



北京师范大学智慧学习研究院
Smart Learning Institute of Beijing Normal University



United Nations
Educational, Scientific and
Cultural Organization



International Research
and Training Centre
for Rural Education

Guidance on Providing Open and Distance Learning for Students with Disabilities during School Closures:

Enhancing Inclusive Learning under COVID-19

August, 2020, Version 1.0



Guidance on Providing Open and Distance Learning for Students with Disabilities during School Closures: Enhancing Inclusive Learning under COVID-19

© Smart Learning Institute of Beijing Normal University (SLIBNU), 2020

Rights and Permissions



This publication is available in Open Access under the Attribution-ShareAlike 3.0 IGO (CC-BY-SA 3.0 IGO) license (<http://creativecommons.org/licenses/by-sa/3.0/igo/>).

Please cite the work as follows:

Huang, R., Liu, D., Tlili, A., Lazor, M., Amelina, N., Varoglu, Z., Chang, T. W., Zhang, X., Jemni, M., Burgos, D., Othman, A., & Altinay, F. (2020). Guidance on Providing Open and Distance Learning for Students with Disabilities during School Closures: Enhancing Inclusive Learning under COVID-19.

**Guidance on Providing Open and Distance Learning for Students
with Disabilities during School Closures:**

Enhancing Inclusive Learning under COVID-19

Acknowledgement

Many people have helped us in finalizing this guidance. They have our great appreciation for the long hours and hard work they devoted to conducting research and developing the content. Without their incredible assistance, this book would not have been realized.

We would like to acknowledge the help of several researchers who worked on developing the contents and organizing the forum for this handbook, including Tamara Milic, Anita Maric, Zehra Altinay, Muhau Zhang, Yihong Shi and Lingling Xu. We would also like to acknowledge the contribution of several experts for their professional feedback to enhance this handbook, including Mr. Cedric Wachholz from UNESCO Communication and Information Sector.

Thanks also go to those experts from the Smart Learning Institute of Beijing Normal University (SLIBNU), the International Association of Smart Learning Environment (IASLE), the Arab League's Educational, Cultural and Scientific Organization (ALECSO), Research Institute for Innovation & Technology in Education (UNIR iTED, Spain), NEAR EAST UNIVERSITY, "Milan Petrovic" boarding school and Edmodo.

Contents

| | |
|--|-----------|
| Executive Summary | 1 |
| Glossary of terms | 2 |
| 1.Students with disabilities in open and distance learning | 4 |
| 1.1.Open and Distance Learning (ODL) | 4 |
| 1.2.Impact of COVID-19 on students with disabilities | 5 |
| 1.3.Protecting students with disabilities from COVID-19 | 6 |
| 1.4.Motivation, method and context | 9 |
| 2.Facilitating learning process using computers for students with disabilities | 12 |
| 2.1.Visual Impairment | 12 |
| 2.2. Hearing Impairment | 16 |
| 2.3. Mobility Impairment | 17 |
| 3.Facilitating learning process using mobile devices for students with disabilities | 18 |
| 3.1.Visual Impairment | 18 |
| 3.2.Hearing Impairment | 30 |
| 3.3.Mobility Impairment | 38 |
| 4.Utilizing digital resources and tools for students with disabilities | 42 |
| 5.Designing learning activities for students with disabilities | 45 |
| 5.1.Learning methods | 45 |
| 5.2.Learning assessment methods | 51 |
| 6.Developing learning materials based on universal design | 52 |
| 7.Role of parents for active learning at home | 58 |
| 7.1.Role of parents during open and distance learning | 58 |
| 7.2.Guidelines for parents on helping their children learn | 58 |
| 7.3.Guidelines for parents on ensuring the safety of their children at home | 60 |
| 7.4.Guidelines for communicating between parents and teachers to facilitate learning | 60 |
| 8.Challenges, recommendations and implications | 62 |
| Reference | 67 |

Executive Summary

According to the World Report on Disability, published by the World Health Organization (WHO) and the World Bank, there are almost 2 billion people with disabilities over the globe, accounting for 37.5% of the world's population (Inclusive City Maker, 2019). Children with disabilities are particularly at risk of exclusion from education. Especially, due to the COVID-19 response measures, persons with disabilities, including students, face more specific barriers in carrying out their daily lives and learning. UNESCO (2020) mentioned that those with sensory, physical or intellectual disability are 2.5 times more likely to have never been to school than their peers without disability because they face more complex barriers.

Under the above background, this handbook discusses open and distance learning for students with disabilities during COVID-19, through vivid stories and experiences. Particularly, it describes, through illustrative stories, innovative approaches on how to design learning activities in open and distance learning environments for students with disabilities. Additionally, this handbook provides guidelines on designing accessible learning materials based on Universal Design (UD). Finally, it provides guidelines for different stakeholders, including parents, policy makers, teachers and designers on how to facilitate open and distance learning for students with disabilities.

Glossary of terms

Open Learning: Open learning is an approach to education that seeks to remove all unnecessary barriers to learning, while aiming to provide students with a reasonable chance of success in an education and training system centered on their specific needs and located in multiple arenas of learning (UNESCO, 2015).

Distance Education: It is a planned learning that normally occurs in a different place and requires a well-defined system of delivery that includes modified teaching techniques, alternative modes for communication including, but not limited to technology, as well as alternative administrative and organizational components (Moore & Kearsley, 1996).

Inclusive Education: It aims to ensure that learners with diverse needs and preferences (e.g., learners with disabilities) can have equal opportunities in accessing learning resources, services and experiences in general (Florian & Linklater, 2010).

Open Educational Resources (OER): OER is learning, teaching, and research materials in any format and medium that reside in the public domain or are under copyright that have been released under an open license that permit no-cost access, [reuse], [repurpose], adaptation, retention and redistribution by others (Stracke et al., 2019; UNESCO, 2019).

Open Educational Practices (OEP): Wiley and Hilton (2018) considered OEP as an OER-enabled pedagogy and defined it as a 'set of teaching and learning practices that are only possible or practical in the context of the 5R permissions (Retain, Reuse, Revise, Remix, Redistribute) that are characteristic of OER'.

Information and Communication Technology (ICT): It refers to equipment and services related to broadcasting, computing, and telecommunications, all of which process, store and transmit information through computer and communications systems.

E-inclusion: A concept refers to enabling equal access and participation of all individuals in every aspect of Information and Communication Technology (ICT) with the aim to promote the use of ICT to overcome community exclusion, and improve economic performance, employment opportunities, quality of life, social participation and cohesion.

Accessibility: It is the degree to which a product, device, service, or environment is available to as many people as possible. It can be viewed as the "ability to access" and benefit from some system or entity. The concept often focuses on people with disabilities or special needs.

