time to process or respond to information, are not excluded from the content.

- **avoid pop-ups** that are difficult or impossible to close. Pop-ups that can't be closed can be frustrating and confusing for users, especially those with disabilities. By making sure that all pop-ups are easy to close, individuals with disabilities can engage with the content without unnecessary barriers or obstacles.
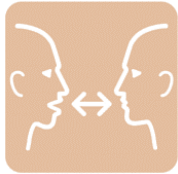
d.   Speech Disabilities

What are speech disabilities?

Speech disabilities are conditions that make it difficult for individuals to produce speech that can be understood by others or recognized by software. This can be due to a range of factors, including problems with volume, clarity, or articulation. Some of the most common speech disabilities include:

- **Muteness** - inability to speak. It could be a result of mental disorders, cognitive impairments, or inability to learn to speak.

- **Dysarthria** - weakness or paralysis of the muscles required to speak, including lips, lungs, throat, and tongue.

- **Stuttering** - speaking with continued involuntary repetition of sounds, especially initial consonants.

While the speech disabilities discussed above are among the most frequently observed, it's essential to realize that this list isn't exhaustive, and there are other, less common types of speech disabilities as well.

Needs of people with speech disabilities in terms of accessible web content

As voice-based technologies become more prevalent in our daily lives, it's crucial to ensure that people with speech disabilities have access to alternative communication options. Many individuals with speech disabilities may be unable or uncomfortable communicating orally, making it important to provide them with other means of communication. To improve accessibility, it's important to offer text-based communication options and reduce the reliance on voice-only prompts, making it easier for individuals with speech disabilities to access information and services online.

Overall, when designing digital content for the web, it's important to consider the same principles and enhancements that have been outlined above for making content accessible to individuals with hearing disabilities including **providing text-based alternatives for any voice-based communication methods.**

Note: The Communication Disability Access Canada association have designed an alternative icon (the one we have used above) to illustrate speech disabilities. It is largely used across Canada and North America. Instead of the sign language symbol which may suggest that sign language services are available, this one underlines that communication access is provided.

Recommendations for web content for people with speech disability

- provide alternative communication channels in addition to phone and video calls. This can include options like chatbots, email, and feedback forms, which provide individuals

with a variety of communication methods to choose from. By offering these alternatives, organizations can make it easier for individuals with disabilities to access their services and communicate with their team, regardless of their communication preferences or abilities.

- provide alternatives to voice prompts such as text-based alternatives or other non-voice options. Voice prompts can be challenging for individuals with speech or hearing disabilities, as well as for those who are unable or uncomfortable communicating orally.

- ensure that users can correct their mistakes. This means providing easy-to-use editing and deletion functions, as well as clear instructions on how to correct errors. By enabling users to correct their mistakes, organizations can make their digital content more user-friendly and reduce frustration and confusion.

- provide users with enough time to read text content.

e.   Cognitive, learning, and neurological disabilities

Click on this link to access a visualized on the left image of modern representation and a project about intellectual disability

What are cognitive, learning, and neurological disabilities?

These disabilities encompass a wide range of conditions, including neurological, behavioural, and mental health disorders that can impact an individual's ability to comprehend and process information. This can include conditions that affect cognitive functioning, learning, memory, attention, and other mental processes.

- **Attention deficit hyperactivity disorder (ADHD)** - a condition that can make it difficult for individuals to focus on a single task, as they may become easily distracted or have trouble sustaining attention for longer periods of time. This can impact a person's ability to learn, communicate, and engage with digital content.

- **Autism spectrum disorder (ASD)**, which includes conditions such as "autism" and "Asperger syndrome," can make it challenging for individuals to maintain social communication and interactions. This can include difficulty with verbal and nonverbal communication, as well as challenges with social cues, empathy, and building relationships.

- **Perceptual disabilities (or "learning disabilities")** - it involves difficulty processing sensory information such as auditory, tactile, visual. The most common ones involve difficulties in reading, writing, and spelling - dyslexia; writing and fine motor skills - dysgraphia; managing mathematic concepts and calculations - dyscalculia.

- **Intellectual Disability** – a condition where an individual has significant limitations in intellectual functioning and adaptive behaviour. This means they may have difficulty with things like problem-solving, communication, self-care, and social interactions – e.g., Down Syndrome, Fetal Alcohol Syndrome.

- **Neurological Disabilities** - conditions affect the nervous system, including the brain, spinal cord, and nerves throughout the body. They can cause a wide range of symptoms and impairments, including movement difficulties, sensory impairments, cognitive deficits, and communication challenges. Those can include Epilepsy, Parkinson's Disease, Multiple sclerosis, Traumatic brain injury (TBI), Cerebral palsy, Alzheimer's disease, Huntington's diseases, Amyotrophic lateral sclerosis (ALS), Migraines.

While the cognitive, learning, and neurological disabilities mentioned above are some of the most recognised, it's important to acknowledge that this list isn't comprehensive, and there are other, less commonly known types of these disabilities as well.

Needs of people with cognitive, learning, and neurological disabilities in terms of accessible web content

Cognitive, learning, and neurological disabilities vary extremely. Though there are common needs that could be identified. In some cognitive disabilities, individuals may understand abstract and complex information while they could not interpret visual (dyslexia, dysgraphia) or emotion-related (autism) content. In other case, individuals find difficulties to retain their attention or to recall content. While some may need different representation of the content – text, visual, audio to discern the information, others would prefer adapted representation of the content in way they achieve larger success in processing and comprehending it.

Recommendations for web content for people with cognitive disability

- ensure that your website has a logical structure that is consistent, clear, and well-structured. People with certain disabilities can only interpret content that is presented in this way. This requires a clear visual layout and consistent formatting for similar types of information,

- present information in concise, straightforward sentences, using a maximum of 80 characters per sentence,

- maintain consistency in the placement, colour, and font of the elements on the webpage,

- provide alternatives for multimedia content, such as transcripts or captions for videos,

- make text and images simpler, such as using a single left-aligned column for text or images with fewer elements,

- ensure that content is clearly separated with appropriate use of white space and formatting to reduce visual clutter and distractions for the user,

- ensure that the webpage remains functional even if images and styles are disabled, and the content is still usable when displayed in larger text sizes,

- ensure that images, icons, and graphics are used to aid in the comprehension of the content. This can include Illustrations or diagrams that provide visual representations of complex concepts or ideas; Icons or symbols that represent actions or concepts, such as a magnifying glass to indicate search; Infographics that display information or data in a visual and easy-to-understand format or photographs or images that help to provide context or support a written description.

- provide clear instructions/error messages and large time intervals for filling out forms,

- avoid unnecessary underlining of words, italics or caps lock,

- consider using dyslexia-friendly fonts, such as EasyReading, OpenDyslexic, Lexie Readable, and Dyslexie, which are designed to improve readability for people with dyslexia. Commonly used fonts such as Times New Roman, Arial, Verdana, and Helvetica are also helpful.

Did you know?

1. There is a holistic digital package created for people with dyslexia, incl. extension to the chrome browser, office package, font Dyslexie - www.dyslexiefont.com/en/home

2. There is an application created by several universities, including the UNITUS, Italy, which provide services for people with dyslexia in Italian and English (converting versatile file formats in easy to read fonts, explaining and reading aloud of terms, etc.) - tech4all.ai/en/reasy-to-go

Dyslexia is a multifaceted disorder involving phonological difficulties and challenges with visual perception and decoding. Introduced at the 2003 European Parliament's congress in Strasbourg, the concept of high readability, a measure of text's ease of comprehension, has proven to be significantly beneficial for dyslexic individuals. Linguistic and graphic are the two types of readability, influencing the language usage and visual representation of texts respectively. To assist dyslexic readers, 'dyslexia-friendly' fonts, designed with distinct letter shapes and sufficient letter spacing to minimize confusion, have been developed. Research by C. Bachmann and L. Mengheri showed that the use of the EasyReading font led to improved reading activities compared to using Times New Roman. S. Pinnelli's study also compared Arial, EasyReading, OpenDyslexic, and Biancoenero fonts, finding that the choice of font influenced reading speed, accuracy, and the level of perceived fatigue. These findings underscore that dyslexia-friendly fonts and high readability texts can significantly improve the reading experience for dyslexic individuals by addressing the condition's visual and phonological aspects.

⚠️ Consideration: While 'dyslexia-friendly' fonts aim to aid dyslexic readers, it's important to consider recent research questioning their efficacy. Such fonts like OpenDyslexic and Dyslexie, designed to enhance visual perception, may not address the core issue of dyslexia - the different processing of language sounds. As such, their usage may not improve recognition and could even potentially cause despair among dyslexic individuals when expected improvements do not materialize. Ultimately, in terms of reading speed and accuracy, these specialized fonts often perform no better, and occasionally worse, than common fonts like Arial and Times New Roman.

3. Web accessibility implies that content is user-friendly, or it is closer to their needs and requirement. What would we say about the learning patterns of web developers? Today, there are several video games for web developers to sensitize them on challenges and practices of web accessibility. **Want to play**? Check out the GATE game or explore further with the Accessibility Maze

To address the needs of people with disabilities in a holistic way – physical, emotional, psychological – you may wish to use icons to indicate the respective disability which respect to the whole spectrum of an impairment type and to the individuals themselves. Instead of putting icons which represent people with disabilities in a passive posture, you would better choose icons where they are shown in action or with different abilities. The pictures you of different types of impairments are hyperlinked to demonstrate different representation. Links lead to fee downloadable icons in different formats to be used depending on your requirements.

It is crucial that web creators, web designers and web developers are aware and understand the needs of people with disabilities in processing and interacting with web content so that they address these needs and preferences to guarantee user-friendly and smooth experience to all. **Website accessibility thus refers to the practice of building and maintaining web content in a way that people of all abilities can access and understand the information**.
In this sense, this guide is designed to introduce main aspects to be considered when creating web content **for all types of disabilities.**

III. Digital Accessibility in Education: Essentials

a. Target Groups of the Guide

Developed as part of the Map4Accessibility project, one of the primary objectives of the present guide is to facilitate the formal integration of service-learning within higher education. To that end, it is specifically designed to address the challenges and key features of providing web accessibility to various target groups, including:

1. **Higher education institutions**

    Universities and colleges are encouraged to implement web accessibility measures to ensure that their digital content, platforms, and resources are easily accessible by students, faculty, and staff with disabilities. This will create a more inclusive learning environment and support equal opportunities for all.

2. **Primary, secondary, and high schools**

    These educational institutions play a crucial role in providing accessible digital environments for students with disabilities. By adopting web accessibility practices, they can create a more equitable educational experience. Mandatory in its nature, primary and secondary school education thus ensure equity to all students to fully participate in school activities and reach their potential.

3. **Other organisations looking to improve their accessibility environment**

    This guide can also benefit various organisations, including non-profits, businesses, and government agencies, who wish to enhance their accessibility offerings. By implementing web accessibility solutions, they can provide better and more inclusive environments for people with disabilities, thereby fostering greater engagement, collaboration, and equal opportunities for all.

b. Strategies for identifying Digital Accessibility Needs

There are various methods to identify and understand the needs of people with disabilities to minimize disadvantages when it comes to digital resources. In all instances, the primary objective is to gain a comprehensive understanding of the requirements of individuals with diverse abilities. Below, we outline some well-established practices for determining users' needs.

- **User Stories**

Transcript: Above there is an image of the user stories process, e. g. sheets of paper with crossed fields of a list, 3 pencils and a mobile phone.

User stories, originating from software development, are brief and straightforward descriptions of a feature or requirement from an end user's perspective. In this case, end users may have different types of disabilities. User stories are an essential tool for capturing the needs and requirements of end users in an easily understandable and relatable format. They allow developers and stakeholders to focus on the user's perspective when designing and building digital content, ensuring that it is accessible, usable, and meaningful for the target audience. As Wautelet et al. (2014) describe, a user story typically follows a template such as: "As [the WHO], I want/want to/need/can/would like [the WHAT], so that [the WHY]." User stories capture requirements for a particular feature in a clear, concise, and easily understandable format that allows for discussion and refinement by the development team and stakeholders.

> *Example*: "As someone with a visual impairment, I need content designed to be read by a screen reader, so that I can access the website like someone without a visual impairment."

To effectively apply user stories for digital accessibility:

1. Involve users with disabilities in the process of creating and refining user stories. This can be done through interviews, focus groups, or usability testing.

2. Use a diverse set of user stories representing various disabilities and accessibility needs to ensure comprehensive coverage of potential issues.

3. Regularly review and update user stories to reflect changes in technology, user needs, or accessibility standards.

Inclusivity NOTE: Consider how to present user stories in different formats to address different disabilities summarized above (or others not mentioned).

Inclusivity NOTE: Consider how these stories could be developed if your target group is students who have not fully develop speech abilities (e.g. young children)

- ## **Workshops with experts**

Transcript: Above there is an image of an example of workshops with experts, e. g. a group of people, some shaking hands, others listening attentively and interacting with electronic devices

Workshops with experts are an invaluable method to gain insights, learn best practices, and develop skills in digital accessibility. Those are interactive sessions led by professionals who have extensive knowledge and experience in a specific field, such as digital accessibility. Workshops can range from a few hours to multiple days and can be tailored to various skill levels, from beginner to advanced. They may include presentations, hands-on exercises, group discussions, and real-world examples to help participants understand and apply the concepts being taught.

Besides internal sessions with more experienced colleagues, there are numerous external freelancers and consultants who offer their services to interested clients. Participating in a course led by an expert ensures that the digital content meets digital accessibility requirements to a high degree.

What types of expert workshop can there be? Below are a few examples:

1. **Workshop on: Accessibility Audits**

   A workshop focused on teaching participants how to conduct accessibility audits using manual testing, automated tools, and user testing. Participants can learn how to identify and fix common accessibility issues in web and mobile applications.

2. **Workshop on: Accessible Web Design**

   This workshop can cover topics such as designing for keyboard accessibility, using proper semantic markup, creating accessible forms, and employing ARIA (Accessible Rich Internet Applications) to enhance the accessibility of web content.

3. **Workshop on: Accessible Document Creation**

   A workshop that covers the creation of accessible documents using popular tools like Microsoft Word, PowerPoint, and PDFs. Participants can learn about formatting, structure, and the use of alternative text to ensure that documents are accessible to users with disabilities.

4. **Workshop on: Inclusive Design Principles**

Workshops that teach the fundamentals of inclusive design, focusing on designing products and services that cater to the broadest possible range of users, regardless of their abilities. Participants can learn about universal design principles, user personas, and techniques for creating more inclusive digital experiences.

• Accessibility Audits
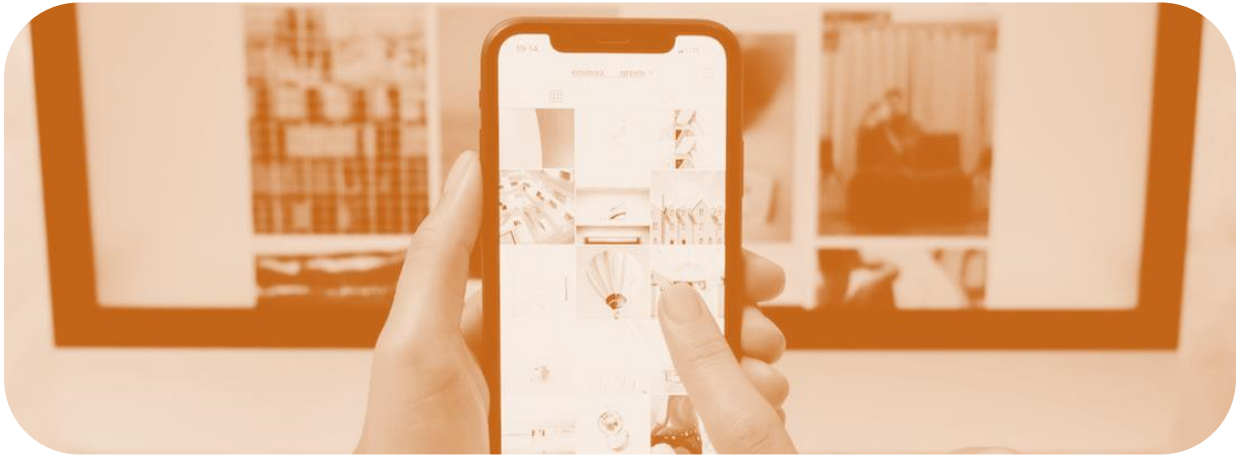
Transcript: Above there is an image visualising an accessibility audit of a website on a mobile phone.

