



Embracing diversity in ASIA through the adoption of Inclusive Open Practices

618615-EPP-1-2020-1-UKEPPKA2-CBHEJP

D2.2 DIVERSASIA Toolkit for Transfer of Best Practices on Implementation of Inclusive Education in HEI

V1.0 (Final)

Lead WP2 by P1

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1 Introduction

The document at hand provides an overview of how the toolkit provides a vast array of information, guidance and handy tools which has been shared with our partners in India and Bangladesh, but which are equally relevant to other countries, even in Europe.

Once all content was selected, and created, it was subsequently presented in an attractive interactive manner using the H5P approach, and was integrated directly in our DiversAsia project website to ensure the easiest barrier-free access. During the course of 2023 all the content was further updated and adjusted based on received comments using the H5P editor as was embedded in our CMS.

In a next step, the optimised Toolkit content was integrated with the online and mobile DiversAsia learning applications that were created as part of WP2. There we followed a persona driven approach, whereby branching scenarios allowed to provide detailed content matching with the selected persona by the user.

This document outlines the creation of the actual toolkit, while the persona driven approach for the online/mobile learning applications is documented in “D2.3 DIVERSASIA portal with integrated mobile app”.

2 Outline of the project website and the learning portal

2.1 The website

The project website, <https://diversasia-accessible-he.eu/>, provided immediate access to the DiversAsia toolkit via its main menu (<https://diversasia-accessible-he.eu/toolkit/>). This approach was chosen to lower as much as possible the access barriers for our target groups.

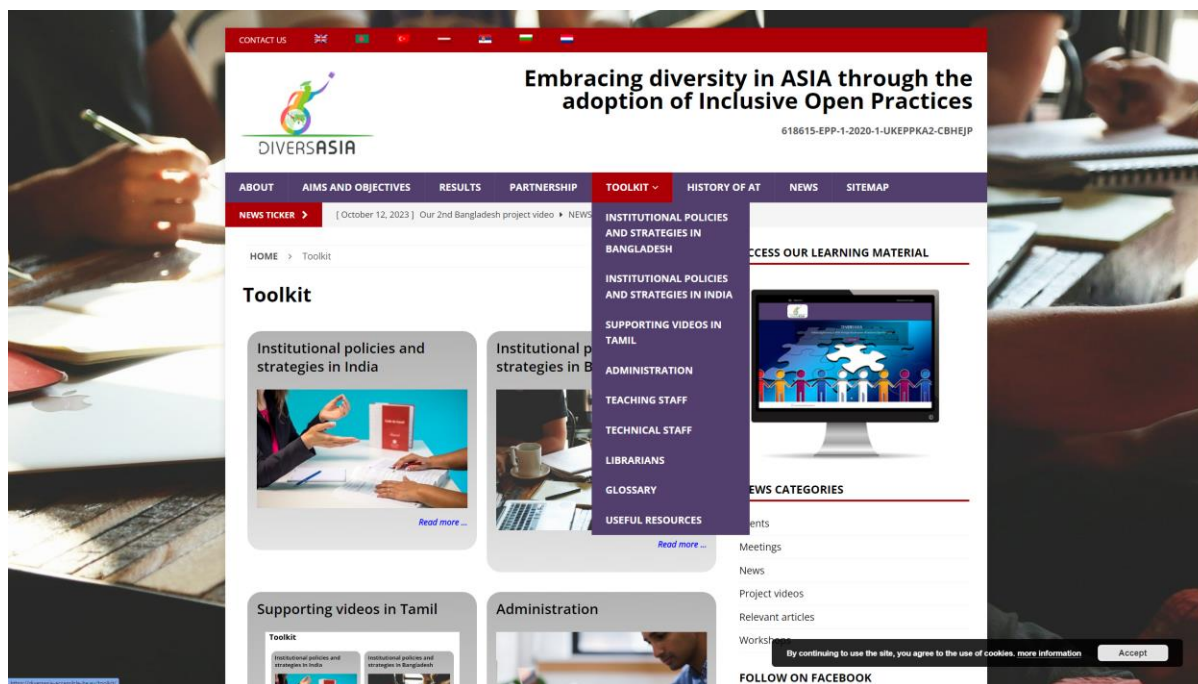


Figure 1: DiversAsia Toolkit access via project website

To make the material engaging and interactive, an H5P formatting was selected. H5P is a free and open-source content collaboration framework based on JavaScript. H5P is an abbreviation for HTML5 Package, and was selected due to its accessibility features to integrate content into our selected CMS WordPress. The selected H5P approach also allows any third party to download any of the content and customise/localise/translate it using e.g. the free “desktop” editor LUMI (<https://app.lumi.education/>), and reupload it wherever they desire.

The content as was initially outlined in “2.2a DIVERSASIA toolkit creation (including pedagogical approach)” was uploaded in the H5P format, and was subsequently further detailed and customised during the piloting process in the last year of the project. It was enriched with video material, images, etc.

Subsequently the optimised content was also uploaded to our learning portal, but following a persona driven approach as documented in “D2.3 DIVERSASIA portal with integrated mobile app”.

2.2 The online/mobile portal

The WCAG2.0 compliant portal at <https://diversasia-accessible-he.eu/elearning/> is supported by Moodle platform (including also a synchronised mobile app for Android and iOS).

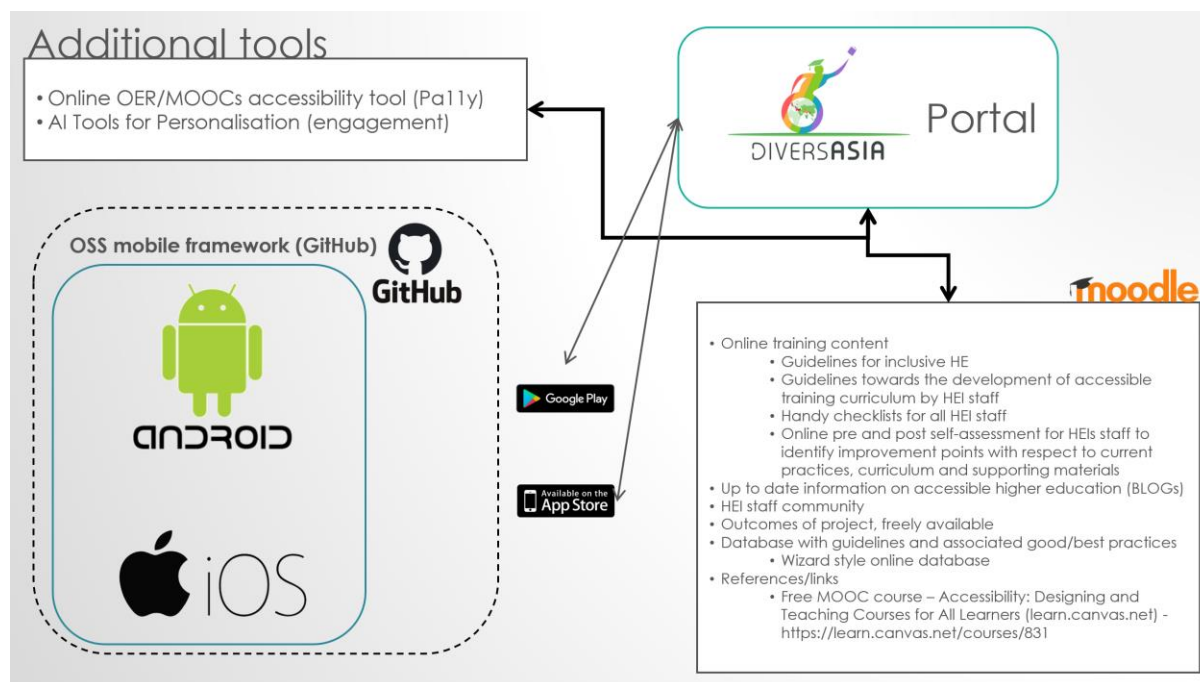


Figure 2: Technical outline online/mobile LMS

It contains:

1. Place where persona driven DIVERSASIA toolkit is hosted:
 - Here the optimised toolkit content as was prepared for the project website was integrated, following however a persona driven approach as documented in “D2.3 DIVERSASIA portal with integrated mobile app”.
2. HEI staff community
 - Moodle platform functionality offers community functionalities.
3. Outcomes of project, freely available
 - DiversAsia native mobile applications for iOS and Android
 - A wizard style online database (semantically driven using relevant ontology) of best/good practices hosts collected practices. In addition, also the MyHub

(<https://www.inclusion-hub.eu/>) practices database has been integrated into the portal.

- Integrated SCORM accessibility validator Pa11y
- A glossary of terms relevant to disability, accessibility and technology

The screenshot shows the home page of the DIVERSASIA portal. At the top, there is a black navigation bar with "Home" on the left and "You are currently using guest access Log in" on the right. The main content area has a dark blue background. In the center, there is a logo for "DIVERSASIA" featuring a stylized figure in a wheelchair with a globe as a wheel. Below the logo, the text "Introducing Accessibility" is displayed, followed by a sub-headline: "This short task is designed to give you a guided introduction to the materials available on this site." At the bottom center, there is a green button labeled "Begin →". On the right side, there is a vertical scroll bar and a purple question mark icon.

The screenshot shows a modal window for user selection. The modal has a white background and is overlaid on a dark background. At the top left of the modal is a white speech bubble icon containing a plus sign. The text "I am..." is centered at the top. Below this, there are three selectable options, each in a light gray box with a right-pointing arrow: "a member of staff", "a student", and "an interested third party". At the bottom center of the modal is a green button labeled "← Back". On the right side of the background page, there is a vertical scroll bar and a purple question mark icon.

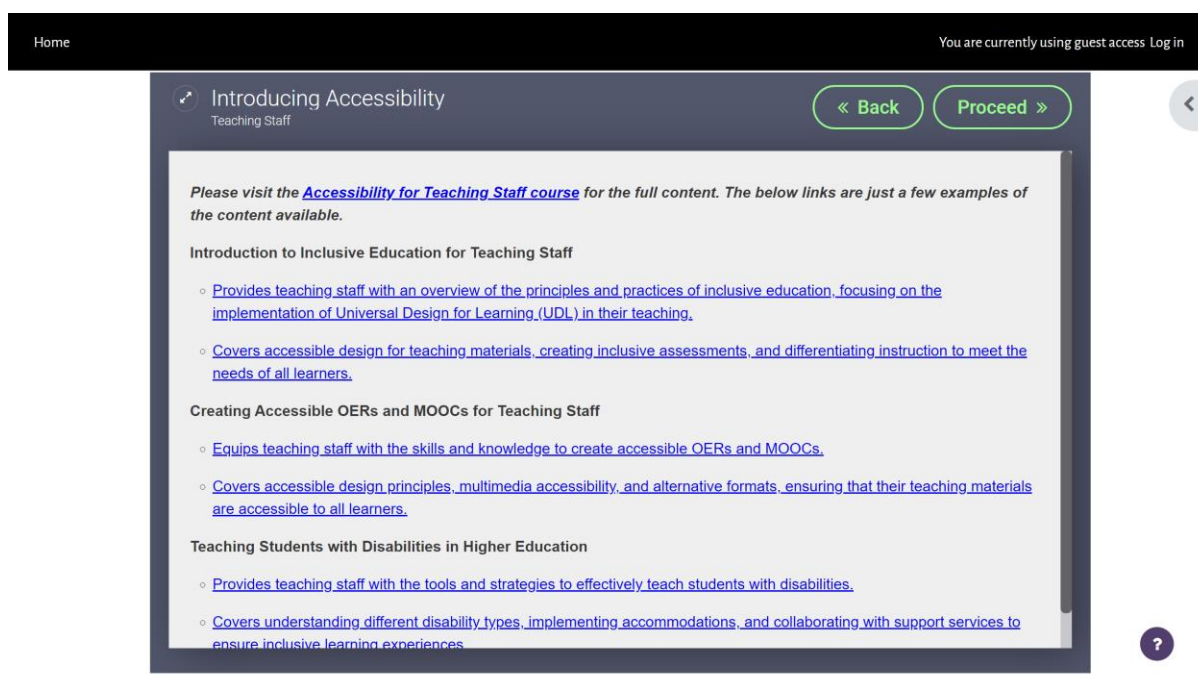
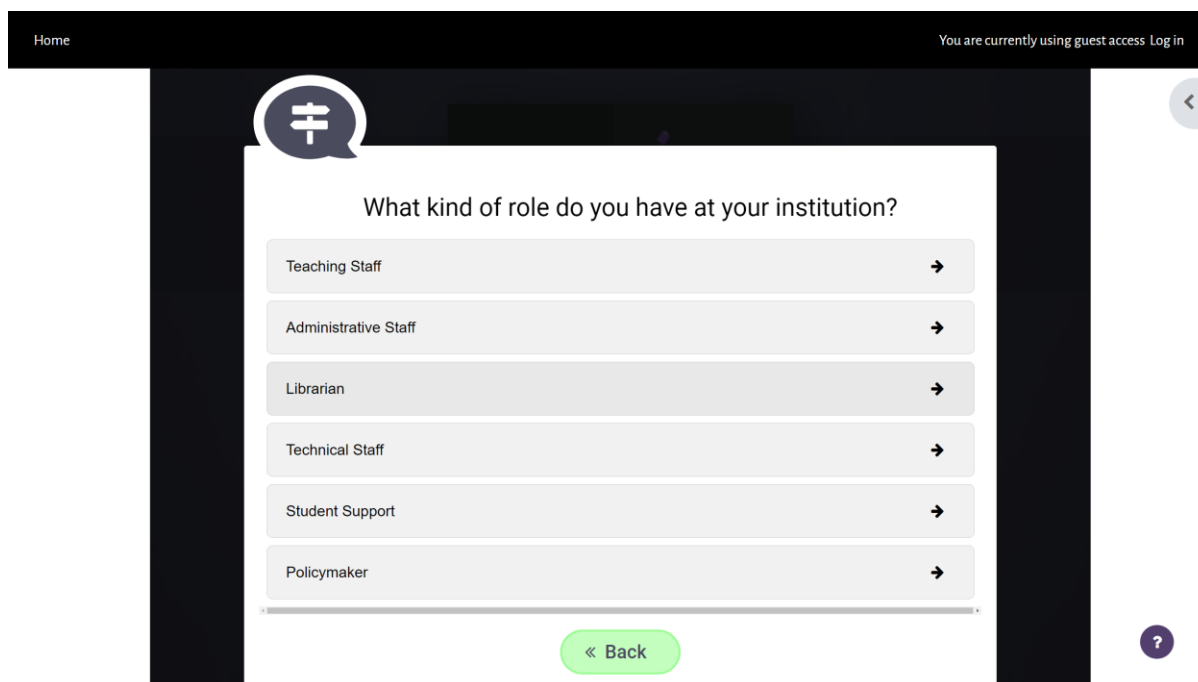


Figure 3: Persona driven access to Toolkit

3 Content of the toolkit

3.1 Creation process

The creation process of the toolkit content took 4 distinct steps:

1. At the time of the proposal preparation, we had a pretty good idea of what would be needed for higher education institutions to implement inclusive education practices. However, we also had to test this with the reality in India and Bangladesh.

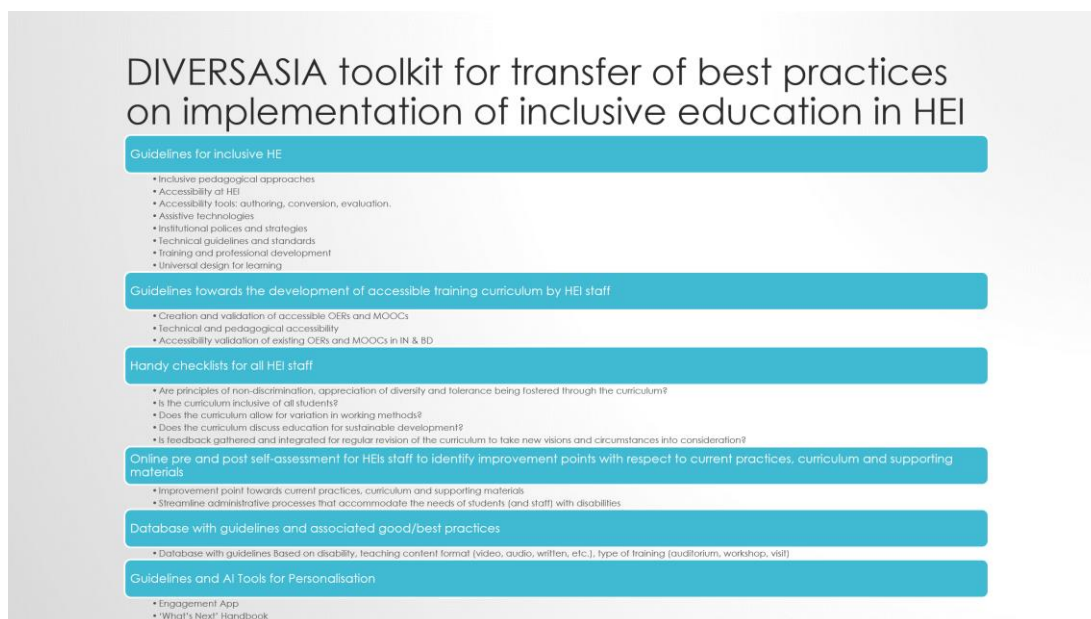


Figure 4: Original Toolkit overview

2. The surveys that were organised in 2021 in India and Bangladesh allowed for a large amount of feedback to be collected which was then structured as part of WP1.
3. During the Plovdiv, Bulgaria meeting, 26-27-28/05/2022, we crosschecked our earlier findings with the analysis of the surveys conducted (371 in total) and organised a workshop with all partners. As outcome of that exercise, we starting identifying groups of domains that the toolkit had to offer, as well as an increased granularity.
4. During the Vellore, India meeting, 17-18-19-20/10/2022, another workshop took place with all partners, whereby we pinpointed what partners would provide what content, thereby relying on best practices and tutorials that are already existing.

SUMMARY AFTER WORKSHOP DAY 1 MEETING PLOVDIV WITH ALLOCATED INPUT BY PARTNERS (AGREED DURING VELLORE MEETING) – **BOLD** = LEADING PARTNER

Guidelines for inclusive HE

- Inclusive pedagogical approaches (**P7**, P8)
- Accessibility at HEI (**P1**, P8, P11)
- Accessibility tools: authoring, conversion, evaluation. (**P3**, P11)
- Assistive technologies (**P1**, P2, P3, P5, P11)
- Institutional policies and strategies (P2, **P3**, P4, P5)
- Technical guidelines and standards (**P4**)
- Training and professional development (**P10**)
- Universal design for learning – see Jutta work (**P1**, P6, P7, P8, P11)

Figure 5: Consolidated feedback example for "Guidelines for Inclusive HE"

The main WP2 Toolkit work was finalised by end of January 2023 when the content was assessed during our Dhaka meeting in January 2023 in Bangladesh, and was subsequently adjusted where needed during the final year piloting activities. This iterative approach, combined with the flexibility of H5P resulted in a finalised version as is now available via the project website and the online learning portal.

3.2 Toolkit topics

The partnership agreed on following topics that had to be provided in the toolkit embedded in the portal:

1	Content of the toolkit
1.1	Guidelines for inclusive HE
1.1.1	Inclusive pedagogical approaches
1.1.2	Accessibility at HEI
1.1.3	Accessibility tools: authoring, conversion, evaluation
1.1.4	Assistive technologies
1.1.5	Institutional policies and strategies
1.1.6	Technical guidelines and standards
1.1.7	Training and professional development
1.1.8	Universal design for learning

- 1.2 Inclusive teaching practices
 - 1.2.1 Inclusivity process for student
 - 1.2.2 Train the trainers
 - 1.2.2.1 Different disabilities require different solutions (AT matching)
 - 1.2.2.2 (A)Technologies in teaching and assessment
 - 1.2.2.3 How to produce more materials related to:
 - 1.2.2.3.1 Vision - Reading: Brail/Audio books/screen readers
 - 1.2.2.3.2 Vision - Writing: speech to text / text to speech, voice command
 - 1.2.2.3.3 Vision + Hearing - categorical tools focusing on specific disabilities
 - 1.2.2.3.4 Slow learners - tools to identify learner's expression (e.g., face) to engage with them later
 - 1.2.2.3.5 Accessible assessment - develop tools/ technologies to allow assess students with disabilities in technological subjects.
 - Augmented reality - making them accessible and this could be used in mobility related disabilities. (P1, P6)
 - 1.2.2.4 Accessible/inclusive communication
 - 1.2.3 Indicative good/best practices case studies
 - 1.2.4 Courses/trainings about accessible and assistive technologies to most universities (public and private). Available online courses on inclusive teaching practices
- 1.3 Guidelines towards the development of accessible training curriculum by HEI staff
 - 1.3.1 Prepare accessible source material (.doc, .odt, .ppt, .pdf, HTML, etc.)
 - 1.3.2 Prepare accessible contents in MOOC
 - 1.3.3 Online accessible training facilities
 - 1.3.4 Creation and validation of accessible OERs and MOOCs
 - 1.3.5 Technical and pedagogical accessibility
 - 1.3.6 Accessibility validation of existing OERs and MOOCs in IN & BD
 - 1.3.7 Make content accessible yet attractive for young students (usage H5P for content delivery)
 - 1.3.8 Free MOOC course – Accessibility: Designing and Teaching Courses for All Learners (learn.canvas.net)

- 1.3.9 Tools to co-develop accessible content, games, including pedagogical approach
- 1.3.10 Co-creation and sharing/personalisation of content, disruptive technologies
- 1.3.11 Guidelines for the use of disruptive technologies towards XR/AR/VR/Games/Simulation-based inclusive immersive content
- 1.4 Handy checklists for all HEI staff
 - 1.4.1 Are principles of non-discrimination, appreciation of diversity and tolerance being fostered through the curriculum?
 - 1.4.2 Is the curriculum inclusive for all students?
 - 1.4.3 Does the curriculum allow for variation in working methods?
 - 1.4.4 Does the curriculum discuss education for sustainable development?
 - 1.4.5 Is feedback gathered and integrated for regular revision of the curriculum to take new visions and circumstances into consideration?
- 1.5 Online pre and post self-assessment for HEIs staff to identify improvement points with respect to current practices, curriculum and supporting materials
 - 1.5.1 Improvement point towards current practices, curriculum and supporting materials
 - 1.5.2 Streamline administrative processes that accommodate the needs of students (and staff) with disabilities
- 1.6 AT
 - 1.6.1 Embedded AT in mainstream products used in education (pc, laptop, smartphone, ...) (P1, P2, P11)
 - 1.6.2 General info
 - 1.6.3 Resource databases
 - 1.6.4 Overview proprietary/free/OSS AT solutions relevant for higher education usage
- 1.7 Database with guidelines and associated good/best practices
 - 1.7.1 Database with guidelines based on disability, teaching content format (video, audio, written, etc.), type of training (auditorium, workshop, visit)
- 1.8 Guidelines and AI Tools for Personalisation
 - 1.8.1 Engagement App
 - 1.8.2 'What's Next' Handbook
- 1.9 Overall awareness

1.9.1	Teachers
1.9.2	Students
1.9.2.1	Where are special educational needs addressed, provided and how
1.9.2.2	Increase AT knowledge
1.9.3	Policy makers
1.9.3.1	White papers
1.9.4	Premises
1.9.4.1	Accessibility guidelines
1.9.4.2	Awareness what is provided

The actual content of these topics, as well as the supporting materials, are captured in chapter 4 and 5 of the document at hand and formed the initial content as was transferred to the Toolkit, while subsequent iterations and improvements were directly uploaded to the online toolkit.

The content style follows an easy-to-read approach throughout, where apart from explanations, also concrete examples, videos and links to Open-Source tutorials and software are provided. All was captured in an appealing H5P content, thus ensuring an engaging and interactive approach.

In the process of transforming the content into H5P, we applied a modular approach, supported with many references to third parties' initiatives, videos, etc., thus making the learning experience engaging. Following table gives an outline.