Disability: The preamble of the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) recognizes that: 'disability is an evolving concept and that disability results from the interaction between persons with impairments and attitudinal and environmental barriers that hinder their full and effective participation in society on an equal basis with others'. Article 1 states that: 'Persons with disabilities include those who have long-term physical, mental, intellectual or sensory impairments which in interaction with various barriers may hinder

their full and effective participation in society on an equal basis with others’.

Assistive Technology: Any item, software, piece of equipment, or product system, whether acquired commercially, modified, or customized, that is used to increase, maintain, or improve functional capabilities of individuals with disabilities.

Universal Design: It means the design of products, environments, programmes and services to be usable by all people to the greatest extent possible, without the need for adaptation or specialized design. “Universal design” shall not exclude assistive devices for particular groups of persons with disabilities where this is needed.

Universal Design for Learning: It is an approach to addressing the diversity of learner needs by suggesting flexible goals, methods, materials, and assessment processes that support educators to meet varied needs. Curricula created using UDL are designed from the outset to meet the needs of all learners. A UDL framework incorporates flexible design of learning situations with customizable options, which allow all learners to progress from their own individual starting points.

Web Content Accessibility Guidelines (WCAG): It focuses on providing an international technical standard for web content. It has 12 guidelines that are organized under four principles: perceivable, operable, understandable, and robust. The guidelines each have a testable success criteria, which are at three levels: A, AA, and AAA.

Creative Commons: Creative Commons (CC) is the most developed alternative licensing approach founded by Larry Lessig of Stanford University in 2001. The CC approach provides user-friendly open licenses for digital materials and avoids the automatically applied copyright restrictions. (UNESCO, 2015).

1. Students with disabilities in open and distance learning

1.1. Open and Distance Learning (ODL)

Open and Distance Learning (ODL) combines the aspects of both “open learning” and “distance learning,” and these are also sometimes conflated with “distance education.” Gaskell (2017) stated that “while these are often connected in theory and in practice, they are essentially different concepts. “Open learning” is an educational philosophy that emphasizes openness in terms of learner’s choices, most frequently in relation to access, flexibility, and time and place of study. In its fullest sense, it can include choice of curriculum and assessment method, though these have not so far been implemented in practice very frequently or successfully.”

“Open learning” and “distance learning” are not directly opposed and are usually interrelated; open learning can support learning at a distance, and distance learning increases the degree of learning openness, as students are not limited anymore to the campus for learning (Gaskell, 2017). Therefore, the combined term “open and distance learning” (also called open distance learning) became particularly popular from the late 1980s to the early 2000s with reference to a philosophy of openness within a system that used multiple media for delivery. UNESCO (2002, p. 22) further mentioned that the reason for the combination of terms was that “The use of the term open is intended to highlight this key feature of the theory and practice of distance education.” It further mentioned that:

“the terms open learning and distance education represent approaches that focus on opening access to education and training provision, freeing learners from the constraints of time and place, and offering flexible learning opportunities to individuals and groups of learners. Open and Distance Learning is one of the most rapidly growing fields of education, and its potential impact on all education delivery systems has been greatly accentuated through the development of Internet-based information technologies, and in particular the World Wide Web.”

(UNESCO 2002, p. 7)

The Commonwealth of Learning (COL) mentioned in “Open and Distance Learning: Key Terms and Definitions” that Open Distance Learning (ODL) also covers other terms, including “flipped classroom,” “learning technologies,” “open schooling,” and “virtual education” (COL, 2015). ODL has been reported to reduce educational costs, provide flexible high-quality learning and ensure inclusive learning of persons with disabilities or in rural areas (Gaskell, 2017). Specifically, ODL can address the challenges that students with disabilities might face, including geographical distance from centers of learning, sensory systems challenges (e.g. vision, hearing), and mobility challenges (e.g. physical disabilities) (Chambers, Varoglu, & Kasinskaite-Buddeberg, 2016).

One of the methods to provide Open Distance Learning is by using Open Educational Resources (OER) and Open Educational Practices (OEP). OER are “learning, teaching and research materials in any format and medium that

reside in the public domain or are under copyright that have been released under an open license that permit no-cost access, re-use, re-purpose, adaptation and redistribution by others” (UNESCO, 2019). Huang et al., (2020) defined OEP as a practice centered approach which focuses on the innovative ways of using OER to enhance learning outcomes. Additionally, Huang, Tlili, Chang, Zhang, Nascimbeni, & Burgos (2020) presented an OEP framework which is composed of several dimensions, including open teaching, open collaboration, open assessment and enabling technology. Zhang et al. (2020) further mentioned that OER and OEP can facilitate inclusive learning, especially for students with disabilities, since permissions granted by an open license remove legal barriers to adapting and customising OER, making it possible to create learning environments that are more flexible, accessible and robust for all students. One of the objectives of the UNESCO OER recommendation (2019) is to provide inclusive learning, even for those with disabilities.

1.2.Impact of COVID-19 on students with disabilities

According to the World Report on Disability, published by the World Health Organization (WHO) and the World Bank, the number of people with disabilities over the globe is almost 2 billion, accounting for 37.5% of the world's population (Inclusive City Maker, 2019). The United Nations (UN) Convention on the Rights of Persons with Disabilities (UNCRPWD) defined persons with disabilities as “those who have long-term physical, mental, intellectual or sensory impairments which, in interaction with various barriers, may hinder their full and effective participation in society on an equal basis with others” (CRPD, 2006, Article 1, para. 2). Due to COVID-19 response measures, persons with disabilities, including students, face specific barriers in carrying out their daily lives in the community. Particularly, staying at home restrictions can create disruptions and new risks to their autonomy, health and lives, as these restrictions are against the needs (e.g., daily short walks) of some persons with disabilities. Additionally, many persons with disabilities might find themselves at-risk of not having food or water as they rely on others to bring those daily vital needs to them.

In the education sector, according to the recent statistics by UNESCO (2020), The COVID-19 pandemic affected more than one billion students worldwide. All these students, including those with disabilities are experiencing education disruption. Therefore, several universities and schools started remote teaching and learning from home. Hodges et al. (2020) defined remote teaching as “a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances. It involves the use of fully remote teaching solutions for instruction or education that would otherwise be delivered face-to-face or as blended or hybrid courses and that will return to that format once the crisis or emergency has abated.” Generally, students with disabilities are less likely to attend school and complete primary or secondary education than person without disabilities. They are also more likely to be out of school (UNESCO 2018). Specifically, during the COVID-19 pandemic, the learning challenges for students with disabilities and their parents are even higher.