Accessibility Audits are essential for ensuring that digital content remains compliant with accessibility standards and provides an inclusive experience for all users. Regularly conducting audits allows you to identify potential issues, areas for improvement, and monitor your progress in addressing accessibility concerns. Here's an expanded look at Accessibility Audits with more factual and practical information:

1. **Automated Tools**

There are several automated tools available that can help you quickly scan your digital content for common accessibility issues. Some popular tools include:

- **WAVE (Web Accessibility Evaluation Tool)**: A free online tool that checks web pages for accessibility issues and provides suggestions for improvements https://wave.webaim.org/

- **axe**: A free, open-source accessibility testing tool that can be integrated into your development process, available as a browser extension or an API https://www.deque.com/axe/

- **Siteimprove**: A subscription-based service offering website scanning, reporting, and monitoring to help you maintain accessibility compliance https://siteimprove.com/

Keep in mind that automated tools can only identify a portion of accessibility issues, and manual testing is still required for a comprehensive audit.

2. **Manual Testing**

Manual testing involves evaluating your digital content by simulating the experience of users with disabilities. Some manual testing techniques include:

- **Keyboard testing**: Navigate your digital content using only a keyboard to ensure that all interactive elements are accessible and functioning properly.

- **Screen reader testing:** Use screen readers like JAWS, NVDA, or VoiceOver to test how your content is read and interpreted by these assistive technologies.

- **Colour contrast testing**: Evaluate the colour contrast of your content to ensure it meets the minimum requirements for readability, using tools like WebAIM's Colour Contrast Checker (https://webaim.org/resources/contrastchecker/).

3. **Engaging External Consultants**

If you lack the expertise or resources to conduct accessibility audits in-house, consider hiring external accessibility consultants. These professionals can provide a thorough assessment of your digital content, identify issues, and recommend solutions to improve accessibility. To find a reputable consultant, look for:

- Certifications or affiliations with accessibility organizations, such as IAAP (International Association of Accessibility Professionals) or W3C (World Wide Web Consortium).

- A proven track record of conducting accessibility audits and working with clients in your industry or with similar content types.

- Client testimonials or case studies that demonstrate their expertise and success in improving digital accessibility.

4. **Continuous Monitoring and Improvement**

Accessibility is an ongoing effort, and it is crucial to monitor your digital content regularly to ensure compliance with evolving standards and user needs. Establish a schedule for conducting audits, addressing identified issues, and reassessing your content to track your progress.

- ## Collaboration with Disability Support Services in your university or educational institution

Transcript: Above there is an image of collaboration process between a man with dark sunglasses and woman guiding his hands.

Building a strong relationship with disability support services at educational institutions is crucial for understanding the specific needs of students with disabilities and devising strategies to

address those needs in your digital content. Regular meetings with disability support services staff can be scheduled to discuss current challenges, trends, and best practices in digital accessibility. Disability support services staff can also be encouraged to identify accessibility champions within their department or among students with disabilities. These champions can serve as points of contact for your development team, providing insights, guidance, and feedback on accessibility issues and solutions.

c. Key aspects of Digital Accessibility in Education

Digital accessibility for educational institutions encompasses a variety of components that contribute to an inclusive and engaging learning environment, including, but not limited to the following:

- **Institutional website content**

  This involves providing accessible information about the institution, its educational programmes, curricula, courses, and other relevant details on the higher education institution's website.

- **Virtual university/school interactions**

  Ensuring accessibility in communication and collaboration among students, faculty, and administration, including the use of social media, forums, and other platforms for interaction.

- **E-learning and blended learning opportunities**

  Creating accessible online and hybrid learning experiences that cater to the diverse needs of students, allowing them to engage with course materials effectively.

- **Learning management systems (LMS)**

  Implementing accessible LMS platforms that enable students, faculty, and staff to manage coursework, access resources, and track progress efficiently.

- **Digitally enhanced lessons**

  Incorporating accessible digital tools and resources within traditional classroom settings to support diverse learning styles and needs.

- **Gamification of lessons**

  Designing accessible and engaging game-based learning experiences that cater to different abilities and foster motivation and active participation.

- **Accessible events**

  Ensuring that both hybrid and fully virtual events, such as conferences, workshops, and webinars, are accessible to all participants, including those with disabilities.

- **Assistive technologies**

  Supporting the use of assistive technologies, such as screen readers, text-to-speech software, and alternative input devices, to ensure equal access to digital content for all users.

Comparing the requirements for digitally accessible content for students in higher education with the requirements for digital accessibility in the non-academic environment, there is no fundamental difference. Even if learning resources cover different topics - depending on the subject to be studied - the requirements for clarity, unambiguity and usability remain the same.

The Inclusive Mobility.EU project booklet reveals that in a survey carried out among students about the Erasmus+ mobility opportunity, the most represented groups are those with dyslexia (39%), chronic illness (30%), and physical disability (25%). Least represented groups are autism, visual impairment, mental illness, hearing impairment, psychiatric disorders, dyspraxia, dyscalculia, tic disorder, and stuttering. Of the respondents, 22% have been abroad for studies or traineeships, and 41% plan to participate. The survey, which was carried out among 1,134 students with disabilities, 114 higher education institutions, and 23 EHEA Ministries of Education, is a trustworthy source. It shows that more than 50 % of students with disabilities have or wish to go abroad. These results imply the necessity of providing the largest possible accessibility by the higher educational institutions both in terms of physical environment and digital content.

d. Common practices for providing digitally accessible content by higher education institutions

Universities with accessibility commitment provide an overall support to their students, including tuition free/discounts, hardware and software assistive technology, individual advise.

Most universities have built systems to deliver virtual lectures to enable students to access digital study materials and submit their coursework online. Several higher education institutions have developed mobile applications that allow students to schedule one-on-one meetings with their professors, check on their next lecture, book a workspace at the library, and handle other tasks. Lectures are often recorded and shared virtually which provides students the opportunity to participate online even when they can't attend in person.

Among the common measures universities adopt to provide web and digital accessibility are to:

- **Have a (web/digital) accessibility statement in their mission or elsewhere:** as a first step to digital accessibility this statement is present in all committed higher education institutions. You may wish to benefit from free statement generator here: https://www.nomensa.com/blog/writing-an-accessibility-statement

- **Develop and implement policies and plans for integrating accessible digital content for students and staff:** University of Leeds, UK; University of Oslo, Norway; University of Barcelona, Spain

- **Provide students with assistive technologies (screen readers, closed capturing and subtitling software, etc.)**: University of Bordeaux, France; University of Salamanca, Spain; Trinity College Dublin, Ireland

- **Have an internal design system of reusable components that have been holistically tested for accessibility:** European University Institute, Italy

- **Have digitally enhanced their websites and published guidelines and checklists on digital accessibility for teaching and learning:** Vrije University Amsterdam, the Netherlands; University of Helsinki, Finland; Karlsruhe Institute of Technology, Germany

- **Have a dedicated unit/centre/team which ensures digital accessibility and provides advise on it:** Aarhus University, Denmark; University of Vienna, Austria; Lund University, Sweden;

- **Perform web accessibility checks (external support, online tools, etc.) and publish the report online**: Technical University of Dortmund, Germany; Tampere University of Applied Sciences, Finland; Aalborg University, Denmark

e. Case Studies

Multiple universities in Europe have committed to embedding digital accessibility standards into their online learning environments to ensure that students with disabilities have equal access to education. The number of higher educational institutions adhering to digital accessibility principles increase with the evolving requirements of the Web Accessibility Directive (WAD). You may see more about it in Chapter VI of this guide, where "Other legislation requirements across the EU" are reviewed.

In the examples below we would like to demonstrate several best practices and innovative ideas in tackling digital accessibilities by higher education institutions. They do not present the full extent to which those universities have committed to embedding accessibility and inclusivity practices within their strategy, operations, curriculum, etc.

University of Potsdam, Germany

In July 2020, the University of Potsdam established a *Digital Accessibility Steering Group*, led by the Chief Information Officer (CIO). This group comprises employees from various departments, including representatives for students and staff with health impairments and chronic illnesses, the chancellor's office, and the Centre for Information Technology and Media Management.

Another key challenge lies in providing continuous support and education for employees responsible for creating digital content for students, ensuring that they remain informed and up-to-date on digital accessibility best practices. To **assist lecturers** in creating accessible learning materials, the steering group developed a website featuring helpful tutorials, information, and guidelines on crafting digitally accessible documents and presentations. As part of ongoing improvement efforts, the University plans to implement a tool for the automated generation of subtitles in educational videos.

To learn more, visit the website of the university: www.uni-potsdam.de/en/university-of-potsdam

University of Technology Chemnitz, Germany

The University of Technology Chemnitz improved digital accessibility for students and employees by adopting an **accessibility implementation strategy** and **integrating accessibility standards** in the action plan "the University of Technology Chemnitz on the way to an inclusive university."

The university faced a major challenge adapting its 25,000-subsite website for accessibility. They hired a web coordinator for digital accessibility, replacing external workshops with internal

trainings. They also introduced weekly open office hours and an e-learning platform for accessibility discussions. Consultancy firms' advice played a crucial role in making teaching materials digitally accessible.

To learn more, visit the website of the university: https://www.tu-chemnitz.de/index.html.en

Karlsruhe Institute of Technology, Germany

The Karlsruhe Institute of Technology (KIT) is dealing with digital accessibility since 1987, where the "Center for digital accessibility and assistive technologies" (ACCESS@KIT) was founded. Together with the focus group "Computer Vision and Human-Computer Interaction", they are researching digital accessibility, with a focus on accessibility for people having a visual impairment. Furthermore, ACCESS@KIT supports students through editing teaching and exam documents to their needs.

To research these needs, the KIT established a laboratory of reality, where they investigate accessibility aspects in the fields of architecture, human-machine-interactions, gaming, digital accessibility, and assistive technologies. These investigations are getting intensified by two new professorships within the subject of accessibility.

The website of the Karlsruhe Institute of Technology can be visited at: https://www.kit.edu/english/index.php.

Aalto University, Finland

The University of Aalto provides holistic assistance in digital accessibility guidance. It has a web page with links to information and dedicated tools for Aalto publishers of digital content. Their tutorials are dedicated to designing a site structure, creating/editing an article at aalto.fi, general writing, accessibility on Moodle, social media and mobile accessibility.

In cooperation with other universities, e.g., Tampere university, Finland, they offer free of charge course on digital accessibility.

See more about the web accessibility services of the university here: https://www.aalto.fi/en/drupal-aaltofi-website/digital-accessibility

Tampere University of Applied Sciences, Finland

The Tampere University of Applied Sciences have prepared and published on their website comprehensive guidelines and tool sets on both Digital tools for teaching and Digital tools for staff. Among the Digital tools for teaching are effective tools for presentations, materials and sharing information; learning environments and tools; assessment, feedback, and demonstration of learning.

The university has further published their strategic goals in terms of digital accessibility, the Key accessibility-related development targets at TAMK for 2023–2024.

In line with their dedication to ensuring actual web accessibility, the Tampere University of applied Science have performed an external evaluation of their web accessibility. The report of this evaluation can be found here: https://www.tuni.fi/en/about-us/web-accessibility-statement-tampere-universities

f. Going further with digital accessibility literacy and handy materials

- **Guidelines for implementing UDL practices in the inclusive virtual classroom**

For further instructions and tips on web accessibility in the education, you may also wish to refer to the resources of the Success4all project under the Erasmus+ programme, coordinated by the Poznan Supercomputing and Networking Center, in particular, the guidelines to preparing web accessible learning content by teachers. It discerns between design principles and tips for learning content for i) presentation of a topic, ii) learners' engagement, and iii) stimulation to action & expression.

- Repository of Accessible Digital Tools and Resources

Developed by the European Association of Service providers for Persons with Disabilities (EASPD) and the Inclusive University Digital Education (InclUDE) project, the platform aims to provide a comprehensive repository of resources that can be used by teachers, lecturers, students, social service providers and their families to increase the accessibility and inclusivity of online learning practices at education and training levels.

- **Digital accessibility training**

Want to quickly test your knowledge in different areas of providing digital accessibility, you may wish to do so with the online quizzes of the Digital Accessibility project, co-funded by the Erasmus+ programme. The project has developed a certified digital accessibility training for the job positions of a i) Digital Accessibility Manager; ii) Digital Accessibility Tester; iii) Web developer with expertise in digital accessibility; and iv) Web designer with expertise in digital accessibility.

- **The Digital Badge for Universal Design for Learning**

The AHEAD organization supports the initiative for awarding Digital Badges for Universal Design for Learning. AHEAD is an independent non-profit organisation working to create inclusive environments in education and employment for people with disabilities. AHEAD works with graduates and employers through the GET AHEAD Graduate Forum and the WAM Mentored Work Placement Programme. The open badge awarding system was developed for the Forum by AHEAD and UCD Access & Lifelong Learning.

AHEAD provides materials and a course design where institutions can contact the National Teaching and Learning Forum to download the full Course Facilitator's pack with all the instructions and materials required to run this CPD course.

To explore further the digital badge and free training follow the link:
https://www.ahead.ie/Digital-Accessibility-for-Educators

IV. Design: Web accessibility practices for educational digital content

a. Universal Design for Learning (UDL)

Architects have long employed universal design principles to ensure that physical environments are accessible and beneficial to all users. These principles dictate that physical products and environments must be equitable, adaptable, demand minimal physical effort, and minimize risks by effectively conveying information in various forms while providing sufficient size and space for diverse individuals to utilize them. Observing how architects designed accessible physical environments, educators began to apply the principles of Universal Design to the realm of education, which eventually laid the foundation for the accessibility factors in education within the UDL framework.

UDL, drawing inspiration from the universal design concept for products and environments, aims to make educational settings accessible to everyone, irrespective of physical, cognitive, or developmental barriers[5].

The UDL framework emphasizes on considering the intricate interplay of various elements, including factors of accessibility, UDL principles, and neuroscience, to understand the broader context of learning, rather than merely focusing on individual components. By recognizing the complexity of learning, educators, administrators, and learners can address more effectively the diverse needs of classroom groups. The approach is grounded in the interconnectivity of brain networks and the three core principles of UDL, which collectively guide the development of learning experiences that cater to a wide range of learners:

- **Multiple means of representation**

To cater to diverse learning styles, educators can present a historical event through a combination of a short video, a text summary, and an infographic that visually illustrates key events and dates.

Inclusivity NOTE: In the case of visual representation with people, make sure that there is diversity in terms or race, gender, etc.

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[5] Barteaux, S. (2014). Universal Design for Learning. BU Journal of Graduate Studies in Education, 6(2). Retrieved from https://files.eric.ed.gov/fulltext/EJ1230738.pdf

- **Multiple means of expression**

To enable learners to demonstrate their understanding of a concept, educators can offer options like creating a written essay, an oral presentation, or designing a multimedia project that incorporates graphics and audio elements.

- **Multiple means of engagement**

To engage learners with different interests and motivations, educators can provide a choice between individual or group projects, offer a selection of topics to research, or use game-based learning techniques to encourage participation[6].

Inclusivity NOTE: Ensuring diverse representation of values and background of people is also a mean of promoting engagement.

b. Accessible Iconography & the Accessible Icon Project

Accessible Iconography refers to the use of visual symbols and images that are easily recognizable and understandable by a wide range of users, including those with disabilities. This includes using simple, clear, and universally recognized symbols that can be easily interpreted, even by users with cognitive impairments or visual impairments.

Case Study: the Accessible Icon Project
Click on this link to access the Accessible Icon Project.