Module	Subsections
Institutional policies and strategies in India	<ul style="list-style-type: none"> • https://diversasia-accessible-he.eu/toolkit/institutional-policies-and-strategies-in-india/
Institutional policies and strategies in Bangladesh	<ul style="list-style-type: none"> • Best Practices in Inclusive Education Policies in Bangladesh • Institutional policies and strategies
Supporting videos in Tamil	<ul style="list-style-type: none"> • https://diversasia-accessible-he.eu/toolkit/supporting-videos-in-tamil/
Administration	<ul style="list-style-type: none"> • Accessibility at HEI

Module	Subsections
	<ul style="list-style-type: none"> • Audit the physical accessibility of HE premises • Inclusion readiness assessment and reflection tool for HE • Streamline administrative processes that accommodate the needs of students (and staff) with disabilities • Training and professional development • Understanding the barriers and difficulties students face
Teaching staff	<ul style="list-style-type: none"> • Accessibility tools: authoring, conversion, evaluation • Accessibility: Designing and Teaching Courses for All Learners (free MOOC course) • Assistive technologies (AT) • Co-creation and sharing/personalisation of content, disruptive technologies • Creation and validation of accessible OERs and MOOCs • Database with guidelines based on disability, teaching content format, type of training • Guidelines and AI Tools for Personalisation • Handy checklists for all HEI staff • Inclusive Higher Education SWOT Analysis • Inclusive pedagogical approaches • Inclusive teaching practices • Make content accessible yet attractive for young students (usage H5P for content delivery) • Prepare accessible source material • Universal Design for Learning (UDL)
Technical staff	<ul style="list-style-type: none"> • Assistive technologies (AT) • Audit the physical accessibility of HE premises • Handy checklists for all HEI staff

Module	Subsections
	<ul style="list-style-type: none"> • Inclusion readiness assessment and reflection tool for HE • Make content accessible yet attractive for young students (usage H5P for content delivery) • Useful resources
Librarians	<ul style="list-style-type: none"> • Accessibility at HEI • Glossary • Handy checklists for all HEI staff • Inclusion readiness assessment and reflection tool for HE • Prepare accessible source material • Universal Design for Learning (UDL) • Useful resources
Glossary	<ul style="list-style-type: none"> • https://diversasia-accessible-he.eu/toolkit/glossary/
Useful resources	<ul style="list-style-type: none"> • https://diversasia-accessible-he.eu/toolkit/useful-resources/

As mentioned before, we also uploaded this content onto our Moodle platform where the content can now be accessed following a persona driven approach.

3.3 Our DiversAsia tools

In addition to the training content in the Toolkit, we also provide access to 4 other very distinct tools in our learning portal:

3.3.1 DIVERSASIA - Best practices databases

As part of the project, all partners collected good practices. In order to cover the whole field, the work focused on three target groups / three levels. The collection of good practices and the analysis of data allowed us to look at existing experiences in different countries in relation to all target groups and at all levels, but with a particular focus on the international level. A total of 333 good practices were collected and evaluated during the project. Most of them in English (278), but a significant number are also in Bulgarian (32) and Turkish (19). Accessible via <https://diversasia-accessible-he.eu/elearning/mod/data/view.php?id=12>.

We also integrated The European Inclusive Learning Hub database, a large repository of inclusive, searchable and usable learning resources, methods, tools and mechanisms, already tested, approbated and deployed in certain countries. It acts as a wizard-style driven

and semantically supported logical framework for systematization/categorisation of inclusive learning resources, methods, tools and mechanisms in various education levels: early childhood, primary & secondary school, vocational education and training, higher education, adult education. This inclusive education database was created by the Erasmus+ project "MyHUB: a one-stop-shop on inclusion practices, tools, resources and methods for the pedagogical staff at formal and non-formal educational institutions" (MyHUB – 604454-EPP-1-2018-1-LV-EPPKA3-IPI-SOC-IN), and has been integrated into our own portal. Accessible via <https://diversasia-accessible-he.eu/elearning/mod/data/view.php?id=8>.

Home
You are currently using guest access [Log in](#)

General Resources

DATABASE
DIVERSASIA - Best practices

As part of the project, all partners collected good practices. In order to cover the whole field, the work focused on three target groups / three levels.
The collection of good practices and the analysis of data allowed us to look at existing experiences in different countries in relation to all target groups and at all levels, but with a particular focus on the international level.
A total of 333 good practices were collected and evaluated during the project. Most of them in English (278), but a significant number are also in Bulgarian (32) and Turkish (9).
Although some of the good practices are not in English, all of the descriptions are, and can be translated and adapted as needed (at the request of Asian partners).

DATABASE
European Inclusive Learning Hub

The European Inclusive Learning Hub is a large repository of inclusive, searchable and usable learning resources, methods, tools and mechanisms, already tested, appropriated and deployed in certain countries.
It acts as a wizard-style driven and semantically supported logical framework for systematization/categorisation of inclusive learning resources, methods, tools and mechanisms in various education levels: early childhood, primary & secondary school, vocational education and training, higher education, adults education.
This inclusive education database was created by the Erasmus+ project "MyHUB: a one-stop-shop on inclusion practices, tools, resources and methods for the pedagogical staff at formal and non-formal educational institutions" (MyHUB – 604454-EPP-1-2018-1-LV-EPPKA3-IPI-SOC-IN), and has been integrated into our own portal.

PAGE
SCORM content package accessibility validator tool

GLOSSARY
A glossary of terms relevant to disability, accessibility and technology

?

General Site Information

Home You are currently using guest access Log in

DIVERSASIA

Site pages / DIVERSASIA - Best practices / View list

DIVERSASIA - Best practices

As part of the project, all partners collected good practices. In order to cover the whole field, the work focused on three target groups / three levels.

The collection of good practices and the analysis of data allowed us to look at existing experiences in different countries in relation to all target groups and at all levels, but with a particular focus on the international level.

A total of 333 good practices were collected and evaluated during the project. Most of them in English (278), but a significant number are also in Bulgarian (32) and Turkish (19).

Although some of the good practices are not in English, all of the descriptions are, and can be translated and adapted as needed (at the request of Asian partners).

List view

Entries per page: 10 Search Sort by: Title of practice Ascending Advanced search

1 2 3 4 5 6 7 8 9 10 ... 35 »

Title of Practice: AT for Educational Needs of Students with Physical Impairments
Country where the practice is developed: International

Figure 6: DiversAsia best practices database

Home You are currently using guest access Log in

DIVERSASIA

Site pages / European Inclusive Learning Hub / View list

European Inclusive Learning Hub

The European Inclusive Learning Hub is a large repository of inclusive, searchable and usable learning resources, methods, tools and mechanisms, already tested, approved and deployed in certain countries.

It acts as a wizard-style driven and semantically supported logical framework for systematization/categorisation of inclusive learning resources, methods, tools and mechanisms in various education levels: early childhood, primary & secondary school, vocational education and training, higher education, adults education.

This inclusive education database was created by the Erasmus+ project "MyHUB: a one-stop-shop on inclusion practices, tools, resources and methods for the pedagogical staff at formal and non-formal educational institutions" (MyHUB-604454-EPP-1-2018-1-LV-EPPKA3-IP1-SDC-IN), and has been integrated into our own portal.

List view

Entries per page: 10 Search Sort by: Time added Ascending Advanced search

1 2 3 4 5 6 7 8 9 10 ... 23 »

Title: Building opportunities in early childhood from the start - A teacher's guide to good practices in inclusive early childhood services
Type of the resource: Handbook/Guide/Manual

Figure 7: MyHub best practices database

3.3.2 A glossary of terms relevant to disability, accessibility and technology

Apart from the glossary with nearly 140 terms we made available via the Toolkit itself, we also created a separate glossary page within the Moodle LMS (see <https://diversasia-accessible-he.eu/elearning/mod/glossary/view.php?id=17>).

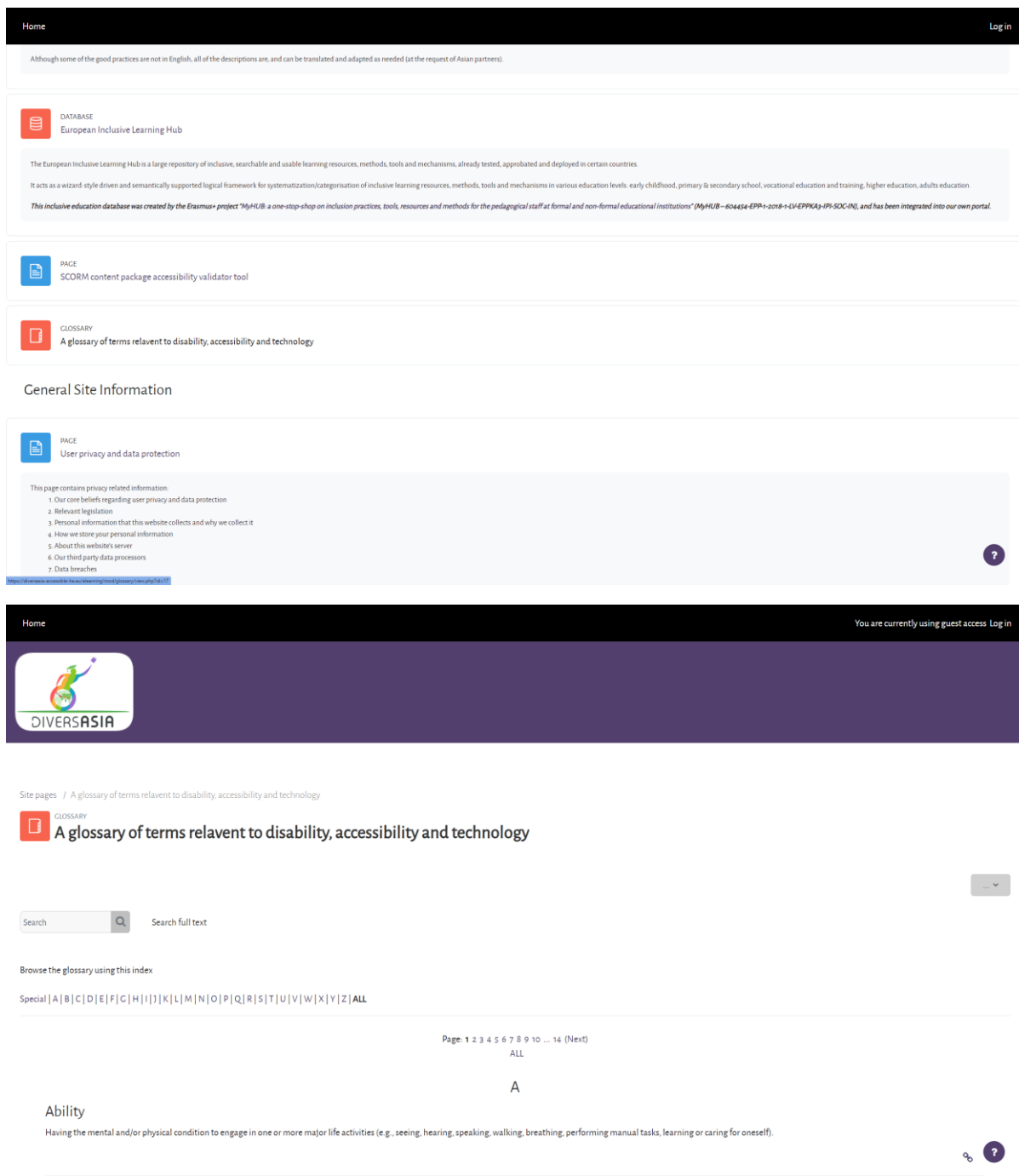


Figure 8: Glossary of terms

3.3.3 Integrated SCORM accessibility validator Pa11y

Pa11y (<https://pa11y.org/>) is an open-source tool we integrated to create the accessibility validator for SCORM packages. Pa11y includes and implements standards from 2 checkers, namely aXe and HTML CodeSniffer. Pa11y uses Puppeteer to run its own headless Chrome browser. Axe-core is an automated accessibility testing tool.

Pa11y uses HTML Code Sniffer as its default runner, but it can also run axe-core at the same time if you tell it to. HTML_CodeSniffer comes with standards that enforce the three

conformance levels of the Web Content Accessibility Guidelines (WCAG) 2.1, and the web-related components of the U.S. "Section 508" legislation.

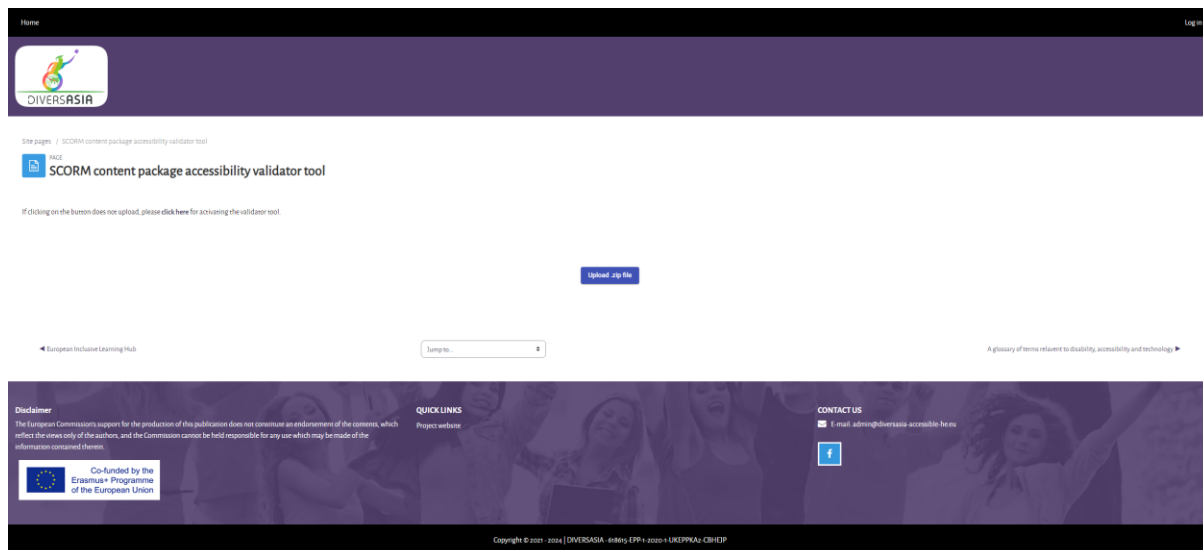


Figure 9: Uploading a package

Name	Size	Packed	Type	Modified	CRC32
File folder					
assessmenttemplate_report10566965980382849902.csv	711	414	Microsoft Excel Comma Separated Values File	29/09/2022 14:...	2C5592CC
CalculatingHandicap_report10273863404564217103.csv	45	39	Microsoft Excel Comma Separated Values File	29/09/2022 14:...	40320645
CalculatingScore_report17258622763323906376.csv	45	39	Microsoft Excel Comma Separated Values File	29/09/2022 14:...	40320645
Course_report12215903078646098808.csv	45	39	Microsoft Excel Comma Separated Values File	29/09/2022 14:...	40320645
Distracting_report13771658577081440743.csv	45	39	Microsoft Excel Comma Separated Values File	29/09/2022 14:...	40320645
Error html testing_report5448146936246740117.csv	469	295	Microsoft Excel Comma Separated Values File	29/09/2022 14:...	8CC353C8
Example_report4189340066961932419.csv	45	39	Microsoft Excel Comma Separated Values File	29/09/2022 14:...	40320645
HowToHaveFun_report18385080445987434943.csv	45	39	Microsoft Excel Comma Separated Values File	29/09/2022 14:...	40320645
launchpage_report17024932425483769824.csv	559	352	Microsoft Excel Comma Separated Values File	29/09/2022 14:...	D08ABD6A
MakeFriends_report14459703008124876538.csv	45	39	Microsoft Excel Comma Separated Values File	29/09/2022 14:...	40320645
OtherScoring_report8196424849664113384.csv	45	39	Microsoft Excel Comma Separated Values File	29/09/2022 14:...	40320645
Overview_report4381299056931851574.csv	45	39	Microsoft Excel Comma Separated Values File	29/09/2022 14:...	40320645
Par_report16571505328996432897.csv	45	39	Microsoft Excel Comma Separated Values File	29/09/2022 14:...	40320645
Play_report13791483759890938495.csv	45	39	Microsoft Excel Comma Separated Values File	29/09/2022 14:...	40320645
Playing_report17746076801906602945.csv	45	39	Microsoft Excel Comma Separated Values File	29/09/2022 14:...	40320645
RulesOfGolf_report423995601975703518.csv	45	39	Microsoft Excel Comma Separated Values File	29/09/2022 14:...	40320645
Scoring_report9091798068515513728.csv	45	39	Microsoft Excel Comma Separated Values File	29/09/2022 14:...	40320645

Figure 10: Receive feedback per HTML page in package

	A	B	C	D	E
1	type	code	message	context	selector
2	error	WCAG2AA.Principle2	A title should be provided for the document, using a non-empty title element in the head section.	<head>\n <!--title>How to Have Fun...</head>	html > head
3	error	WCAG2AA.Principle1	img element missing an alt attribute. Use the alt attribute to specify a short text alternative.		html > body > img
4					

Figure 11: Detailed analysis of notices, warnings, errors

It is available at <https://diversasia-accessible-he.eu/elearning/mod/page/view.php?id=13>.

3.3.4 DiversAsia native mobile applications for iOS and Android

Using the Moodle mobile framework (<https://github.com/moodlehq/moodleapp>), we customised this to accommodate the needs of the DiversAsia portal, and realised a native mobile iOS and Android app, which, using secure webservices, is synchronised with the

online portal based on Moodle. The advantage is that any content update of these 2 mobile applications can be performed via the WYSIWYG editor (incl. H5P editor) functionality of Moodle, thus ensuring no developer or designer is needed whenever content needs to be updated.

- Download link Android app (Google Play):
<https://play.google.com/store/apps/details?id=com.diversasia.mobile>
- Download link iOS app (App Store):
<https://apps.apple.com/us/app/diversasia/id6444756230>

Moodle/Android/iOS

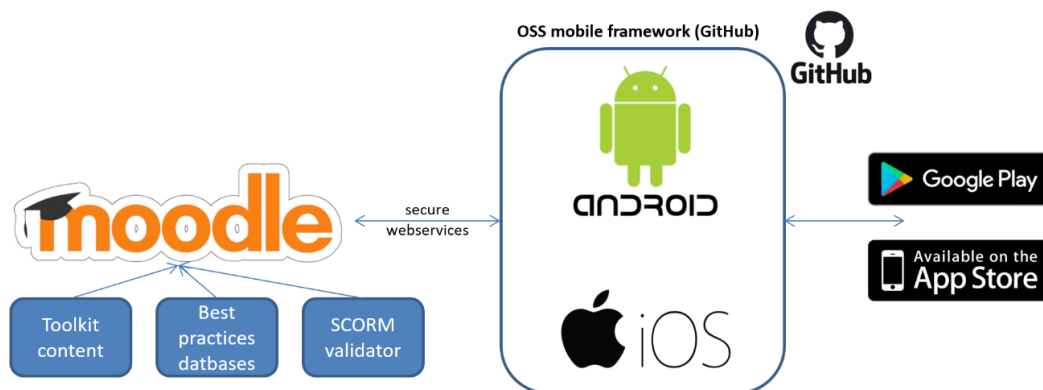


Figure 12: Android/iOS mobile framework deployment

These links are also integrated onto the project website:

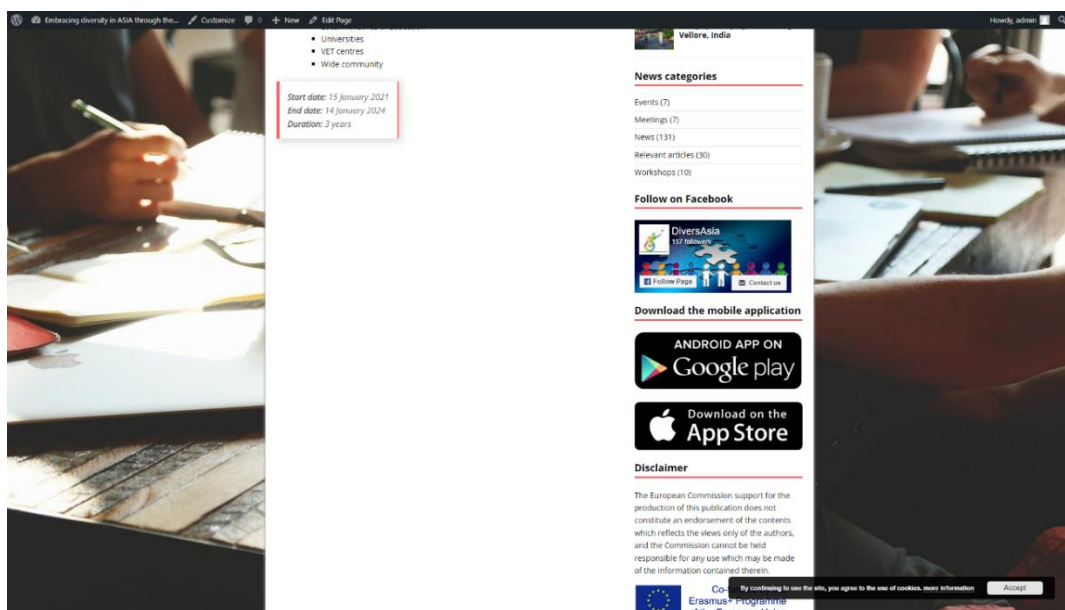


Figure 13: Android/iOS mobile apps download links on project website

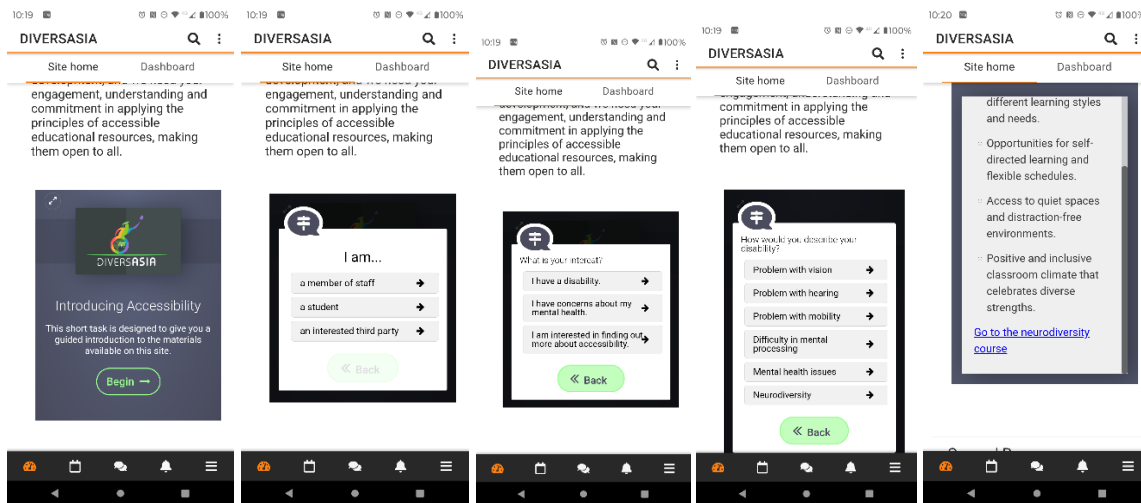


Figure 14 - A typical use of the app to access relevant (H5P) content (left to right)

Figure 14 shows a set of screen captures from the Android version of the DiversAsia Moodle app. The user starts at the home page (left) and is directed through the content selecting their user type, their reason for interest, their particular disability interest and are then guided to the correct course materials to suit their needs. The course content has been built up from the comprehensive set of H5P modules developed in the project and described fully in D2.2, and each course was created by curation of relevant H5P modules for each use case in the branching tree structure, thus creating course content tailored to specific users, personae and interest.

More information about above tools is included in “D2.3 DIVERSASIA portal with integrated mobile app V1”.

4 Introduction to Toolkit content

The idea of the DiversAsiaToolkit was to bring together a wide range of tutorials, some developed by us, some by others, that prepare HEI staff to welcome students with disabilities in their educational institutions' community.

The focus lies hereby on the educational accessibility in terms of administrative processes and overall readiness of (teaching) staff to accommodate for students with disabilities; communication overall; course provision whether printed and/or online; and the physical accessibility in terms of actual access to the educational premises.

What do we provide?

1. Tutorials on establishing accessible inclusive communication;
2. Concrete guidelines towards creating accessible printed/online courses;
3. How to create alternative formats based on accessible source material;
4. Provision guidelines towards inclusive online course creation and provision;
5. Assessment of accessibility SCORM package;
6. How to measure overall engagement of students when applying inclusive approaches.