Remote learning brings students with disabilities both advantages and disadvantages (Laabidi, Jemni, et al. ,2014). According to Holloway and Foley (2018), remote learning has several advantages for students with disabilities, such as:

- Avoiding the challenges of travelling to classroom for students with physical disability.
- Learning in a familiar, comfortable environment, such as at home instead of studying at big classrooms for the students with autism disorders, or other struggle socially problems is more helpful.
- Communicating with others through forums or social networks which can reduce students’ pressure and enhance their learning performance.

However, to succeed the student journey in remote learning during COVID-19 crisis, the home environment is different from school classrooms, therefore students with disabilities might experience a variety of barriers during remote education, such as:

- Learners with disabilities are easily frustrated, showing aggressive behavior since it is very difficult for them to be confined in a limit space without any social exposure.
- Learners with disabilities are often provided with less help and inadequately trained teachers (Unicef, 2020).
- More time and resources are required for students with disabilities to actively participate in learning (Ohchr, 2020). This includes equipment, internet access and specially designed materials and support. This makes learning more costly for students and their families.
- Many teachers lack ICT skills and knowledge. They are unprepared to teach online and cannot ensure student engagement, specifically for students with disabilities.

The World Health Organization (2020) mentioned that actions need to be taken during COVID-19 pandemic to provide all the required services for people with disabilities, including health care and education. Therefore, this handbook aims to investigate the current situation of providing students with disabilities with remote open and distance learning during COVID-19. Special education refers to a range of educational and social services provided by the public school system and other educational institutions to individuals with disabilities. To the best of our knowledge, no study was conducted in this context. Based on the findings, recommendations are reported that can help several stakeholders (educators, teachers, pedagogues, etc.) provide remote teaching/learning for students with disabilities in crisis.

1.3.Protecting students with disabilities from COVID-19

Since persons with disabilities rely most of the time on others to take care of them, they cannot maintain social distancing. Additionally, public information on COVID-19 measures is not systematically communicated nor disseminated in accessible formats and means to reach all persons with disabilities (e.g. sign language interpretation, captioning, Easy to Read format, etc). Therefore, persons with disabilities, including students, are at a higher risk of being infected with COVID-19. In this context, several initiatives were taken as reported in the following stories.



Story 1: The Tunisian Ministry of Health provided their live and TV communications using sign language

To keep persons with disabilities, including students, protected from the COVID-19 and up to date with the daily statistics and guidance taken by the Tunisian Ministry of Health, the ministry provided all its live and TV communications during this pandemic situation using sign language for deaf persons, as shown in Figure 1.

















Figure 1. Tunisia provides live announcements using sign language



Story 2: MADA center used Pictograms related to COVID-19 for students with Communication impairment

MADA center created a series of symbols have been created to educate children using AAC symbols about the COVID-19 pandemic and steps to safeguard from it. This is a part of MADA' s continuous effort to keep the Tawasol Symbols relevant and up to date for providing the latest inclusive educational content. In this context, 30 symbols have been designed to represent a COVID-19 guide interpreting the basic hygiene and safety measures to be followed – including depiction of the typical COVID-19 symptoms, proper hand washing procedures, respiratory hygiene, and calling for medical help were the main focus of the illustrations (see Table 1).

Table 1. A set of COVID-19 Tawasol Symbols

| Action / Term | Symbol | Action / Term | Symbol |
|-------------------------------|---|---|---|
| Wear a medical mask |  | When sneezing or coughing, use the elbow by bending the arm |  |
| difficulties breathing |  | Persistent dry cough with pain |  |
| Nasal congestion / Runny nose |  | Tired |  |
| Sore throat |  | Aches and pains |  |
| I have a fever |  | dry cough |  |
| I don't touch animals |  | I don't shake hands |  |
| Put soap overhand |  | Handwashing with soap and water |  |



Story 3: Providing exceptions for persons with disabilities during confinement

Since several persons with disabilities may need to perform some activities outside, such as walking, to keep healthy, several countries, including The United Kingdom of Great Britain, France and Northern Ireland have made some exceptions during confinement rules and allowed persons, including autistic persons and other persons with disabilities, to go outside (ref).

1.4. Motivation, method and context

According to the Convention on the Rights of Persons with Disabilities (CRPD)- Article 24.2:

- (a) Persons with disabilities are not excluded from the general education system on the basis of disability, and that children with disabilities are not excluded from free and compulsory primary education, or from secondary education, on the basis of disability.
- (b) Persons with disabilities can access an inclusive, quality and free primary education and secondary education on an equal basis with others in the communities in which they live.

The above article shows that education is a human right and no one should be excluded from it. This right was further emphasized in the 2030 Sustainable Development Agenda, where Goal 4 of the 17 Sustainable Development Goals aims to ensure equal access to all levels of education for people with disabilities. However, despite this legal ground, children with disabilities are still facing various forms of discrimination that lead to their exclusion from society and school (Unicef, 2020). This discrimination might even be bigger during this pandemic of COVID-19 where face-to-face teaching is banned and all students need to learn from home (Unicef, 2020; UNESCO, 2020).

Particularly, during COVID-19, to ensure inclusive learning even for those with disabilities and that no one should be left behind, UNICEF (2020) called for supporting education actors to ensure that: (1) distance learning platforms are safe and accessible to children with disabilities; (2) teachers are trained on supporting children with disabilities remotely; (3) any special education programmes are included in measures to ensure continuity of education; (4) provide support to caregivers of children with disabilities, including those with development and/or intellectual disabilities, in implementing specific consideration when managing care and education of their children at home, and their own mental health and psychosocial wellbeing. Therefore to empower inclusive education for students with disabilities, and move from exclusion to inclusion, this handbook provides a set of practical guidelines and vivid stories to enhance inclusive learning for students with disabilities in Open and Distance Learning (ODL).

Specifically, both UNICEF (2007) and UNESCO (2016) mentioned that to ensure inclusive education for students with disabilities, the right to access education by developing accessible learning environments should be fulfilled. In these environments, students with disabilities acquire the core academic curriculum and basic cognitive skills,

together with essential life skills. In line with this, Section 2 and 3 provide accessibility functionalities on both computers and mobile devices respectively to ensure inclusive learning and facilitate the learning process.

Additionally, UNESCO (2016) both mentioned the importance of developing appropriate learning tools and raising awareness about these tools to facilitate the learning process for students with disabilities. In line with this, as teachers and families may not have a solid background on teaching learners with disabilities in open and distance environments or at home, Section 4 presents free and open learning tools that could be used in the learning process.