Transcript: On the left there is a picture of the design of the disability icon, where a person in a wheelchair is in movement, driving independently the wheels with their hands.
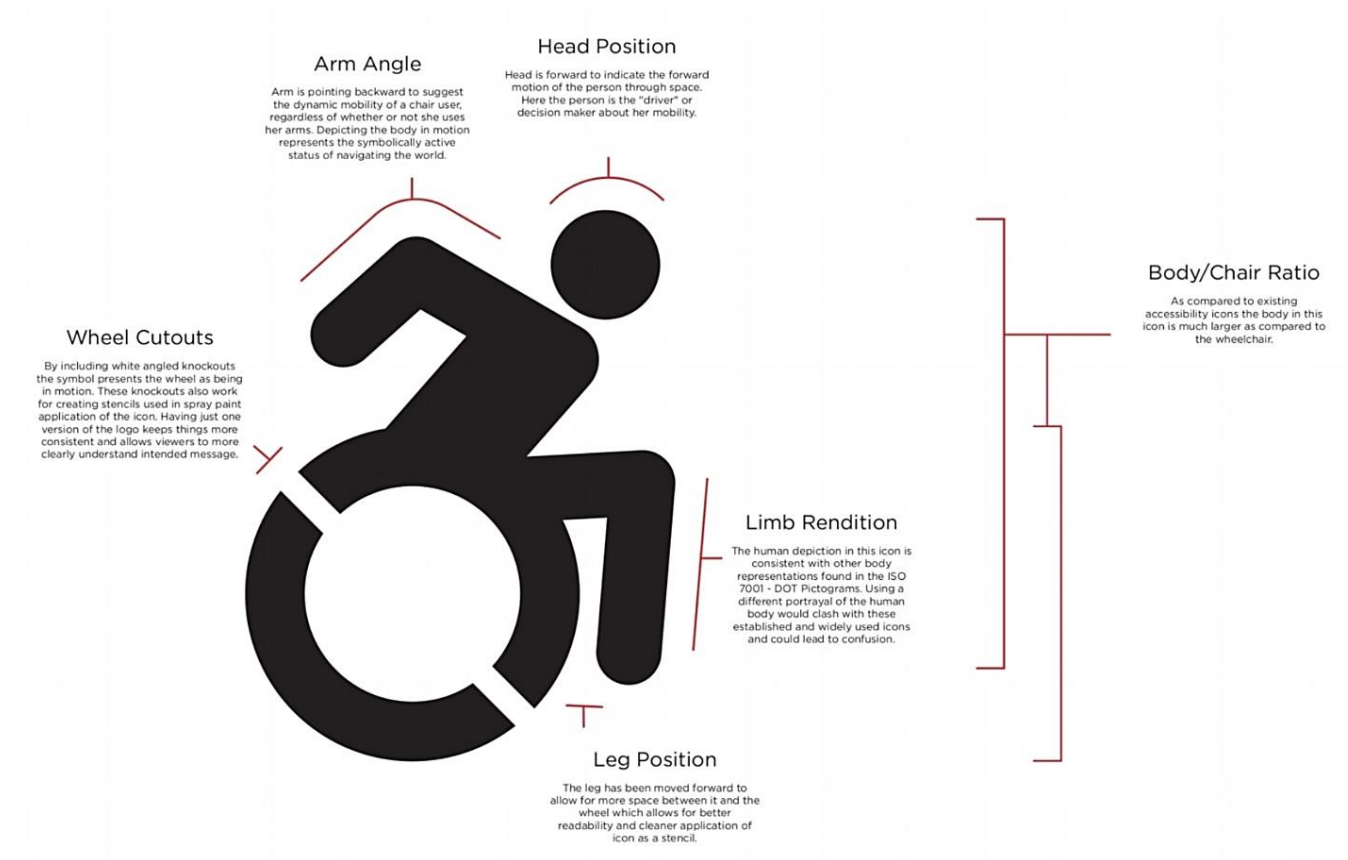
The Accessible Icon Project is an initiative aimed at creating a more accessible and inclusive society. The project focuses on changing the symbol used for accessibility, typically a stylized figure in a wheelchair, to a more active and empowering symbol. The new symbol features a stylized figure in a wheelchair with arms outstretched and pushing forward, creating a more dynamic and inclusive image.

It starts spontaneously as a as a citizen-led effort, aiming to alter the perception of people with disabilities as active citizens who live, explore and act independently. The very first project actions were to modify and/or place an "active" disability sign on public places. This was done through a collaborative effort between designers, developers, and accessibility advocates, and implemented in various settings, including public spaces, government buildings, and websites. The goal of the project is to create a more inclusive and accessible world by changing the way accessibility is perceived and promoting the idea that accessibility is not just about

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[6] https://ec.europa.eu/programmes/erasmus-plus/project-result-content/94806ccb-da2c-4547-b295-ffd62b3e0b2b/Universal-Design-for-Learning-1.pdf

accommodating people with disabilities, but about creating environments that are usable and accessible for everyone.

Arm Angle

Arm is pointing backward to suggest the dynamic mobility of a chair user, regardless of whether or not she uses her arms. Depicting the body in motion represents the symbolically active status of navigating the world.

Head Position

Head is forward to indicate the forward motion of the person through space. Here the person is the "driver" or decision maker about her mobility.

Body/Chair Ratio

As compared to existing accessibility icons the body in this icon is much larger as compared to the wheelchair.

Wheel Cutouts

By including white angled knockouts the symbol presents the wheel as being in motion. These knockouts also work for creating stencils used in spray paint application of the icon. Having just one version of the logo keeps things more consistent and allows viewers to more clearly understand intended message.

Limb Rendition

The human depiction in this icon is consistent with other body representations found in the ISO 7001 - DOT Pictograms. Using a different portrayal of the human body would clash with these established and widely used icons and could lead to confusion.

Leg Position

The leg has been moved forward to allow for more space between it and the wheel which allows for better readability and cleaner application of icon as a stencil.

Transcript: The scheme above provides guides and proportions of the icon, created within the Accessible Icon project

[Click on this link to access the Icon Graphic Elements and instructions](#)

What the project has achieved is creating and widely accepting an **important symbol for accessibility and inclusion**. Likewise, by using the new symbol, organizations and individuals can demonstrate their commitment to accessibility and inclusiveness and contribute to raising awareness of the importance of accessible design.[7] Today the Accessible Icon project represents an ongoing "design activism" towards a more accessible world. You can download the simple design for free or contribute to the project and benefit from a more enhanced versions of it, order plates, etc.

Below is a list of respectable accessibility iconography websites offering free and paid icon designs for download:

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[7] http://www.brianglenney.com/accessible-icon-project

- Vecteezy - Free and paid accounts for downloading images in different formats

Example 1: **Click on a link to disability icons** , illustrating persons in wheelchairs facing different everyday situations of free and independent movement – climbing a ramp, going to a restaurant, etc. Hearing and vision impairment icons are also present.
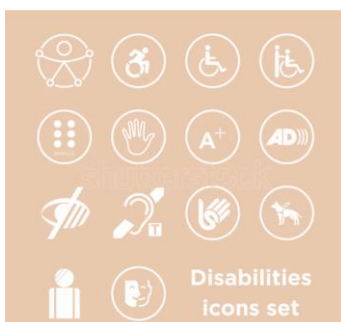

Example 2: **Click on a link with permanent and temporary disabilities, elderly, parents with small kids and pregnant women**

- Shutterstock - Free and paid accounts for vector images with online editing

Example 1: **Click on a link with icons illustrating natural and empathic interaction between people with different abilities**

Example 2: **Click on a link with modern icons, illustrating different types of disabilities**

- Adobe Stock – Paid accounts for downloading images in different formats

Example 1: <u>Click on a link to a physical disability icon, illustrating a person in a wheelchair tossing a basketball ball</u>. It demonstrates that people with motor disabilities could be physically active and good at sports.

Example 2: <u>Click on a link to an icon, illustrating the autism disorder in a modern way</u>. The picture represents the eternity mathematical sign in bright colors – blue, velvet, pink, red, orange, yellow and green. The symbol represents the infinite potential of individuals with autism, as well as their limitless possibilities and abilities. The rainbow colours reflect the diversity of different forms of autism.

- Flaticon - Free and paid accounts for downloading and editing images in different formats

Example 1: <u>Click on a link to a physical disability icon of a person in a wheelchair, playing with a ball.</u> It demonstrates that people with physical disabilities could be physically active and good at sports.

Example 2: <u>Click on a link to an icon, illustrating cognitive disability</u>. The image is of a head of a person and two palms open one against the other with soil and growing plant between them, which are located at the place of a human brain. It demonstrates the creativity and the huge cognitive potential people with cognitive disabilities have.

V. Use of enabling technologies

Assistive, or enabling technologies encompass a wide range of tools, devices, and software such as screen readers for individuals with visual impairments or hearing aids for those with hearing loss, aimed at enabling individuals with disabilities to perform tasks, participate in society, and improve their overall quality of life.

The development of assistive technologies has come a long way since their inception. The first electronic assistive technology ever developed was the **Akouphone**, a portable hearing device with a carbon microphone and earphones, introduced in the early 1900s by Miller Reese Hutchison[8]. Around the same time, Louis Braille, who was blind since early childhood, modified Charles Barbier de la Serre's military communication system to invent the **Braille alphabet**, which transformed the way blind people could access written content[9]. The transition from printed to talking books began in 1935 with the recording of Agatha Christie's novel The Murder of Roger Ackroyd, paving the way for electronic **text-to-speech** synthesizers that would be unveiled a few decades later.

From the early days of the Akouphone and Braille alphabet to the modern era of text-to-speech synthesizers and AI-driven solutions, assistive technologies have continually evolved to address various challenges faced by individuals with disabilities. Yet, what they should not be mistaken for is a one-size-fits-all solution, as the effectiveness of an assistive technology largely depends on the individual user's unique needs and preferences. While we have gone through what specific assistive technologies should be addressed for different types of disabilities (Chapter II) in this chapter we will make a brief overview of the types and the best way educational institutions may apply them.

Visualized in Table 1, various assistive tools can aid students with disabilities. In this sense, what are the essential, practical steps that educational institutions can make to effectively integrate these enabling devices and tools for an inclusive and accessible educational environment? Below is a list of steps that consider both an empathetic approach and thoughtful implementation for a supportive learning environment:

1. **Stop and listen**: Educational institutions must actively engage with their students, particularly those with disabilities, to understand their needs and experiences with digital content and platforms. By involving students in the accessibility evaluation process and soliciting their feedback, schools can create more inclusive and accessible digital environments tailored to their needs.

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[8] Kenefick, J. A. (2009). Hearing aid innovation: 100+ years later. Volta Rev. 109, 33. doi: 10.17955/tvr.109.1.comm

[9] Jiménez, J., Olea, J., Torres, J., Alonso, I., Harder, D., Fischer, K., et al. (2009). Biography of louis braille and invention of the Braille alphabet. Surv. Ophthalmol. 54, 142–149. doi: 10.1016/j.survophthal.2008.10.006

2. **Seek to understand**: Institutions should invest in training and resources for faculty, staff, and students to foster a deeper understanding of digital accessibility and the importance of enabling devices and tools. By providing opportunities for learning and growth, institutions can encourage a culture where individuals feel comfortable discussing their needs and exploring the use of assistive technologies[10].

3. **Be responsive and adaptive**: Educational institutions must be willing to adapt and respond to the diverse needs of their students by developing and implementing compassionate accessibility policies. These policies should be flexible enough to accommodate the unique requirements of students with disabilities and should guide the creation and delivery of accessible and inclusive digital content.

4. **Build bridges through collaboration**: To effectively integrate enabling devices and tools, educational institutions should actively collaborate with accessibility experts and disability services providers. By forging partnerships that prioritize the needs and experiences of students with disabilities, institutions can ensure that they are creating an inclusive and accessible learning environment for all.

Table 1. Assistive technologies aligned to impaired communication disorders

Affected Ability	Disorder	Assistive Technology

[10] Burgstahler, S. (2015). Opening Doors or Slamming Them Shut? Online Learning Practices and Students with Disabilities. Social Inclusion, 3(6), 69-79. doi:https://doi.org/10.17645/si.v3i6.420

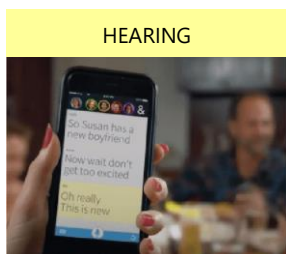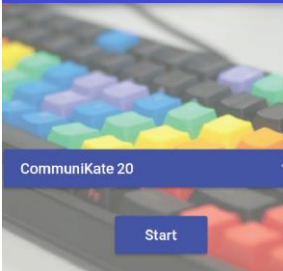| SPEECH		
	Apraxia of Speech	Click the link to read an abstract and request full access to a scientific article about a **Tabby Talks** assistive technology, a multi-tier system for remote administration of speech therapy – Sashin et a., 2015 https://www.researchgate.net/publication/275060395_Tabby_Talks_An_automated_tool_for_the_assessment_of_childhood_apraxia_of_speech
	Dysarthriea	Click the link to read an abstract and request full access to a scientific article about **VIVOCA device**, voice-input voice-output communication aid for people with dysarthria who have disordered or unintelligible speech. The device is developed under the Italian project Vivoca (Mulfari et al., Lokitha et al., 2022) https://www.researchgate.net/figure/A-member-of-the-project-team-demonstrating-the-prototype-VIVOCA-device-The-user-is_fig2_221009594
	Mutism	Click the link to request full access to a scientific article about the **BridgeApp** - an assistive mobile application that assists communication between people that are deaf and mute– Samonte et al., 2019. This tool makes use of Text-to-Speech, Speech-to-Text, Text-to-Image and Haptic Feedback technology, based on Filipino Sign Language and American Sign Language and it only works offline - https://ieeexplore.ieee.org/document/8939866
	Shuttering (stammering)	Click the link to read a scientific article about **StutterNet**, a novel deep learning based stuttering detection capable of detecting and identifying various types of disfluencies – Sheikh et al. 2021https://arxiv.org/pdf/2105.05599.pdf
	Articulation disorder	Click the link to read a scientific article about **LipNet**, an End-to-End Sentence-level Lipreading - Yannis Assael, 2016 - https://arxiv.org/abs/1611.01599
		Click here to follow the link to the LipNet technology - https://lipnet.ai/
SIGHT	Blindness	Click here to read a scientific article about the challenges in adopting assistive technologies in the workplace for people with visual impairments (Wahidin et al., 2018) - https://dl.acm.org/doi/abs/10.1145/3292147.3292175
		Click here to read about the **JAWS** technology, a screen reader, which provides speech and Braille output for the most popular computer applications on your PC. It combines Electronic Braille, Emacspeak, ORCA, VoiceOver, Windows-Eyes - https://www.freedomscientific.com/products/software/jaws/
HEARING	Deafness	Click here to access and download the **Ava**, Live transcript assistive technology, empowering Deaf & hard-of-hearing people and inclusive organizations with live captioning solution - https://www.ava.me/
		Click here to read an article about transcription apps - https://heardthat.ai/blog-content/the-best-transcription-apps-for-hearing-loss-of-2020

HEARING & SIGHT	Dual Sensory loss (deafblindness)	Click here to read a scientific article about **communication gloves, tactile boards** - Ozioko et al., 2018; Theil et al., 2020 - https://www.researchgate.net/publication/354541544_Smart_Tactile_Gloves_for_Haptic_Interaction_Communication_and_Rehabilitation
NAVIGATION CommuniKate 20 Start	Spinal Cord Injury	Click here to read a scientific article about **ColorCode**, which is an AAC (augmentative and alternative communication) system with two buttons that uses Bayesian inference to determine what the user wishes to communicate - ColorCode: A Bayesian Approach to Augmentative and Alternative Communication with Two Buttons https://aclanthology.org/2022.slpat-1.2/ Click here to access ColorCode, provided as open-source software - https://github.com/ mrdaly/ColorCode

Note: Adapted from "Cutting-edge communication and learning assistive technologies for disabled children: An artificial intelligence perspective," by K. Zdravkova, V. Krasniqi, F. Dalipi, & M. Ferati, 2022, Frontiers in Artificial Intelligence, 5. https://doi.org/10.3389/frai.2022.970430

II. Development and Standardisation in Creating Accessible Web Content

In the EU inaccessible web content poses a significant barrier for millions of people, particularly those with disabilities. A 2021 study by the European Disability Forum revealed that nearly 80% of public websites in the EU are not fully accessible, causing around 100 million people with disabilities to face difficulties in accessing critical information and services online[11]. This exclusionary digital landscape not only impacts individuals' ability to participate in society but also has personal and emotional consequences – depriving people of opportunities for social connection, professional growth, and economic independence.

At European and International level, the primary legal reference for persons with disabilities is the UN Convention adopted in 2007 and signed by all Member States and by the EU (first convention joined). The United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) is an international treaty that identifies the rights of disabled people as well as the obligations of the States parties. It aims to ensure that disabled people enjoy the same human rights as everyone else and that they can participate fully in society by receiving the same opportunities as others[12].

The UN Convention considers accessibility a key element, an essential pre-requisite for effective and equal enjoyment of civil, political, economic, social and cultural rights by persons with disabilities. In particular, Article 9 UNCRPD recognizes the right to access, on an equal basis with others, to the physical environment, to transportation, to information and communications, as an essential element to enable persons with disabilities to live independently and participate fully in all aspects of life. It invites State parties to take all necessary measures in this regard.

In Europe, the protection of rights of people with disabilities became part of primary law in 1997 with the Treaty of Amsterdam, which included the fight against discrimination (also on the grounds of disability) among the priorities of the Union (now Art. 19 TFEU). In 2010 the EU became a member of the UNCRPD, first international treaty signed by the Union, committing itself to the respect of the rights and obligation coming from that International Treaty.

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[11] European Disability Forum. (2021). The digital divide: The fight for accessible websites. Retrieved from http://www.edf-feph.org/newsroom/news/digital-divide-fight-accessible-websites
[12] https://social.desa.un.org/issues/disability/crpd/convention-on-the-rights-of-persons-with-disabilities-crpd

Apart from the UN Convention, a binding tool for all its members, the main reference at EU level for the rights and policies for disabilities is the European Disability Strategy (ESRPD)[13]. The ESRPD is a tool that allows the EU to **implement the UNCRPD** and to put the support for people with disabilities among the priorities of the Union.