The following sections constituted the initial content for the toolkit, which was then further updated directly in the toolkit by partners, and was split up in various branches as deemed suitable for a range of profiles.

5 Content of the toolkit

5.1 Guidelines for inclusive HE

5.1.1 Understanding the barriers and difficulties students face

In order to improve the access to education for students with a disability, we need to understand the main barriers and difficulties. We have grouped them here in topics, which will be addressed throughout the toolkit.

5.1.1.1 Lack of information to families or prospective students

Starting a new educational career requires that one is fully informed about what s/he can expect in the higher education institution in terms of education and prospect. However, as a student with a disability, a major aspect is to be aware what provisions have been made to accommodate the needs of students with disabilities. This requires that the HEI clearly indicates the accessibility accommodations in all its communications, whether printed, online, orally, etc.

Question: Does your institution have a dedicated section on its website that addresses these concerns?

5.1.1.2 Lack of information to families about procedures

Prospective students would like to know what procedures are in place for them once they apply to become a student.

Video to watch: <https://youtu.be/pCYvBoPt1CQ>

Question: Is there a concrete accessibility office within your HEI?

5.1.1.3 Inconsistency (lack of equivalence)

While the public accessibility policy statements may be clear, often in reality students are confronted with staff which is unaware of the needed accommodations, or provisions which are inadequate.

Question: Is your HEI consistent in ensuring that every staff member is aware of accommodations and provisions, or can refer the student to the relevant person/service to address her/his needs?

5.1.1.4 Co-ordination between services, departments and ancillary staff

The need for collaborative service provision is great in supporting students with disability because it brings together a wide array of expertise, from psychological, to pedagogical and to technical. Students will however often experience that different services within a HEI are unaware of accessibility and inclusion initiatives.

Question: Are all services within your HEI aligned with each other to ensure that accessibility is addressed and acknowledged throughout all services provided by the HEI (whether it concerns inclusive course material to accessible student living premises)?

5.1.1.5 Funding for student disability support

Insufficient provision of funds is the biggest issue in providing equal access to education for students with disability. The HEI administrative services should be aware of the funding support a student can have access to, and provide guidance. Procedures for applying for disability support funding is often characterised by fragmented provision, long delays in approval,

Question: Are funding/subsidy streams identified that are relevant for a student with a disability, and is s/he guided in applying for those? Does the HEI provide a budget for accessibility support and accommodation?

5.1.1.6 Visible versus invisible disabilities

There are some disabilities that do not manifest physically. Students with invisible disabilities are frequently perceived as "strange" or "off" by others, but in reality, they are dealing with a disability that causes them to act the way we do. Understanding the distinction between the two entails learning about what constitutes a visible disability and what constitutes an invisible disability.

Visible disabilities can be seen with the naked eye and by simply looking at the person. They may have facial features that indicate a disability, involuntary shaking throughout their body, or they may be physically unable to move as the average person does. Down syndrome, amputations, and paralysis are common examples of visible disabilities.

Invisible disabilities can have an impact on how an individual thinks, hears, speaks, and interacts with others. It can be difficult to recognize when someone has an invisible disability because most of these people are dismissed by their peers and society as "odd" or "off." ADHD, anxiety, bipolar disorder, depression, Asperger's (ASD), diabetes, and other chronic illnesses are examples of invisible disabilities.

So important, not all disabilities are visible. Be kind, respectful and never assume!

Videos to watch: <https://youtu.be/pEtNmbCFfTM>, <https://youtu.be/ENzHs8yjtq4>

Question: Has the HEI staff been made aware of visible and invisible disabilities?

5.1.1.7 *Lack of accessible communication*

Communication, whether digital or face to face, needs to be accessible for all parties involved in the communication. HEI staff sometimes is not aware how to appropriately conduct communication with others with a disability.

Communicating in a disability-inclusive manner acknowledges that people communicate in unique ways. As a result, a variety of techniques incorporating all forms of communication, both verbal and nonverbal, may be required.

Videos to watch: <https://youtu.be/9YGIZCrONaU>, https://youtu.be/9_tB_NEDKnM, <https://youtu.be/eI7ukfT6J4M>

Useful readings: https://www.un.org/sites/un2.un.org/files/un_disability-inclusive_communication_guidelines.pdf, https://bridgingthegap-project.eu/wp-content/uploads/BtG_Inclusive-and-accessible-Communication-Guidelines.pdf

Question: Does your HEI provide training and awareness how to conduct accessible communication?

5.1.1.8 *Equipment, technological aids and other devices are insufficient*

Obtaining appropriate equipment for individual students, such as hearing and vision aids, electronically adapted mobility devices, and walking frames, is a continuing barrier that prevents students with limited financial resources from having full access to information and/or premises. As a result, it is critical that the HEI responds to any request for supportive assistive technology from a student.

A solution may be to offer second hand equipment, as well as providing access to free open-source software.

Question: Does your HEI have a pool of assistive technologies to support those students with less financial strength?

5.1.1.9 *Curriculum and course content provision and delivery adaptation needed*

Although much work has been and continues to be done to develop appropriate adaptations of educational curricula and course content for a variety of students with varying capacities and abilities, this is one of the most difficult areas for education providers and their students. Because of the individual nature of students, as well as their needs and levels of readiness to learn, it is a vast field. There are areas where not enough has been done, or where curriculum needs and curriculum content adaptation and delivery are underappreciated.

Question: Is your HEI providing adaptation of curriculum and course content, and its delivery?

5.1.1.10 *Teacher training and support*

Many teachers were trained decades ago with no expectation of having students with disabilities in their classes. The vast majority of teachers are willing to work with a diverse range of such students, but in order to gain the confidence required for creative and responsive teaching, they require training, regular practical and theoretical reinforcement, and a support and consultation mechanism - someone to call and ask what to do about an issue that has arisen (“inclusion ambassadors”). Some teachers who have not received training in working with students with disabilities are negative and resistant. Most are not, but they require significant input in managing the inclusive class.

Question: Does your HEI provide sufficient training to its teaching staff so as to accommodate for students with disabilities in their class?

Question: Does your HEI have trainings for its teaching staff how to create accessible course material, and how to use the available technologies in an inclusive manner?

5.1.1.11 *Access to buildings*

Many higher education buildings are inaccessible. Many of these are either unmodifiable or would necessitate massive expenditure to modify.

Others are made accessible, but do not follow standards, resulting in too narrow doors, too small toilets, etc.

Videos to watch: <https://youtu.be/YmouK1VZSjc>, <https://youtu.be/kf9tSbYXQ4Y>

Question: Has your HEI worked together with disability and accessibility (used) experts to make your premises as accessible as possible?

5.1.1.12 *Prejudice and discrimination, or complaints, by non-disabled students*

Some non-informed peers, whether staff or other students, may complain about certain accommodations granted to certain students with (non-)visible disabilities.

Question: Does your HEI have an ongoing awareness campaign about visible and non-visible disabilities, and its impact on the life of students?

5.1.2 Inclusive pedagogical approaches (see toolkit)

5.1.3 Accessibility at HEI

Higher Education Institutions must embrace the notion of a diverse student body, where students with physical disabilities, students with cognitive differences and students from marginalised backgrounds are welcomed and can contribute to the academic and social

activities on campus. It is well known that students from such disadvantaged backgrounds are more likely to drop-out of higher education.

Accessibility at higher education institutions includes ensuring that students' living spaces and learning situation is adequate for all cases, that educational materials are produced in a format suitable for accessible use, that the technologies are available to allow access to the resources, and that staff know what is required of them to make materials meaningfully accessible.

5.1.3.1 Disability support

Higher education institutions should make modifications or adjustments to classes and activities to accommodate a student's disability. The purpose of such "reasonable accommodations" is to allow students with disabilities an equal opportunity to achieve, while not overburdening the institution in providing such accommodation(s).

There should be an office within the institution (e.g. a section of Student Services or a dedicated disability support program) that will assist in determining what support services or modifications can be made. They may also request documentation about a disability, from a doctor or other qualified professional. The institution can then define adjustments based on the disability and also individual specific needs.

The student should make the request for an accommodation. The request should be made in writing to the specific office that supports students with disabilities.

The requirements for requesting reasonable accommodations will be different for each institution, and it may be necessary to submit specific requests each semester, since accommodations differ depending on the classes taken.

5.1.3.2 NTU – A real world example

NTU has a strategy of "[University, reimagined](#)", which has six core principles at its heart: Creating Opportunity, Valuing Ideas, Enriching Society, Embracing Sustainability, Connecting Globally and Empowering People. Stemming directly from this are the two principles of Sustainability and [Equality, Diversity and Inclusion](#) (EDI). As such, the university puts both of these themes at the heart of all its activities.

NTU has a focus on EDI, and various mechanisms are in place to ensure that accessibility is a first-class amenity in NTU's education provision. Disability is prominent within the University's strategy and public statements, and it is '[Disability Confident Committed](#)' under the UK government's Disability Confident employer scheme. The services offered to [support disabled students](#) are well signposted throughout the NTU website, and the question of what support needs a student may have, is point 6 on the [Starting at NTU Checklist](#). The referral

into Disability Inclusion Services here asks which support needs a student might have (from six major categories: ADHD; Autism Spectrum; Dyslexia, Dyspraxia or Dyscalculia; Long Term Medical or Health Condition; Physical/Mobility; Visual or Hearing Loss). Each of these issues has dedicated and specific support around it, summarised on the [Disability Services](#) section of [StudentHub](#), NTU's student help, advice and services mini site. It is the responsibility of the student to approach all appropriate services in order to receive help and support (funded in the UK through [Disabled Students' Allowances](#) (DSAs)).

NTU has a published [Disability Charter](#) setting out what a disabled student can expect from NTU, and in turn, what is expected of a student accessing the Disability Teams at NTU.

Alongside these services, [NTU Libraries are fully accessible](#), and offer a range of enhanced services, such as an enhanced loans service (extending the allowed borrowing period), proxy borrowing and postal loans, fetch-and-carry services, individual inductions and [SensusAccess](#) (an online tool that can convert documents into a range of alternative formats). The [CUDOS](#) system allows electronic management of support workers – allowing effective access to matching, electronic timesheets, invoicing and payroll – giving details of the support arranged and by who. Also, NTU's [Student Accommodation Service](#) can make particular adaptations and adjustments for students who inform them of their additional needs.

There is an available VIDEO on Equality, Diversity and Inclusion at Nottingham Trent University presented by Professor Richard Bull, Deputy Dean and Chair of the Equality, Diversity and Inclusion committee in the School of Architecture, Design and the Built Environment. He discusses the School's commitment to ensuring opportunities for all. See <https://www.ntu.ac.uk/study-and-courses/academic-schools/architecture>.

5.1.3.3 Gazi University – A real world example (see toolkit)

5.1.4 Accessibility tools: authoring, conversion, evaluation.

Accessible digital teaching material requires that the source material itself is accessible. Hence, when starting by applying accessibility guidelines to a document being produced via a text editor (e.g. Libre Office, Open Office, MSWord, etc.), you can then easily export it to another format, such as an accessible PDF or a Daisy audio book or even to Braille.

Equally, paper-based learning materials can also benefit from guidelines on how to create inclusive and accessible teaching/learning materials.

So where do you start?

There are some core guidelines that will ensure that a document is accessible, both in digital and in printed format:

5.1.4.1 *Font*

7. A plain, evenly spaced sans serif font ensures better readability for people with low vision or even for people with dyslexia. Recommended fonts: Arial, Verdana, Tahoma.
8. The font size should be 12-14 points (by default in text editors, font size is measured in points (pt)). But in practice you want to use a large enough font size for body text so that people can comfortably read the text.
9. If the text needs to be printed, then a font size to use is 14 points as it eases eye strain, while making the document text easier to read.
10. Be cautious when using bold. Only use it to emphasise key words or phrases. Avoid using bold in any other contexts, such as for example to indicate a heading without using the proper heading functionality for an electronic document. Do at the same also explain why you have put the text in bold. Maybe you want to indicate important places or events?
11. In general, you should avoid underlining of text, or applying italics as such formatting makes it for some readers as if text runs together.
12. ALL CAPITAL LETTERS should be avoided. The reason is simple: readability is drastically reduced because all words have with all caps a uniform rectangular shape, and readers may not be able to identify words by their shape. It also makes it harder to emphasize key words.
13. Avoid the use of “textboxes” because screen readers cannot navigate into text boxes, thus making the content in them invisible. A better alternative is to insert a picture with the text in it, use the formatting to wrap text around the picture and add alternative text to the picture.

5.1.4.2 *Colour*

14. The core principle here is to use dark coloured text on a light background for paper, computer and visual aids. Avoid where possible white as it can appear too dazzling. Instead, colours like a soft pastel colour (e.g. cream) or a 10% grey scale will ensure a better readability.
15. Colours for text or graphics should avoid combining certain colours like green/red, green/pink, red/black, and blue/yellow combinations. Such combinations make text

hard to read for people with colour vision deficiency, while it may also trigger migraine attacks or even induce epileptic attacks in some cases. If we look at the web, WCAG 2.0 requires a contrast ratio of 4.5:1 for normal text and 3:1 for large text. Therefore, it is also important that you should not use a colour alone to convey a meaning. If a text is important, do not only put it in red, but apply also a secondary method, such as italics or bold for text. Below is an example of “vibrating” colour combinations.

Red/Green	Red on Green	Green on Red
Green/Magenta	Green on Magenta	Magenta on Green
Yellow/Blue	Yellow on Blue	Blue on Yellow
Black/Red	Black on Red	Red on Black

16. Be careful with putting a textured background. It makes it sometimes very hard to read a text.
17. If you have made a graphic and you use colours to indicate the different datasets, you should consider using a different line style as well for each line so as to clearly indicate there are different datasets.
18. Colour blindness simulator: <http://www.iamcal.com/toys/colors/>

5.1.4.3 Headings

19. Headings should always have a larger font size in bold.
20. Whatever text editor you use, do use the heading functionality embedded in these editors. Only in that way can a screen reader correctly understand the structure of headings.
21. Do not create headings by simply putting a heading number, a heading text, and then having it all formatted in bold. It may look nice, but it is absolutely not accessible for a screen reader user. Equally, any exported format, such as a .pdf will equally become inaccessible.

5.1.4.4 Layout

22. Always use a left-justified text with a ragged right edge (this is a text margin treatment in which all lines begin hard against the left-hand margin but are allowed to end short of the right-hand margin). In case of writing e.g. Persian, Arabic and Hebrew, you would apply a right-justified text with a ragged left edge
23. All words should be equally spaced. For this reason you should apply:
 - Line height (line spacing) to at least 1,5 times the font size;

- Spacing following paragraphs to at least 2 times the font size;
- Letter spacing (tracking) to at least 0,12 times the font size;
- Word spacing to at least 0,16 times the font size.

24. Narrow columns like being used in newspapers should be avoided.

25. Avoid starting a sentence at the end of a line.

26. Bullet points or numbering make a text easier to digest. After each such bullet point or numbering; do put a full stop or a semicolon. This way screen readers know they have reached the end of the point.

27. If you have more than one page, it is recommended to number the pages, preferably at the top right-hand corner.

28. As mentioned before, you should use the inbuilt heading styles to create a navigable structure.

29. A table of contents at the beginning of a document is recommended to facilitate navigation. Equally, at the end of long documents you should put an index. Again, you should use the inbuilt functionalities of your text editor to do so.

5.1.4.5 Writing style

30. Plain language writing with short, simple sentences in a direct style is preferred. It facilitates the reading process, especially when otherwise lots of punctuation issues may cause screen reader issues.

31. When using abbreviations, do ensure you explain these abbreviations, or provide a glossary of abbreviations and jargon in your document.

5.1.4.6 Visual impact

32. Pictograms and graphics may help to locate information, especially to those who need easy to read language.

33. A flow chart may help to explain procedures.

34. Images require “alt” tags or potentially also some explanatory text. That is, only in the case that the image is not purely decorative.

5.1.4.7 Large print documents

Large print documents facilitate education and communication while also increasing a person's ability to consume information. Large print also reduces eye strain, making it an

option for those suffering from digital eye fatigue. It's also in an easy-to-read format for seniors or those with visual impairments.

Following guidelines will help you when creating large print documents:

35. The font size should be at least 18 points.
36. Verdana, Helvetica, Tahoma, Arial, and Futura are examples of sans serif fonts that should be applied.
37. To emphasize a section of text, use bold text, asterisks, or dashes. Line spacing of 1.5 or greater is recommended
38. Upper- and lower-case letters should be used in the text.
39. Titles and headings should be larger and aligned to the left.
40. Items with bullets should be double spaced.
41. Page numbers should be in the same font and size as the body of the text.
42. Do not use italics or coloured text.
43. Include captions for charts, graphs, and images.
44. Choose the highest possible colour contrast between background and text colours (for example, black text on a white background).
45. Large print paper should have a matte or dull finish.
46. Bind large print documents with saddle stapling or spiral binding.

More reading at: <https://www.ukaaf.org/wp-content/uploads/2020/03/MS03-UKAAF-Minimum-standards-Clear-and-large-print.pdf>

5.1.4.8 Conversion to an accessible format

When we have created our accessible document, we are able to transform it into another format, whether it is an accessible .pdf, an audiobook (MP3 and DAISY), an e-book (EPUB, EPUB3 and Mobi) or digital Braille. The important thing is that the more accessible the source material, the less additional manual intervention may be required as this may be very time consuming. Annotating a badly formatted .pdf can take considerable time, especially if text has been put in images and needs to be all put into “alt” text with a proper reading order.

Via your text editor

MOffice / Office 365

47. To pdf: <https://support.microsoft.com/en-us/office/create-accessible-pdfs-064625e0-56ea-4e16-ad71-3aa33bb4b7ed>

Libre Office / Open Office

48. To pdf:
- Libre Office: Universal Accessibility (PDF/UA) - https://help.libreoffice.org/latest/he/text/shared/01/ref_pdf_export_universal_accessibility.html
 - Open Office: https://wiki.openoffice.org/wiki/Documentation/OOo3_User_Guides/Getting_Started/Exporting_to_PDF
49. To audio: odt2Daisy (not recently updated) - <https://odt2daisy.sourceforge.net/downloads/>
50. To Braille: odt2Braille (not recently updated) - <https://extensions.openoffice.org/en/project/odt2braille>

A good paid version for MS Word is:

51. EasyConverter Express: this software converts Microsoft Word .doc(x) to Braille, large print, MP3 and ePub. It is integrated as a tool bar add-in for Words: <https://yourdolphin.com/EasyConverter-Express> / https://youtu.be/P_-Re_Qp_FM

Online

A handy online tool to perform such conversions is the SensusAccess Accessible Document Converter tool (<https://www.sensusaccess.com/convert-a-file/>). The tool converts documents into a range of alternate and accessible formats including digital Braille, MP3, DAISY and e-books. The service can also be used to convert inaccessible documents such as image-only PDF files, images, and PowerPoint presentations into more accessible formats.

Explanatory video: https://www.youtube.com/watch?v=nyq_0ozjVno

Free tools

52. .doc(x)
- To audio: Free online software ZAMZAR: <https://www.zamzar.com/convert/doc-to-mp3/>

- To Braille: Free online software to convert .doc(x) documents to TXT BRAILLE format: <https://www.vertopal.com/en/convert/doc-to-txt-braille>
- To pdf: From the File menu, select “Save As...” and choose where you want the file to be saved. In the Save As dialog box, select PDF from the Save as type list. By default, this produces a PDF that preserves the document structure and assures accessibility.

5.1.4.9 Guidelines for your text editor

The main text editor software packages have made accessibility guidelines available online which detail how to create accessible documents.

We selected some of the most popular software for text editing, as well as for creating spreadsheets and presentations:

53. MSOffice / Office 365 (applicable for Word for Microsoft 365, Word for Microsoft 365 for Mac, Word for the web, Word 2021, Word 2021 for Mac, Word 2019, Word 2019 for Mac, Word 2016, Word 2016 for Mac, Word 2013, Word for iPad, Word for iPhone, Word for Android tablets, Word for Android phones, Word Mobile)

- Make your content accessible in the Microsoft 365 apps: <https://support.microsoft.com/en-gb/office/make-your-content-accessible-in-the-microsoft-365-apps-8a04499b-8a58-4db6-8c9d-5837f60745ef>
- WebAim guidelines: <https://webaim.org/techniques/word/>
- Video: <https://support.microsoft.com/en-gb/office/video-check-the-accessibility-of-your-document-9d660cba-1fcd-45ad-a9d1-c4f4b5eb5b7d/> / https://wus-streaming-video-rt-microsoft-com.akamaized.net/2ab47f03-52ac-4565-867d-541a443deefe/496190be-869c-4d64-be08-fcb436ac_6750.mp4

54. Libre Office

- How to Create Accessible LibreOffice files: https://wiki.documentfoundation.org/Accessibility/Creating_Accessible_LibreOffice_Files

5.1.4.10 Validation tools

After you have created a text, you may want to validate its accessibility. There exist a range of such accessibility validators:

55. MSOffice (applicable for Office 2016, Office 2016 for Mac, Microsoft 365 for home, Office for business, Office Mobile for Android, Microsoft 365 for Mac)

- Accessibility checker: <https://support.microsoft.com/en-gb/office/make-your-content-accessible-to-everyone-with-the-accessibility-checker-38059c2d-45ef-4830-9797-618f0e96f3ab>

- Readability checker: <https://support.microsoft.com/en-us/office/get-your-document-s-readability-and-level-statistics-85b4969e-e80a-4777-8dd3-f7fc3c8b3fd2>

56. Libre Office:

- ODF Accessibility Checker for OpenOffice.org and LibreOffice Writer (not recently updated) - <https://sourceforge.net/p/accessodf/wiki/UserGuide/>

57. Open Office:

- ODF Accessibility Checker for OpenOffice.org and LibreOffice Writer (not recently updated) - <https://sourceforge.net/p/accessodf/wiki/UserGuide/>

58. PDF:

- Online Tingtun Checker (free) - <https://checkers.eiii.eu/en/pdfcheck/>
- PAC PDF Accessibility Checker (free, Windows only):
<https://pdfua.foundation/en/pdf-accessibility-checker-pac>
- Commonlook PDF Checker (free plugin within Adobe Acrobat, tests against Section 508, WCAG 2.0 AA, WCAG 2.1 AA, PDF/UA and HHS standards):
<https://commonlook.com/accessibility-software/pdf-validator/>
- Pave (free): <https://pave-pdf.org/pave/index.html>

5.1.4.11 *Supporting videos*

59. Creating Accessible Documents: <https://youtu.be/-WYus6eHuM>

60. Making documents accessible: <https://www.csps-efpc.gc.ca/video/making-documents-accessible-eng.aspx> / https://video.csps-efpc.gc.ca/p/103/sp/10300/playManifest/entryId/0_zoi15gp5/flavorId/0_wnddec8f/format/url/protocol/https/a.mp4

61. Webinar - Introduction to Making a Word Document Accessible:
https://youtu.be/DfD6sqd858Q?list=PLoZ_XD6LkwMJOfw2MEjeExdjKQinHWm3q

62. Convert your PowerPoint into an accessible video:
https://youtu.be/mEQi36ttKZo?list=PLoZ_XD6LkwMJOfw2MEjeExdjKQinHWm3q

63. Creating Accessible Word Documents: <https://youtu.be/IWRaw7krQuq>

64. Creating accessible documents: <https://www.youtube.com/watch?v=ZEIgfAnkdfS>

65. Creating Accessible Word Documents and Formats (11 very informative videos):
<https://youtu.be/7tSTp4cvaQU>

5.1.4.12 Online courses

66. Creating accessible documents (tutorial by University of Washington):

<https://www.washington.edu/accessibility/documents/>

67. Creating Accessible Documents (by AbilityNet):

<https://abilitynet.org.uk/factsheets/creating-accessible-documents-0>

68. Document Accessibility (by North Carolina State University):

<https://classroomaccess.oit.ncsu.edu/documentaccessibilitylesson3/>

69. Creating accessible documents (by WebAIM): <https://webaim.org/techniques/word/>

5.1.5 Assistive technologies (see toolkit)

5.1.6 Institutional policies and strategies (see toolkit)

5.1.7 Technical guidelines and standards (see toolkit)

5.1.8 Training and professional development (see toolkit)

5.1.9 Universal design for learning (see toolkit)

5.2 Inclusive teaching practices

What is a college or university's ability to value, engage and include the rich diversity of students, staff, faculty, administrators, trustees, alumni, institutional partners and guests? That is the core question one needs to ask when considering inclusive teaching practices.