Furthermore, UNICEF mentioned that students with disabilities do not only have the right to simply access education, but also to have right quality education. This can be ensured by designing curriculums, innovative teaching methods that take account of all learners. In line with this, the first subsequent section of Section 5 provides teaching and assessment methods that have been applied in open and distance learning environments to maintain uninterrupted learning during COVID-19 in different countries (high-income countries and low-income countries cannot). Besides, UNICEF (2011) pointed out that "Assessment issues constitute one of the most significant challenges for the development of inclusive education for all children. A commitment to ensuring that children with disabilities are able to fulfil their educational potential implies the need for sensitive and constructive methods of appraising and monitoring their work, which take account of the barriers they face." Therefore, the second subsequent section of Section 5 provides several learning assessment methods that could be used in open and distance learning with students with disabilities. In the same context. Section 6 further provides guidelines on how to develop digital learning materials based on universal design to provide accessible and quality learning materials for everyone.

Moreover, UNICEF (2017) mentioned that involving both parents and communities is necessary to have a successful inclusive education. UNESCO (2020) also mentioned that parents of children with disabilities are another COVID-19 front line as their job will be more than parenting. In line with this, section 7 presents guidelines for parents to provide active and safe open and distance learning for their children with disabilities.

Finally, UNICEF and UNESCO highlighted the importance of providing evidence-based research to advance inclusive education based on practical collected data. In line with this, this book, including Section 8, used surveys to collect the needed data for investigating open and distance learning during COVID-19 for students with disabilities, including the challenges that teachers faced during open and distance learning for students with disabilities (Section 8). These challenges should be considered by different stakeholders. Besides, Section 8 further presents recommendations to improve inclusive open and distance education for persons with disabilities.

To collect the needed information for this investigation, forty-seven participants from fourteen countries participated in this experiment by answering an online survey and participating in online discussions. All these participants are working directly with learners with disabilities. For instance, some of them are pedagogues in special education schools, teachers of learners with disabilities. Educational associations focusing on learners with disabilities, and coordinators at the Ministry of Education (MoE). As shown in Figure 2, these participants were from fourteen different countries in order to draw a wider picture, from several contexts, about the application of open and distance learning under COVID-19.

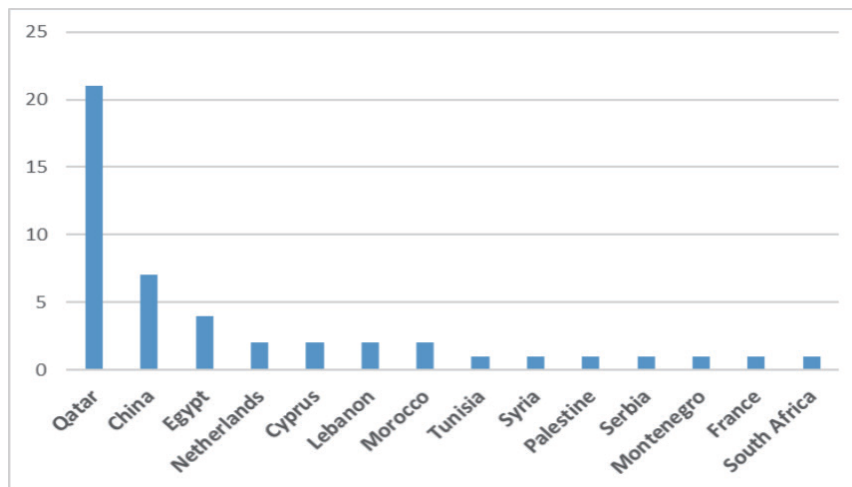


Figure 2. Distribution of participants by country

Additionally, the learners' disabilities that the participated are working with were grouped into five categories, as shown in Figure 3, after consulting the International Classification of Functioning, Disability, and Health (Perenboom & Chorus, 2003). Mainly, the impact of a disability on personal and physical development, as well as a learner's participation in various activities determined the categorization scheme. Particularly, emotional or attention-related disabilities affect target learners' neurodevelopment, behaviors, and communication. Intellectual disability is related to a general learning disorder that affected their intellectual and adaptive functioning. Physical disabilities affect movement and physical development, and sensory impairments affect the five senses (e.g. eyesight or hearing). Speech impairments affect one's ability to communicate and learning difficulties affect one's abilities to gain knowledge or skills. Specifically, Figure 3 shows that sensory impairment is ranked as the top category where most of the learners have visual or hearing impairments, followed by emotional or attention-related disabilities, intellectual disability, physical disabilities, and learning difficulties. It should be noted that several participants are working with more than one disability category.

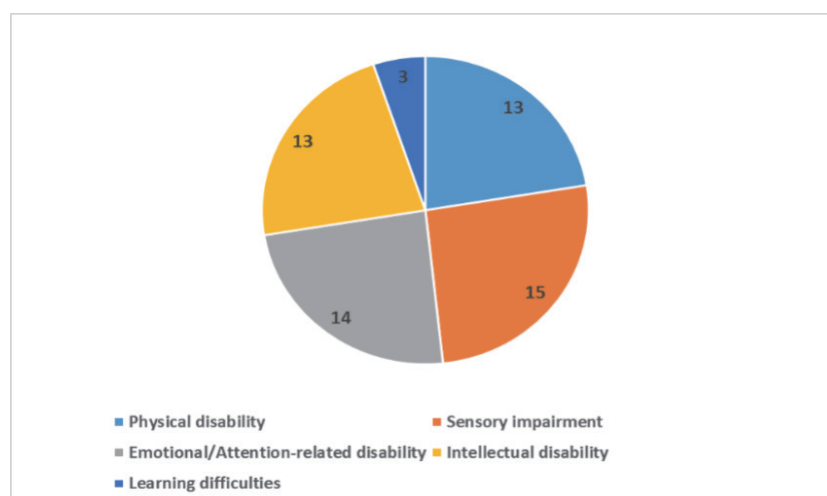


Figure 3. Categorization of learners' disabilities during the remote teaching


2. Facilitating learning process using computers for students with disabilities

One of the main challenges for learners with disabilities is the accessibility of the learning environment. Therefore, to overcome this challenges, several Computer companies such as, Microsoft and Apple, have embedded several accessibility features to ensure accessible computer-based learning. These features could be very useful especially during this pandemic, since learning has shifted to distance learning where computers are used. However, it is seen that several learners, parents and teachers do not know about these features, hence they cannot make full use of their computers. Therefore, this section presents the accessibility features on computers according to three impairment types, namely, visual, hearing and mobility.

2.1. Visual Impairment

People with visual impairment has 13% share of world population, which indicates the significance of providing access to learning for this specific group of people. In this section, we are introducing features of popular operating systems to help people with visual impairment better utilize their devices.