A first Strategy was adopted for the period 2010-2020, which made it possible to place support for people with disabilities among the priorities of the EU and its Member States, and to make improvements in the areas of accessibility, awareness-raising, education and training, social protection and health.

A new 2021-2030 strategy has been adopted to guide Member States and European institutions in the current decade regarding the rights for persons with disabilities. Its objective is to direct and guide the action of the Member States and European institutions, based on the achievements of the previous Strategy and proposing solutions to the challenges to come, for better inclusion of people with disabilities in all areas of the society. The new Strategy aims at ensuring that progress is made in all areas of the UNCRPD, both at EU and Member State level. Through the Strategy, the EU is expected to develop and implement various initiatives, all articulated around three main themes: Rights; Autonomy; Non-discrimination and equal opportunity.

The 21-30 Strategy actions are all articulated around eight flagship initiatives:

- The creation of an "**AccessibleEU**" resource centre, which will identify accessibility practices in all sectors and, through its work, must will pave the way for the EU to set up a regulatory agency aiming at boosting accessibility for persons with disabilities in all areas of life;

- A **European Disability Card** to facilitate the free movement of disabled persons;

- **recommendations** to MS for improvements in independent living and community inclusion;

- The establishment of a **European quality framework for excellent social services** for people with disabilities.

- Improving the situation on the labour market for PSH: a **package** to improve labour market outcomes of persons with disabilities;

- The establishment of **Disability Platform** to support the implementation of the Strategy as well as national disability strategies, bringing together national UNCRPD focal points, organisations of persons with disabilities and the Commission.

- The publication of **guidelines on the participation of PwDs in the electoral process** (as candidates and voters) in 2023, in order to ensure that they can fully enjoy their rights as European citizens;

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[13] https://ec.europa.eu/social/main.jsp?catId=1484&langId=en

- A new human resources strategy for the EC to promote the employability of PwDs in the institutions.

We ca see that accessibility play a key role in the new strategy as it is the key element to ensure rights to independent living and allow persons with disabilities to move freely in the EU.

Below, we additionally look at a few standards widely accepted across the EU that assist in fostering a more inclusive and equitable digital environment and can easily be more fully adopted across EU universities.

a. WCAG 2.1

WCAG (Web Content Accessibility Guidelines) are a set of guidelines and standards for making web content more accessible to people with disabilities. These guidelines are developed by the World Wide Web Consortium (W3C), a recognised international organization that sets standards for the web. WCAG is recognized internationally as a key standard for web accessibility, and many organizations use it to evaluate the accessibility of their websites.

The guidelines are organised around *four key principles of accessibility*: perceivable, operable, understandable, and robust. These principles outline the ways in which web content can be designed to be accessible to users with a range of abilities, including those with visual, auditory, physical, and cognitive impairments.

The latest version of WCAG (Web Content Accessibility Guidelines) is currently in version 2.1 and comes in 3 levels: A, AA, AA. WCAG 2.2 is scheduled to be completed and published in May 2023. WCAG 2.1 builds on previous versions of the guidelines and provides recommendations for making web content accessible to people with disabilities, including those with visual, auditory, physical, and cognitive impairments.

Below are some of the **key recommendations in WCAG 2.1** applicable in a university setting (also presented in the Fact sheets at the end of this guide) classified by its medium:

- Alternative text for images and multimedia: Ensure all images, graphs, and multimedia elements have descriptive alternative text or captions. This makes content accessible to users with visual impairments who rely on screen readers.

- Video captions and transcripts: Provide captions for all pre-recorded and live videos, as well as transcripts for video and audio content. This benefits users hearing impairments and supports non-native speakers in language comprehension.

- Clear and consistent navigation: Design intuitive and consistent navigation across all university websites and online platforms. Use descriptive headings, labels, and logical page structures to assist users with cognitive disabilities and make content easily discoverable for all users.

- Keyboard accessibility: Ensure that all interactive elements, such as forms, buttons, and menus, can be operated using a keyboard. This benefits users with physical impairments who may rely on alternative input devices or keyboard navigation. It also supports users with cognitive disabilities such as autism who need structured presentation to access web content.

- Adjustable text size and contrast: Enable users to adjust font sizes and colour contrast, ensuring legibility for individuals with visual impairments or dyslexia.

- Accessible documents: Offer accessible versions of documents, such as syllabi and course materials, in formats that are compatible with screen readers and other assistive technologies (e.g., PDFs with properly marked headings, lists, and tables).

- Provide sufficient time: Allow users to request extended time for completing online assessments or activities if needed, to accommodate those with cognitive or physical impairments.

- Compatibility with assistive technologies: Ensure that all university digital resources are compatible with a range of assistive technologies, such as screen readers, magnifiers, and speech input software, to create an inclusive experience for all users.

A set of steps for adopting WCAG by public or private educational institutions follow below with each organisation being advised to directly refer to the latest release of the guidelines and adapt the requirements based on their context and needs:

1. Conduct an **accessibility assessment**: Begin by evaluating the university's current digital resources, including websites, applications, and online learning platforms, to identify areas that require improvement to meet WCAG 2.1 standards. This assessment will help prioritize accessibility issues and guide the creation of an action plan.

2. Develop an **accessibility policy and action plan**: Based on the assessment results, create a comprehensive accessibility policy that outlines the university's commitment to digital inclusion. The policy should include an action plan that details the necessary steps, timelines, and responsibilities to address and resolve identified accessibility issues.

3. **Train staff and faculty**: Provide training and resources to ensure that university staff and faculty understand the principles of web accessibility, WCAG 2.1 guidelines, and their roles in creating and maintaining accessible digital content. This training should encompass web developers, content creators, and educators involved in online course development and delivery.

4. **Implement and monitor accessibility improvements**: Apply the necessary changes to improve accessibility across university digital resources. Continuously monitor and test these resources to ensure ongoing compliance with WCAG 2.1 guidelines. Encourage feedback from students and staff and address any emerging accessibility issues promptly[14].

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[14] https://www.w3.org/TR/WCAG21/

Remember - conforming to WCAG requires an ongoing commitment to accessibility and a proactive approach to making your website or application accessible to all users. Regular checks of updates, audits and user feedback will be crucial to ensure you are.

b. EN 301 549 standard[15] - European standard for digital accessibility

In Europe, the **EN 301 549 standard**, which is based on WCAG, provides guidelines for accessible web design for public sector organisations and as such might apply to some public universities. The standard covers a wide range of areas, including software applications, websites, electronic documents, and multimedia content.

Many of the **key recommendations of the EN 301 549 standard** overlap with WCAG's recommendations (since it is based on it). While the standard incorporates WCAG guidelines for web content, it further covers other ICT aspects. A set of those have been provided below:

- **Accessible hardware and peripherals**: Ensure that hardware devices, such as computers, tablets, and interactive whiteboards, are designed with accessibility in mind. This includes providing tactile indicators on touchscreens and offering compatibility with assistive devices like Braille displays, screen magnifiers, and alternative input methods.

- **Accessible software and user interfaces**: Design software applications and user interfaces to be accessible and usable by individuals with diverse abilities. This may involve providing customizable text sizes, colours, and contrast settings, as well as offering voice-command functionality and compatibility with assistive technologies.

- **Accessible electronic documents**: In addition to making web content accessible, ensure that electronic documents, such as PDFs, Word documents, and PowerPoint presentations, are designed with accessibility features like properly structured headings, lists, tables, and alternative text for images.

- **Accessible communication tools**: Implement accessibility features in communication tools, such as email clients and video conferencing platforms. This includes providing real-time captions for video conferences, ensuring compatibility with screen readers, and offering alternative means of communication, like instant messaging or chat.

- **Accessible procurement processes**: Develop procurement processes and policies that prioritize the acquisition of accessible ICT products and services. This ensures that any new technology or software implemented in the educational setting is designed with accessibility in mind from the start.

- **User testing and feedback**: Involve users with diverse abilities in the development and testing of ICT products and services. Encourage feedback from students, staff, and faculty

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[15] https://digital-strategy.ec.europa.eu/en/policies/latest-changes-accessibility-standard

to identify areas for improvement and to ensure that accessibility features are effective and user-friendly.

How to adhere to EN 301 549?

To adhere to EN 301 549, you can take these steps to make sure your websites and applications are accessible:

- **Develop an EN 301 549-focused accessibility policy:** Create a university-wide accessibility policy specifically addressing the requirements of EN 301 549 for ICT products and services. This policy should include a roadmap for compliance, covering aspects such as hardware, software, electronic documents, and communication tools.

- **Conduct targeted training sessions:** Organize training sessions for relevant university staff and faculty to familiarize them with the unique aspects of EN 301 549, ensuring they understand the distinctions between this standard and WCAG 2.1. Emphasize the importance of incorporating accessibility into all aspects of the university's ICT infrastructure.

- **Adapt procurement procedures**: Modify the university's procurement processes to explicitly require compliance with EN 301 549 when acquiring ICT products and services. Engage with suppliers to confirm that their offerings adhere to the standard and support the university's commitment to digital accessibility.

- **Execute targeted accessibility enhancements**: Identify and prioritize specific areas where the university's ICT resources do not meet EN 301 549 requirements. Implement targeted improvements, focusing on hardware, software, electronic documents, and communication tools that fall under the scope of the standard.

- **Establish ongoing monitoring and evaluation**: Set up a monitoring and evaluation system tailored to the EN 301 549 standard, addressing its unique requirements compared to WCAG 2.1. Encourage an open feedback loop with the university community, and proactively address any identified accessibility concerns.

c. Other legislation requirements across the EU

Apart from the regulations already reviewed herein above there is a set of other requirements across the EU to which we advise educational to abide. Below you will see an overview of key EU legislation acts which provide for web and digital accessibility:

The EU General Data Protection Regulation (GDPR)

The General Data Protection Regulation (GDPR) is a comprehensive data privacy regulation that came into effect in the European Union on May 25, 2018. It aims to harmonize data protection laws across EU member states, enhance the privacy rights of individuals, and give them more control over their personal data. GDPR applies to organizations operating within the EU and those outside the EU that process personal data of EU residents.

The regulation introduces several key principles, including lawfulness, fairness, and transparency; purpose limitation; data minimization; accuracy; storage limitation; integrity and confidentiality;

and accountability. Organizations must adhere to these principles when processing personal data and must demonstrate compliance with the regulation.

Under GDPR, individuals have several rights concerning their personal data, such as the right to access, rectify, erase ("right to be forgotten"), restrict processing, data portability, object to processing, and not be subject to automated decision-making, including profiling.

Non-compliance with GDPR can result in significant fines, up to €20 million or 4% of an organization's annual global turnover, whichever is higher. GDPR emphasizes the importance of privacy by design and privacy by default, requiring organizations to consider data protection throughout their processes and systems[16].

In overall, GDPR regulation has been heavily tracked all across the EU and has been implemented at an almost 100% across various organisation.

The European Accessibility Act (EEA)

The European accessibility act is a directive that aims to improve the functioning of the internal market for accessible products and services, by removing barriers from divergent rules in the Member States.

Businesses will benefit from:

- common rules on accessibility in the EU leading to costs reduction,
- easier cross-border trading,
- more market opportunities for their accessible products and services.

Persons with disabilities and elderly people will benefit from:

- more accessible products and services in the market,
- accessible products and services at more competitive prices,
- fewer barriers when accessing transport, education, and the open labour market,
- more jobs available where accessibility expertise is needed.[17]

By establishing common accessibility standards for products and services used in educational settings, such as computers, smartphones, tablets, e-books, and e-commerce platforms, the EAA complements the Web Content Accessibility Guidelines (WCAG), which focus primarily on web content. While WCAG offers guidance for making websites and online content accessible, the

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[16] https://gdpr.eu/

[17]https://ec.europa.eu/social/main.jsp?catId=1202#:~:text=The%20European%20accessibility%20act%20is, EU%20leading%20to%20costs%20reduction

EAA extends its reach to the broader spectrum of digital technologies, hardware, and services that are crucial for an inclusive learning environment.

The Web Accessibility Directive (WAD)

The Web Accessibility Directive (WAD) is an EU directive that mandates public sector bodies to make their websites and mobile applications accessible to all users. Adopted in 2016, the WAD requires EU member states to ensure that public sector websites and apps conform to the Web Content Accessibility Guidelines (WCAG) 2.1 Level AA standard. The Directive complements the European Accessibility Act which covers a wide range of products and services also in the private sector.

Other legislation in the field of digital accessible includes:

- The **European Electronic Communications Code** ensures that everyone has access to affordable electronic communications services, including emergency services.

- The recently revised Audiovisual Media Services Directive (AVMSD) covers the means to achieve accessibility such as with sign language, subtitling for the deaf and hard of hearing and audio descriptions for both television broadcasting (i.e. linear services) and video on demand (VOD).

- The eIDAS Regulation (on electronic identification and trust services for electronic transactions in the internal market) requires that trust services and end-user products are accessible for persons with disabilities. Examples of these services is, eSignatures which aid in signing legal documents and email in a paperless manner.

- The Marrakesh Directive and Regulation (2017) aim to facilitate the access to print works, including e-books, in formats adapted for persons who are blind, visually impaired or those who have difficulties reading.[18]

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[18] https://digital-strategy.ec.europa.eu/en/library/accessibility-essential-some-useful-all

III. Map4Accessibility: Tackling Web Accessibility in Project Implementation

a. The games we play

Game 1: The Map4accessibility experimental needs identification

Gathered physically together, all Map4accessibilitiy partners' committed representatives took part in an experimental experience at their 3rd Transnational project meeting on 6th December 2022 in Berlin, Germany. Inspired by their research about web accessibility needs' identification for people with different abilities, Europroject suggested to test the method where people experience the challenges of the research target group by facing similar conditions.

To make the experience playful and to set a strategic final goal, participants had the task to invent a story together in the form of a brainstorming session. They were not given time beforehand to contemplate on the story plot, story characters, challenges for the characters to meet and the ending of the story. Instead, the first participant started spontaneously a telling with an invented character and situation in which the action took place. Then in turn each participant continued it with their own development, complying with the rule of saying no more than 3 sentences.

Introduction to the storytelling and brainstorming rules was made to participants. You may find them outlined herein. The main characteristics of the storytelling are: a Setting - the time and location in which the story takes place; Characters divided into a Protagonist: the main character of a story, and an Antagonist: a character opposing to the protagonist(s), standing between them and their ultimate goals; a Plot - the sequence of events that connect the audience to the protagonist and their ultimate goal; a Conflict / Challenge - what drives the story, creating tension and building suspense, which is the element that makes a story interesting; Outcomes – they tell about how the protagonist have overcome the challenge, and in particular, Learning outcomes - the lessons at the end of the story for the protagonist and the society which drive towards the progress.

The main rules for a brainstorming are: to have a judgment-free zone - people can build from each other's ideas; to encourage positivity and inclusivity, e.g. using "and" instead of "but"; to encourage wild ideas - let's embrace out-of-the-box notions; to stay focused on the topic or to the storyline elements; to have one conversation at a time - avoid interrupting and respect each other's turn.

What is the element of web accessibility experimental experience? Participants were then divided in four groups of several people. Each of these groups faced different challenges: 1. Participants interacted with masks covering their eyes; 2. Participants interacted with noise isolating headsets on their ears; 3. Participants had to interact with digital devices using the keyboard only; 4 Participants had to use a different One Drive document to follow the story, in which the font used is difficult to read. Groups used assistive software to perform the task - the dictate function of the Microsoft online services on a shared document in OneDrive. Participants realized from first hand that using voice-to-text is a slower process than in a conversation without assistive software. It is because words needed to be articulated accurately so that the right one appears on the document. Most voice-to-speech software have different voice recognition tools to grasp better the user dictation in the future. Yet, it may recognize accents, natural speech, and various languages but it is not smart (AI applied) to understand the meaning of the sentence. To avoid misinterpretation, users should be mindful of the limitations of the software. Likewise, it was advisable that shorter and simpler sentences were used for better responsiveness. All groups but one used a shared document with normal font and the last one followed a document with a font like the way people with dyslexia report to see words – e. g. dancing, melting, blurred in different angles or in the middle. The whole story was supposed to be read out loud using text-to-speech software for the participants with covered eyes to perceive the overall story.

Experimental exercise development and conclusions: In reality, participants were divided in 3 groups – one with covered eyes, one with covered ears and one which had to use only keyboard to interact with the computer. It turned out at the very beginning that the final group did not know how to navigate with keyboard commands on the main menu of Microsoft online products and this was a bottleneck that prevented them from experiencing the exercise. This group was suggested to switch to document displaying the words in a font similar to the one people with dyslexia see letters.

In the group of participants there was one person with physical disability in a wheelchair. He participated in the exercise with covered eyes to discover different challenges.