“Inclusive education is about a fundamental shift in the existing education system from seeing difference as a problem to be fixed to celebrating the diversity of learners and providing all necessary supports to enable equal participation.”

The Alliance for Inclusive Education

This is not a story that is black or white as accommodations needs to follow also the needs of students with disabilities, and these needs can be very diverse, and may require customised approach. Others may benefit from a streamlined approach, such as for example physical accessibility of the premises.

At the cover of the ongoing drive towards inclusive education lies first of all the Article 24 of the UN Convention on the Rights of Persons with Disabilities (CRPD) that provides not only that people with disabilities should not be discriminated against but also that they should be able to participate in the general education system. (Source:

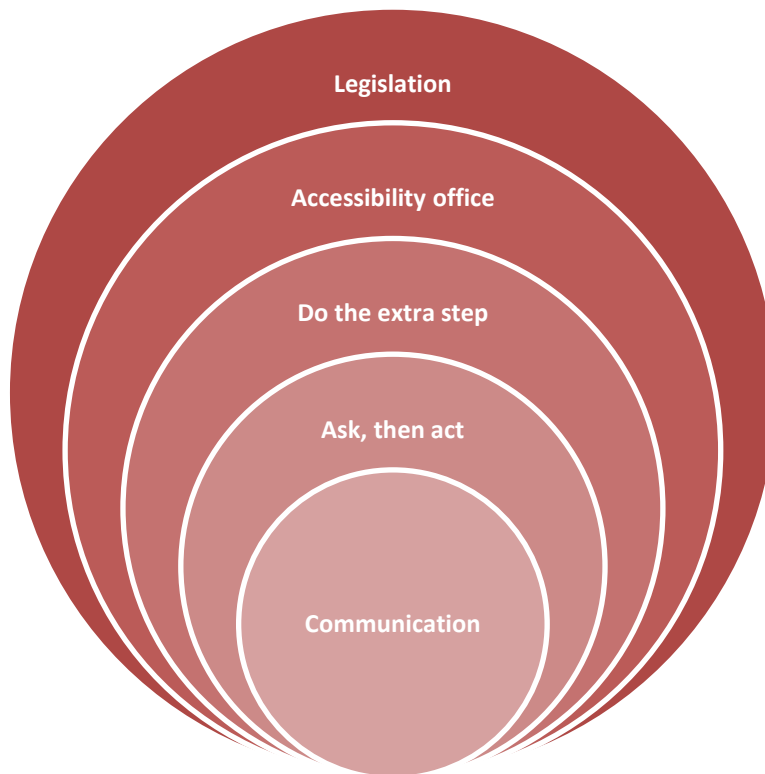
<https://www.un.org/development/desa/disabilities/convention-on-the-rights-of-persons-with-disabilities/convention-on-the-rights-of-persons-with-disabilities-2.html>)

Once the legislation was in place on an international level, the next step has been to implement it in the national legislation. This has been steadily implemented in countries worldwide, however, changes in the field did not really go as fast. In fact, we observe many differences across countries, and across regions. This is surprising or not, also linked to the financial prosperity of regions. As such, a person in The Netherlands is more likely to benefit from well supported inclusive education practices, then a student in Romania.

For a student to have access to inclusive education there is the need for physical accessibility, but equally the framework to be in place in higher education institutions that provide inclusive service provision to these students. Accessibility offices offer hereby a real added value. This practice is well established in countries like the United Kingdom and Belgium. These accessibility offices ensure that the campus community is committed towards recognizing disability as a valued aspect of diversity, towards embracing access as a matter of social justice, and towards designing more welcoming and inclusive environments. The main responsibilities are to:

70. Assess accommodation requests based on the documentation provided by each student;
71. Make reasonable and appropriate accommodations and/or support services available to students with disabilities;
72. Assist students in communicating about their disability and required accommodations (as needed).
73. Maintain the privacy of all information relating to a student's disability; and
74. On request, provide students with disabilities with information about policies, procedures, rights, and responsibilities in accessible formats.

Above all however, it is important that there is an open communication with a mutual respect, whereby the “ask first, then act” principle ought to prevail.



In order to identify the different domains and areas where the higher education institution needs to act, we will first look at how a student with a disability eager to continue higher education can become a student in such institution, continue to be a student and succeeds professionally afterwards.

5.2.1 Inclusivity process for student

Going to higher education is a dream for many students. Yet, when you are a student with a disability, you may wonder if you will be able to participate fully, without being faced with barriers. For this reason, we have identified possible hurdles and how they could be addressed during a student's "higher education lifetime".

- Student with a disability shows interest in higher education:
 - Questions
 - Does the student have access to all information in an accessible manner?
 - How will the student be able to subscribe in an accessible manner?
 - How will they be informed about accessible access to HEI premises?
 - Answers

- The **public available information should exist in an accessible manner**. One of the main access points will be the institution's website, which should meet WCAG2.1 guidelines. At the same time, **all provided documents** (pdfs to complete, online subscription form, etc.) should be equally accessible.
- A dedicated section in the institution's website should describe the **accessibility policy** and who to contact with regards to specific needs.
- The institution may hold a **(virtual) summer intake meeting** to allow new students with disabilities to register before the start of the first semester.
- An **accessibility office** should be in place that bring together all knowledge about how to accommodate a student with disability in terms of accommodation, teaching material, physical access, etc.
- Tasks of student
 - In order to receive accommodations, the **student must self-identify as a student with a disability** and register with the accessibility office. This disclosure should occur in a confidential manner. The student may need to **re-assess the disability in order to provide current documentation**. Suggested required documents:
 - Learning disabilities: A recent psychoeducational evaluation.
 - Attention Deficit/Hyperactivity Disorder (ADHD): a diagnosis made by a psychologist, psychiatrist, or physician who has received neuropsychological disorder training.
 - Autism Spectrum Disorder (ASD): a qualified specialist's medical form or letter, or a psycho-educational assessment.
 - Mental health disorders: A medical form or letter from a qualified specialist indicating the student's areas of disability and functional limitations.
 - Deaf or hard-of-hearing people: audiologist's report.
 - Blindness or low vision: a vision evaluation.
- Students are in their classes

- Questions
 - Is the student able to fully participate in the class activities?
- Answers
 - Certain accommodations and considerations may be needed:
 - During exams the student is given **extra time**.
 - Only **one exam per day** is scheduled.
 - Exams are possible with **access to a computer or spell check software**.
 - **In-class note-taker** is allowed.
 - An **interpreter of sign language** is allowed.
 - Learning materials are provided in **different formats** (e.g., Braille).
 - **Transport** means may need **adjustments** (accessible vehicle for wheelchair user).
 - The institution has the responsibility to:
 - **Include** students with disabilities in classroom and extracurricular activities.
 - **Inform** students, or their parent(s)/guardian(s), of available accommodations and support services, as well as the process for obtaining these resources.
 - Accept a student's request for accommodation in **good faith**, unless there are compelling reasons not to do so.
 - Take an active role in **investigating alternative approaches** and potential accommodation solutions.
 - Obtain **expert opinion or advice** as needed, and bear the costs of any disability-related information or assessment that is required.

- Maximize a student's right to **privacy and confidentiality**, including only sharing disability information with those directly involved in the accommodation process.
- **Limit requests for information** to those that are reasonably related to the nature of the need or limitation and only for the purpose of facilitating access to educational services.
- Respond to accommodation requests in a **timely** manner.
- Ensure that the institution's **teaching environment is welcoming** and that all students treat one another with respect.
- Take immediate **corrective action** in situations where bullying and harassment is or may be occurring.
- **Educate** all faculty, staff, and students.
- Regular self-assessment is required to:
 - **Review** the accessibility of the educational institution as a whole, including all educational services.
 - **Design and develop new or revised** facilities, services, policies, processes, courses, programs, or curricula with people with disabilities in mind.
- Tasks of Student
 - The student needs to advise the institution on the need for accommodation related to her/his disability and participate in discussions how the institution may address it.
 - The student needs to highlight relevant restrictions or limitations, well justified.
 - The student needs to co-operate with any experts whose assistance is required to ensure her/his needs can be accommodated.
 - The student needs to feedback on a regular basis and highlight difficulties that may be experienced.
- Appropriate supports and services

- Questions
 - Are the learning content and activities accessible and based on individual needs?
 - Are all activities designed to be accessible for all students?
- Answers
 - The **learning content itself should apply strict content accessibility guidelines**, whether this content is printed, in auditory format, in digital textual format, etc.
 - Support should be provided so that **every student can participate in every activity**, unless such involvement would create a danger for the student with a disability.
 - This requires not only **physical access to the regular classroom**, but also to outdoor venues or laboratories that are being used/visited.
 - Any **information about physical accessibility** should be readily available.
 - Where needed, **activities are modified** to accommodate for all students.
- Tasks of Student
 - The student needs to get well informed about what accessibility aspects have been addressed in terms of content accessibility, but also with regards to activities overall.
 - The student needs to actively contribute in this area by highlighting any shortcomings.
- Active Participation
 - Questions
 - Can the student participate in every activity?
 - Is the student actively engaged in learning and social activities?
 - Answers
 - **All activities need to be designed to be accessible** for all students

- All social activities that take place in the campus should be **barrier-free in terms of content, access and active participation.**
- Teachers should **pursue universal design in all aspects.**
- **All classes should practice/apply inclusion,** without any exception.
- Diversity is **valued throughout all environments, activities and events.**
- Tasks of Student
 - The student should be aware where information about (social) activities can be found.
 - The student should highlight any accessibility shortcomings.
- All students have a sense of belonging
 - Questions
 - Are students with disabilities actively stimulated to participate in all (non-)class activities, indoors and outdoors?
 - Are students actively engaged in the learning/student activities?
 - Answers
 - **Grouping students with and without disabilities** is the first step to ensure peers with and without disabilities get engaged with each other in student activities.
 - A teacher should **cultivate community** within the classroom.
 - Teachers should provide opportunities for **students with disabilities to share their own experiences and perspectives.**
 - A teacher needs to **respect diverse people and diverse talents.**
 - Tasks of Student
 - A student needs to share the own experiences and perspectives.
- Teachers get ready for students
 - Questions
 - Are teachers ready to teach students with disabilities?

- Do the teachers know how to interact with students with disabilities?
- Do the teachers know what different formats of teaching and course content there exist that could support their students with disabilities?
- Answers
 - Students with disabilities do not have to get "ready" to be included, rather, as staff we need to **accommodate their needs where reasonable.**
 - There are **no prerequisites for inclusion.**
 - **Staff ought to be trained** based on students' needs. This can range from communication to physical access to alternative teaching/course formats.
- Tasks of Student
 - Be "articulate" about the reasonable requirements and needs.
 - Provide advice or even training material (book, online tutorial, etc.) so as to help teachers better address your needs.
- Achievement of Goals
 - Questions
 - Does the institution apply repeated self-assessment so as to improve what is not inclusive yet?
 - Answers
 - All **aims and objectives should be SMART:** specific, measurable, attainable, results-oriented, and time-bound.
 - Every member of the teaching staff, administrative staff and support staff should **self-evaluate their inclusion readiness** on a regular basis.
 - **Obstacles are issues waiting for solutions.**
 - Tasks of Student
 - Be "articulate" in following up on changes, on whether your remarks have been addressed, and if not, why not.

- Collaboration and Team Planning
 - Questions
 - Are people appointed to follow up on inclusion in every aspect of campus life (physical accessibility, content accessibility, community accessibility, communication accessibility, accommodation accessibility, and overall integration)?
 - Answers
 - General and special education trained staff need to **have ownership of students with disabilities.**
 - All team members should **collaborate and communicate frequently.**
 - A **technical/pedagogical/administrative inclusion ambassador** in the institution would be an asset.
 - Tasks of Student
 - Be “articulate” in following up on changes, on whether your remarks have been addressed, and if not, why not.
 - Provide advice or even training material (book, online tutorial, etc.) so as to help the inclusion team to better address your needs.

Stakeholders

Below table provides an overview of the different aspects of inclusive higher education; and the involvement of the different stakeholders.

Different aspects of inclusive HE educations	Physical access	Accessible teaching material	Complete and accessible information	Accessible communication	Inclusive learning / teaching	Team
Stakeholders						
Student	X	X	X	X	X	X
Peers	X					X
Teachers		X		X	X	X

Administrative staff			X	X		X
Infrastructure responsables	X		X	X		X
Parents	X					X

Key disability terms¹ to be aware of:

- Accessibility
- Accessible communication and alternative formats
- Anticipatory adjustments
- Assistive technology
- Competence standards
- Disability
- Inclusive teaching practice
- Inclusive education
- Universal design for learning
- Neurodiversity
- Personal emergency evacuation plan (PEEP)
- Reasonable adjustments
- Social model of disability (and medical model / deficit perspective)
- Student support plan

¹ More info at: <https://academic.admin.ox.ac.uk/files/das-glossary-key-disability-termspdf>.

5.2.1.1 Do's and don'ts²

5.2.1.1.1 **Anticipate students' variability**

Ask yourself: Who are the students that might show up in your classroom?

Consider things such as:

- disability
- language learner status
- socioeconomic status

This simple anticipatory exercise can help prepare you for the creative work of designing your course for everyone, as opposed to simply modifying existing activities to accommodate individuals with disabilities or a subset of students.

With this in mind, make your course methods, materials, and assessments more variable.

Do

- If you normally lecture, incorporate other activities that allow students to engage in peer learning during the class period.
- If your activities are typically centred on peer or group learning, include some activities that allow students to explore the topic on their own.

Don't

Don't rely on just one type of activity, material, or evaluation method.

5.2.1.1.2 **Create or use multiple means of representation (content)**

Organize information so that students can make connections.

Do

- Highlight patterns, key features, big ideas, and relationships, particularly near points where students may become stuck.
- Connect new information to prior knowledge explicitly.
- Before using new vocabulary, present concepts and big ideas in simple language.
- Clarify terminology, acronyms, and symbols.

² Sourced from <https://accessibility.umn.edu/what-you-can-do/design-inclusive-courses/classroom-activities>

- Throughout the course, use a variety of media, such as video, animations, or other multimedia (and offer these in alternative formats).

Don't

- Don't expect students to understand key concepts, new information, or unfamiliar vocabulary, acronyms, or symbols right away.
- Introduce new vocabulary only after students have mastered concepts and big ideas.
- Don't rely solely on one type of media to disseminate information.

5.2.1.1.3 Create multiple means of engagement (activities)

Consider the various interactions that are taking place in your classroom at the same time. Students should interact with one another, you, the content, and the technology (whatever form that takes).

Do

- Various activities and assignments.
- Include opportunities for self-assessment and reflection (raising self awareness of learning aids learning).
- Encourage students to use and apply course information in authentic real-world assignments.
- Encourage intentional collaboration and community to assist students who require interaction for learning.
- Reduce distractions (e.g., use plain and simple writing, minimize the number of decorative elements in your course websites and on your slides, etc.).

Don't

- Don't use technology just for the sake of using technology; the technology-driven activities you design should be meaningful and useful in and of themselves.
- Students should not be expected to only access or recall information.
- Students should not be expected to complete all assignments on their own.
- Use simple language and avoid using too many or distracting graphics.

5.2.1.1.4 Provide multiple means of actions and expression (assessment)

In your course, assessment activities usually have higher stakes. They are where students spend the majority of their time and attention.

Do

- Try some unconventional assignments (e.g., a mapping project, digital story, in-class presentation, or online exhibition).
- Request that students respond in non-traditional formats (for example, a podcast or video recording), and vary these parameters throughout the semester.
- Ensure that the tools you promote for non-traditional activities are easily accessible.
- Increase the amount and frequency with which you provide feedback at all levels and in all contexts.
- Provide feedback using rubrics (rows and columns: the rows correspond to the various criteria of an assignment, while the columns correspond to the level of achievement expressed for each criterion).

Don't

- Do not only assign research papers.
- Do not require students to respond solely in class.
- Avoid providing infrequent feedback.
- Don't give each student personalized feedback.
- Don't assume that non-traditional activities are out of reach.

5.2.1.1.5 Ask about barriers to learning

Determine methods to identify potential barriers or learning needs of your students at the start of the semester.

Do

- Consider having them fill out an index card (or online form, or email) with an answer to a question like:
 - What would you like me to know about your preferred learning style?
 - How can I best assist you in completing this course?
 - What can I do to best meet your educational needs?
 - Do you have any special access requirements that you'd like me to be aware of?

- Invite students to your office hours or schedule individual meetings with you. Make sure your syllabus includes an access statement.

Don't

Don't expect students to immediately disclose their disabilities to you.

Make no assumptions that students with similar disabilities will require the same accommodations.

5.2.1.1.6 Build accessibility into learning outcomes

Do

- Engage students in improving accessibility in the course by incorporating accessibility best practices. As an example:
 - Show students how to caption their own video assignments and award points for submitting a captioned video on your rubric.
 - Designate a class note taker for each class session, who will then share their notes with the rest of the class (and assign extra credit points for this task).
 - Create best practices by including captions or alt text for all static graphics and images in your documents.
 - Inquire with the class about anything else that would improve class accessibility.

Don't

- Don't assume that all students are aware of accessibility.

5.2.1.1.7 Offer alternative activities or assignments

Not all applications are accessible to students who use assistive technology such as screen readers or text-to-speech programs, or who use voice commands and/or a keyboard to navigate on their computer (instead of a mouse). Even accessible applications may contain inaccessible features.

Do

- Prepare to provide an alternative option to assignments that require students to use, for example, Flip (a video-based tool that allows for discussion across digital devices), such as writing a text response or using the learning platform's discussion tool.

- Consult with technical accessibility staff if you're unsure whether a piece of technology or a feature within it is accessible.

Don't

- Don't force students to use an inaccessible tool without giving them alternatives.

5.2.1.1.8 Consider light sources

Some students may experience disability symptoms if they see flashing, strobing, or flickering lights in videos or slides shown in class. Some people may also encounter difficulties as a result of the combination of ambient lighting and colour contrast, such as the contrast of slide text against a coloured background in a dimly lit room.

Do

- Inform students ahead of time if a video clip you're going to show contains flashing, strobing, or flickering effects.
- Collect and act on feedback from your students about classroom lighting. You may have different access needs in a single classroom, so you may need to problem solve with your students to find a workable solution.
- Inform campus management if you need to find a room that meets the needs of students.

Don't

- Flashing, strobing, or flickering effects should not be used on your slides.

5.2.2 Train the trainers

5.2.2.1 Different (dis)abilities require different solutions (AT matching)

Our goal is to work with assistive technology users to help them get the most out of their devices. People with disabilities can attend regular education as a result of assistive technology, thanks in large part to technological advances over the last century. This technological advancement has facilitated a shift from a medical model to a social model of technology delivery, an approach that places equal emphasis on the user's community reintegration as it does on his or her physical abilities. This shift implies that instead of viewing technology delivery as an end in itself, one should go one step further and collaborate with students to ensure that assistive devices are used to their full potential.³

³ Scherer, M. J. (Ed.). (2002). Assistive technology: Matching device and consumer for successful rehabilitation. American Psychological Association. <https://doi.org/10.1037/10420-000>

At the core of the AT matching lies “**feature matching**”. This is a process whereby technology features are being identified that would benefit the AT user based on their abilities and needs.

This process of identifying technology features will be based on the abilities and needs of the user. As a result, before considering AT, the educational team must clearly identify the user's unique needs and the tasks to be performed in the educational program.

The following AT assessment process will identify targeted tasks and environments for each task. The student's needs and abilities should then be evaluated/observed if they have not already been identified. Then we must match AT features to those needs and abilities.

We must therefore take a student-centred approach. The accessibility teams will look at the student's strengths, needs, and preferences before identifying technology features that would benefit the AT user based on their abilities and needs. Only then should we consider the capabilities of available technology. Once the technology has been identified, we must narrow it down to a few broad options. Finally, once the technology features have been brainstormed, the accessibility team can begin looking for specific technology that matches those features. The chosen AT may include readily available or commercially available AT, modified AT, or custom-made AT.

The HAAT Model (Cook & Hussey, 1995)⁴ comes in handy here. While the Human Performance Model – HPM (Bailey, 1996)⁵ outlines that people performing in systems have in common that they are each somebody (a person), doing something (an activity), at someplace (within a context), the HAAT Model is an extension of HPM where it has four components - the human, the activity, the assistive technology, and the context in which these three integrated factors exist.

Applying this to higher education, we obtain following HAAT model.

⁴ The Human Activity Assistive Technology (HAAT) model was developed by Al Cook, Sue Hussey and Jan Polgar (Assistive Technologies: Principles & Practice, 5th Edition).

⁵ The Human performance model (HPM) is an attempt to integrate and study the factors, and aspects that influence the performance of a human during performing a job.

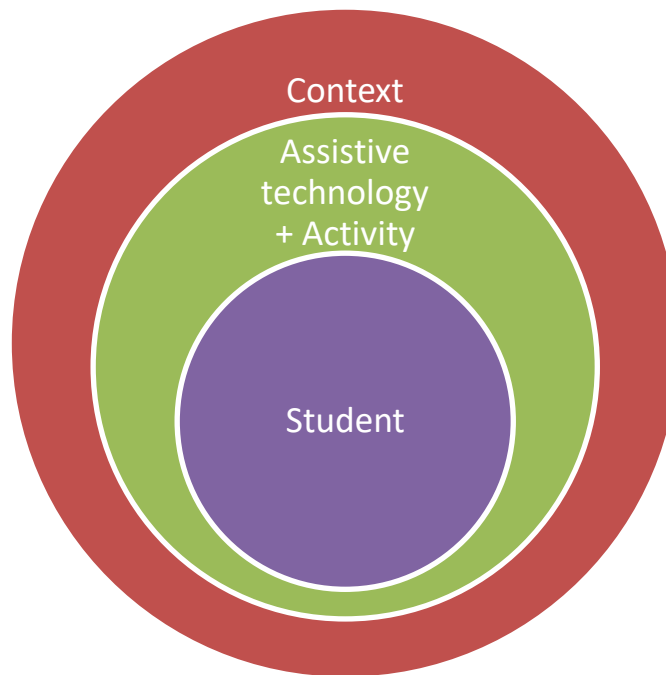


Figure 15: Adapted HAAT model

Thus, following 4 aspects should be considered carefully when “feature matching”:

- The student is at the core and drives the quest for a suitable AT, by focusing on her/his functional abilities.
- The AT needs to be chosen in line with the activity this student needs to perform inside/outside a classroom, but equally while participating in community activities.
- Finally, the context is very important: is there e.g., a quiet environment or is there a lot of noise that requires a different approach?
- The process of matching users to assistive technologies and devices is key in optimising the likelihood of the user benefitting from the said technology. It is important as many assistive technologies are expensive, that the correct selection is made based on the user’s preferences and requirements, the environment in which they will be using the technology, and the potential benefits that the technology can offer the user.

5.2.2.2 *How to produce more materials related to:*

5.2.2.2.1 Vision - Reading: Brail/Audio books/screen readers

Many of these approaches apply a transformation of some kind to the visual output, to enable it to be understood and interpreted by people with limited or no vision. Audio Output Devices (E-Readers).

Many of these devices allow high contrast scalable text which may be much easier to read than a paper book. Some of these devices enable digital text to be read aloud to the user. This is accomplished by converting the displayed text to speech, and heard via either an inbuilt speaker or headphone connection (wired or Bluetooth).

Good examples include:

Amazon Kindle (<https://www.amazon.com/kindle/>): Kindles - 7th generation and newer, have the tool VoiceView which effectively works like text-to-speech, once enabled. The VoiceView Screen Reader is designed to make the Kindle usable for people with vision problems. For the purposes of audio reading, you must check that the model purchased has speakers or headphone support if you require text-to-speech. This is not a feature of all e-readers. Almost all models offer scalable text size for low vision support.