Enlarging the size of text, apps, and other items

If text and other items on the desktop are too small, it is possible to enlarge them without changing the screen resolution or turning on Magnifier by following these steps (See Figure 4): (1) Open **Ease of Access** by pressing **Windows Logo Key**  + U; (2) Select **Display**; (3) Under **Make text bigger**, adjust the slider to change the size of text that's displayed; and, (4) Select **Apply**

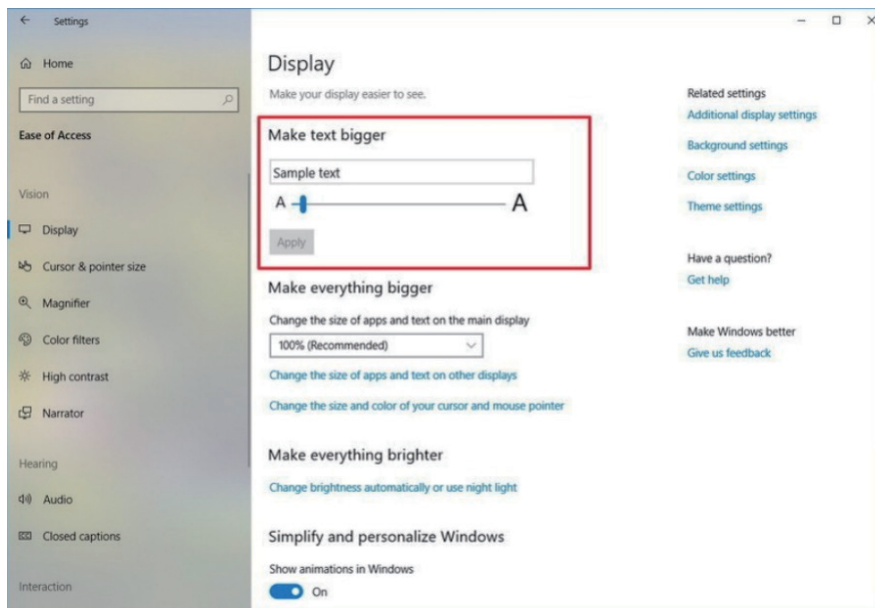


Figure 4. Enlarging the size of texts in Windows operating system

Hearing text read aloud with Narrator

Narrator is the built-in screen reader that reads text on your screen aloud and describes events, such as notifications or calendar appointments (see Figure 5). To start or stop **Narrator**, press **Windows Logo Key** + **CTRL** + **Enter**. On Windows Mobile devices, press **Windows Logo Key** + **Volume UP** key to toggle **Narrator** on/off. Additionally, you can press **Windows Logo Key** + **Ctrl** + **N** to open **Narrator settings**.

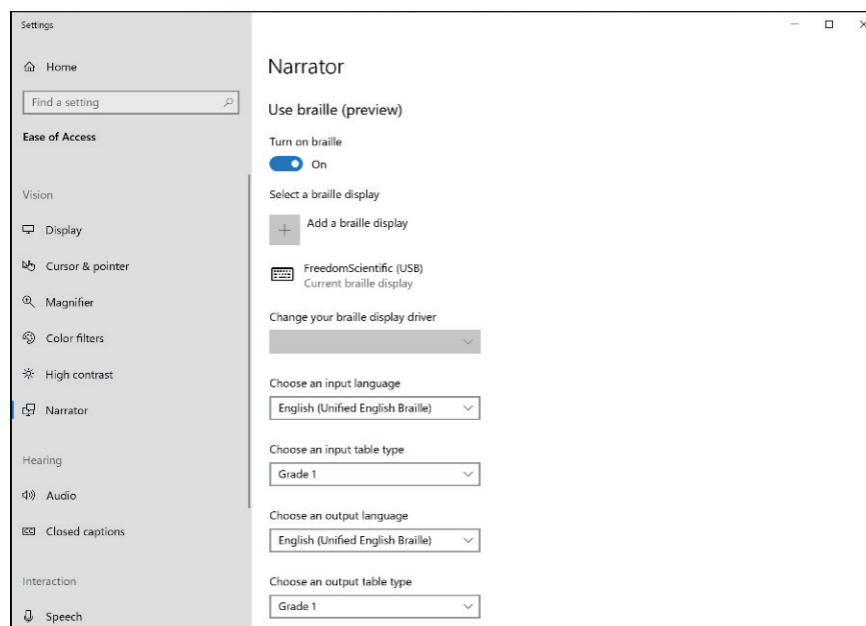


Figure 5. Hearing texts using Narrator in Windows operating system

Using color filters to distinguish between objects

Color filters change the color palette on the screen and help distinguish between items that differ by color by following these steps (see Figure 6): (1) Press **Windows Logo Key** + **U** to open **Ease of Access**; and, (2) Select **Color filters**

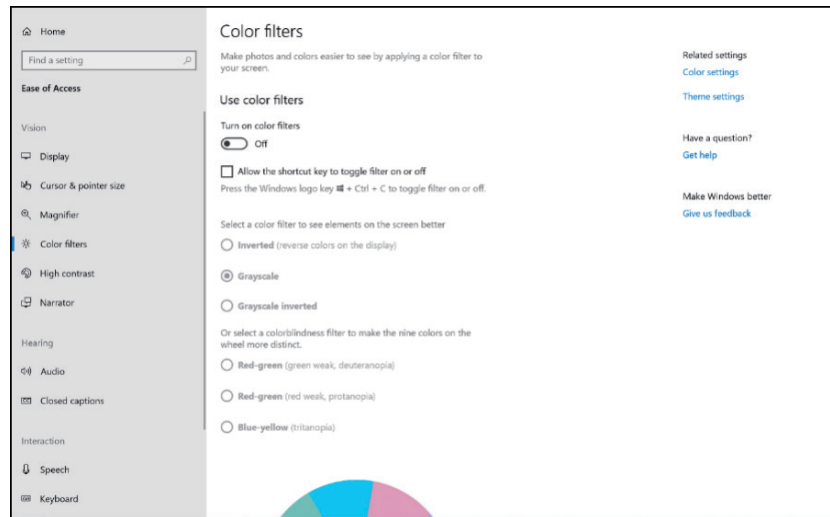


Figure 6. Using color filters in Windows operating system

Changing the Cursor and pointer size and color

You also can change the cursor size, color, and thickness in Windows. Additionally, you have the option of creating a custom color and showing visual feedback around touch points when you need to touch the screen (see Figure 7). To get there press the **Windows Logo Key** + **U** then select **Cursor & pointer**.