People reported to have felt naturally in the experience and to have been sufficiently assisted during the exercise. The dictate software at the beginning displayed words in English. But then it recognized the natural language of the leading partner in the activity (Europroject – Bulgarian language) and started providing non-sense text in Cyrillic. This caused some disturbance and took time to figure out corrective measures.

The cumulative experience leads to the conclusion that today's assistive technology allows for people with different abilities to interact digitally. However, relying on technology is strongly related to the level of awareness and capacity of using all its functionalities and furthermore, to malfunctions/errors/misinterpretation of the technology. While artificial intelligence is pushing technologies to provide higher responsiveness, users need to be trained on how to overcome different obstacles of this character. In overall, sufficient reaction time should be foreseen in the design and development of the web content to ensure smooth experience to people using assistive technologies or in general.

For the curious: Interested in the story the team invented within the exercise, you cand find it here below:

"There is a wolf in wood – very beautiful. It is cold and rainy. It is not so good and so it is exhausted. The two friends were walking and were afraid of their surroundings. It is getting dark and there are no people around. There is an empty building which is known by being visited by a lot of ghosts. Now it is cold and dark but soon all of us will be with their families around the Christmas tree. And we will celebrate the most fascinating time of the year. Celebrating Christmas is a way not to be scared about ghosts. It is a cold and foggy day in the forest. I cannot see anything, but no one can see me neither. And at this time something happened. A terrible noise happened but there is nothing to be afraid. And they lived happily ever after. "

Game 2: Cut, play & design - Crafting Inclusive Student Classes

During one of our partner meetings in Catania, Italy, 15th – 16th June, 2023, we did a craft play to design 4-5 student resources for secondary and university students on inclusivity, digital and physical accessibility. They were designed by the consortium experts, practitioners, and academics. Should you wish to benefit from some practical exercises for yourself, your team of professionals, school or higher education students, you may refer to the activities provided in Annex 1, part of this document. They are further downloadable as independent sources at the resources page of the Map4Accessibility website.

The four activities published herein are inspired by the initiative of The Economist Educational Foundation, called Topical Talk. It provides a series of free resources for discussion on intriguing topics of modern society. Students aged 9+ develop essential critical-thinking and communication skills through accessing following structured activity sheets, presented by their sheets. An example of 'Topical Talks' on accessibility could be found on the link here: https://talk.economistfoundation.org/resources/discrimination-in-design-disability/.

Based on the Topical Talk template, the Map4accessibility team has developed 4 unique discussion activities addressing four specific challenges of digital accessibility. All of them has identical structure:

1) **Introductory page** which has: i) the lesson topic; ii) earning objectives; iii) ddefinitions and sources of information; iv) learning outcomes.; v) Sustainable Development Goals of the United Nations (SDGs) addressed (optional). A link to SDGs can be found following the link here: https://sdgs.un.org/goals

2) An **Activities** page outlines: i) activity one – individual groups, get-to-know exercise; ii) activity two – groups exchange, debate and collective decision-making; iii) activity three – design & develop on your own, interact

a) The **Materials** pages displays: i) ready-to-use materials illustrating the problem – maps, cards, news topics, others; ii) emoji figures to assess and level-up severity of the problem

b. Progressive Web App Development Challenges in Map4Accessibility: Initial Insights

This section below delves into two topics – initially, Associação Salvador's journey in developing the + Acesso para Todos app and next – our teams' efforts in co-creating the "Map4Accessibility" progressive web app by building on the previous development experience of the "+ Acesso para Todos" application. From acknowledging the primary challenges to analysing results, we are currently crafting and refining a tool designed to enhance the accessibility of various locations and thus create an inclusive physical environment accessible to all.

Where did you go for dinner, yesterday? Was it accessible? Probably you don't know! Most probably it wasn't.

"Every time I go out I need to do a detailed planning of my day because I don't know what obstacles I will find: I need to know if the place where I am going to have a meeting is accessible and how I can get there – there are few adapted transports and even if I go by car it's very typical that there aren't any accessible parking slots nearby or that they are occupied by a person with no mobility problems. I also need to call several times a restaurant to check if it is accessible and most of the times when I get there I cannot go in because it has at least a step at the entrance. These are just some of my daily challenges." – Salvador Mendes de Almeida, Associação Salvador's President.

How would you feel if you had to deal with these embarrassing situations EVERY SINGLE DAY? Or, if you need to go to a pharmacy and you end up trying to enter three or four ones until you buy a medicine? Or, if you have to wait on the street for more than an hour on a rainy day, in front of the Finance Services? Or, if you have to wait two years to study because the university is not accessible? All true, and not so fun situations. Do you want to know more?

The lack of accessibility is one of the main constraints for full integration of people with disabilities. This is not only a problem of private spaces - very often state services also lack accessibility. Accessibility is not only for people in a wheelchair, but also for parents with children and elder people.

The experience in building the "+ Acesso para todos" app

In Portugal, laws addressing accessibility date from more than 20 years ago. There is a huge necessity for further actions in ensuring accessibility with respect to all these situations enumerated above and many others. Thus, Associação Salvador has launched a mobile application called "+ Acesso Para Todos" (that means More Access to Everyone), with the objective to contribute to solving these challenges. Associação Salvador had already had previous projects related to the collection of accessibility information. Yet, over time these data became outdated while there was a lack of funding to go out again to the sites to collect new information. A different tool was then important to be created.

Perhaps you are wondering how the "+ Acesso para todos" app can solve problems with accessibility? That is simple! In this app, recently compared to the Trip Advisor of Accessibility,

all users (not only the ones with reduced mobility challenges) can classify places in Portugal as accessible or not. In a single click the user can select a shop, a post office, a pharmacy or a restaurant and rate it based on its accessibility. Another great feature of the app allows users to file a complaint in less than 1 minute. Complaints filed through the app are official and instantly reach the respective city councils and the National Institute for Rehabilitation responsible for accessibility inspection. "+ Acesso para todos" is believed to be the world's first application allowing users to file official complaints against public buildings and businesses that do not meet accessibility legal requirements. It contributes to creating a large and useful database of accessible and not accessible spaces with the possibility to trigger competent entities to act. The number of complaints during the first year of the app operation have doubled as compared to the previous one where responsible body felt urged and took actions.

The "+ Acesso Para Todos" app makes it possible to provide feedback on the following 4 aspects: entrance, toilet, space inside and parking. It has been designed to address the following objectives:

- To map accessible and inaccessible places to people with reduced mobility, very focused on people using wheelchairs.
- To sensitize building / spaces owners and responsible bodies to take steps to adapting their inaccessible spaces.
- To request inspection by the authorities of spaces which do not meet accessibility legal requirements and that have not adapted their spaces within the period stipulated by law.
- To facilitate the access to filing a complaint, especially in terms of avoiding embarrassing situations where a person asks for the complaints book, or/ and to ensure that the respective complaint reaches the respective person in charge, in the case where people are unable to write in the complaints book.

In this sense, there are several challenges, described below:

- Associação Salvador analysed related legal framework to verify whether sending an automatically generated digital document would be legally valid. A pdf document was created to be sent via email in a format officially accepted by respective entities, namely Instituto Nacional para a Reabilitação (INR), Autoridade de Segurança Alimentar e Económica (ASAE), Town Halls across the country.
- A survey of responsible persons' emails at national level was carried out to adjust that the complaint document is sent by email to the respective entities and city councils according to the type of service to which it refers.
- One of the biggest challenges which Associação Salvador encountered was to obtain the legal data of the companies or entities responsible for the spaces at the location to which the user referred. As there are hundreds of thousands of spaces, it is impossible to carry out this survey with the support of human resources only. As such Associação Salvador analysed the various open APIs to obtain the data. For these purposes, the app started to be fed by the data from the API's of google places and TripAdvisor. This ensured access to data from the vast majority or almost all spaces in Portugal.
- Another challenge was to create an effective, easy-to-use app that didn't require a lot of data and that had an easy-to-navigate interface for all users, particularly for users with little dexterity in handling the phone.

- A way to engage different target groups and the whole society in entering data in the app had to be discovered.
- Finally, the last challenge was to launch the app so that it could be used by people with reduced mobility, by their friends and family, but also by supporters of the cause of accessibility.

The main issues of the "+ Acesso para todos" app:

- Old technologies which do not allow further development.
- Dependency on only internal Associação Salvador communication and lack of partners.
- Application only for People with physical disabilities.
- Possibility to add very few information to the app.
- It is impossible to add obstacles and places that are not on google map.

The experience in co-creating the Map4accessibility" progressive web app

The "+ Acesso para Todos" application and the experience in its development, inspired the creation of the Map4Accessibility app. Understanding the main challenges, analysing the achieved results and how these could be leveraged and improved have fed the specifications of the new app. Below are main characteristics and challenges in the Map4Accessibility app:

Characteristics of the app – https://map4access-app.pipecodes.com/home.

Transcript: Below there is a picture of the Mapp4accessibility app displaying a rated restaurant in Sofia, Bulgaria.
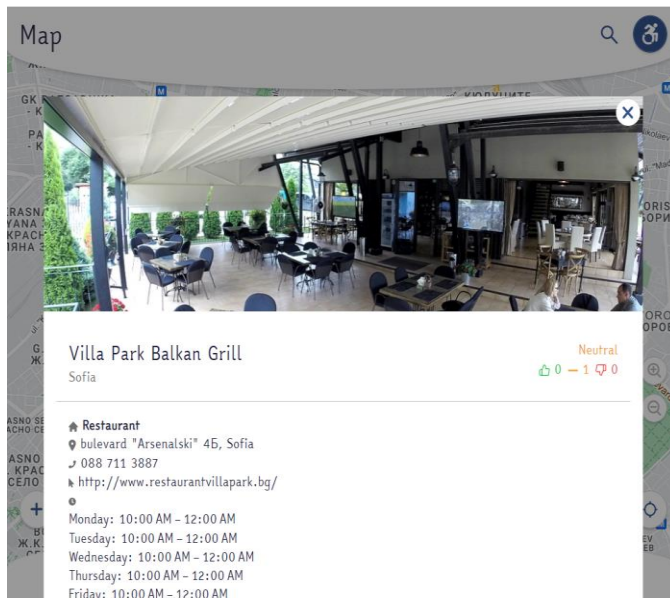
The Map4accessiblity app has been thought to address the needs of largest possible users.

- **People with disabilities and the general public**: they will wish to choose a route or to visit a place where certain commodities are available. The app is trying to tackle the most disability types to ensure that rated place serve to the highest percent of people. Very often it is not only a matter of preferences for reaching a comfort level but of actual ability to enter or pass through certain locations.

To stay attractive and gain contributors the app needs to be **simplistic, little time-consuming** and **with intuitive interface**. It further must comply with current trends in building similar apps (e.g., voting system, display characteristics, interaction modes) to be easily to recognize and navigate, but also for the users to opt for it.

Similarly, having people with disabilities as its primary user group, the Map4accessibility app should exclusively **comply with principles for web accessible content**. Thus, it requires minimum fields to be complete by hand and is provided in a compatible to assistive technology format.

On the other hand, to provide **qualitative and valuable information to users with different disabilities** the app needs to obtain and return data on the nature of accessibility obstacles and on accessibility details. Thus, the Map4accessibility app has a simple rating system where users evaluate whether a place (all types, underground, road, public transport station, private or public building, etc.) is accessible, not accessible, or neutral. It is then followed by several mandatory questions of a multiple-choice type to concretise the choice of accessibility in terms of internal circulation, entry, transportation to the place, outdoor space, parking opportunities, utilities, customer service, bathroom and the possibility of making an independent experience. The user may choose to submit their rating or to continue with specific questions detailing these categories (or to answer the optional questions which are again in the form of multiple choice). Finally, users have the option to upload media files which demonstrate or further elaborate the condition of the place/obstacle that is being evaluated.

People can evaluate existing places (depicted from Google map) or choose to add a new entry in the form of an obstacle. Once, the obstacle reaches a certain number of "accessible" votes, dating after the time of its creation, then it will be automatically deleted (considering the changed conditions).

The same group could act both as direct users and contributors. For the Map4accessibility app to be successful and trust-worthed in the information it returns queries its wider download and use needs to be ensured in the cities and countries of the project partners and beyond. The design and functionalities of the app reflect this aspect. This is especially valid considering that "in 2018, 74% of all apps were downloaded less than 1000 times" and that "the average app loses 77% of its daily active users within the first three days after download, whereas top apps have significantly higher retention rates".[19] Service-learning and the urge to improve surrounding environment are often the strongest drivers for contributors, especially the Map4accessibility app.

- **Scientific circles:** the data entered in the app could be further used for scientific research, complying with the GDPR rules. For this purpose, the Map4accessibility app allows for downloading sets of data in xls (xlsx) and other formats.

- **Places owners**: the app serves to places owners, whether public or private, in evaluating their accessibility and applying strategies to enhancing those to gain highest attractiveness.

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[19] „There's an app for that! Understanding the drivers of mobile appliations downloads, Journal of Business Research, February 2021, Zeynep Aydin Gokgoz, M. Berk Ataman, Gerrit H. van Bruggen

Challenges in building and maintaining the Map4accessibility app – considerations, which apply to today's progressive web apps

- Using/upgrading with most fit modern technological solutions and developments.
- Understanding how to address accessibility for all types of disabilities.
- Modifying the accessibility paradigm and making everything universally accessible.
- Continuously implementing technological facilitators to involving different target groups (including different background – e.g. economic, race, ethnic, gender, culture, nationality, etc.)
- Understanding how to provide relevant information about accessibility to all people (not just about accessibility for people with physical disabilities).

There is an abundance of information, whereas the features of the app should display the relevant (yet not an exhaustive) information in the specific cases to guarantee the interest and involvement of users, but also to respond to all needs. Particularly, in the Map4accessibility project, this involved specifying the types of questions which the Map4Accessibility app should pose for the users to evaluate public places.

- Creating an evaluation/classification system which is easy and user-friendly.
- Analysing the possibility of a greater integration of Google tools and definition of routes/gps.
- Analysing approaches to inserting existing information (previously entered information).
- Understanding current legislation and ways to involve different countries.
- Guaranteeing thrusted and relevant information for a person with a particular disability, respectively needs (e. g. information about the route and mode users should choose with the fewest obstacles).
- Ensuring that users understand easily how the app works and the importance of the entire project.

"Some people get discouraged from complaining because they think nothing will ever change," she said. "The app is a very smart way of making us exercise our rights."

c. The way forward

Share

The Alpha version of the Map4accessibility app is now available to be tested (April 2023). You can download it from here - https://map4access-app.pipecodes.com/home.

What's coming next is developing a comprehensive dissemination and marketing strategy to engage the largest possible audience to test and continuously contribute to mapping accessible urban environments. Its web accessibility, user-friendliness and attractiveness will be evaluated and improved. The ambition is that the Map4accessibility application is to support people with different abilities in using the physical and digital space during their daily activities with as much ease.

Spread the word and **stay tuned for Map4accessibility events** (workshops, urban walks, etc.) in your city and online.

Get involved

If you read these lines, you are already interested in making your online page, digital content or learning and teaching materials more accessible and inclusive.

1. Why won't you try one of the methods of identifying your target group needs? Make focus group, experiment in improvised similar conditions. You can use **Map4Accessibility resources page** to get familiar with what you can do now and how you can do it.

2. Do you have ideas about **improving the Map4accessibility app**? **Download it**, test it and provide your feedback.

3. Do you wish to get involved as a place owner, receiving direct feedback about their accessibility? Do you get inspired to integrate further useful functionalities that bring value to people with different abilities?

Contact us:

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Help us build an impactful and entirely web accessible app for people across the EU and beyond - become a user or a contributor! The more we share, test and play, the more we contribute for a more inclusive environment.

VIII Fact Sheets: Digital Assets Accessibility Tips for Education

With over 135 million people in Europe, or 18% of its population, living with disabilities, ensuring digital accessibility is crucial for inclusivity and equal opportunities in educational settings[20]. Digital accessibility further creates benefits for the elderly, people with temporary impairments, and users with situational limitations. Indeed, accessible e-learning resources positively impact both disabled and non-disabled students' learning experiences, proving that accessibility is vital for creating a more equitable and effective educational landscape[21].

Hence, we have designed the below fact sheets to provide a **compilation of best practices, tips, and tricks for creating fully accessible web content and digital assets for education**. These encompass various aspects of digital accessibility, including iconography, documents, presentations, online meetings, websites, video, and audio content (e. g. podcasts), online courses, learning management systems (LMS), and social media. They represent a curated selection of (as of 2023) open-source, free, and/or freemium tools to facilitate the implementation of these accessibility guidelines. The below fact sheets have been designed to be practical and brief, but they are not exhaustive in covering all aspects of accessibility requirements or scenarios. It is essential to regularly consult with comprehensive accessibility guidelines, such as the Web Content Accessibility Guidelines (WCAG) by the World Wide Web Consortium (W3C), outlined in Chapter VI in this guide, and engage with your target audience to gather feedback and address any potential barriers.