Refreshable Braille Displays: Braille is a useful way for the blind to be able to read, however it should be noted that only a small proportion of those registered blind are able to read Braille. For example, the British RNIB quote 7%, and the American RFB quote under 10%. This means that though a viable solution in a small number of cases, this solution is likely to be suited to a small subset of blind students. A braille display is a specific piece of computer hardware which consists of a series of pins which can be raised or lowered to display braille in a physical form. This allows a user who can read braille to read from the computer system by feeling the raised pins. A common issue however is that this technology is prohibitively expensive often costing thousands rather than hundreds of pounds.

Braille embossers: A braille embosser is essentially a printer that prints braille. It uses pressure to indent the paper so that the printed braille can be read by touch. Again, expense is a key limiting issue in their use costing around £2000 where an ordinary printer can be purchased for a 20th of that.

Braille translation software: Special translation software is required to translate a text document into braille that can be printed using an embosser as mentioned above. Much of this software is paid, although there are some free alternatives, for example:

- OdttoBraille an extension available for Open/Libre Office, (<https://odt2braille.sourceforge.net/>)
- Biblos (by DiGrande.it). (<http://www.digrande.it/it/Biblos.aspx>)

Other popular (paid) solutions include:

- Index Braille,
- Duxbury and

- Euler.

Screen readers: Bespoke screen reader software can be purchased enabling flexible and controllable reading of screen content. Most software comes with a selection of reader voices, and many have optional voices that can be purchased additionally. Screen reader software such as Jaws (<https://www.freedomscientific.com/products/software/jaws/>) is available on several different user licences, often paid on a time limited use basis, and can be a costly option, but is frequently used due to reliability and completeness. There are however some free and cheap alternatives – though they may not offer such a smooth experience or all the same features:

- NVDA is a free and open-source screen reader which can be used directly from a USB stick – meaning it is good for students who need to access it on multiple machines through their day. (<https://www.nvaccess.org/download/>)
- Serotek System Access is another more affordable tool, though some additional features require payment to access. (<https://www.satogo.com/en/>)
- ORCA is a free screen reader for Linux and is included on the Ubuntu installer. (<https://help.gnome.org/users/orca/stable/index.html.en>)
- Web Anywhere is another useful one to know about as it requires no software on the machine and can enable web access to blind people on any machine they have access to. (<https://webinsight.cs.washington.edu/wa/>)
- For Google Chrome users, ChromeVox and ChromeVis extensions are worth a visit. These act as web screen reader and webpage magnifier respectively.

5.2.2.2.2 Vision - Writing: speech to text / text to speech, voice command

Low vision aids are a broad area of assistive devices, and low vision aids fall into a number of categories. Magnifiers can use either a lens (such as a magnifying glass) or technology – cameras and displays. They could be products designed in a way to make them clearer such as by using high contrast or colour in a different way. They may be specifically designed devices such as a clock with a bigger face or a digital clock with large bold numbers. Also, something that should be considered is large print versions of documents, newspapers etc. These are often available on request.

Low vision computer software: Modern operating systems on computers come with a range of versatile inbuilt accessibility options which can be turned on and off to help users with a range of disabilities and requirements. In Windows 10 Hold the windows key and press ‘U’ to open the ease of access centre. Within this section there are settings to adjust the display (text sizes, icon sizes, resolution etc), the mouse pointer, the text cursor, there is a

magnifier, colour filters, high contrast modes, and there is also a Narrator that can be used as a simple text to speech option. These modes are also available in iOS and Linux versions, and you should check your documentation on the best ways to access them.

OS X contains a built-in tool called Apple VoiceOver which includes magnification, keyboard control, as well as verbal descriptions of screen interaction. It can convert text content to audio including web pages, emails and documents.

- ORCA is a free open-source screen reader for Linux systems.
(<https://help.gnome.org/users/orca/stable/index.html.en>)

Note takers or automated transcription software can be used by users with hearing impairments to improve their ability to understand meetings, conversations or presentations. Some online meeting technologies such as MS teams have a built-in transcribing tool which supports live transcription of conversations. The accuracy of transcription may be better in some languages than others, and there is always the odd glitch in recognition of speech, but overall, this technology can be a big help.

Scanners with text recognition software, are a valuable tool in converting images of text into actual readable text which can in turn be read by a screen reader or equivalent.

Scanner/reader pens are a valuable tool to help with a number of visual and intellectual disabilities. They allow a user to run the pen over text and hear a spoken version of the text. Many are equipped with headphone jack ports to enable use in the lecture hall without disturbance.

Talking Digital Voice Recorders enable recording of audio, such as a lecture or seminar, with easy-to-use navigation. The devices include software that provides spoken prompts and beeps to assist users with visual impairments while they record their interactions. It can also give notifications on such important factors as battery levels, recordings, and file deletion using audio cues. There are also apps available for smartphones that do similar thing for example, on Android, Recorder for the Blind, or on iPhone, Pocket Recorder.

5.2.2.2.3 Hearing

Induction loop systems may be installed in a lecture room, Students who use hearing aids can take advantage of a hearing loop which can help them to pick out speech sounds more clearly. It makes the hearing aid pick up the sound from microphone connected to the loop system, rather than all noises in the area, which helps to cut out background noise. To use a hearing loop, the student turns their hearing aid to the hearing loop setting.

A radio aid system usually consists of a transmitter and a receiver. The transmitter contains a microphone and can be worn by the lecturer/speaker in a class. The microphone picks up the sound of their voice and transmits it wirelessly to the receiver(s), which are attached to the hearing aid or cochlear implant and can pick up the sound being sent from the transmitter. This allows a deaf student to hear the speaker's voice clearer in relation to unwanted background noises.

Where funding is available, professionals may be employed to help with particular student needs. This may be someone to take notes for a student, someone to translate to sign language, or a lipspeaker. A 'Lipspeaker' is a hearing person who has been professionally trained to be easy to lipread. Lipspeakers reproduce clearly the shapes of the words and the natural rhythm and stress used by the speaker. They may also use facial expression, gesture and, if requested, finger spelling, to aid the lipreader's understanding.

Student safety is an important concern for deaf or hearing impaired students. Vibrating pagers are available which may be linked to a University fire alarm system, used in conjunction with paging transmitters. At night time, a night cradle can be used with this system to ensure an alarm wakes a sleeping student.

5.2.2.2.4 *Learning Differences - tools to identify learner's expression (e.g., face) and engagement with their work*

Technologies are being developed which can use a standard camera feed to track facial expressions in real time. This technology has been used in studies to predict the level of engagement or attention in students working on particular tasks. Such technology has the potential to notify a lecturer in real time if sections of their audience are for example losing focus, or getting frustrated. Such technology would therefore enable the lecturer to change their teaching style or pace to suit individual or groups of students, enhancing the quality of their learning.

The AI-TOP project (<https://www.ai-autism.eu/>) is an example of current work on such a technology to identify engagement in students with autism, and to predict upcoming rumble and meltdown moments. The software will use the laptop webcam to track the student and predict these features.

5.2.2.3 *Accessible/inclusive communication*

To ensure the inclusion and respect of the human rights-based approach, a proper vocabulary must be defined. The best option is to simply ask the person what words or terminology they prefer to use. If this is not possible, we recommend using "person-first language," which prioritizes the person over the impairment. It reflects the human rights model of disability, which views disability as the result of societal barriers. Disability is not a

defining characteristic of a person, but rather one of many. For example, instead of "disabled," we will say "person with disabilities." This advice also applies to illnesses and diseases, for which medical labels should be avoided in order to avoid reinforcing stereotypes of people as 'patients.' We use this terminology because it is consistent with the terminology enshrined in the United Nations Convention on the Rights of Persons with Disabilities (CRPD).

Finally, we should use positive language to refer to people with disabilities, avoiding passive and victimizing words and using language that respects people with disabilities as rights-owners with complete control over their own lives.

IMPORTANT: Although some people with disabilities may use non-politically correct terminology to refer to themselves, such as disabled or even cripp, we should not.

In the following, we provide a range of guidelines⁶ that will facilitate your communication with a person with a disability.

5.2.2.4 General tips for improving communication and interaction skills when interacting with people with disabilities

Do consider the following:

- Address people with disabilities in the same way you address everyone else; speak directly to them, even if an interpreter is present.
- Use a normal tone of voice and avoid patronizing or talking down to others.
- When offering assistance to a person with a disability, ask first, wait until your offer is accepted, and then follow the person's instructions.
- Be patient in getting things done or said. Allow the individual to set the pace for talking and doing things.
- When introducing a person with disabilities, such as those with limited hand use or who wear an artificial limb, it is appropriate to use the usual cultural greeting, such as shaking hands.

5.2.2.5 Persons who are deaf or hard of hearing

Do consider the following:

⁶ https://bridgingthegap-project.eu/wp-content/uploads/BtG_Inclusive-and-accessible-Communication-Guidelines.pdf

- When culturally appropriate, wave your hand or tap on the person's shoulder to get their attention if they are deaf or hard of hearing.
- Determine whether the person prefers sign language, gesturing, writing, or speaking by following his or her cues.
- Look the person in the eyes and speak clearly, slowly, and expressively without overreacting/overemoting to see if they can read your lips.
- Use a normal tone of voice when speaking.
- When speaking, keep your hands and food away from your mouth. Avoid talking while smoking or chewing gum.
- Make an effort to reduce background noise.
- Written notes can often help to improve communication.
- Encourage feedback to ensure a thorough understanding.
- Inform a person who is deaf or hard of hearing if you are having difficulty understanding his or her speech.

5.2.2.6 Persons who are blind or partially sighted / with visual impairment

Do consider the following:

- Always identify yourself and anyone else who may be present.
- When speaking in front of a group, remember to say the person's name to provide vocal cues.
- Use a normal tone of voice when speaking.
- Indicate when you move from one location to another, as well as when you leave or return to a room.
- Inform the person when the conversation is over.
- When you offer to help someone with vision loss, let them take your arm to better guide them.
- When directing, use specifics such as "left at 2 meters."
- Place the person's hand on the back or arm of the seat when offering seating.

5.2.2.7 Persons who are deafblind

Do consider the following:

- DeafBlindness comes in various degrees. As a result, it is critical to follow the guidelines outlined above and tailor them to each individual case.

5.2.2.8 Persons with speech impairment

Do consider the following:

- When speaking to someone who has difficulty speaking, give your undivided attention.
- Make more time for communication.
- Maintain an encouraging rather than correcting demeanour.
- Be patient; do not speak for the individual.
- Ask short questions that require short answers or a nod or shake of the head if necessary.
- Make use of hand gestures and notes.

5.2.2.9 Persons with intellectual disabilities

Do consider the following:

- Please be patient. Allow enough time to ensure clear understanding and to put thoughts into words, especially when responding to a question.
- Create simple sentences and repeat as needed.
- Use precise language with simple words. Avoid using directional terms such as right-left, east-west, and so on.
- To obtain accurate information, phrase your questions correctly. Verify answers by asking each question in a different way.
- Give specific instructions, such as "Return from lunch at 13:30," rather than "Return in 30 minutes."
- Don't give too many instructions at once.

5.2.2.10 Persons with reduced mobility/wheelchair users

Do consider the following:

- When speaking with someone in a wheelchair, address him or her directly and try to be at his or her eye level. To make this easier, you could sit on a chair. If you must stand, take a slight step back so the person does not have to strain his or her neck to see you.

- Consider distance, weather conditions, and physical obstacles such as stairs, curbs, and steep hills when giving directions to people with mobility limitations.
- Treat wheelchairs and mobility aids as extensions of the owner's personal space. Therefore don't lean on someone's wheelchair, or move a person's mobility device.
- Always ask before moving a wheelchair user.
- When transferring from a wheelchair to a car, toilet, or other location, keep the wheelchair within easy reach. Before assisting someone with a transfer, always ensure that the chair is locked.

5.2.2.11 *Service animals*

Do consider the following:

- Service animals, such as guide dogs for the blind, are considered working animals rather than pets. When they are in harness, they should not be petted or otherwise distracted.
- If the animal is not restrained, permission from the animal's companion should be sought and granted before interacting with the animal.

IMPORTANT:

Don't assume that persons with disabilities experience their disability the same way you do.

Don't make assumptions about what persons with disabilities can and cannot do.

5.2.2.12 *Do's and don'ts*

The following table illustrates some examples of terms to avoid and person-first language to be used instead⁷⁸:

Terms to avoid	Recommended terms
Handicapped, disabled, disabled person, person with special needs, handicapable, atypical, person living with a disability, differently abled, people of all abilities, people of determination, those with disabilities	Person(s) with disability/ies

⁷ https://bridgingthegap-project.eu/wp-content/uploads/BtG_Inclusive-and-accessible-Communication-Guidelines.pdf

⁸ https://www.un.org/sites/un2.un.org/files/un_disability-inclusive_communication_guidelines.pdf

Terms to avoid	Recommended terms
Normal person, able-bodied, normal, healthy, typical, whole, of sound body/mind	Other people, person(s) without impairment, broader population
Suffer from, afflicted by, stricken by, troubled with, affected by	With disability/impairment/condition
Mental patient	Person with psychosocial disabilities
Mental handicap, mentally defective, retarded, simple, slow, afflicted, brain-damaged, intellectually challenged, subnormal, of unsound mind, feeble-minded, mentally handicapped, mentally retarded	Person with intellectual disabilities, person with learning disability, person with cognitive disability
Insane, crazy, maniac, psycho, hypersensitive, lunatic, demented, panicked, agitated, mentally deranged, mentally ill, person with mental health problems	Person with a psychosocial disability
Blind	Blind person Person who is blind Person with a vision/visual disability Person with a vision/visual impairment Person with low vision Deafblind person
Visually impaired	Person with visual impairment, partially sighted person
The deaf, hearing impaired, deaf and dumb, deaf-mute	Deaf person Person who is deaf mute Person with a hearing disability Person with a hearing impairment Person with hearing loss Hard-of-hearing person Deafblind person
Hearing impaired	Person with hearing impairment, person who is hard of hearing
Afflicted by / victim of multiple sclerosis	Person who has multiple sclerosis
Autistic	Person with autism

Terms to avoid	Recommended terms
Learning disabled	Person with a learning disability
Mongoloid, special person, Down	Person with Down syndrome
Invalid, handicapped person, crippled, deformed, lame, handicapped, physically challenged, person with physical limitations, limp, person with physical difficulty, home-bound, bedridden	Person with a physical disability
Mute	Person unable to speak
Dwarf, midget	Person of little stature, person who has short stature
Wheelchair bound, confined or restricted to a wheelchair	Person who uses a wheelchair, wheelchair-user
Spastic	Person with cerebral palsy
Post-polio suffered from polio	Person who had polio, person with post-polio paralysis
Birth defect	Congenital disability

5.2.3 Available online courses on accessible teaching practices

5.2.3.1 Your accessible course

An accessible course eliminates as many barriers as possible for students with disabilities. The greater the accessibility, the more likely it is that all students will have equitable learning and growth opportunities. When creating an accessible course, instructors should start with realising the diversity of the students they will (potentially) teach. Students who use wheelchairs, students with low vision or limited hearing, students who cannot easily hold a book or take notes by hand, students with dyslexia or an attention disorder, and students with temporary disabilities such as concussions or broken arms may be enrolled. With this variety in mind, instructors should think about the following three questions:

- “Can all of my students access and benefit from the websites and digital files I use to share information, including those who use screen readers and prefer to listen to the resource rather than read it?”
- “Will all of my prospective students, regardless of their physical ability, be able to participate in core class activities?”
- “Can students demonstrate mastery of learning objectives without encountering unnecessary barriers that may unfairly discriminate against some of them?”

The goal is to provide adaptable and robust learning environments in which all students can thrive without requiring special accommodations.

Instructors need to think of accessibility as an ongoing and iterative process of improvement: even a small step forward in accessibility allows students to focus on learning rather than overcoming obstacles.

Top accessibility tips⁹:

- Discover more about your students: The objectives of an accessible inclusive learning experience are straightforward: every student should have an equal opportunity to learn and demonstrate their knowledge. In an equitable learning environment, access should be equal for all students: the doorway should be the same width regardless of who is entering. It is difficult to anticipate every obstacle that a student may face when attempting to access learning activities and resources. Inviting students to participate in a discussion about accessibility is an effective way to start creating an inclusive learning environment. Establishing a trusting supportive rapport requires demonstrating an openness to learning from students and a willingness to design accessible activities with their suggestions in mind.
- Select inclusive pedagogical strategies: It is critical that your classes have structure and that we communicate clear expectations for student attendance, participation, and engagement. However, rigid course policies and messaging on a syllabus, such as "No exceptions!" can feel intimidating or even exclusionary to some students, and may imply to students with disabilities that the instructor would be reluctant to accommodate them. Universal Design for Learning (UDL) principles are based on the recognition that there is no single best way for all people to learn or demonstrate their learning.
- Improve the usability of your LMS site: While the LMS environment may be accessible, the content you add to your courses may not.
- Include a welcoming accessibility statement on your course syllabus: Including a welcoming accessibility statement on your course syllabus will encourage students who face accessibility challenges to communicate with you. The best syllabus statements communicate friendly, supportive, and personal messages to your students rather than reading like boilerplate policy statements. The three sample

⁹ <https://poorvucenter.yale.edu/strategic-resources-digital-publications/accessible-teaching>

accessibility statements provided below may serve as inspiration for communicating instructors' commitment to inclusive learning environments.

- **Disability and Diversity Statement:** Our institution values diversity and inclusion, and we are dedicated to fostering an environment of mutual respect and full participation. Our goal is to create usable, equitable, inclusive, and welcoming learning environments. If there are any aspects of this course's instruction or design that cause barriers to your inclusion, accurate assessment, or achievement, please notify the instructor as soon as possible. Students with disabilities are also encouraged to contact "*name of your student accessibility services department*" to discuss a variety of options for removing barriers in the course, such as accommodations.
- **Usability, Disability, and Design (Sample 1):** I am committed to designing an inclusive course. If you encounter any barriers, please notify me immediately so that we can determine whether a design adjustment can be made or if an accommodation is required to overcome the design's limitations. I am always open to new ideas as long as they do not jeopardize the purpose of the assessment or learning activity. You may also contact "*name of your student accessibility services department*" to start this conversation or to make accommodations for this or other courses. I appreciate any feedback that will help me improve the usability and experience for all students.
- **Design, Usability, and Disability (Sample 2):** I am concerned about your performance in this class. Because we all learn differently, we will all require accommodations. Please let me know as soon as possible if there are any aspects of this course that prevent you from learning or create barriers to your inclusion. We'll work together to devise strategies that will help you succeed in the course. I encourage you to go to "*name of your student accessibility services department*" to see how you can improve your own learning. If you require official accommodations, you have the right to request them. A variety of resources are also available on campus at "*name of your student assistive technology services department*."
- **Check that readings and files are accessible:** Students should have access to readings, texts, and presentation slides in both physical print and digital text that is properly formatted for text-to-speech technologies. PDFs frequently present accessibility issues for students who rely on text-to-speech software. Many faculty members share PDF scans of books and articles with their students, but depending

on how those scans were made, these PDFs may only be images of the text (which cannot be read aloud by these technologies) rather than text that can be read aloud by these technologies. Although Word documents and PowerPoint slides are more accessible than PDFs, there is a good chance that the Word doc or PPT file will have accessibility obstacles that will make it difficult or impossible to use by some members of its audience. You can check and fix accessibility issues while creating files by selecting "Check Accessibility" in the most recent versions of Word and PowerPoint.

- To audit and improve files, use accessibility checkers: You may want to validate the accessibility of a text after you have created it. There are several types of accessibility validators:

75. MSOffice (applicable for Office 2016, Office 2016 for Mac, Microsoft 365 for home, Office for business, Office Mobile for Android, Microsoft 365 for Mac)

- Accessibility checker: <https://support.microsoft.com/en-gb/office/make-your-content-accessible-to-everyone-with-the-accessibility-checker-38059c2d-45ef-4830-9797-618f0e96f3ab>
- Readability checker: <https://support.microsoft.com/en-us/office/get-your-document-s-readability-and-level-statistics-85b4969e-e80a-4777-8dd3-f7fc3c8b3fd2>

76. Libre Office:

- ODF Accessibility Checker for OpenOffice.org and LibreOffice Writer (not recently updated) - <https://sourceforge.net/p/accessodf/wiki/UserGuide/>

77. Open Office:

- ODF Accessibility Checker for OpenOffice.org and LibreOffice Writer (not recently updated) - <https://sourceforge.net/p/accessodf/wiki/UserGuide/>

78. PDF:

- Online Tingtun Checker (free) - <https://checkers.eiii.eu/en/pdfcheck/>
- PAC PDF Accessibility Checker (free, Windows only): <https://pdfua.foundation/en/pdf-accessibility-checker-pac>
- Commonlook PDF Checker (free plugin within Adobe Acrobat, tests against Section 508, WCAG 2.0 AA, WCAG 2.1 AA, PDF/UA and HHS standards): <https://commonlook.com/accessibility-software/pdf-validator/>
- Pave (free): <https://pave-pdf.org/pave/index.html>

- Adopt accessible technologies: Instructors should ensure that the tools chosen for a class can be used by all students without the need for special accommodations. While it is difficult to anticipate every challenge a student may face with a particular platform, a little testing and planning beforehand is well worth the investment.
- Closed captioning for video resources and live online events will benefit students with a wide range of disabilities, as well as those learning a language or engaging with media in situations where audio is not an option. Captions benefit more than just students who are deaf or hard of hearing. When captions are present, student retention improves¹⁰. Captions are frequently cited as helpful by students with ADHD, whether they are watching videos or participating in class. Finally, captions are now so widely available that many students have grown accustomed to them as an essential part of their multimedia experience. Auto captioning functionality is now default available in platforms such as MSTeams and ZOOM.

5.2.3.2 Available online courses on accessible teaching practices

- Checklists
 - A Checklist for Inclusive Teaching (HTML) (<https://www.washington.edu/doit/equal-access-universal-design-instruction>): Produced by DO-IT (<https://www.washington.edu/doit/>, Disabilities, Opportunities, Internetworking, and Technology) at Washington State University, this checklist exchanged course design for the average student with course design for potential students who have broad ranges with respect to ability, disability, age, reading level, learning style, native language, race, and ethnicity.
 - Quick Accessibility Checklist (HTML) (<http://accessibility.psu.edu/checklist/>): The *Quick Accessibility Checklist* is designed to help faculty and staff who want to develop or modify Web-based course material, lectures, and assignments in an accessible way. It covers multimedia elements, web tools, HTML tags, and advanced web design.
 - Creating your accessible syllabus (<https://www.accessiblesyllabus.com/>): Whether it are images, text, the interaction and the overall examination policies, you find here an accessible alternative.
 - Checklist for accessible teaching (<https://www.su.se/ceul/english/resources/develop-your-teaching/accessible-teaching/checklist-for-accessible-teaching-1.560847>): Accessible teaching means that you adapt your teaching to students' different needs. Pedagogical adaptations that are absolutely necessary for an individual student with a disability also often benefit other students and can also lead to pedagogical development.