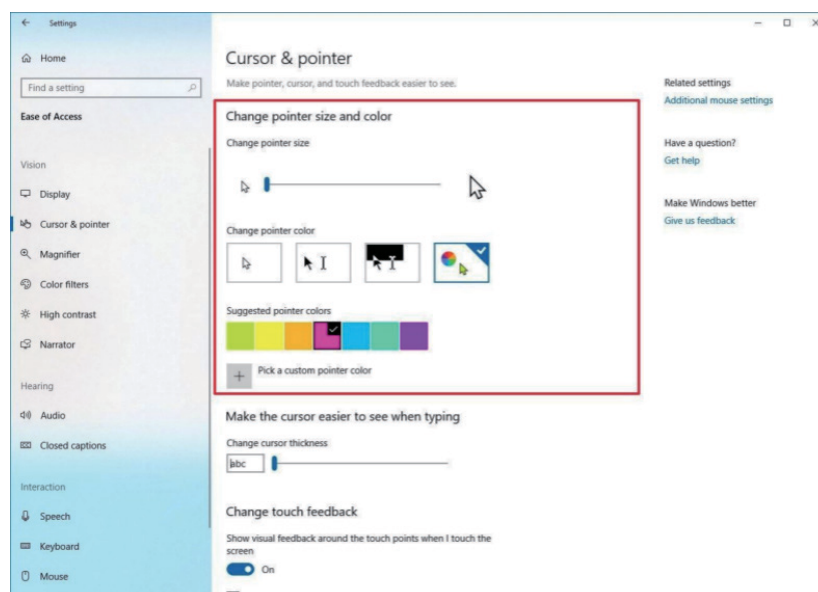






Figure 7. Changing features of the cursor in Windows operating system

Using Magnifier to see items on the screen

Magnifier is a tool that enlarges your screen, so you can see words and images better. You can magnify the entire screen, or just a part of it, and move the magnifier where you want it on your desktop (see Figure 8). Additionally, **Magnifier** can also smooth edges of images and text when zoomed in by following these steps: (1) Open **Magnifier settings**: Press **Ctrl + Windows Logo Key**  + **M**; (2) Turn on Magnifier and Zoom in: Press **Windows Logo Key**  + **Plus (+)**; (3) Zoom out: Press **Windows Logo Key**  + **Minus (-)**; and, (4) Exit Magnifier: Press **Windows Logo Key**  + **Esc**.

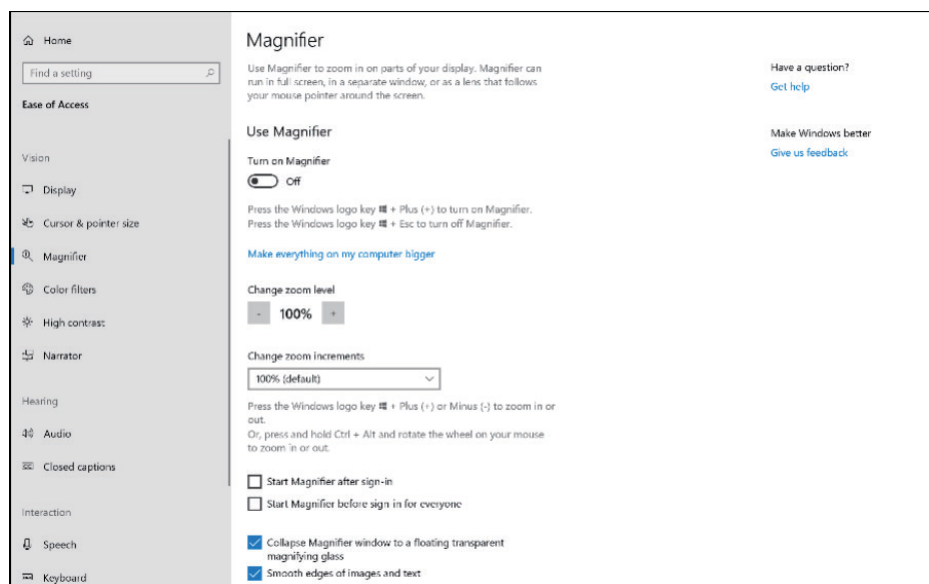


Figure 8. Using Magnifier in Windows operating system


Besides, the following is a list of basic accessibility features that are included with Mac OS X for visual impairment.

- Voiceover - provides both speech input and audible output, combined with support for keyboard navigation
- Talking alerts and spoken items
- Zoom - users can magnify the screen
- Scalable cursor - users can increase the size of the mouse cursor
- Display adjustment - users can adjust or reverse color contrast

2.2. Hearing Impairment

Hearing impairment poses great difficulties grasping audio information and knowledge for people with this disability. Hence, it is of great importance to make sure they can acquire information through other forms. We introduce different functions pertaining to hearing in the hope that this can provide a broader access for people with hearing impairment.

Closed captions

Closed captions let you read the words that are spoken in the audio part of a video or television show. When closed captioning is turned on, closed captions are usually displayed at the bottom of the screen. Closed captions are often used by people with hearing disabilities and by viewers who would rather read than listen to the audio portion of a video. (1) Open **Ease of Access** by pressing the **Windows Logo Key**  + **U**. (2) Select **Closed Captions**.

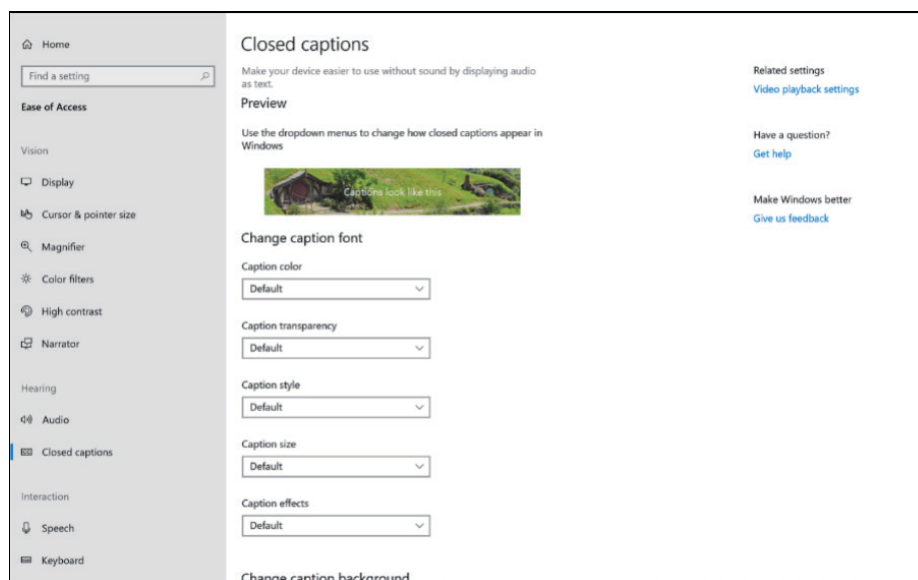



Figure 9. Using Closed captions to read audio portions in Windows operating system

Listening with Mono audio

People with partial hearing loss or complete deafness in one ear can switch **Mono audio** on to hear sounds in both channels. To turn on **mono audio**: (1) Open **Ease of Access** by pressing the **Windows Logo Key**  + **U**; (2) Select **Audio**; (3) Select the **Mono audio** slider to turn it **On**.