Building a more inclusive and accessible society goes beyond merely addressing accessibility requirements; it involves fostering a culture of inclusivity that values diversity and encourages the active participation of all individuals[22]. Creating truly inclusive environments requires a collective effort that engages educators, designers, developers, and policymakers in embracing diverse perspectives and designing solutions that cater to a wide range of abilities and needs. Thus, with this guide it is our humble aim, to address accessibility in education to promote, at least partially, a more inclusive society that caters to the diverse needs of its population.

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[20] https://www.who.int/europe/news-room/fact-sheets/item/disability#:~:text=In%20Member%20States%20of%20the,Europe%20live%20with%20a%20disability.

[21] Seale, J., Nind, M., & Parsons, S. (2018). Inclusive e-learning: the role of the teacher. Journal of Interactive Media in Education, 1(7). https://doi.org/10.5334/jime.469)

[22] Loreman, T., & Deppeler, J. (2020). Creating inclusive environments: the importance of working together. International Journal of Inclusive Education, 24(7), 717-729. https://doi.org/10.1080/13603116.2018.1441910

Iconography

Tips for **Iconography**

○ **Clear and Simple Design:** Create icons with simple, uncluttered designs that convey their meaning effectively and are easy to recognize. Tools to use include Figma or Inkscape.

○ **Consistent Style:** Use a consistent visual style for all icons within a set or application to create a cohesive and professional appearance. Material Icons offer a wide range of icons in consistent styles to ensure a cohesive appearance.

○ **Sufficient Size:** Design icons with an adequate size, ensuring they are easily clickable or tappable and visible for users with visual impairments.

○ **High-Contrast Colours:** Utilize high-contrast colours between the icon and its background to improve visibility for users with low vision or colour blindness.

○ **Inclusive Symbolism:** Select universally recognizable symbols and avoid culturally specific or potentially offensive imagery to ensure inclusivity. The Noun Project and Iconfinder provide a wide range of inclusive and universally recognizable icons.

○ **Alt Text and Labels:** Provide alternative text or labels for icons to aid screen reader users in understanding their purpose and function.

○ **Scalability:** SVGOMG and Vectr allow you to create scalable vector icons that maintain clarity across different devices and screen resolutions.

○ **Focus Indicators:** Ensure focus indicators are visible and distinguishable when users navigate using a keyboard or assistive technology.

○ **Accommodate Customisation:** Allow users to customize icon appearance, such as size, colour, or contrast, to suit their preferences and accessibility needs.

○ **Test and Iterate:** Conduct usability testing with tools like UsabilityHub to gather feedback from a diverse audience and optimize your icons for all users.

Documents

Tips for **Documents**

- **Structured headings and clear language:** Use built-in heading styles to create a logical and organized structure for your document, and write in simple, clear language to make the content easier to understand.

- **Accessible typography:** Choose legible, sans-serif fonts (e.g., Arial, Helvetica, or Verdana) with appropriate font sizes and sufficient line spacing. Avoid using text within images.

- **Organised lists and linear layouts:** Use bullet points or numbered lists to organize information and avoid using columns or ensure proper reading order in multi-column formats.

- **High-contrast colour:** Choose colours that provide adequate contrast (check the [Colour Contrast Analyser](#)) for people with visual impairments, and avoid using colour as the only means of conveying information.

- **Descriptive hyperlinks and bookmarks:** Use meaningful link text for hyperlinks (instead of generic phrases like "click here") and create bookmarks to facilitate navigation to specific locations within the document.

- **Language tags and meaningful file names:** Identify the language of the document using language tags and use descriptive file names for easier identification and organisation.

- **Table of contents and navigation aids:** Include a table of contents to help users navigate the document and use other navigation aids such as page numbers or section summaries.

- **Learning-friendly text:** Enhance the learning experience by listing objectives at the beginning of each section or chapter, clearly outlining expectations and helping users focus on key takeaways.

- **Alternative text and table header:** Add descriptive text alternatives for images, graphs, and charts, and use clear table headers to provide context for screen reader users.

- **Using templates and testing:** Use accessible templates when creating documents and regularly test your document for accessibility, e.g., via the Accessibility Checker in the Microsoft Office documents.

Inclusivity NOTE: Please consider inclusive language related to users' background, e.g. gender, race, ethnic, culture, age, etc.

Presentations

Tips for **Presentations**

- ○ **Use simple and consistent design:** Use a simple and consistent design for your slides, with consistent font, colour, and layout.

- ○ **Use slide titles:** Use descriptive slide titles to provide a summary of the content of each slide.

- ○ **Use simple and clear language:** Use simple and clear language that is easy to understand and avoid using jargon or technical terms.

- ○ **Use slide notes:** Use slide notes to provide more detailed information about the content of each slide, making it easier for users who rely on screen readers to understand the presentation.

- ○ **Use headings:** Use the built-in heading styles to create a logical and organized structure for your presentation.

- ○ **Use high-contrast colours:** Choose colours that provide adequate contrast for people with visual impairments. Use WebAIM Color Contrast Checker to assist you with this.

- ○ **Use alternative text for images:** Add a descriptive text alternative for images, graphs, and charts to provide information for users who rely on screen readers.

- ○ **Use keyboard navigation:** Ensure that your presentation can be navigated using keyboard shortcuts, making it easier for users with disabilities to navigate your slides.

- ○ **Use closed captioning:** Use closed captioning to provide a text alternative for audio content, making it accessible to users who are deaf or hard of hearing.

- ○ **Use meaningful file names:** Use descriptive and meaningful file names, rather than generic names such as "presentation1" or "file2."

Online Meetings

Tips for **Online Meetings**

○ **Clear agenda and discussion points:** Use clear and concise descriptions for any agenda items or discussion topics, making it easier for users to understand and follow the meeting.

○ **Screen reader-friendly platform:** Use an online meeting platform that is accessible to users who rely on screen readers, such as [Zoom](#) or [Microsoft Teams](#).

○ **Clear instructions:** Provide clear instructions for users on how to join the meeting, how to participate, and how to access any shared files or resources.

○ **Simple language:** Use clear and simple language that is easy to understand and avoid using jargon or technical terms.

○ **Adjustable font size:** Allow users to adjust the font size of the content, making it easier for users with visual impairments to see and understand.

○ **Captions or transcripts:** Provide captions or transcripts of the audio content of the meeting using tools like [Subtitle Horse](#) making the meetings accessible to users who are deaf or hard of hearing.

○ **High-contrast colours:** Use high-contrast colours for text and backgrounds, making it easier for users with visual impairments to see and understand the content.

○ **Keyboard-friendly navigation:** Ensure that your online meeting can be navigated using keyboard shortcuts, making it easier for users with disabilities to navigate.

○ **Alternative formats:** Provide alternative formats for any visual content, such as slides or diagrams, making it accessible to users with visual impairments.

○ **Clear and descriptive file names:** Use clear and descriptive file names for any shared files, rather than generic names such as "meeting1" or "file2."

Website Design & Development

Tips for **Websites**

- ○ **Perceivable:** Ensure all content is presented in formats users can perceive, such as offering text descriptions for images, captions for videos, or audio descriptions for visual content.

- ○ **Operable:** Make all interactive elements and navigation accessible through keyboards or assistive devices, including buttons, links, and sliders.

- ○ **Understandable**: Use clear and concise language, provide explanations for complex content, and label form fields with descriptive text.

- ○ **Robust:** Use standard HTML elements and semantic markup to ensure compatibility with various user agents and assistive technologies.

- ○ **Compatible:** Regularly test your website with popular screen readers and other assistive technologies to guarantee compatibility.

- ○ **Text Alternatives:** Use alt text for images, transcripts for audio, and captions for videos to convey information for users who cannot perceive visual or auditory content.

- ○ **Audio and Video Controls:** Implement accessible controls for media, ensuring that they are keyboard-operable and compatible with assistive technologies.

- ○ **Colour Contrast:** Opt for high contrast colour combinations for text and backgrounds to improve readability for users with low vision or colour blindness.

- ○ **Easy to use:** Organize content logically, use descriptive headings, and implement clear navigation menus to facilitate understanding and ease of use for all users, including those with disabilities.

- ○ **Adaptable:** Offer customization options, such as adjustable font sizes, alternative colour schemes, and flexible layouts, to accommodate users' needs and preferences.

Bonus tip Ensure that **focus indicators** are clearly visible and distinguishable for all interactive elements, such as buttons, links, and form fields, to help users with keyboard navigation and assistive technologies know where they currently are on the page.

Inclusivity NOTE: In the case of visual representation with people, make sure that there is diversity in terms or race, gender, etc.

Video and Audio

Tips for **Video and Audio**

○ **Audio Descriptions and Sign Language:** Include audio descriptions for key visuals using a tool like <u>YouDescribe</u> and sign language interpretation for blind, visually impaired, and deaf or hard-of-hearing users.

○ **Clear Language and Narration:** Use plain language, avoid jargon, and provide clear, concise narration. Tools like the <u>Readable app</u> can help improve readability and language clarity in scripts for podcasts and video content.

○ **High-Contrast Colours and Visual Hierarchy:** Choose high-contrast colours for text and graphics and organize content with a clear visual hierarchy. <u>Coolors</u> is a useful tool for accessible colour combinations.

○ **Closed Captions, Transcriptions and Podcast Show Notes:** Add closed captions, transcriptions or show notes of audio content using tools like <u>Subtitle Horse</u> for deaf or hard-of-hearing users and for SEO purposes.

○ **Descriptive Headings and Episode titles:** Create meaningful, descriptive titles for each video or podcast episode, use clear filenames, and include descriptive titles and headings for screen reader users.

○ **Adjustable Playback Speed:** Allow users to adjust the video or audio playback speed to suit their preferred pace and comprehension level.

○ **Keyboard Navigation and Screen Reader Accessibility:** Ensure videos can be navigated using keyboard shortcuts and are accessible to screen reader users with alternative text for images.

○ **Consistent Layout:** Maintain a consistent layout throughout learning videos, using headings, bullet points, and other visual cues to help users easily follow and understand the material.

○ **Test for Accessibility:** Regularly test videos for accessibility with tools like <u>aChecker</u> to make necessary adjustments and cater to a diverse audience, including users with disabilities.

○ **Customisation:** Offer customization options for elements like font size, contrast, and layout, and ensure your content is adaptable to various devices and screen sizes. Use responsive video players like <u>Plyr</u> to accommodate different screen sizes and devices.

Online courses

Tips for **Online Courses**

○ **Comprehensive Accessibility:** Provide alternative format for all course materials – e.g., transcripts, captions, and audio descriptions. Use tools like AMARA or Verbit for video captioning.

○ **Streamlined Navigation:** Design a logical, intuitive course navigation system that is keyboard-friendly and compatible with screen readers, such as JAWS.

○ **Unified Design:** Maintain consistency in layout and design across the course, making it easy for students to locate and navigate materials.

○ **Customizable Text Display:** Enable students to adjust font sizes, styles, and colors to meet their needs. Utilize responsive design and tools like the UserWay Accessibility Widget.

○ **High-Contrast Colors:** Opt for high-contrast color combinations for text and backgrounds to improve readability. Use color contrast checkers like WebAIM's Contrast Checker.

○ **Straightforward Language:** Simplify language, avoid jargon, and provide clear instructions to enhance comprehension. Use readability checkers like Hemingway Editor.

○ **Flexible Timing:** Offer ample time and flexibility in deadlines for assignments and exams to accommodate students who may need additional time. Use Learning Management System (LMS) features to customize deadlines.

○ **Diverse Media Formats:** Present content in various formats, such as text, audio, video, and interactive elements, to accommodate diverse learning preferences. Use tools like H5P for creating interactive content.

○ **Inclusive Interactivity:** Ensure interactive elements like quizzes, forums, or simulations are accessible by providing keyboard navigation, clear instructions, and compatibility with assistive technologies.

○ **Continuous Improvement:** Regularly test your online course for accessibility and gather feedback from diverse students, including those with disabilities. Use accessibility checkers like WAVE or AXE, and make adjustments as needed to ensure an inclusive learning experience.

Learning Management Systems (LMS)

Tips for **LMS**

○ **Consistent Layout:** Create a uniform layout across the LMS to help users easily navigate the platform. Consistent interface elements, such as menus and buttons, reduce cognitive load and enhance usability.

○ **ARIA Landmarks:** Implement ARIA landmarks (navigational aids in web pages enabling screen readers to navigate content sections) help define the structure of a webpage allowing users of assistive technologies to navigate the page more easily.

○ **Responsive Design:** Ensure the LMS is responsive and mobile-friendly, adapting to various screen sizes and devices using the [Bootstrap framework](#)

○ **Skip Links:** Add skip links to help keyboard and screen reader users bypass repetitive content, such as navigation menus, and quickly access the main content.

○ **Accessible Forms:** Design accessible forms with appropriate labels and error messages such as [Google Forms](#).

○ **Multimedia Accessibility:** Offer audio description for visually impaired users and sign language interpretation for deaf users in multimedia content, ensuring a more inclusive experience.

○ **Readable Typography:** Use legible fonts and appropriate font sizes, such as Arial, Helvetica, Verdana, Tahoma, or Segoe UI, with sufficient line spacing, to improve readability and reduce eye strain for users with visual impairments. Segoe UI, in particular, is designed for optimal readability on screens and is used as the default font in many Microsoft products.

○ **Adjustable Time Limits:** Provide options for users to extend or disable time limits for timed activities or assessments, such as the [Quiz settings in Moodle.](#)

○ **Support Resources:** Offer comprehensive accessibility guides and resources such as [Blackboard Ally](#), for both educators and learners to enable learners with disabilities to navigate and use the LMS effectively.

○ **Inclusive Collaboration:** Facilitate accessible collaborative tools, such as discussion boards and chat functions, e.g. via [Microsoft Teams](#), which is available in the [free Office 365 Education plan](#).

Social Media

Tips for **Social Media**

○ **Vibrant Visuals with Alt Text:** Enhance images with alternative text (alt text) to provide context and descriptions for users with visual impairments. There is a native alt text feature on Twitter, Instagram, and Facebook.

○ **Accessible language**: Simplify language and improve readability in your social media posts using [Hemingway Editor](#), a free online tool.

○ **Captions for video content**: Add captions to your videos using free tools like Kapwing or the built-in caption feature on platforms like YouTube and Facebook.

○ **High contrast colours:** Use [WebAIM's Color Contrast Checker](#) to test and adjust your colour combinations for better readability in images and text overlays.

○ **Hashtags:** For screen reader users, capitalize the first letter of each word in your hashtags (camel case) to make them easier to understand.

○ **Emojis and abbreviations:** Limit the use of emojis and abbreviations or provide context for them to ensure clarity for all users.

○ **Describe links:** Use descriptive text for links in your posts rather than generic phrases like "click here" or shortened URLs.

○ **Audio descriptions for video content:** Provide audio descriptions for important visual information in your videos. You can create simple audio descriptions using a free tool like [Audacity](#).

○ **Transcripts for audio content:** Use [Otter.ai](#) to create transcripts for your audio content, such as podcasts or audio clips, to make them accessible to users who are deaf or hard of hearing.

○ **Test for accessibility:** Use free screen readers like [NVDA](#) or VoiceOver to test your social media content for compatibility and overall accessibility.

Open-source and free tools

Open-source, free(mium) **Tools**

○ **Website Building and Design**

WAVE (Web Accessibility Evaluation Tool): Evaluate website accessibility.
WebAIM's Contrast Checker: Check colour contrast for text and backgrounds.

○ **Accessible Documents**

Microsoft Accessibility Checker: Check accessibility in Word, PowerPoint, and Excel.
Tingtun PDF Accessibility Checker: Evaluate PDF accessibility.

○ **Accessible Online Meetings**

Jitsi Meet: Open-source video conferencing with keyboard shortcuts for accessibility.
Google Meet: Provides live captions and keyboard shortcuts for an inclusive experience.

○ **Accessible Learning Management Systems (LMS)**

Moodle: Open-source LMS with built-in accessibility features.
Sakai: Community-driven, open-source LMS with accessibility support

○ **Accessible Learning Courses**

H5P: Create accessible interactive content for e-learning.
Xerte: Open-source tool for creating accessible e-learning resources

○ **Accessible Social Media**

Facebook Automatic Alt Text: Automatically generates alt text for images on Facebook.
Twitter: Built-in support for alt text on images.

○ **Browser Extensions and Widgets**

Accessibility Insights: Browser extension for web accessibility and identifying issues.
Siteimprove Accessibility Checker: Browser extension for identifying accessibility issues.

○ **Screen Readers**

NVDA (NonVisual Desktop Access): Free, open-source screen reader for Windows.
Apple VoiceOver: Built-in screen reader on Apple devices.