¹⁰ Morris, K. K., Frechette, C., Dukes, L., Stowell, N., Topping, N. E., & Brodosi, D. (2016). Closed Captioning Matters: Examining the Value of Closed Captions for All Students. *Journal of Postsecondary Education and Disability* 29(3), 231-238. <https://eric.ed.gov/?id=EJ1123786>

- Accessibility Essentials Checklist (<https://teaching.unl.edu/classroom-climate/dei/accessibility-checklist/>): Use this checklist to address essentials and learn more about accessibility and universal design for learning (UDL).
- Checklist for Making Informal Learning Accessible to Students with Disabilities (<https://www.washington.edu/doit/checklist-making-informal-learning-accessible-students-disabilities>): Some universal design strategies may already be in use at the location you are reviewing and others could be implemented soon. The following checklist will help you identify both. For each of the strategies listed, indicate the following in the Status section of the checklist.
- Checklist for inclusive teaching ([https://www.plymouth.ac.uk/uploads/production/document/path/3/3132/Checklist for inclusive teaching.pdf](https://www.plymouth.ac.uk/uploads/production/document/path/3/3132/Checklist%20for%20inclusive%20teaching.pdf))
- Tips for inclusive teaching (<https://www.torontomu.ca/accessibility/guides-resources/teaching/>)
-
- Accessible content
 - Ten Tips for Accessible Documents (HTML) (<https://support.office.com/en-CA/article/Ten-tips-for-accessible-documents-49b2ccea-5a8b-458a-988e-c273c50f225c>): Have you ever realized that not everyone receiving your documents can read and understand them as well as you think? Regrettably, most of us don't consider people with disabilities when creating documents. The tips in this checklist can help you create documents that cater to your whole audience, not just a portion of it.
 - Ten Tips for Creating Accessible Course Content (HTML) (http://www.3playmedia.com/2015/10/21/10-tips-for-creating-accessible-course-content/?mkt_tok=eyJpIjoiWW1VMU56STRZVGs1WVdRdyIsInQiOiJBXC9OU3I5b3lwZERicDVcL3ZtUHRyMDc2amx5bXVpOUVva1Y4YjNMWjU3QWpNWWhdVQW5yWERoV2RXRnZPVmFOTUR4VkV1WIMyVG5ZSIUzSVVvN250eVQ3OWgzcz0JoR0FFcmplQUZHeWF1YTFVPSJ9): Professors and instructional designers need to make sure all their students enjoy equal access to course materials, including students with disabilities. To help educators tackle that challenge, web accessibility expert Janet Sylvia presented a [webinar](#) on ten tips to creating accessible course content. This article summarizes those tips.
 - Tips for Making Online Documents Accessible: Word, PowerPoint, Excel, and PDF (HTML) (<http://www.3playmedia.com/2015/07/30/tips-for-making-online-documents-accessible-word-powerpoint-excel-pdf/>): Web accessibility means committing to making your website accessible to all users, regardless of their physical or sensory ability. But inclusive design extends beyond your website. To be truly accessible, any documents provided as links to download must also be accessible. This article contains tips for making such documents accessible, as well as links to checklists specific to Word, PowerPoint, Excel, and PDF.
- Accessible teaching
 - Making Your Teaching More Accessible Webinar (https://www.routledge.com/go/making-your-teaching-more-accessible-webinar?utm_source=google&utm_medium=cpc&utm_term=search&utm_campaign=B031184_kr1_3fc_4cm_d949_accessibilitywebinarpromotion&gclid=CjwKCAiAfybBhBKEiwAgtB7fkqC4eKdhBBqIR952yiNS99gmW8c8dtVTQYP)

- [ERP5GZ89FyPCx2MbnxoCvVYQAvD_BwE](#)): This free on-demand webinar features Stacy Scott, our Accessibility Officer here at Taylor & Francis, and two Routledge leading authors in the field of accessible teaching, Joanna Cannon and Katherine Aquino.
- Guide for Inclusive Teaching at Columbia, Center for Teaching and Learning (https://cpb-us-w2.wpmucdn.com/edblogs.columbia.edu/dist/8/1109/files/2020/02/Guide-for-Inclusive-Teaching-at-Columbia_Accessibility-Revisions_15-January-2020_FINAL.pdf)
 - Fostering Accessible Teaching and Learning by University of Toronto (<https://tatp.utoronto.ca/teaching-toolkit/effective-strategies/accessible-learning/>)
 - Accessibility in Teaching by TACCU (Tampere Accessibility Unit) (Tampere University) on <https://research.tuni.fi/taccu/accessibility-materials/accessibility-in-teaching/> references to:
 - Introduction to Accessible Education: <https://accessiblecampus.ca/tools-resources/educators-toolkit/introduction-accessible-education/>; <https://teaching.uwo.ca/img/teaching/COU-AODA-Guide.pdf>
 - Creating Accessible Learning Environments: <https://cft.vanderbilt.edu/guides-sub-pages/creating-accessible-learning-environments/>
 - Using assistive and accessible technology in teaching and learning: <https://www.jisc.ac.uk/full-guide/using-assistive-and-accessible-technology-in-teaching-and-learning>
 - Creating accessible materials: <https://www.ed.ac.uk/information-services/help-consultancy/accessibility/creating-materials>
 - Teaching an Accessible Online Course by Sheryl Burgstahler, January 20, 2022 (<https://youtu.be/rmJiDCRNb9E>), in combination with 20 Tips for Teaching an Accessible Online Course (<https://www.washington.edu/doit/20-tips-teaching-accessible-online-course>), and her book “Creating Inclusive Learning Opportunities in Higher Education: A Universal Design Toolkit”, published by Harvard Education Press. More at <https://www.youtube.com/@TheDOITCenter/videos>.
 - Accessible teaching strategies (<https://teaching.washington.edu/topics/inclusive-teaching/inclusive-teaching-strategies/accessible-teaching/>)
 - Accessible teaching and learning resources by University of Oxford (<https://wwwctl.ox.ac.uk/accessibility-teaching>): This addresses a wide array of accessibility in teaching and learning such as:
 - Accessible and inclusive teaching: What does inclusivity mean in a teaching and learning context?
 - Ensuring all students can access remote learning: Ways to ensure all students can access digital learning materials and activities.
 - Assistive technologies: How technology can help with reading, writing and organisation.
 - Creating accessible educational recordings: Help to improve the quality and accessibility of your educational recordings.
 - Accessible and inclusive Canvas courses: Guidance for ensuring your Canvas courses are accessible to all students.

- Creating accessible handouts and documents: Create handouts and documents that benefit all students.
 - Creating accessible PDF files: Simple ways to ensure accessibility when using PDFs.
 - Creating accessible PowerPoint presentations: Create accessible PowerPoint presentations that benefit all students.
 - Blackboard Ally: Accessible content tool for the Canvas virtual learning environment.
 - SensusAccess: Automated document conversion service for creating accessible documents.
- Online webinars:
 - Online Teaching: Accessibility and Inclusive Learning (microcredential, starts on 13 Mar 2023, 12 weeks, \$799) (<https://www.futurelearn.com/microcredentials/online-teaching-accessibility-and-inclusive-learning>)
 - Making Your Teaching More Accessible Webinar (https://www.routledge.com/go/making-your-teaching-more-accessible-webinar?utm_source=google&utm_medium=cpc&utm_term=search&utm_campaign=B031184_kr1_3fc_4cm_d949_accessibilitywebinarpromotion&gclid=Cj0KCQiA-JacBhC0ARIsAlxybyP_LuMAGdUMT_RPruy5EUmygJ4NZCLma3wyBzanXC_hxcmiHdQblZFlaAoWkEALw_wcB)
 - Webinars Inclusive Universities (<https://www.siho.be/nl/publicaties/webinars-inclusive-universities>): Between December 2020 and July 2021, the Support Centre Inclusive Higher Education (SIHO) hosted a webinar series entitled 'Towards Genuinely Inclusive Universities: an international perspective on best practices in the implementation of universal design'. The series consisted of eight webinars and shed light on several topics closely related to current policies and practices in post-secondary education around the topics of inclusion and universal design. Each webinar focused on case studies concerning implementation.
 - Webinar 1 - State of play on implementing inclusion and universal design strategies in higher education across Europe and beyond
 - Webinar 2 - Universal design as an institutional approach: international good practices
 - Webinar 3 - Universal design for learning in the classroom: best practices for inclusive assessment
 - Webinar 4 - The potential of universal design to create inclusive classroom practices with international students
 - Webinar 5 - The potential of universal design for learning with regards to mental health and wellbeing in higher education
 - Webinar 6 - The potential of universal design for learning in community colleges, colleges of further education, trade schools, and vocation education institutions
 - Webinar 7 - Universal design for learning beyond the Global South
 - Webinar 8 - Looking to the future: framing the next decade of universal design for learning implementation in higher education

5.3 Guidelines towards the development of accessible training curriculum by HEI staff

5.3.1 Creation and validation of accessible OERs and MOOCs

5.3.1.1 Accessible OERs and MOOCs¹¹

Students, teachers, and researchers from all fields use open educational resources (OER) because the documents and media are freely available and openly licensed.

If this is to be made available to e.g., students with visual impairments, then it should be taken into account that they will use software such as JAWS Screen Reader, NVDA (Windows), Serotak System Access (Windows), Apple VoiceOver (OS X), ORCA (Linux), BRLTTY (Linux), Emacspeak (Linux), Spoken Web, and Chrome Vox to access these resources.

A massive open online course (MOOC) is an online course that is open to anyone who wants to take it. MOOCs are typically free, have extremely large class sizes, range in length, and vary in workload and time commitment. MOOCs may combine a variety of OERs. In practice, e-learning, MOOCs, and OER services are mostly delivered via web technologies. As a result, using web content accessibility guidelines (WCAG), Authoring Tools Accessibility Guidelines (ATTG), and User Agent Accessibility Guidelines (UAAG) can greatly benefit OER and MOOCs (UAAG)¹².

MOOCs and OERs can be hosted on an LMS (Learning Management System), but not necessarily. If it is hosted on an LMS, then you can benefit from embedded accessibility checkers that will assess your created content.

- Step 1: Select an accessible LMS

Below is an overview¹³ of LMS (accessibility) features, and a shortlisted set of LMS contain those features (+, ++) or not (O). The selection criteria used were:

- The system should be accessible to people with visual, hearing and mobility impairments.
- It must allow modifications in order to achieve the desired level of accessibility.

¹¹ <https://files.eric.ed.gov/fulltext/EJ1267246.pdf>

¹² Browsers, browser extensions, media players, readers, and other applications that render web content are examples of user agents.

¹³ Based on a more complete version of the table displayed in <https://www.researchgate.net/publication/344919077> [How to Select an Accessible Learning Management System for Distance Education](https://www.researchgate.net/publication/344919077)

- It must be able to deliver full distance higher education programs, and as such handle rich media content, grading management, and advanced communication features like chat and forum.
- It should be licensed as Free and Open Source Software (FOSS). It is therefore possible to implement specific local requirements and fix accessibility issues without the permission of third parties.

Table 1: Comparison of LMS by features

LMS features	Moodle	Open edX	aTutor	Chamilo	Totara Learn	Canvas	Edmodo
Usability	+	++	+	++	+	++	+
Authoring tool	++	+	+	+	++	+	++
Interoperability	+	++	+	++	+	+	+
File repository	++	+	+	++	○	+	++
Video	++	++	+	++	++	++	++
Audio	++	+	+	+	+	+	+
Forum	+	+	+	+	○	○	+
Chat	+	+	+	+	+	+	++
Task and marks	+	++	+	++	++	+	+
Reports	++	+	○	+	++	+	+
Analytics	++	++	-	+	++	+	+
Student mgmt.	++	++	+	++	++	+	++
Open learning	+	+	+	+	+	+	+
Private learning	+	+	+	+	+	+	+
Internationalization	++	+	+	++	+	+	+
Accessibility compliance	++	+	++	○	+	++	+
Keyboard-only	+	+	++	○	○	++	++
Screen reader	++	+	++	○	○	++	++
Subtitles	+	+	+	○	○	++	○
Maintenance	++	++	+	++	○	++	+
Documentation	++	+	+	++	++	++	+
Community	++	+	-	++	+	+	++
Own-hosted	+	+	+	+	○	○	○

LMS features	Moodle	Open edX	aTutor	Chamilo	Totara Learn	Canvas	Edmodo
SaaS	Third-party	+	Third-party	+	+	+	+
License	GPLv3	AGPLv3	GPL	GPLv3	GPLv3	AGPLv3	GNU/GPL

- Step 2: Create accessible content in your LMS

Creating accessible content demands that the creator follows strictly WCAG guidelines. At the same time, the selected LMS should have an accessibility checker which can assist the editor in identifying any other open issues. Examples:

- ATutor¹⁴:
 - Accessibility Verifier: While using the ATutor Content Editor, instructors can check the accessibility of their content to be sure it can be accessed by all students, including those using assistive technologies, or older technologies. While using the Content Editor, select Alt-a to open the accessibility verifier.
 - Accessible HTML Editor: ATutor has a WYSIWYG HTML editor that is both accessible and usable by content authors using assistive technologies, and helps authors create accessible content.
- Moodle¹⁵:
 - The Accessibility Checker button (denoted by a circular accessibility symbol) launches an automated accessibility checker that looks for: common text errors such as images with missing or empty alt text, contrast between the font colour and the background colour and whether it is within the WCAG AA guidelines. The Screenreader helper button (also located at the right end of the second row) displays a tool for screen reader users. It summarizes the text styles, images, and links used in the text box.

¹⁴ https://atutor.github.io/atutor/docs/atutor_accessibility.html,
https://atutor.github.io/atutor/docs/atutor_wcag.html

¹⁵ https://docs.moodle.org/311/en/Accessibility_Toolkit

- The Accessibility Starter Toolkit assists educators and administrators in evaluating the accessibility of their course content and identifying existing common accessibility issues. You can also get a graphic representation of the different types of errors, as well as a report with an overview of all errors. To use it, the site administrator must first register with Brickfield¹⁶ (<https://www.brickfield.ie/brickfield-accessibility-toolkit/>) and then activate the plugin on the Moodle site. The Starter Toolkit's accessibility report includes a heatmap that allows course creators to identify course sections with accessibility issues that need to be addressed.
- Step 3: Provide open access to your course material

To be an OER or even a MOOC, users should be able to freely access the course content, either without any registration, or after free registration. If you expect many users, ensure you select a solid hosting plan!

To find a MOOC, you may use <https://www.classcentral.com/>, it searches into offerings by approximately 1000 Universities worldwide, 70 providers and more than 600 institutions, and provides access to over 100000 courses.

A free MOOC course “Accessibility: Designing and Teaching Courses for All Learners” is available at <https://learn.canvas.net/courses/831>.

5.3.1.2 SCORM

An OER and a MOOC can consist of SCORM (**S**hareable **C**ontent **O**bject **R**eference **M**odel) packaged content. SCORM is a collection of standards and specifications for web-based electronic educational technology. It defines communications between client-side content and a host system, which is commonly supported by a learning management system.

SCORM also defines how content may be packaged into a transferable ZIP file called "Package Interchange Format."

SCORM tells programmers how to write their code so that it can “play well” with other eLearning software. It is the de facto industry standard for eLearning interoperability.

Today it is still the industry standard for eLearning content, and nearly all LMS vendors support SCORM content.

¹⁶ It must be clarified that the free option is only for the Starter Toolkit for Moodle Version 3.11 and 4.0 only.

The advantages of SCORM are:

- Compatibility.
 - Almost any LMS will recognize a SCORM course.
- Saving progress.
 - A student doesn't have to go through the whole course at once. It can be done step by step. A half an hour of work, 10 minutes of rest, and then he's able to continue the lesson from the place where he stopped. All the progress remains. This is also convenient when the system fails or the course is occasionally closed.
- Feedback.
 - As teacher you will be able to assess the student's progress. When a student completes the e-course, the system will show how many points he scored, or the status "Course completed" will be displayed.
- Clear course structure.
 - You can build a clear course structure and set rules for moving between its sections. For example, learners may need to study a lecture first, then watch a video, and only then can they go to the final test.
- Modularity.
 - In a SCORM course, training material consists of standalone units, or modules. Each module can be used in any other course within the LMS.

You can create a SCORM package using a free tool like eXe eXeLearning (<https://exelearning.org>). Resources authored in eXe can be exported in IMS Content Package, SCORM 1.2/2004, or IMS Common Cartridge formats or as simple self-contained web pages. Once created, upload the SCORM zip file, via your browser or LMS administrator user interface.

eXeLearning allows you to create accessible materials following the WAI/WCAG guidelines. When creating materials with the latest version of eXe (currently 2.7), you can apply WCAG 2.1 guidelines, thus rendering your course content accessible and exporting it as a .zip file. Following elements are addressed:

- Properties
- Headings

- Lists
- Links
- Multicolumns
- Alternative text
- Tables with data
- Words in another language
- Styles and colours

The SCORM accessibility validator (see next) implemented by DiversAsia allows to doublecheck the export SCORM .zip file.

5.3.1.3 SCORM validation

To validate the accessibility of SCORM packages, we installed the SCORM accessibility validator Pa11y. Pa11y (<https://pa11y.org/>) is an open-source tool and includes and implements standards from 2 checkers, namely aXe and HTML CodeSniffer. Pa11y uses Puppeteer to run its own headless Chrome browser. Axe-core is an automated accessibility testing tool, while we use HTML Code Sniffer as its default runner. It can also run axe-core at the same time if set up like that. HTML_CodeSniffer comes with standards that enforce the three conformance levels of the Web Content Accessibility Guidelines (WCAG) 2.1, and the web-related components of the U.S. "Section 508" legislation.

How does it work? SCORM accessibility validator unarchives the SCORM package and selects and iterates only through the HTML files, and subsequently performs accessibility validation for each HTML file.

The outcomes are presented in a downloadable .zip file which contains a list of CSV files with the verification results for each HTML file from the validated SCORM package.

The result file contains the list of .cvs files that correspond to the HTML files from the SCORM package. Each .cvs file contains the list of errors that the validator found and that should be corrected.

The .cvs file will provide 5 fields:

- Type: is it a notice (things could be improved), a warning (manual check is required) or an error (correction is required).
 - A notice is general message about an element's accessibility. It isn't necessarily something that is wrong with your implementation, but rather a

notice to be aware of concerning a particular element. For example, a notice can be "Notice: Check that the title element describes the document."

- A warning is something that pa11y considers may be an issue, so you should take a look at it. For example, a warning you may receive on an element with a null alt attribute is "Warning: Img element is marked so that it is ignored by Assistive Technology.". Using a null alt attribute isn't necessarily an error, as null attributes can be intentional (see Alternative Text and Images), but it is something that you should look at to make sure
 - An error is a critical issue that should be fixed. For example, an error you may receive on an unlabelled for input is "Error: This text input element does not have a name available to an accessibility API."
- Code: It will indicate what WCAG2.1 principle was violated.
 - Message: It will provide the textual explanation of what principle was violated.
 - Context: It shows the actual faulty code.
 - Selector: It indicates in what section of the global structure of an HTML document the error occurred.

IMPORTANT: The SCORM package comes as a .zip file, however remove any .zip files within this .zip file to ensure the parser works correctly.

5.3.2 Digital Accessibility Checklist for Courses

See example <https://www.angelo.edu/faculty-and-staff/instructional-design/accessibility-checklist.php>.

Accessibility Checklist for Online Course Development:

<https://www.eiu.edu/fdic/docs/Accessibility-Checklist-for-Online-Course-Development.pdf>,
<https://www.qub.ac.uk/directorates/AcademicStudentAffairs/CentreforEducationalDevelopment/LearningTeachingandAssessment/LearningandTeaching/InclusiveLearningandTeachingandAccessibility/Resources/InclusiveTLandAccessFiles/Filetoupload,915536,en.pdf>,
<https://www.csun.edu/universal-design-center/course-accessibility-checklist>,
<https://www.waynec.edu/wp-content/uploads/vlcCourseAccListUpdated.pdf>,
<https://www.ed.ac.uk/information-services/learning-technology/accessibility/checklist>,
<https://teaching.unl.edu/classroom-climate/dei/accessibility-checklist/>,
<https://myresources.spcollege.edu/userfiles/Accessibility%20Checklist%20for%20Course%20Development2019.pdf>, <https://disabilityservices.gatech.edu/faculty/accessible-inclusive->

[instructional-material-checklist, https://www.su.se/ceul/english/resources/develop-your-teaching/accessible-teaching/checklist-for-accessible-teaching-1.560847](https://www.su.se/ceul/english/resources/develop-your-teaching/accessible-teaching/checklist-for-accessible-teaching-1.560847)

5.4 AT

Assistive technologies (AT) are devices that can assist you with daily tasks related to work or learning. They are necessary for many people to overcome obstacles, but they are also beneficial to everyone. In addition to AT, there are also everyday technologies for assistance. In fact, many educational and learning technologies make work and learning easier. They are not necessarily assistive per se, but they can be used to help.

On a campus, assistive technologies can be helpful in a number of areas:

- Reading
- Writing
- Maths
- Organisation

Typical barriers or difficulties that assistive technologies can help people overcome include:

- Sight: People who have trouble seeing will use technologies to help them magnify text on the screen, increase contrast, or have text read to them.
- Text decoding: For some people, decoding written letters is far more difficult. They are often best served by technologies that allow them to listen to text rather than read it. However, they benefit from larger text and fewer distractions. The same difficulty makes writing difficult. Dictating text is therefore an excellent solution.
- Distractibility: Some people have a much harder time focusing than others. They will benefit from tools that aid in the removal of distractions. Using productivity shortcuts to speed up or shorten long lists of tasks will also make it much easier for them to get things done.
- Keeping everything organized is much more difficult for some people than for others. Many tools, such as to-do lists, notes apps, and calendars, can be useful. However, many people find tools like mind maps (e.g., FreeMind - https://sourceforge.net/projects/freemind/files/freemind/1.0.0/FreeMind-Windows-Installer-1.0.0-max-java-installer-embedded.exe/download?use_mirror=deac-riga&download=) to be extremely useful for organizing information.

- Physical limitations: Many people find it difficult to control the computer in traditional ways. They might benefit from using a keyboard instead of a mouse or even speaking to navigate.
- Hearing: People who cannot hear clearly (or at all) benefit from technology that adds captions to voice. There are also many technologies that make sound clearer and louder to assist people with limited hearing.

IMPORTANT: Many people have similar experiences and can benefit from these technologies as well.

The solutions to the aforementioned problems are frequently very similar.

- Interaction should be barrier free¹⁷:
 - Language learning communication: word scanners, audio books and players, alternative keyboards, text readers, voice-recognition software, or word-prediction software.
 - Speech communication: voice-output devices, pantomime, pocket translators, pictures and symbols on paper, electronic switches, and computer-generated speech-output devices, text-to-voice and voice-to-text software, touch screens that give choices for communication, and translating devices. Text-to-speech and voice dictation (speech-to-text) technology (see <https://youtu.be/j4oAr5DSyG8>)
 - Reading comprehension: magnification, text-to-speech software, concept-mapping, audio books, players, and scanners with optical character recognition, text reading software, word prediction, pens that recognize specific words or letters, word processors with spell and grammar check, font size and colour options, smart phones, eReaders, visual thesauri, iPod eBook creator, bubbl.us (a graphic organizer for students to create a visual representation of text to assist in comprehension).
 - Listening Communication Devices: hearing-aid technology, hearing enhanced headphones.
 - Sound amplification communication systems: microphone and speaker, telephones fitted with amplifiers, sound-field amplification.
 - Voice amplifiers communication: ear voice amplifiers.

¹⁷ Overview of Assistive Technology Possibilities for Teachers to Enhance Academic Outcomes of All Students, Joseph P. Akpan Ph.D., Lawrence A. Beard* Ed.D., Universal Journal of Educational Research 1(2): 113-118, 2013, DOI: 10.13189/ujer.2013.010211, <https://files.eric.ed.gov/fulltext/EJ1053993.pdf>

- Magnifiers communication: magnification aids (optical and nonoptical) - handheld magnifiers, stand magnifiers, prisms of special lenses built into glasses to extend visual field, telescopes worn on the head or held in the hand; enlarged print books and enlarged print computer screen, high intensity lamps, and high contrast colours on print, screen enlarger, closed circuit television devices with larger image size, automatic reading of text, talking books.
- Voice recognition software communication: voice recognition software.
- Augmentative communication: non-speech methods of communication, including gesture, manual signs, picture or symbol-based communication systems, and computer-based speech-generating devices, object-based communication displays, picture communication boards and books, alphabet boards, talking switches, light technology voice output communication devices, middle technology voice output communication devices, high technology voice output communication devices, and integrated communication solutions.
- Physical aids communication: microswitch, voice output, Braille operating appliances.

Suitable solutions in a class environment

Below is an example overview of suitable solutions¹⁸:

Examples of Assistive Technology by domain

	Low- to Mid-tech	Mid- to High-tech	Apps for Mobile Devices
Receptive	Notepad – Notepads are an excellent way to record information. Students with learning disabilities (LD) may appreciate having the information colour-coded based on the purpose, topic, or function of the information.	<p>Audio recorders – Audio recorders that store hundreds of hours of audio.</p> <p>Talking dictionary – Students with LDs can use talking dictionaries to verify definitions and spelling. Talking dictionaries are small enough to be carried in a pencil case and are not as</p>	Audiobooks – Provides a simple way to listen to books.