Besides, the following is a list of basic accessibility features that are included with Mac OS X for hearing impairment.

- Visual alert of all system sounds
- iChat - deaf users can communicate with one another using sign language using this video conferencing system due its excellent video quality.
- QuickTime - Apple's QuickTime media player supports display of closed captions, if available.

2.3. Mobility Impairment

NANDA International (formerly the North American Nursing Diagnosis Association) defines mobility impairment as a limitation in independent, purposeful physical movement of the body, making accessible devices with tailored functions more important for people with mobility impairment. Here we are presenting functions of popular operating systems that help people with mobility disability to better control and use their devices.

Using computer with Eye Control

Eye Control is an input method for Windows that allows you to use your eyes to control a mouse, keyboard, and basic text-to-speech features. To turn on **Eye Control** go to **Settings > Ease of Access > Eye Control**. Then turn on **Control your PC and type with an eye tracking device**.

Dictation on the Desktop

Dictation is a speech-to-text software that gives users the ability to input text in any application using a microphone and perform basic text editing. Here are two ways you can start **Dictation**: (1) Press **Windows Logo Key + H**; (2) Select the **Touch Keyboard** and then the **Microphone**

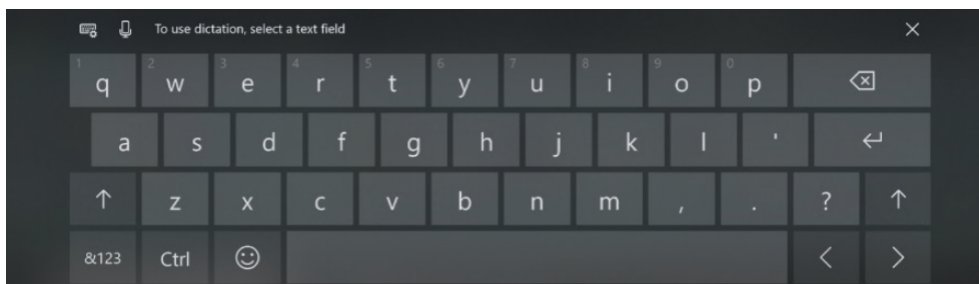


Figure 10. Using Dictation to input text by speaking in Windows operating system

Besides, the following is a list of basic accessibility features that are included with Mac OS X for mobility impairment.

- Slow Keys - adds a delay between when a user presses a key and when it takes effect to help prevent unintended multiple keystrokes
- Sticky Keys - allows users to press keys in sequence that are otherwise required to be pressed simultaneously.
- Keyboard navigation - much improved in OS X, allows keyboard access to most standard interface elements
- Mouse Keys - use the keyboard to control the mouse cursor
- Speech recognition and talking alerts - use speech commands to open, close, and navigate the operating system and software. This utility does not support dictation, but third party dictation programs are available such as Dragon Dictate for Mac)

3.Facilitating learning process using mobile devices for students with disabilities

Mobile devices are now frequently used worldwide for mobile learning, where students can learn from anywhere at any time. Additionally, it is seen in several regions that learners cannot afford computers, hence they use mobile devices instead for learning. In this context, just like computers (see Section 2), several accessibility features are found in mobile device that could facilitate the learning process for learners with disabilities, especially during this critical moment of COVID-19. Therefore, this section presents the accessibility features on computers according to three impairment types, namely, visual, hearing and mobility.

3.1.Visual Impairment

iPhone

VoiceOver

With VoiceOver—a gesture-based screen reader—you can use iPhone even if you don't see the screen. VoiceOver gives audible descriptions of what's on your screen—from battery level, to who's calling, to which app your finger is on. You can also adjust the speaking rate and pitch to suit your needs.

When you touch the screen or drag your finger over it, VoiceOver speaks the name of the item your finger is on, including icons and text. To interact with the item, such as a button or link, or to navigate to another item, use VoiceOver gestures.

When you go to a new screen, VoiceOver plays a sound, then selects and speaks the name of the first item on the screen (typically in the top-left corner). VoiceOver tells you when the display changes to landscape or portrait orientation, when the screen becomes dimmed or locked, and what's active on the Lock screen when you wake iPhone.

You can practice VoiceOver gestures in a special area without affecting iPhone or its settings. When you practice a gesture, VoiceOver describes the gesture and the resulting action.

Try different techniques to discover which works best for you. If a gesture doesn't work, try a quicker movement, especially for a double-tap or swipe gesture. To swipe, try brushing the screen quickly with your finger or fingers. For best results using multi-finger gestures, touch the screen with some space between your fingers.

(1) Go to Settings  > Accessibility > VoiceOver.

- (2) Turn on VoiceOver, tap VoiceOver Practice, then double-tap to start.
- (3) Practice the following gestures with one, two, three, and four fingers:
 - Tap
 - Double-tap
 - Triple-tap
 - Swipe left, right, up, or down
- (4) When you finish practicing, tap Done, then double-tap to exit.

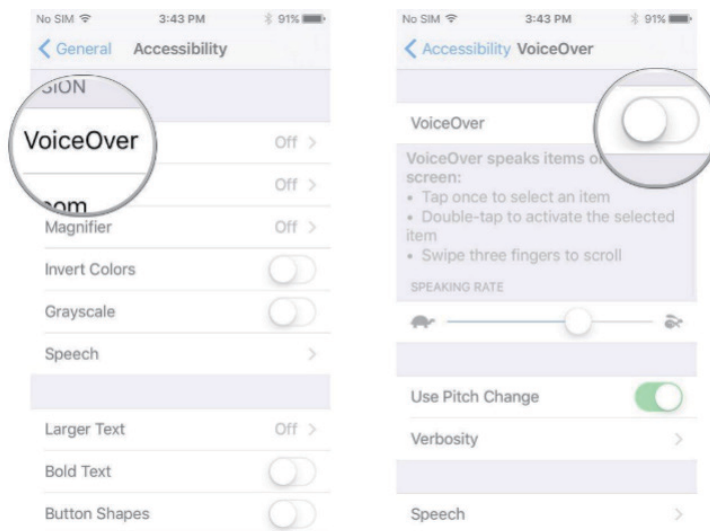



Figure 11. Using VoiceOver in iOS operating system

Zoom

You can magnify the entire screen (Full Screen Zoom) or magnify only part of the screen with a resizable lens (Window Zoom). And, you can use Zoom together with VoiceOver.

Set Up Zoom

- (1) Go to Settings  > Accessibility > Zoom, then turn on Zoom.
- (2) Adjust any of the following:
 - Follow Focus: Track your selections, the text insertion point, and your typing.
 - Smart Typing: Switch to Window Zoom when a keyboard appears.
 - Keyboard Shortcuts: Control Zoom using shortcuts on an external keyboard.
 - Zoom Controller: Turn the controller on, set controller actions, and adjust the color and opacity.