○ **Captioning and Transcription**

Amara: Free tool for creating captions and subtitles for videos.
YouTube: Offers automatic captions for uploaded videos.

○ **Text-to-Speech and Speech-to-Text:**

Balabolka: Free text-to-speech application for Windows.
Google Docs Voice Typing: Speech-to-text tool integrated into Google Docs.

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Annex I. Class lessons

1. Class lesson on: How to make discussions accessible to all learners

Note: "The following material has been adapted from The Economist Foundation, 2023. Retrieved from the link which follows:
https://cdn.burnetnewsclub.com/media/documents/EconomistFoundation_Tips_for_students_who_need_extra_support.pdf

2. Class lesson on: Digital discrimination and design

Disclaimer: The following is a lesson designed by the educational foundation of The Economist. It can serve as an inspiration for your future in-class discussion addressing the topics of design, development and accessibility.

To compare examples of inaccessible, accessible and inclusive design, then adapt designs to increase inclusivity.

For a detailed definition of disability by the World Health Organisation, look here: bit.ly/WHO_Disability. It is important to use the correct language when discussing disability. For support, look here: bit.ly/DiscussionSupport.

Before the lesson you, as a trainer or teacher, will need to:

- Print the TEACHER Instructions, or have them to hand

- Have the Examples ready to show on screen

- Print, copy and cut the Cards, enough for one set between four

The teacher instructions have been shared in the next page while the full resource can be found here: https://talk.economistfoundation.org/resources/discrimination-in-design-disability/

3. Class lessons on: 1) Universal Design for Learning, 2) Digital Access for All, 3) From Physical to Digital Services for Citizens 4) Accessible Iconography

Note: In the below few pages, you will find 4 ready exercises on digital accessibility prepared by the project consortium. These could be used in any form of education and training (e.g. to school or higher education students, practitioners, etc.) to illustrate and activate critical thinking in developing digital accessible content. You may wish to follow the examples and create your own exercises. ENJOY!

EXERCISE 1

Topic: Universal Design for Learning

Transcript: *Pictures of universal design for learning (UDL)*

THIS LESSON DEVELOPS:

Objective:
- To understand the principles of UDL,
- To develop critical thinking in reviewing web content, and
- To be able to evaluate the necessities of people with different abilities in delivering digital learning content.

Information sources: PR2 Digital Accessibility Guide, p.33
Or: https://udlguidelines.cast.org/

Sustainable Development Goals

For more information about the SDGs of United Nation follow the link here: https://sdgs.un.org/goals

Transcript: picture of SDG4 Quality Education

Transcript: picture of SDG10 Reduced Inequalities

Transcript: picture of SDG16 Peace, Justice and Strong Institutions

Understand the principles of UDL

Discuss knowledgably UDL

Apply successfully UDL
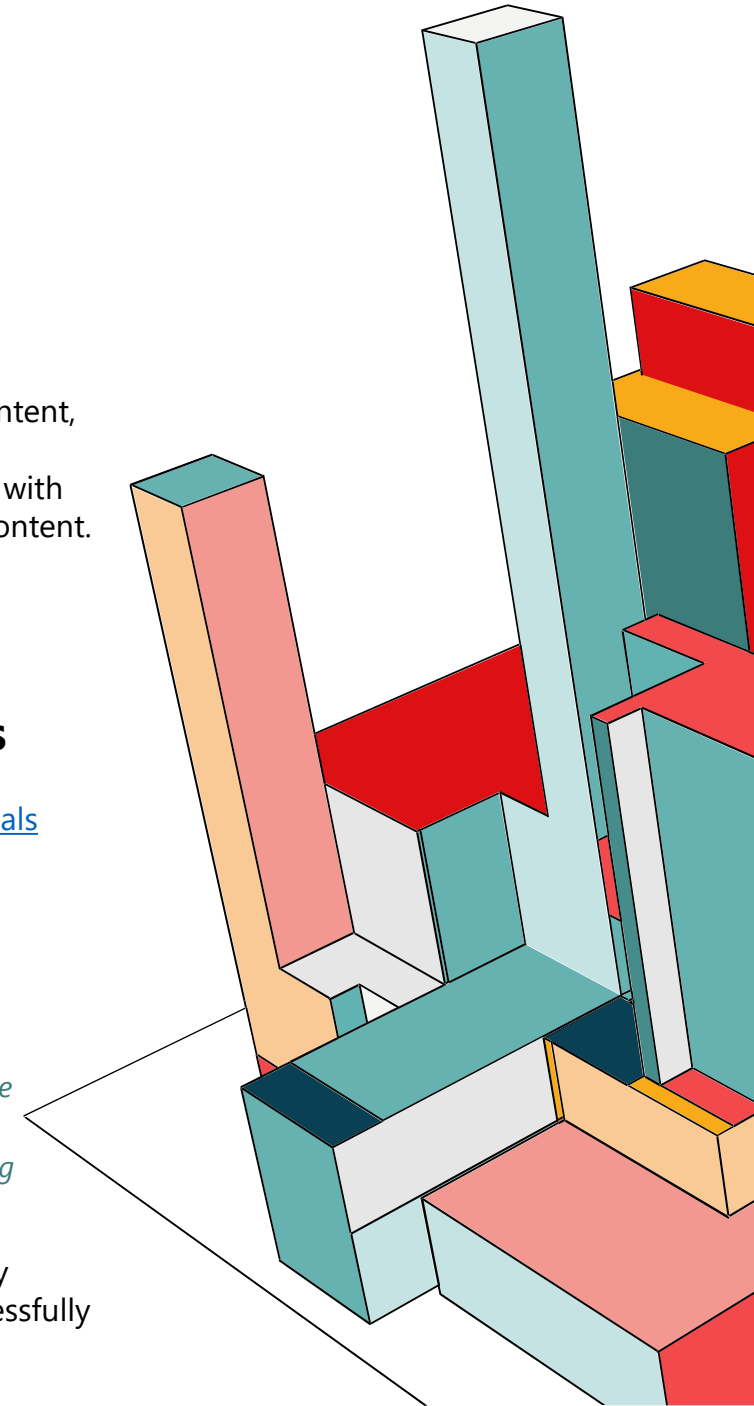
TEACHER INSTRUCTIONS

Activity 1

Once you get familiar with the basics of UDL, you may be ready to experience and understand UDL application.

Review the next three pages (slides) and discuss in groups the strengths and shortfalls of these real examples of online learning offerings in terms of digital accessibility.

Activity 2

You have now agreed in a group on the shortfalls of the online learning content and requirements for UDL. Next you will learn to discuss and make a collective decision.

Present your findings to the other groups. Work together collectively to agree on three (and only 3) most important features to implement on these real examples.

Activity 3

You have already gained basic understanding of UDL principles. In the next activity you will be expected to obtain some practice in applying UDL.

Work in the same groups as in Activity 1 and prepare on your own digital accessible learning content on a chosen topic (e.g., urban design, biology, astronomy, etc.). You may wish to use the ready materials available herein and/or draw and write your own.

Materials: white sheets of paper, pens, color aquarelle pencils, ready samples.

Keywords

Universal Design for learning - a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn

Digital accessibility - a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn

Inclusivity - the practice or policy of providing equal access to opportunities and resources for people who might otherwise be excluded or marginalized.

Universal Design for Learning Guidelines

Provide multiple means of **Engagement**

Affective Networks
The "WHY" of learning

Transcription: human brain, marking in green circle line the middle

Provide multiple means of **Representation**

Recognition Networks
The "WHAT" of learning

Transcription: human brain, filled in violet in the middle

Provide multiple means of **Action & Expression**

Strategic Networks
The "HOW" of learning

Transcription: human brain, filled in blue in the back end

Access

Provide options for Recruiting Interest

Optimize individual choice and autonomy
Optimize relevance, value, and authenticity
Minimize threats and distractions

Provide options for Perception

Offer ways of customizing the display of information
Offer alternatives for auditory information
Offer alternatives for visual information

Provide options for Physical Action

Vary the methods for response and navigation
Optimize access to tools and assistive technologies

Build

Provide options for Sustaining Effort & Persistence

Heighten salience of goals and objectives
Vary demands and resources to optimize challenge
Foster collaboration and community
Increase mastery-oriented feedback

Provide options for Language & Symbols

Clarify vocabulary and symbols
Clarify syntax and structure
Support decoding of text, mathematical notation, and symbols
Promote understanding across languages
Illustrate through multiple media

Provide options for Expression & Communication

Use multiple media for communication
Use multiple tools for construction and composition
Build fluencies with graduated levels of support for practice and performance

Internalize

Provide options for Self-Regulation

Promote expectations and beliefs that optimize motivation Facilitate personal coping skills and strategies
Develop self-assessment and reflection

Provide options for Comprehension

Activate or supply background knowledge
Highlight patterns, critical features, big ideas, and relationships
Guide information processing & visualization
Maximize transfer and generalization

Provide options for Executive Functions

Guide appropriate goal-setting
Support planning and strategy development
Facilitate managing information and resources
Enhance capacity for monitoring progress

Goal

Expert Learners who are...

| Purposeful and Motivated | Resourceful and Knowledgeable | Strategic and Goal-Directed |

Customization (anthropological) - *the process of cultural appropriation and creation of bespoke design*

Customization (international marketing) *- a* country-*tailored product strategy*

Visual information *- refers to various visual media with or without sound that generally includes still and motion photography, audio video recording, graphic arts, and visual presentations*

Auditory information - *- refers to various auditory media representing information and provoking feeling and/or reaction with sound*

Map4Accessibility

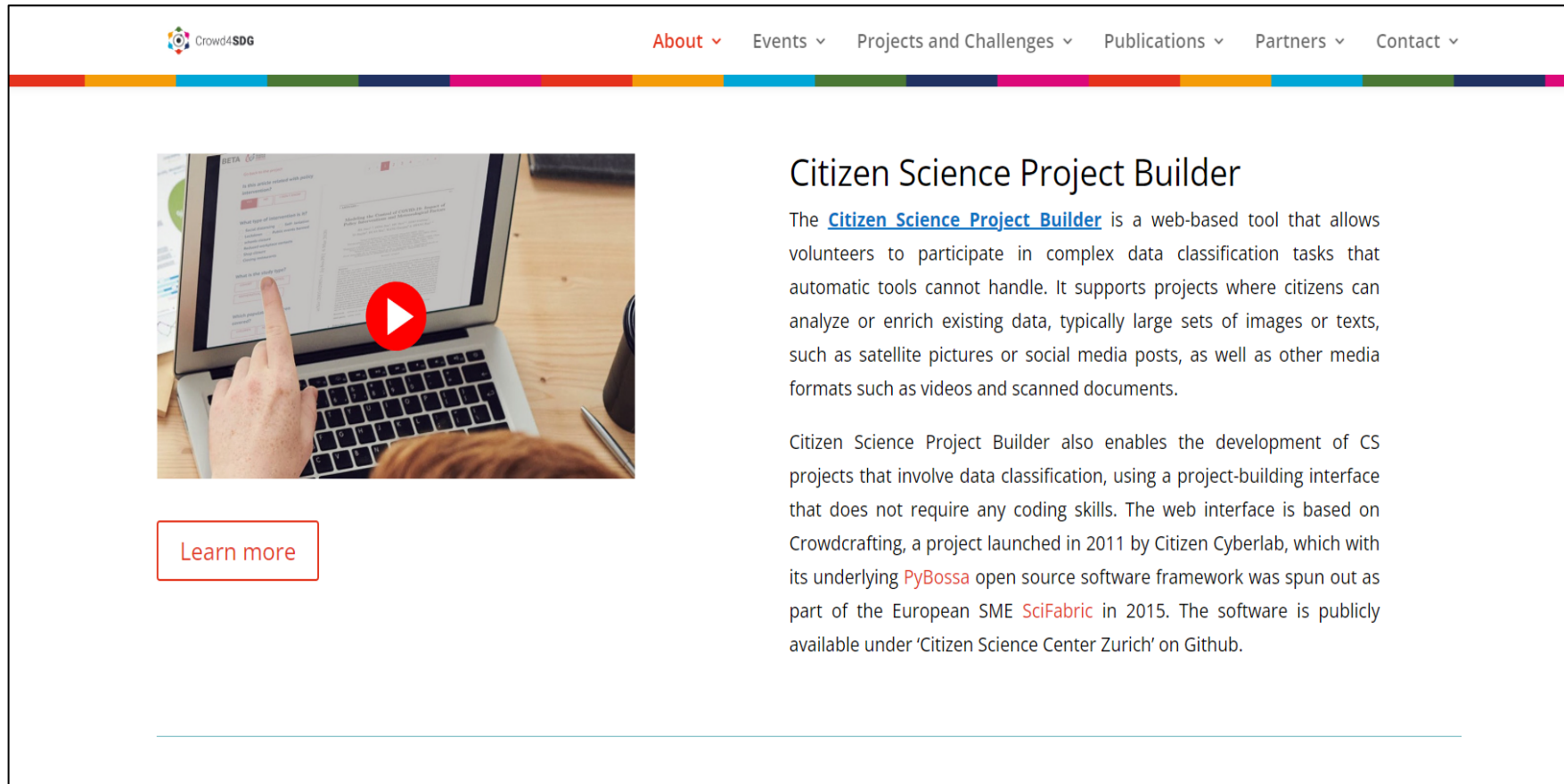**EXAMPLE 1**   An Erasmus+ project offering information on a training opportunity

Transcript: A picture from the BIMZEED project landing page. Should you wish to experience it on your own you may follow this link: https://bimzeed.eu/ The landing page contains 3 buttons: Training centre, About, Results which lead the user to the respective fields. Beneath the buttons there is a picture of illustrated boxes with statistical information about building information modelling and the net-zero emission buildings (nZEB).
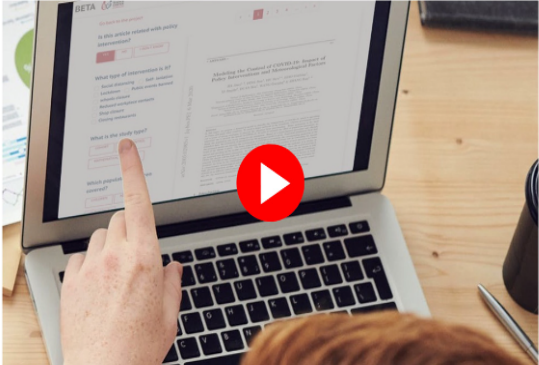
The information in blue and in the boxes are all one picture.

EXAMPLE 2   A citizen science project calling for interaction from the society

Crowd4SDG

About ˅   Events ˅   Projects and Challenges ˅   Publications ˅   Partners ˅   Contact ˅

Citizen Science Project Builder

The **Citizen Science Project Builder** is a web-based tool that allows volunteers to participate in complex data classification tasks that automatic tools cannot handle. It supports projects where citizens can analyze or enrich existing data, typically large sets of images or texts, such as satellite pictures or social media posts, as well as other media formats such as videos and scanned documents.

Citizen Science Project Builder also enables the development of CS projects that involve data classification, using a project-building interface that does not require any coding skills. The web interface is based on Crowdcrafting, a project launched in 2011 by Citizen Cyberlab, which with its underlying PyBossa open source software framework was spun out as part of the European SME SciFabric in 2015. The software is publicly available under 'Citizen Science Center Zurich' on Github.