¹⁸ Source: Adapted from <https://www.ldatschool.ca/assistive-technology/>

		expensive as computers or tablets.	
		Visuwords – This free online dictionary allows students to look up words to find their meanings and associations with other words and concepts.	
Speaking	Cue cards – Cue cards provide helpful hints for the oral presentation of information, and the process of composing cue cards can help organize the information before-hand.	Prezi – A free 3D graphic organizer which can be used to create presentations. Prezis can be collaborative as students can comment and build upon other Prezis.	ShowMe Interactive Whiteboard – In order to reduce anxiety, students may opt to record presentations on their iPad beforehand. Video recordings can be uploaded on YouTube or a more private domain.
Reading	Highlighter strips – Translucent rectangles of colour can help eliminate extra visual clutter by blocking out the rest of the text. Sticky notes – Students with LDs may find it useful to summarize the main ideas of the text with sticky notes which can be stuck directly on the page.	Kurzweil 3000 – Text-to-speech software, such as Kurzweil 3000, can read aloud digital or printed text. Project Gutenberg – Over 45,000 free e-books. Wikipedia – The Simple English function on Wikipedia allows content to be “translated” into plain English which is easier to read.	Speak Selection – Located in the accessibility features of Apple devices, Speak Selection can be used to read aloud electronic text. Free Books – This app contains more than 23,000 free books. Notes, highlight option, bookmark and dictionary tools are provided. GoodReader – This PDF reader allows you to add sticky notes, highlight and take notes.
Writing	Pencil grips – For students who struggle with handwriting, pencil grips can provide a surface that is easier to manipulate. Computerized pens – These pens can automatically transmit handwriting into digital text. Some computerized pens have audio-recording functions that allow the writer to listen to specific sections of the audio file by tapping on the written notes.	Word processing – Functions such as spell check, dictionary options, synonym support, and word-prediction features are helpful for students with learning disabilities.	Pages – The Pages app allows you to compose, edit work and share. It also includes word prediction, speech-to-text, and spell check functions. iWordQ – iWordQ provides reading assistance, word choice and proof-reading functions. Dragon Dictation – This easy-to-use voice recognition application allows you to speak and instantly see your text or e-mail messages. You must be connected to the Internet for this application to work.
Reasoning	Graphic organizers – Organizing ideas visually allows students with LDs to	Inspiration – This software helps students organize ideas visually without the challenge of	SimpleMind+ – This app allows you to brainstorm and organize your ideas. Completed concept maps can

	<p>see the connections between ideas.</p> <p>Audio recorders – Many students with LD experience difficulty translating oral language into written text. Recording ideas early in the thinking process can provide a record for later recall and clarification.</p>	<p>handwriting or spelling requirements. The content can be instantly translated into outlines for essays or compositions.</p> <p>Spark-Space – This software supports the writing of students who are visual learners through the use of functions such as idea mapping essay writer tool.</p> <p>Audacity – Audacity is a free software program which allows you to record and edit sounds.</p>	<p>be automatically converted to an outline.</p>
Math	<p>4-function calculator – Depending on the type of work being done, a 4-function calculator can be a great help without providing disproportionate advantage to students with LDs.</p>	<p>Graphing calculator - Graphing computers can solve complex equations, and the dynamic display screen allows the student to verify the results before solving on paper.</p> <p>Math Dictionary for Kids – An animated, interactive online math dictionary that explains over 600 common mathematical terms in simple language.</p>	<p>ShowMe and ScreenChomp – These apps provide an interactive whiteboard interface to solve problems. The actions on the screen and audio can be recorded and shared as a video file.</p>

5.4.1 Assistive technology per target group

Below table¹⁹ shows the relevant domains of potential AT application by disability.

Disability	Domains					
	access	behaviour/social	communication	independence	learning	mobility
autism spectrum disorder	•	•	•	•	•	
deafness	•		•	•	•	•

¹⁹

Disability	Domains					
	access	behaviour/social	communication	independence	learning	mobility
deaf-blindness	•		•	•	•	•
emotional and behavioural disorders		•			•	
hearing impairment	•			•	•	
intellectual disability	•	•	•	•	•	•
orthopaedic impairments	•			•	•	•
specific learning disability	•			•	•	
speech language or communication	•	•	•	•	•	•
traumatic brain injury	•		•	•	•	•
visual impairment	•		•	•	•	•

Our focus in DiversAsia is mainly on communication and learning domains when it regards having inclusive access to course content, while also the accessibility of premises is considered.

Following section focuses on the communication and learning part.

5.4.1.1 *Blind / vision impaired*

- Screen reading software: Screen reading software allows students who are blind or visually impaired to access and navigate computers and digital content. The software reads aloud buttons, body text, websites, and so on, and allows blind users to access most computer functions via keyboard shortcuts and tabbing. JAWS, NVDA (free),

VoiceOver and Narrator are the most commonly used screen reader²⁰. And which screenreader works best with which browser?²¹:

- JAWS works well with Chrome, Edge, Firefox.
 - NVDA works well with Firefox, Chrome, and Edge.
 - Narrator works best with Microsoft Edge.
 - VoiceOver works best with Safari.
- Scanning/text to speech software: Kurzweil 1000 is a screen reading tool for the blind and visually impaired. It uses a computer and a scanner to convert printed text into speech. It enables the student to edit scanned documents. As the student types, the text is spoken aloud. Kurzweil can even speak a highlighted section of text before the student cuts, copies, or pastes it. The Kurzweil 3000 allows text to be scanned from a paper source and read back by the software while the student listens. The student can highlight important information and annotate the document.
 - Screen magnification software: Consider ZoomText. This software enlarges the image on a computer screen so that students with vision impairments can see it more clearly. Screen magnification frequently necessitates the use of a larger monitor. This provides enough information on the screen for the student to continue making sense of the data and its relationship to the document as a whole.
 - Voice recognition software: Voice recognition systems, such as Dragon Naturally Speaking, allow people with disabilities to dictate documents to computers instead of using the keyboard and mouse. Consistent speech patterns, as well as a brief period of training the software to recognize your speech patterns, are required, as is some post-dictation editing.

5.4.1.2 Deaf / hearing impaired

- Induction loop systems: A hearing loop, also known as an induction loop, T-Loop, or audio frequency induction loop (AFIL), is an assistive listening system that provides access to facilities for people who have hearing loss and use a hearing aid. An induction loop system broadcasts room audio via an electromagnetic field created by a concealed wire running around the room's perimeter. The speaker's microphone sends electromagnetic signals along the wire to the user's hearing aids.
- Real time captioning systems: Real-time captions, also known as Computer Assisted Real-time Translation (CART), are generated in real time as an event occurs. A

²⁰ <https://webaim.org/projects/screenreadersurvey8/>

²¹ <https://dequeuniversity.com/screenreaders/survival-guide>

captioner (who is often trained as a court reporter or stenographer) works with a stenotype machine equipped with a phonetic keyboard and special software.

5.4.1.3 *Mobility impairment*

- Voice recognition software: Voice recognition systems, such as Dragon Naturally Speaking, allow people with disabilities to dictate documents to computers instead of using the keyboard and mouse. Consistent speech patterns, as well as a brief period of training the software to recognize your speech patterns, are required, as is some post-dictation editing.
- Adapted/ergonomic keyboards: Adapted or ergonomic keyboards are designed and shaped to meet the needs of the user. Two-way tilts, wrist rests, and split angle key layouts are among the features available, and in some cases, the entire shape and layout of the keyboard is altered. Models for one hand are also available. The keyboards are specifically designed to reduce strains, movements, twists, and tensions, as well as the pain and effort associated with typing. They are best suited for students who have difficulty with hand dexterity.
- Mouse controls: These types of AT provide an alternative mouse input method and are useful for students who have fine motor control issues or who have difficulty controlling a standard mouse.

5.4.1.4 *Specific learning difficulty*

- Mind mapping software: E.g., FreeMind. Mind mapping software helps students to plan projects visually and understand ideas through connecting visual concepts. Inspiration is a Windows based organisational and study skills tool, which assists students with the organisation and planning of written tasks. It is particularly valuable for those who tend to think in non-linear fashion, such as students with dyslexia.
- Reading and writing tools: E.g., Read & Write Gold, Kurweil 3000. These tools have a wide range of specialist facilities which can help students both digest written text and compose it with accurate spelling and grammar. They include a read-back facility, word completion, word suggestion, automatic corrections, the capacity to screen-read spelling options, homophone recognition and a speaking thesaurus as well as added on project planning tools. These packages have been specifically designed for computer users with dyslexia and other specific learning difficulties.

5.4.2 Embedded AT in mainstream products used in education (pc, laptop, smartphone, ...)

The Accessibility application programming interfaces (APIs) that have been developed for various desktop and mobile operating systems, starting with Windows 95 in 1995, have

pushed assistive technology to a complete other level. Why? Because APIs are used to communicate semantic information about the user interface to assistive technology software used by people with disabilities. Hence, from then on there was no more scanning of an interface required, instead the operating system ensured that the assistive technology knew exactly what the content (objects and events) was it had to convey to the screen reader, the refreshable braille display or braille terminal, etc.

- 1. iOS
 - Accessibility features for iOS (<https://www.apple.com/ca/accessibility/mac/learning/>)
- 2. Android
 - Accessibility features for Android (<https://www.android.com/accessibility/>)
- 3. Windows
 - Accessibility features for Windows (https://www.microsoft.com/en-us/accessibility/windows?activetab=pivot_1:primaryr2)

Check:

https://www.researchgate.net/publication/338497138_Assistive_Technology_to_Help_Students_With_Disabilities

Global report on assistive technology

(<https://apps.who.int/iris/rest/bitstreams/1424204/retrieve>):

<https://link.springer.com/article/10.1007/s11423-022-10127-7>

5.4.3 General info

5.4.3.1 History of assistive technology

Although the first wheelchair was invented hundreds of years ago, the invention of Braille in the nineteenth century is widely regarded as the origin of modern assistive technology devices. Yet, technology as a whole contributed with bits and pieces to the creation/invention of assistive technology. The intertwining between consumer technologies and assistive technologies has been a productive combination, as is demonstrated in below timeline:

- 1808 – 1st typewriter
 - Pellegrino Turri creates the first typewriter. He made it for his visually impaired friend, Countess Carolina Fantoni da Fivizzano. He wanted to assist her in writing legibly.
- 1829 - Creation of Braille

- Braille is a tactile writing system used by the blind and visually impaired that is still widely used today. After being developed by Frenchman Louis Braille, it was officially published in 1929. Braille had been blinded as a child in an accident.
- 1872 – Bell teaches deaf teachers
 - Alexander Graham Bell establishes a permanent residence in the United States at 35 Newton Street in Boston, where he teaches normal classes for deaf teachers.
- 1876 - The first hearing aid
 - Alexander Graham Bell receives a telephone patent (No. 174,465). The telephone was one of many devices Bell created to aid his work with the deaf. Alexander Graham Bell's technology is used to create the first portable hearing aid.
- 1886 – Punched cards
 - Herman Hollerith came up with the idea of using punched cards to store and transport information, which was used until the late 1970s. The punched cards were read electronically by transporting them between brass rods, which made contact when there were holes in the cards, allowing an electric current to flow. This device was built in order to tabulate the 1890 census. This construction was a significant improvement over hand tabulation, which was expected to take more than a decade. This tiny invention was dubbed the computer.
- 1896 - Tabulating Machine Company
 - Hollerith established the Tabulating Machine Company.
- 1898 - First electronic hearing aid
 - The first electronic hearing aids, small enough to fit in a purse, are developed. They are known as the Akouphone.
- 1916 – Binaural headset
 - Harvey Fletcher joined Bell Labs' Research Division to work with Irving Crandall on hearing and speech. In the 1920s, he built the Western Electric Model 2A hearing aid and a binaural headset, and in 1929, he published the widely-read book *Speech and Hearing*, which analysed the properties of sound.
- 1917 – Condenser microphone

- The condenser microphone was invented by E.C. Wente [Bell Labs] which converted sound waves into electrical waves that could be transmitted by the vacuum tube amplifier.
- 1918 – 1st balanced-armature loudspeaker driver
 - On October 6, 1922, Henry Egerton patents the first balanced-armature loudspeaker driver, based on Thomas Watson's 1882 balanced armature telephone patent, and used in the Bell Labs No. 540AW speakers developed by N. H. Ricker.
- 1921 – 1st public address systems
 - The first public address systems were created by combining amplifier, microphone, and loudspeaker innovations. The largest public demonstration of such a system occurred on Armistice Day, when over 80 loudspeakers linked by telephone lines in New York, San Francisco, and Arlington heard the national broadcast of the burial of the Unknown Soldier at Arlington Cemetery. The following year, standardized public address systems were introduced.
- 1924 - Tabulating Machine Company becomes IBM
 - Twenty-eight years after Hollerith [1896] founded the Tabulating Machine Company, it becomes International Business Machines (IBM), a well-known company today. Everyone associates this company's name with the use of computers.
- 1935 - Talking books
 - By reading aloud books, the phonograph is used for both entertainment and education.
- 1934 - Readphone
 - In this year, the Readphone was invented. It reproduced literature and music on long-playing discs. Dr. Herbert Putnam, librarian, and Dr. H.H. B. Meyer, director, Project, Books for the Blind, Library of Congress, were shown this "Readophone Talking Book." The Readophone disc had a recording time of two hours and twenty minutes, which equated to twenty-eight thousand words.
- 1936 - First electronic speech synthesizer
 - Bell Labs had been interested in the properties and analysis of human speech since its inception, originally developed to help deaf people learn to speak intelligibly. Because of this work, it was unavoidable that a Bell Labs scientist would create an artificial talking machine, which H.W. Dudley did in 1936. It

was the world's first electronic speech synthesizer, and it required an operator to supply "prosody" - the pitch, timing, and intensity of speech - via a keyboard and foot pedals. Dudley dubbed his device the "voice coder," but it quickly became known as "Voder."

- 1948 - First transistor hearing aids
 - In order to develop more reliable, powerful, flexible, smaller, cheaper, cooler-running, and less power-consuming hearing aids, John Bardeen and his Bell Labs colleagues William B. Shockley and Walter H. Brattain invented the transistor. This well-known invention earned Bardeen and his colleagues the Nobel Prize in Physics in 1956. Hearing aids are hereby becoming smaller and easier to use as technology advances.
- 1951 - Perkins Braille typewriter
 - The Perkins Braille typewriter allows people to type in Braille. Writing Braille used to be a difficult task.
- 1952 – 1st speech recogniser
 - The first speech recognizer was developed in 1952 by Bell Labs' Davis, Biddulph, and Balashek as an offshoot of Bell's work in the deaf community. It was reported that after training, the machine achieved 97 percent accuracy on spoken forms of ten digits.
- 1960's - Sip and puff wheelchair
 - The Sip and Puff technology, developed by the University of Chicago, controls the device via air pressure, similar to puffing through a straw. Sip and Puff systems are primarily used today by quadriplegics.
- 1972 - ARPANET
 - The ARPANET's host-level protocols were created by Vinton Cerf. The first large-scale packet network was ARPANET. Cerf, who had been deaf since birth, married a deaf woman. Cerf used text messaging to communicate with his wife.
- 1975 - OCR
 - CCD (Charge Coupled Device) flatbed scanners, which are now commonplace, did not exist in the early 1970s, when Ray Kurzweil and his team at Kurzweil Computer Products developed the Kurzweil Reading Machine and the first omni-font OCR (optical character recognition) technology. The Kurzweil team developed its own scanner using the first CCD integrated chip, a Fairchild 500 sensor linear array. They did this work to help the blind.

- 1976 - Kurzweil Reading Machine
 - The first computer program that recognized printed letters was the Kurzweil Reading Machine. The first handheld speech synthesizer was also developed that year.
- 1977 - Adaptive Firmware Card (AFC)
 - This card enables people with disabilities to use an alternate keyboard on a computer while only requiring one switch.
- 1986 – 1st screenreader
 - IBM Screen Reader, created by Jim Thatcher, was the first screen reader (for DOS). The Research Centre for the Education of the Visually Handicapped (RCEVH) at the University of Birmingham also developed a Screen Reader for the BBC Micro and NEC Portable.
- 1988 – Picture based keyboard
 - Picture-based keyboards were for the first time being used in retail point-of-sale (POS) devices (mostly fast-food restaurants). This technology was created in the mid-1960s to allow people who couldn't speak to communicate using a keyboard, computer, and speech synthesizer.
- Mid-1990's - Many new products
 - Voice-activated phones, lamps, and switches were available for people who were paralyzed. There were talking caller IDs, pagers, alarm clocks, calculators, watches, and variable-speed/pitch tape recorders for the blind. There were phones with large button keypads for people with mobility issues. There were phones with volume controls for the deaf and hard-of-hearing.
- 1992 - Computer operating systems include speech synthesizers
 - Text-to-speech computer programs are included to assist people with disabilities in accessing written materials.
- 1996 - FM amplification hearing aids
 - Students with hearing impairments, as well as other students in the classroom, benefit from FM amplification technology.
- 1997 - Microsoft Active Accessibility (MSAA)
 - Microsoft Active Accessibility (MSAA) is a user interface accessibility application programming interface (API). MSAA is intended to assist Assistive Technology (AT) products in interacting with standard and custom user interface (UI) elements of an application (or the operating system), as well as accessing, identifying, and manipulating UI elements of an application. The MSAA 1.0 becomes the original add-on release for Windows 95. MSAA has

been built into all versions of the Windows platform since Windows 98 and Windows NT 4.0 Service Pack 4, and has received periodic upgrades and patches over time.

- 1998 - ATIA
 - The Assistive Technology Industry Association (ATIA) is founded in 1998.
- 1998 - Loopset
 - Nokia releases the LPS-1 Loopset. Hearing aid users now have newfound mobility thanks to this new device. The Loopset, which uses induction technology, enables hearing aid users to communicate on digital mobile phones. It has an integrated microphone for hands-free operation and is compatible with Nokia 5100 and Nokia 6100 series phones that have an automatic answer function that works with the Nokia Loopset.
- 1999 - WCAG
 - The World Wide Web Consortium (W3C) publishes Web Content Accessibility Guidelines. Web content developers can use this specification to create accessible web pages.
- 2000 – On-screen keyboard
 - Microsoft Windows 2000 was released, and it included an on-screen keyboard and the ability to convert text to speech for illiterate or blind users.
- 2002 – Apple’s Universal Access
 - With the launch of OS X 10.2 Jaguar, Apple introduced Universal Access. Universal Access is a feature of the macOS operating system that allows people with visual, hearing, or physical disabilities to use computers.
- 2006 - Release of free OSS screenreader NVDA
 - Concerned by the high cost of commercial screen readers, Michael Curran initiated in 2006 the development of NonVisual Desktop Access (NVDA), a free and open-source, portable screen reader for Microsoft Windows. In 2021, NVDA was the second-most popular screen reader in use throughout the world in a survey by WebAIM.²²
- 2006 - Release of Speak, to become eSpeak
 - eSpeakNG is a free and open-source, cross-platform, compact, software speech synthesizer. It works on Linux, Windows, macOS and FreeBSD.²³
- 2006 - Release Orca screenreader for Unix

²² https://en.wikipedia.org/wiki/NonVisual_Desktop_Access

²³ <https://en.wikipedia.org/wiki/ESpeak>

- Orca is a free and open-source, flexible, extensible screen reader from the GNOME project for individuals who are blind or visually impaired. Orca is provided by default on a number of operating system distributions, including Solaris, Fedora, openSUSE and Ubuntu.²⁴
- 2009 – Apple’s VoiceOver
 - The iPhone 3GS with VoiceOver was released by Apple. This was the first screen reader to use touch screen gestures. Over the years, Apple products, such as the iPhone, iPod, and iPad, include a plethora of apps that people and students with disabilities can use, such as voice recording.
- 2015 – Microsoft Learning Tools
 - Microsoft’s Learning Tools for Dyslexia make their debut, the result of an accessibility hackathon that took place the same year. Microsoft Learning Tools are free tools that use proven techniques to improve reading and writing for people of all ages and abilities. The Microsoft Learning Tools suite is natively built into Office 365 and Microsoft Edge applications and aids in the improvement of reading, writing, and comprehension. The immersive reader feature in Learning Tools allows users to have content read aloud to them and adjust settings such as breaking words into syllables, text size, and background colours.

5.4.4 Assistive technology resource databases

5.4.4.1 Europe

The EASTIN Portal (<http://www.eastin.eu/en-gb/searches/products/index>) aggregates the contents of six national AT databases, searchable in 22 European languages. It is such Europe's most important assistive technology information system.

²⁴ [https://en.wikipedia.org/wiki/Orca_\(assistive_technology\)](https://en.wikipedia.org/wiki/Orca_(assistive_technology))

The screenshot shows the EASTIN database website. At the top, there is a navigation bar with links for SEARCHES, WHAT IS EASTIN, ABOUT US, DOCUMENTS, ASPREX, and GATE. Below this is the main header with the text "Global Assistive Technology Information Network" and "The worldwide search engine on Assistive Technology". A search bar is present with a "SEARCH" button. Below the search bar, there is a section for "Search Assistive Products" with several input fields: "Enter the product name (brand name or model number of the product)", "Enter the manufacturer's name", "Select a keyword (each word matches with an ISO classification code)", and "Select the product's insertion date". There are also "Advanced Search" and "Search" buttons. At the bottom, there is a cookie notice.

Figure 16: EASTIN database

You can perform a search based on:

- Assistive product – search by ...
 - Product name (brand name or model number of the product)
 - Manufacturer's name
 - Keyword (each word matches with an ISO classification code)
 - Product's insertion date
- Companies – search by ...
 - Name
 - Keyword (each word matches with an ISO classification code)
- Library – search by ...
 - Type of document
 - Articles
 - Case descriptions
 - Ideas
 - Title
 - Author
 - Keyword (each word matches with an ISO classification code)

Everyone can also contribute by submitting a product.

The EASTIN database uses the ISO classification codes, defined by the ISO 9999:2016 standard. The main classes are:

- 04: assistive products for measuring, supporting, training or replacing body functions
- 05: assistive products for education and for training in skills
- 06: assistive products attached to the body for supporting neuromusculoskeletal or movement related functions (orthoses) and replacing anatomical structures (prostheses)
- 09: assistive products for self-care activities and participation in self care
- 12: assistive products for activities and participation relating to personal mobility and transportation
- 15: assistive products for domestic activities and participation in domestic life
- 18: furnishings, fixtures and other assistive products for supporting activities in indoor and outdoor human-made environments
- 22: assistive products for communication and information management
- 24: assistive products for controlling, carrying, moving and handling objects and devices
- 27: assistive products for controlling, adapting or measuring elements of physical environments
- 28: assistive products for work activities and participation in employment
- 30: assistive products for recreation and leisure

Each of them goes deeper in subclasses and divisions.

For DiversAsia, the most relevant are:

- 05: assistive products for education and for training in skills
- 22: assistive products for communication and information management
- 28: assistive products for work activities and participation in employment
- 30: assistive products for recreation and leisure

Example:

You can find a DOLPHIN - EASY READER as following (ISO Code 22.30.03):

- The first two digits stand for Class 22 “Assistive products for communication and information management”;
- The following two digits stand for subclass 22.30 “Assistive products for reading”;
- The last two digits stand for this specific division 22.30.03, “Reading materials with audible output”.


IMPORTANT: Free AT is also included

5.4.4.2 Africa

In Africa the Southern Africa AT Database (<https://assistivetechmap.org/>) is one key component of the Assistive Technology Information Mapping Project (AT-Info-Map). The initiative is mapping the availability of different types of assistive technology in 10 countries in Southern Africa (Angola, Botswana, Eswatini, Lesotho, Malawi, Mozambique, Namibia, South Africa, Zambia, Zimbabwe).

The main functionalities are:


- Search for companies that sell assistive technology products in southern Africa across 17 categories (see <http://atinfomap.org/assistive-technology.html>).
- Search for Organizations that Provide disability services in southern Africa across 4 categories (<http://atinfomap.org/disability-services.html>).
- Everytime a listing can be added as well.