Learn more

*Transcript: A picture from the Crowd4SDG project page with citizen science solution kits. Should you wish to experience it on your own you may follow this link: https://crowd4sdg.eu/about-2/tools/ The page contains several tools with video to the left and written description to the right.
Beyond each video there is a video, saying learn more.*

EXAMPLE 3 A project developing skills in digital inclusiveness

Figure 1. Universal Design for Learning guidelines (CAST, 2018)
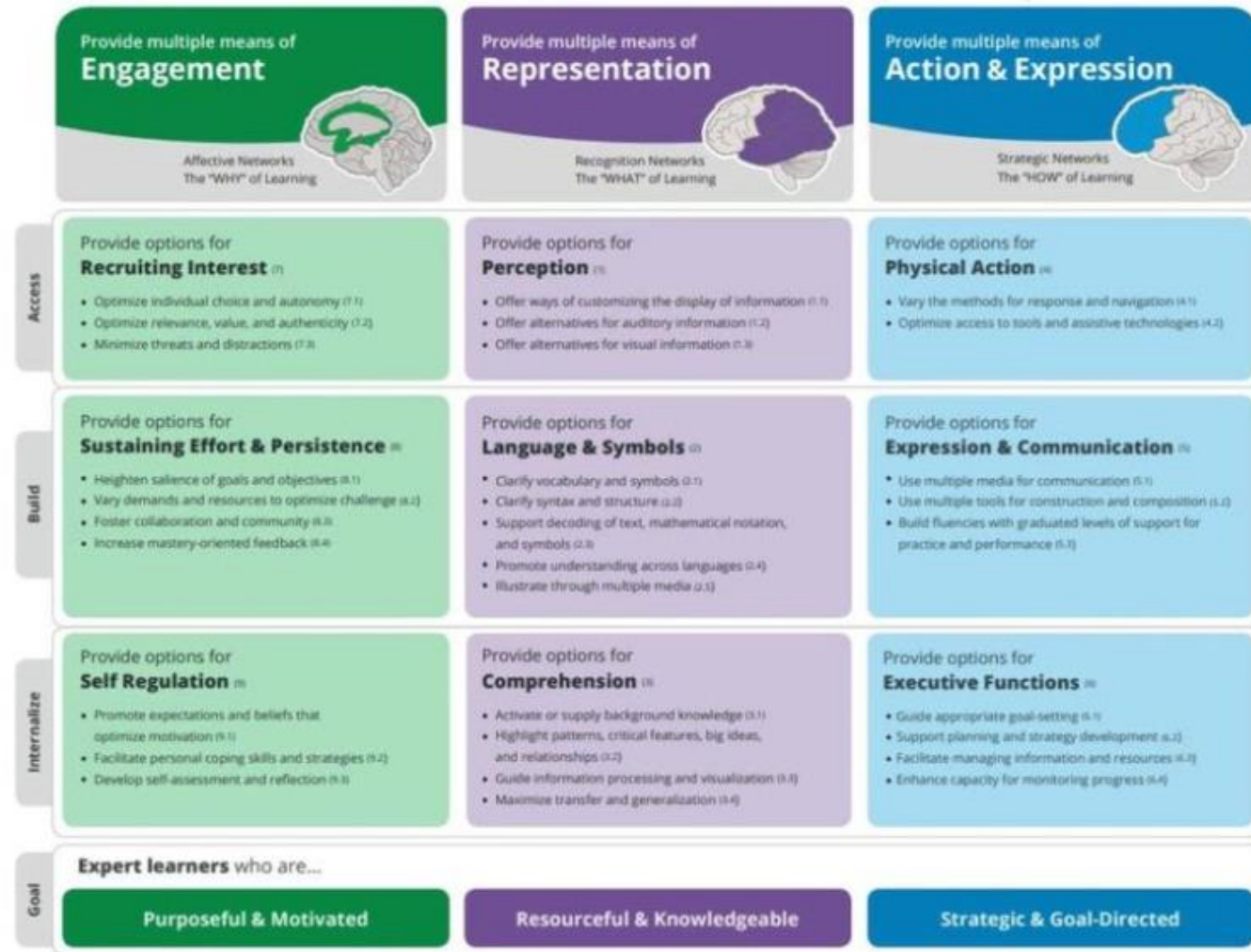
Transcript: *A picture from the Success4all project page with training materials on UDL. Should you wish to experience it on your own you may follow this link:* *https://success4all.eu/guide/universal-design-for-learning-udl/?cn-reloaded=1* *The page is informative, containing text in html in versatile headings and boxes. The main principles of universal design for learning are illustrated in a picture format. If you wish to access these principles, you may refer to page 2 of this exercise.*

SUPPORTING MATERIALS (SAMPLES)

Transcript: *a picture of a HOME button*

Transcript: *an icon of modern representation of a hearing disability*

Transcript: *an icon for assistive technology*

Transcript: *an icon of modern representation of a motor disability (a female activating her wheelchair). The contours are white and the background – black.*

Transcript: *an icon of modern representation of a motor disability (a female activating her wheelchair). The contours are black and the background – white.*

Transcript: *an icon of modern representation of a seeing disability*

Transcript: *an icon of modern representation of a motor disability.*
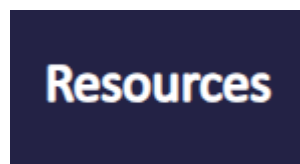
Transcript: *a picture of a Resources button.*

Transcription

Click on the link to review

Adjust your preferences

EXERCISE 2

Topic: Digital Access for All

Transcript: Pictures of assistive technology - a keyboard in color

Transcript: Pictures of assistive technology – Jelly Bean Twist

THIS LESSON DEVELOPS:

Objective:
To demonstrate the power and applicability of digital devices in improving the digital accessibility of people.

Information sources: PR2 Digital Accessibility Guide, p.8 to p.21

Sustainable Development Goals

For more information about the SDGs of United Nation follow the link here: https://sdgs.un.org/goals

Transcript: picture of SDG9 Innovation and Infrastructure

Transcript: picture of SDG10 Reduced Inequalities

Transcript: picture of SDG11 Sustainable Cities and Communities

Creativity   Problem Solving   Communication
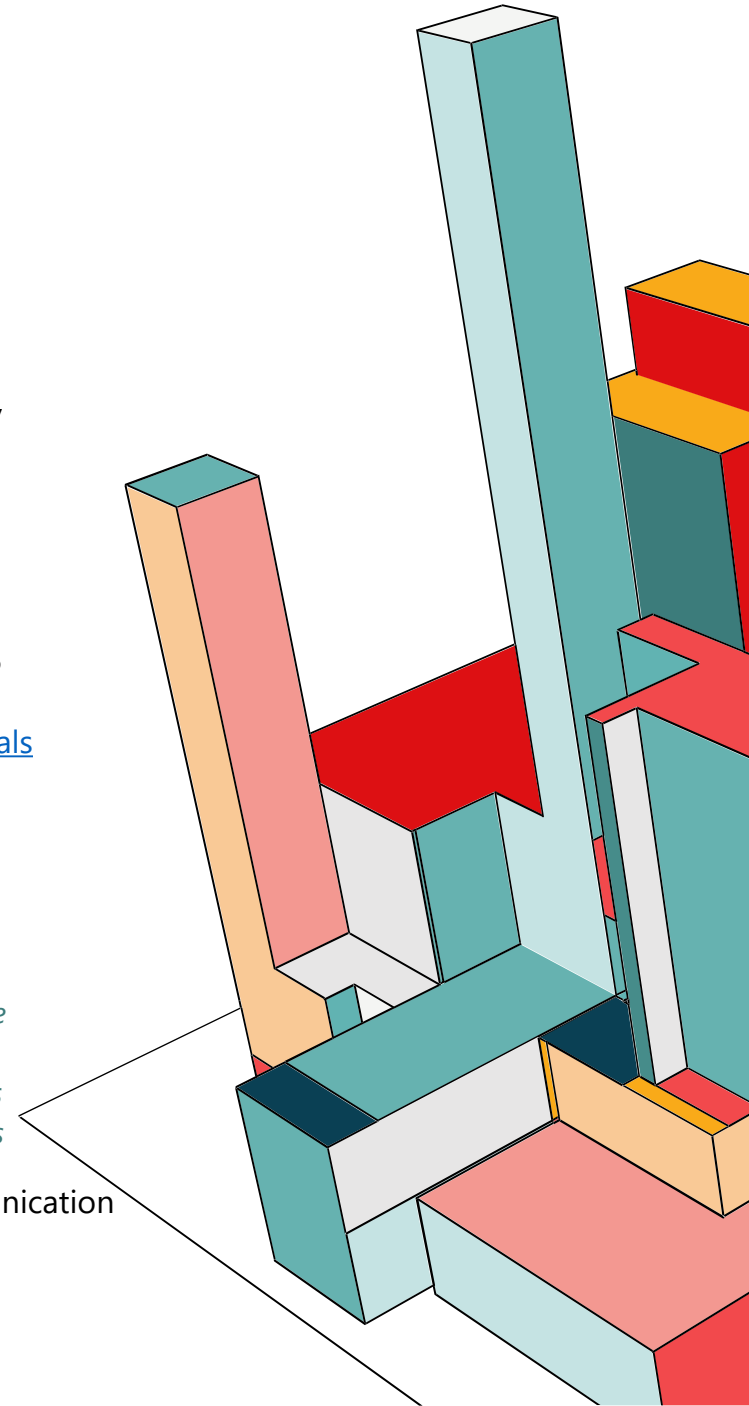
TEACHER INSTRUCTIONS

Activity 1

Once you get familiar with the types and modalities of assistive technology in accessing digital content, you are invited to share your thoughts, challenges and feedback.

Read about the assistive technology and the challenges they address. Share in a group what you know, your reaction to further challenges the technology still needs to overcome, find about existing solutions to those.

Activity 2

Test how much you have learned on how different assistive technology devices support different disability challenges.

See the next page and connect the name of the device (picture) with the correct challenge it addresses. Next put/classify the device into the type of accessibility it corresponds.

Activity 3

The discussion from activity 1 has prepared for the identification of challenges not sufficiently addressed via assistive technology.

Work in groups to develop a case study, where challenges of an existing assistive technology device are reviewed and suggestions for improvement are made.

Activity 2 Materials

Text to speech

Speech to text

Gartner®

Voice recognition/dictation

Seeing challenges

Hearing challenges

Learning disability

Physical disability

Switches

TiPY Keyboard

Transcript: a keyboard with mouse and buttons in a hand palm shape to be used by one hand only

Braille Keyboard

Transcript: a keyboard with braille symbols engraved to sense the letter you want to type

EXERCISE 3

Topic: From Physical to Digital Services for Citizens

Transcript: *A picture illustrating accessible digital services*

THIS LESSON DEVELOPS:

Objective:
- To understand the challenges of providing accessible digital services;
- To collect information on digital services already being offered by local administration;
- To collect / survey opinions about digital services / offer.

Information sources: PR2 Digital Accessibility Guide, p.7
Or: https://futurice.com/blog/accessible-digital-services-are-an-essential-part-of-an-inclusive-world

Sustainable Development Goals

For more information about the SDGs of United Nation follow the link here: https://sdgs.un.org/goals

Transcript: picture of SDG9 Innovation and Infrastructure

Transcript: picture of SDG10 Reduced Inequalities

Transcript: picture of SDG11 Sustainable Cities and Communities

Problem-solving

Empathy / Creativity / Inclusion

Digital skills

TEACHER INSTRUCTIONS

Activity 1

Once you get familiar with accessibility of digital services you may wish to relate it with practical examples.

Search for a definition of digital service. Next outline 3 best practices for accessible digital services from websites of different EU cities. Finally, agree in groups on important services which need to be offered digitally from city administration. Present your choice in front of all groups. You may refer to an exemplary list on the next page.

Activity 2

Having considered most important services to be offered digitally instead of physically, you are now invited to think it through.

In groups discuss and describe how the selected services in Activity 1 should/can be provided to end users with highest possible accessibility. Complete your presentation illustrating your suggested accessible digital services.

Activity 3

Activity 1 and 2 have been a good warm-up to contemplate about physical/digital services.

Imagine / design a digital twin of the city. What form would it take – an application, a web portal, a simulator? Present your group outcome on a poster.

A definition of a digital twin of a city is given by the DUET European Innovation Initaitive: "Digital Twins provide virtual city replicas which make it easy to understand the complex interrelation between traffic, air quality, noise and other urban factors. Powerful analytics model the expected impacts of potential change to help you make better evidence-based operational decisions and longer term policy choices."

Keywords

Digital accessibility *- a framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn*

Inclusivity *- the practice or policy of providing equal access to opportunities and resources for people who might otherwise be excluded or marginalized*

Simplification *- Simplification is the process of removing as much IT complexity as possible without impacting needed business functionality. Simplification reduces costs and recaptures capacity*

EXEMPLARY IDEAS

❑ Waste e-trading platforms, e. g. pay-as you throw systems using digital identification;

❑ Cooperative intelligence transport systems (GITS);

❑ Sensorization of traffic lights or public lightning systems to gather spatially disturbed information about traffic, air pollution, accidents;

❑ Creation of a digital identity (SPID) to access and manage personal information such as taxation, health and social services, etc.

EXERCISE 4

Topic: Accessible Iconography

Transcript: A picture illustrating the accessible icon (a person in a wheelchair in an active position) and contemporary digital icons

THIS LESSON DEVELOPS:

Objective:
- To contemplate on the added value of the accessible iconography, and
- To learn how to improve the impact of visual icons.

Information sources: PR2 Digital Accessibility Guide, p.34

Sustainable Development Goals

For more information about the SDGs of United Nation follow the link here: https://sdgs.un.org/goals

Transcript: picture of SDG10 Reduced Inequalities

Transcript: picture of SDG11 Sustainable Cities and Communities

Critical thinking

Empathy / Creativity / Inclusion

Apply accessibility icons
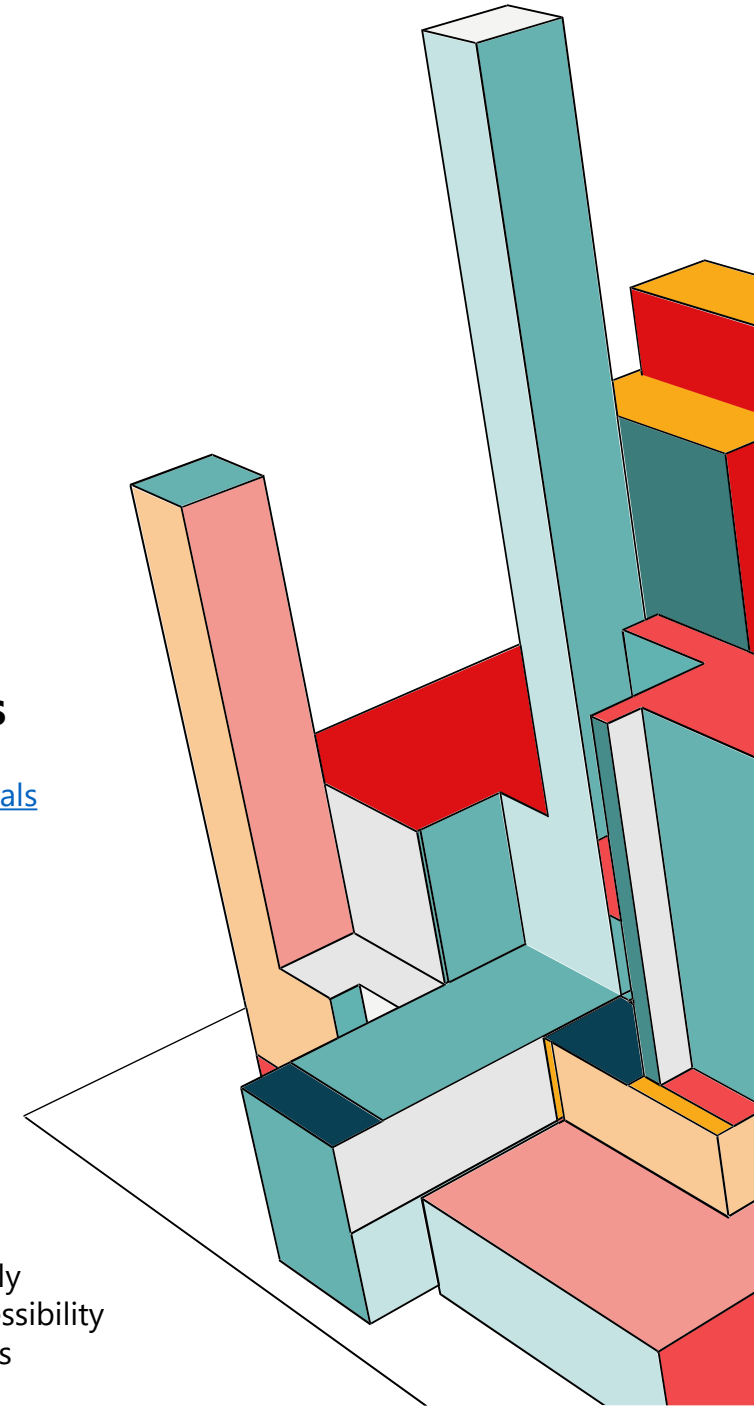
TEACHER INSTRUCTIONS

Activity 1

Once you have reviewed the information about accessible iconography, esp. modern trends which consider psychological perceptions, you can now contemplate on the topic.

Work in pairs to find examples of accessible icons which reflect positive psychological features. Select 4 and present them in front of the whole class, including type of accessibility, how it is illustrated to foster positive attitude/connotation by the general public and the persons with disability.

Activity 2

Having gained more practical experience on accessible iconography, now you can dive deeper in discussions about their impact.

Work in the same pairs and elaborate further any features that you find essential and are not sufficiently displayed in the selected icons in Activity 1. Think about versatile aspects of inclusion, e.g. stressing on the social change, introducing more technologies. Consider inequalities in the design of icons. Present your agreed findings to the rest.

Activity 3

Having gone through inspiring discussions, now it is time to be creative.

In the same groups, design your own icon which reflect all discussed aspects of inclusiveness and equality.

To add competitiveness the class will finally vote for the best icon which addresses the following aspects:

- meaning

- requirements addressed

- design