HOME
ABOUT US
SUBMIT LISTING
DONATE
LEARN ABOUT AT
CONTACT US

Search for Assistive Technology


Search for companies that sell assistive technology products in southern Africa across 17 categories











Add Listing >

Search for Disability Services

Search for Organizations that Provide disability services in southern Africa across 4 categories




Add Listing >

 Clocks Alarms And Memory
 Communication
 Eating And Drinking
 Environmental Modifications
 Eye And Skin Protection
 Hearing
 Mobile And Computer
 See All

Southern Africa AT Database











This **Assistive Technology (AT) Database** is one key components of the Assistive Technology Information Mapping Project (AT-Info-Map). The project is funded by the Google Impact Challenge to make the world more accessible for persons with disabilities by increasing access to assistive technologies. AT includes a wide range of technology products that are used to support persons with disabilities as they work, learn, play and live in their communities. Some examples of AT include: crutches, wheelchairs, ramps, hearing aids, Braille printers, adaptive software, communication devices, just to mention a few. This project serves to map the current availability of different types of AT in ten countries in Southern Africa, and works with local disability organizations to address gaps in AT availability.


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Figure 17: Southern Africa AT Database

IMPORTANT: Unsure if Free AT is also included

5.4.4.3 Belgium – Database AT for HE

The Support Centre Inclusive Higher Education (<https://www.sihob.be/en/tools>) provides a database of AT especially useful for students in higher education. It is available in Dutch and English.

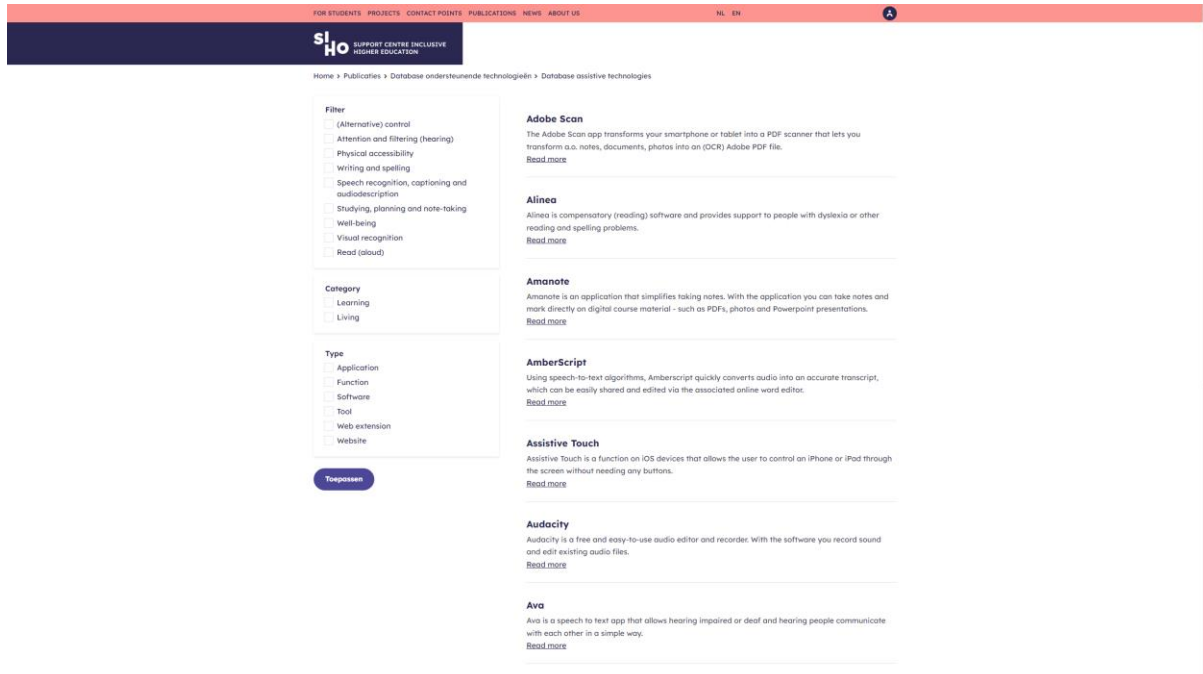


Figure 18: Support Centre Inclusive Higher Education AT database

The Support Centre for Inclusive Higher Education (SIHO) serves both policy makers and institutions in the development and implementation of equity measures for inclusive higher education.

The search is organised as following (cumulative checkboxes):

- Filter
 - (Alternative) control
 - Attention and filtering (hearing)
 - Physical accessibility
 - Writing and spelling
 - Speech recognition, captioning and audiodescription
 - Studying, planning and note-taking
 - Well-being
 - Visual recognition
 - Read (aloud)
- Category
 - Learning

- Living
- Type
 - Application
 - Function
 - Software
 - Tool
 - Web extension
 - Website

IMPORTANT: Free AT is also included

This website provides also an overview (contact details - <https://www.siho.be/en/contact-points>) of all contact points for students with disabilities of every higher education institution in Flanders. The student can consult the contact point for questions about study choice, support, housing, and studying abroad.

5.4.4.4 Australia

Australia has its Australia's National Equipment Database (<https://askned.com.au/>) which provides information about more than 20000 AT products.

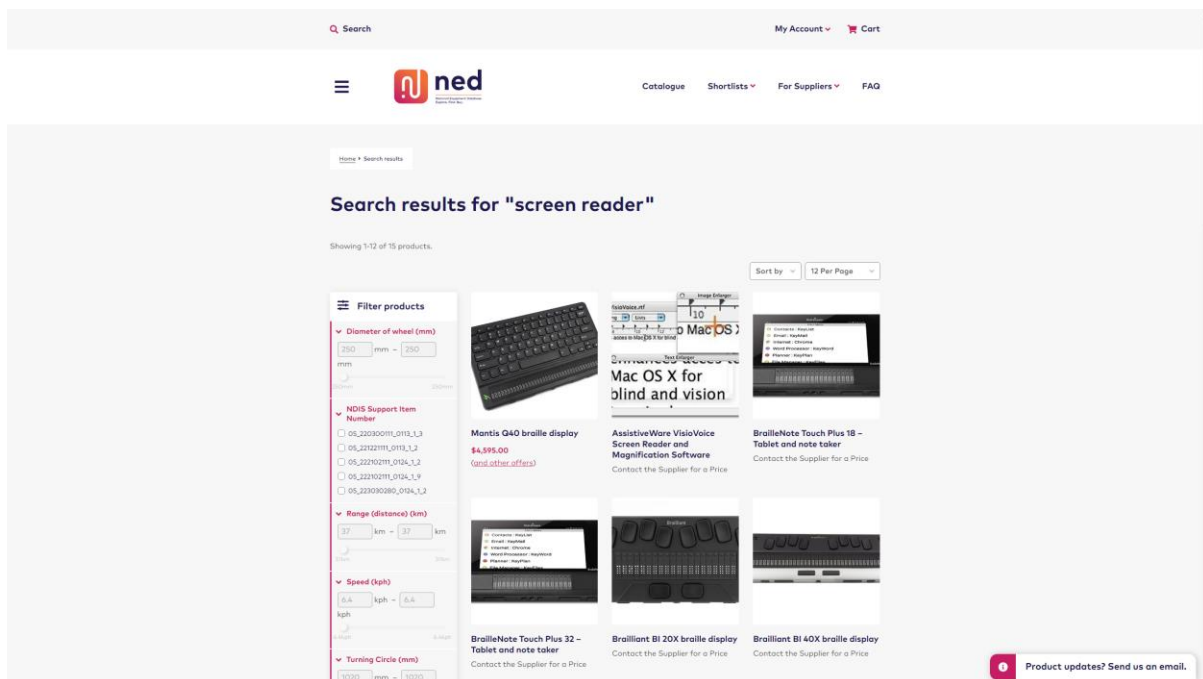


Figure 19: Australia's National Equipment Database

IMPORTANT: Free AT is seemingly not included

Also Assistive Technology Australia operates an online database (https://at-aust.org/home/assistive_technology/assistive_technology). Regarding computer access (https://at-aust.org/major_groups/13/grid/1) they offer a simplified search mechanism.

Assistive Technology Australia™
Endless Possibilities for All

[Home](#) [Who We Are](#) [What We Do](#) [Product Search](#) [Assistive Technology](#) [Access](#) [Training](#) [Publications](#)

Browse Products: Computer Access

[Login](#)

[Back to All Categories](#)

Browse - Computer Access

Cases	Mouth Sticks / Head Pointers / Hand Sticks	Software - Speech Recognition for Computer Access
Keyboards, Keypads and Alternatives	Notebooks and Notetakers	Software - Switch Access
Keyguards & Other Keyboard Accessories	Resource People	Software and Apps - Language, Literacy Support
Miscellaneous	Software - Access Enhancement and Word Prediction	Switch Interfaces and Accessories
Mounts and Stands	Software - General	Switches
Mouse Options, Emulators and Accessories	Software - Screen Reading	Touch Screen Monitors

Displaying products 1 - 8 of 360 Sort by [Name: Alphabetically](#) [Update](#)

View as: [Grid](#) | [List](#)
[« Previous](#) | [1](#) | [2](#) | [3](#) | [4](#) | [5](#) | ... | [44](#) | [45](#) | [Next »](#)

 360 Rotating Tablet Stand Desk <small>Gooseneck Mount for Tablets</small> A 360 degree rotating mount for tablets. Padded to protect your tablet from s...	 3M Ergonomic Mouse A computer mouse with an upright vertical grip that reduces wrist strain. Ava...	 No Image Available Ability Technology Ability Technology provides a service for people with disabilities in the are...	 Able Net Chester Creek VisionBoard 2 The Chester Creek VisionBoard 2 has large and high visibility keys. Suitable ...
 Ablenet Big Beamer Twist Switch (Wireless) The Big Beamer Twist Switch is a large round switch with a built in wireless ...	 AbleNet Big Blu VisionBoard The AbleNet Big Blu VisionBoard has white keys with bold black lettering to m...	 AbleNet BigTrack Trackball The BigTrack is a trackball style device that can be used in place of a stand...	 AbleNet Blue2 Bluetooth Switch The Blue2 switch is compatible with all switch accessible apps. It provides s...

[« Previous](#) | [1](#) | [2](#) | [3](#) | [4](#) | [5](#) | ... | [44](#) | [45](#) | [Next »](#)

[Contact](#) [Donate](#) [Virtual Tour](#) [Disclaimer](#) [Terms](#) [Privacy](#)

Figure 20: Assistive Technology Australia AT database

IMPORTANT: Free AT is also included

5.4.4.5 Open Assistive: Open Software and Hardware

Open Assistive (<https://openassistive.org/>) allows to share, catalogue and find open assistive technology hardware and software projects.

The provided search facilities allow to find catalogued projects via an overall search or by browsing all items by tag (<https://openassistive.org/tags/>). Doing the latter, a complete overview is available of all free hardware and software.

The screenshot shows the search results for the keyword "screen" on the Open Assistive website. The search bar at the top contains the word "screen" and a "Lookup" button. Below the search bar, it indicates "36 posts found". The results are listed as follows:

- Screader** (27 Jan 2016): A screen reader using software or hardware speech synthesizer. The background program screader reads the screen and puts the information through to a software Text-To-Speech package (Like 'festival') or a hardware speech synthesizer (like Accent).
- OptiKey** (24 Aug 2017): An assistive on-screen keyboard which runs on Windows. It is designed to be used with a low cost eye-tracking device to bring keyboard control, mouse control and speech to people with motor and speech limitations, such as people living with Amyotrophic Lateral Sclerosis (ALS) / Motor Neuron Disease (MND). OptiKey was written to challenge...
- KeyboardX** (24 Oct 2017): A multi-purpose on-screen keyboard. It was designed with the needs of handicapped persons in mind. Due to its flexibility it can be used for several tasks though. Find more in [features](#). It was originally developed as a master thesis project for [Instituut Integriert Studeren at JKU](#). Currently it's hosted as an open source project...
- FatBits** (11 Jan 2016): Magnifies an area of the screen centered around the mouse pointer and paints the giant pixels into a small, tastefully decorated window. This can be indispensable when you want to see something right down to the last pixel. Once the text has been magnified (up to 20x), Fatbits can also smooth it, and change the colours used. The website...
- Non Visual Desktop Access (NVDA)** (27 Jan 2016): NVDA (NonVisual Desktop Access) is a free screen reader for computers running on the Windows operating system. Here is a snapshot of just some of NVDA's features.
 - Support for popular applications including web browsers, email, internet chatting, and office programs including Word and Excel.
 - NVDA can be installed directly on to your computer, but...
- Click-N-Type virtual keyboard** (27 Jan 2016): This is a flexible and powerful on-screen keyboard. To customise the keyboards you will need to be fairly computer literate, but other than that it is also quite easy to use. It includes basic word prediction. Click-N-Type is an on-screen keyboard which allows you to type with the use of a pointing device (e.g. mouse or tracker ball) rather than...
- SAW - Special Access to Windows** (27 Jan 2016): SAW - Special Access to Windows - is a programmable on-screen keyboard. It is a powerful tool for providing Access to the Windows operating system for people who need alternative Switch or Pointing device input options. The use SAW 6 version - sponsored by the AFGIS project (<http://www.aafis-project.eu/>) - is now available. It is fully Windows 7...

Figure 21: Overall search

The screenshot shows the search results for the tag "alternative-access" on the Open Assistive website. The search bar at the top contains the word "alternative-access" and a "Lookup" button. Below the search bar, it indicates "36 posts found". The results are listed as follows:

Search tag

alternative-access alternative and augmentative communication text-to-speech switches communication learning and education viewing the screen educational and learning switch input software using the mouse computer automation other function text input projects unmoderated accessing the web alternative mice on screen keyboard projects eyegaze symbols developer tools joysticks long-aid weighing framework other-need symbol library alternative mice daily living voice-recognition head-mouse mobility general-mobility environmental-control general-tools face-mouse moderated mouse-cow mounting supports

alternative-access (43)

- Agrip - June 21, 2016
- AssistiveKey - June 21, 2016
- CClickKey - June 21, 2016
- Click-Catch - June 21, 2016
- Click-N-Type virtual keyboard - June 21, 2016
- Inclusive Serial Switch Driver - June 21, 2016
- Jamba - June 21, 2016
- JoyToKey - June 21, 2016
- Orca - June 21, 2016
- PP Power Reader - June 21, 2016
- Plaphoons - June 21, 2016
- Point N Click - June 21, 2016
- SITPLUS - June 21, 2016
- Sensory Switch Driver - June 21, 2016
- Speech Dasher - June 21, 2016
- Zen Key - June 21, 2016
- Linear Glide Arm Trough for Children With Disabilities - May 8, 2017
- Giant Hospital Nurse Call Button 3D Printed - May 8, 2017
- Head Mounted Laser Pointer Communicator - May 8, 2017
- Universal Wireless Switch Access - May 8, 2017
- VoiceHover - August 21, 2017
- Sensei - August 24, 2017
- Blink Based Aural Scanning Keyboard - August 24, 2017
- Dasher - August 24, 2017
- OptiKey - August 24, 2017
- No Soldier Battery Interrupter - October 22, 2017
- Bliss Symbols (Viewers) - October 22, 2017
- Pupils Labs Open Source Eye Tracking - October 22, 2017

Figure 22: Search by tag

5.5 Guidelines and AI Tools for Personalisation

5.5.1 'What's Next' Handbook

UNESCO released a background paper²⁵ prepared for the 2020 Global Education Monitoring Report, addressing inclusion and education, with focus on relevant technology for inclusion. It contains a set of recommendations which we need to consider when we address inclusive education and the usage of AT to support it:

- Prioritize the use of technology to support inclusive education, including disabled learners, based on UDL principles as a global development goal and in the provision of development assistance.
- Research and develop measures and a toolkit to ensure that all measures to introduce and encourage the use of ICT, particularly in education, taking into account the needs of disabled people.
- Research on ICT accessibility barriers for disabled staff, as well as recommendations for making all ICT used in educational institutions fully accessible and usable by them.
- Create an international repository of accessible learning materials and reusable ATs.
- Create repositories of training materials in various languages for using AT and ICT in education and the learning/teaching of various groups of disabled people, and ensure that all teachers have access to paid-for training during working hours.
- Create guidelines/recommendations for the use of SMS and mobile devices in learning that are fully accessible and usable by disabled learners and teachers.
- International research leading to recommendations on best practices in differentiated learning.

5.6 Extensive resources:

- Checklists
 - Plenty of checklists (https://access-ed.r2d2.uwm.edu/Tools_Resources/Checklists_Evaluations): Various assessment tools (checklists) help campuses review their overall accessibility as well as specifically measure the impact of accessible instruction, physical environments and information environments and related products. This resource provides a wide overview of such checklists.
 - Event accessibility (<https://csd.uconn.edu/wp-content/uploads/sites/607/2015/01/ACCESSIBILITY-CHECKLIST-FOR->

²⁵ <https://unesdoc.unesco.org/ark:/48223/pf0000373655>

- [UNIVERSITY-EVENTS-Fall-2014.pdf](#)): When organising an event, this accessibility checklist will guide you.
- A Checklist for Inclusive Teaching (HTML) (<https://www.washington.edu/doit/equal-access-universal-design-instruction>): Produced by DO-IT (<https://www.washington.edu/doit/>, Disabilities, Opportunities, Internetworking, and Technology) at Washington State University, this checklist exchanged course design for the average student with course design for potential students who have broad ranges with respect to ability, disability, age, reading level, learning style, native language, race, and ethnicity.
 - Quick Accessibility Checklist (HTML) (<http://accessibility.psu.edu/checklist/>): The *Quick Accessibility Checklist* is designed to help faculty and staff who want to develop or modify Web-based course material, lectures, and assignments in an accessible way. It covers multimedia elements, web tools, HTML tags, and advanced web design.
 - Creating your accessible syllabus (<https://www.accessiblesyllabus.com/>): Whether it are images, text, the interaction and the overall examination policies, you find here an accessible alternative.
 - Checklist for accessible teaching (<https://www.su.se/ceul/english/resources/develop-your-teaching/accessible-teaching/checklist-for-accessible-teaching-1.560847>): Accessible teaching means that you adapt your teaching to students' different needs. Pedagogical adaptations that are absolutely necessary for an individual student with a disability also often benefit other students and can also lead to pedagogical development.
 - Accessibility Essentials Checklist (<https://teaching.unl.edu/classroom-climate/dei/accessibility-checklist/>): Use this checklist to address essentials and learn more about accessibility and universal design for learning (UDL).
 - Checklist for Making Informal Learning Accessible to Students with Disabilities (<https://www.washington.edu/doit/checklist-making-informal-learning-accessible-students-disabilities>): Some universal design strategies may already be in use at the location you are reviewing and others could be implemented soon. The following checklist will help you identify both. For each of the strategies listed, indicate the following in the Status section of the checklist.
 - Checklist for inclusive teaching ([https://www.plymouth.ac.uk/uploads/production/document/path/3/3132/Checklist for inclusive teaching.pdf](https://www.plymouth.ac.uk/uploads/production/document/path/3/3132/Checklist%20for%20inclusive%20teaching.pdf))
- Accessible content
 - Ten Tips for Accessible Documents (HTML) (<https://support.office.com/en-CA/article/Ten-tips-for-accessible-documents-49b2ccea-5a8b-458a-988e-c273c50f225c>): Have you ever realized that not everyone receiving your documents can read and understand them as well as you think? Regrettably, most of us don't consider people with disabilities when creating documents. The tips in this checklist can help you create documents that cater to your whole audience, not just a portion of it.
 - Ten Tips for Creating Accessible Course Content (HTML) (http://www.3playmedia.com/2015/10/21/10-tips-for-creating-accessible-course-content/?mkt_tok=eyJpIjoiWW1VMU56STRZVGs1WVdRdyIsInQiOiJBXC9OU3I5b3lwZERicDVcl3ZtUHRyMDC2amx5bXVpOUVva1Y4YjNMWjU3QWpN)

[WHdVQW5yWERoV2RXRnZPVmFOTUR4Vkv1WIMyVG5ZSIUzSVVvN25OeVQ3OWgzC0JoR0FFcmplQUZHeWF1YTFVPSJ9](https://www.3playmedia.com/2015/07/30/tips-for-making-online-documents-accessible-word-powerpoint-excel-pdf/)): Professors and

instructional designers need to make sure all their students enjoy equal access to course materials, including students with disabilities. To help educators tackle that challenge, web accessibility expert Janet Sylvia presented a [webinar](#) on ten tips to creating accessible course content. This article summarizes those tips.

- Tips for Making Online Documents Accessible: Word, PowerPoint, Excel, and PDF (HTML) (<http://www.3playmedia.com/2015/07/30/tips-for-making-online-documents-accessible-word-powerpoint-excel-pdf/>): Web accessibility means committing to making your website accessible to all users, regardless of their physical or sensory ability. But inclusive design extends beyond your website. To be truly accessible, any documents provided as links to download must also be accessible. This article contains tips for making such documents accessible, as well as links to checklists specific to Word, PowerPoint, Excel, and PDF.
- Accessible teaching
 - Making Your Teaching More Accessible Webinar (https://www.routledge.com/go/making-your-teaching-more-accessible-webinar?utm_source=google&utm_medium=cpc&utm_term=search&utm_campaign=B031184_kr1_3fc_4cm_d949_accessibilitywebinarpromotion&gclid=CjwKCAiAfybBhBKEiwAgtB7fkqC4eKdhBBqIR952yiNS99gmW8c8dtVTQYPERP5GZ89FyPCx2MbnxoCvVYQAvD_BwE): This free on-demand webinar features Stacy Scott, our Accessibility Officer here at Taylor & Francis, and two Routledge leading authors in the field of accessible teaching, Joanna Cannon and Katherine Aquino.
 - Guide for Inclusive Teaching at Columbia, Center for Teaching and Learning (https://cpb-us-w2.wpmucdn.com/edblogs.columbia.edu/dist/8/1109/files/2020/02/Guide-for-Inclusive-Teaching-at-Columbia_Accessibility-Revisions_15-January-2020_FINAL.pdf)
 - Accessible teaching and learning resources by University of Oxford (<https://wwwctl.ox.ac.uk/accessibility-teaching>): This addresses a wide array of accessibility in teaching and learning such as:
 - Accessible and inclusive teaching: What does inclusivity mean in a teaching and learning context?
 - Ensuring all students can access remote learning: Ways to ensure all students can access digital learning materials and activities.
 - Assistive technologies: How technology can help with reading, writing and organisation.
 - Creating accessible educational recordings: Help to improve the quality and accessibility of your educational recordings.
 - Accessible and inclusive Canvas courses: Guidance for ensuring your Canvas courses are accessible to all students.
 - Creating accessible handouts and documents: Create handouts and documents that benefit all students.
 - Creating accessible PDF files: Simple ways to ensure accessibility when using PDFs.
 - Creating accessible PowerPoint presentations: Create accessible PowerPoint presentations that benefit all students.

- Blackboard Ally: Accessible content tool for the Canvas virtual learning environment.
 - SensusAccess: Automated document conversion service for creating accessible documents.
- TechDis - UK Government's Assistive Technology Website (<http://www.jisctechdis.ac.uk/>): Information on AT, both free and commercial.
- Enable Ireland's AT Training Service (<http://www.enableireland.ie/at>): service provided to train up people with disabilities on using assistive technology.
- Online webinars:
 - Webinars Inclusive Universities (<https://www.siho.be/nl/publicaties/webinars-inclusive-universities>): Between December 2020 and July 2021, the Support Centre Inclusive Higher Education (SIHO) hosted a webinar series entitled 'Towards Genuinely Inclusive Universities: an international perspective on best practices in the implementation of universal design'. The series consisted of eight webinars and shed light on several topics closely related to current policies and practices in post-secondary education around the topics of inclusion and universal design. Each webinar focused on case studies concerning implementation.
 - Webinar 1 - State of play on implementing inclusion and universal design strategies in higher education across Europe and beyond
 - Webinar 2 - Universal design as an institutional approach: international good practices
 - Webinar 3 - Universal design for learning in the classroom: best practices for inclusive assessment
 - Webinar 4 - The potential of universal design to create inclusive classroom practices with international students
 - Webinar 5 - The potential of universal design for learning with regards to mental health and wellbeing in higher education
 - Webinar 6 - The potential of universal design for learning in community colleges, colleges of further education, trade schools, and vocation education institutions
 - Webinar 7 - Universal design for learning beyond the Global South
 - Webinar 8 - Looking to the future: framing the next decade of universal design for learning implementation in higher education
- Digital accessibility toolkit (https://www.cbm.org/fileadmin/user_upload/Publications/CBM-Digital-Accessibility-Toolkit.pdf)