- Zoom Region: Choose Full Screen Zoom or Window Zoom.
 - Zoom Filter: Choose None, Inverted, Grayscale, Grayscale Inverted, or Low Light.
 - Maximum Zoom Level: Drag the slider to adjust the level.
- (3) If you use iPhone with a pointer device, you can also set the following below Pointer Control:
- Zoom Pan: Choose Continuous, Centered, or Edges to set how the screen image moves with the pointer.
 - Adjust Size with Zoom: Allow the pointer to scale with zoom.
- (4) To add Zoom to Accessibility Shortcut, go to Settings > Accessibility > Accessibility Shortcut, then tap Zoom.

Use Zoom

- (1) Double-tap the screen with three fingers or use accessibility shortcuts to turn on Zoom.
- (2) To see more of the screen, do any of the following:
- Adjust the magnification: Double-tap the screen with three fingers (without lifting your fingers after the second tap), then drag up or down. Or triple-tap with three fingers, then drag the Zoom Level slider.
 - Move the Zoom lens: (Window Zoom) Drag the handle at the bottom of the Zoom lens.
 - Pan to another area: (Full Screen Zoom) Drag the screen with three fingers.
- (3) To adjust the settings with the Zoom menu, triple-tap with three fingers, then adjust any of the following:
- Choose Region: Choose Full Screen Zoom or Window Zoom.
 - Resize Lens: (Window Zoom) Tap Resize Lens, then drag any of the round handles that appear.
 - Choose Filter: Choose Inverted, Grayscale, Grayscale Inverted, or Low Light.
 - Show Controller: Show the Zoom Controller.
- (4) To use the Zoom Controller, do any of the following:
- Show the Zoom menu: Tap the controller.
 - Zoom in or out: Double-tap the controller.
 - Pan: When zoomed in, drag the controller.

While using Zoom with Magic Keyboard, the Zoom region follows the insertion point, keeping it in the center of the display. See Use Magic Keyboard with iPhone.

To turn off Zoom, double-tap the screen with three fingers or use accessibility shortcuts.



Figure 12. Turning on Zoom in iOS operating system

Magnifier

Use your iPhone as a magnifying glass to zoom in on objects near you.

Set Up Magnifier








- (1) Go to Settings  > Accessibility > Magnifier.
- (2) Turn on Magnifier.

This adds Magnifier as an accessibility shortcut.

- (3) To automatically adjust the brightness of Magnifier based on ambient light settings, turn on Auto-Adjust Exposure.

Turn On and Adjust Magnifier

- (1) Use accessibility shortcuts to turn on Magnifier.
- (2) Make any of the following adjustments:
 - Adjust the magnification level: Drag the Zoom Level slider.

- Add more light: Tap  to turn the flashlight on or off.
 - Lock the focus: Tap . Tap again to unlock the focus.
 - Apply color filters: Tap . Tap the different color filters to preview their effects. To adjust the brightness and contrast, drag the sliders. To invert the colors, tap . To apply the selected filter and return to Magnifier screen, tap  again.
 - Freeze the frame: Tap . To adjust the magnification, drag the Zoom Level slider. To save the image, touch and hold the image, then tap Save Image. To unfreeze the frame, tap  again.
- (3) To turn off Magnifier, do the following:
- On an iPhone with Face ID: Swipe up from the bottom edge of the screen.
 - On an iPhone with a Home button: Press the Home button.

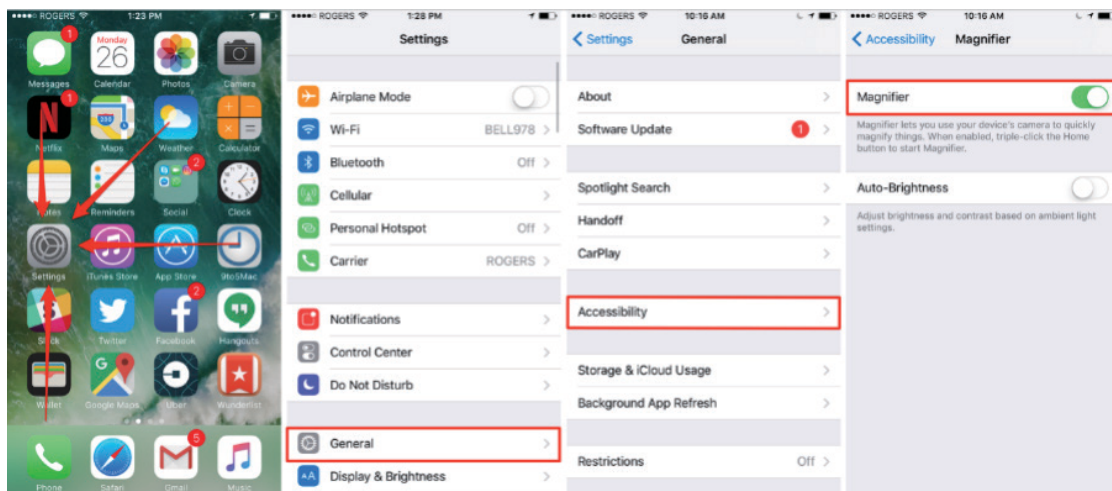


Figure 13. Turning on Magnifier in iOS operating system



Figure 14. Using Magnifier in iOS operating system

Display & Text Size

(1) Go to Settings  > Accessibility > Display & Text Size.

(2) Adjust any of the following:

- Bold Text: Display the text in boldface characters.
- Larger Text: Turn on Larger Accessibility Sizes, then adjust the text size using the Font Size slider.

This setting adjusts to your preferred text size in apps that support Dynamic Type, such as Settings, Calendar, Contacts, Mail, Messages, and Notes.

- Button Shapes: This setting underlines text you can tap.
- On/Off Labels: This setting indicates switches turned on with “1” and switches turned off with “0”.
- Reduce Transparency: This setting reduces the transparency and blurs on some backgrounds.
- Increase Contrast: This setting improves the contrast and legibility by altering color and text styling.

Apps that support Dynamic Type—such as Settings, Calendar, Contacts, Mail, Messages, and Notes—adjust to your preferred text size.

- Differentiate Without Color: This setting replaces user interface items that rely on color to convey information with alternatives.
- Smart Invert or Classic Invert: Smart Invert Colors reverses the colors of the display, except for images, media, and some apps that use dark color styles.
- Color Filters: Tap a filter to apply it. To adjust the intensity or hue, drag the sliders.
- Reduce White Point: This setting reduces the intensity of bright colors.

- Auto-Brightness: This setting automatically adjusts the screen brightness for current light conditions using the built-in ambient light sensor.

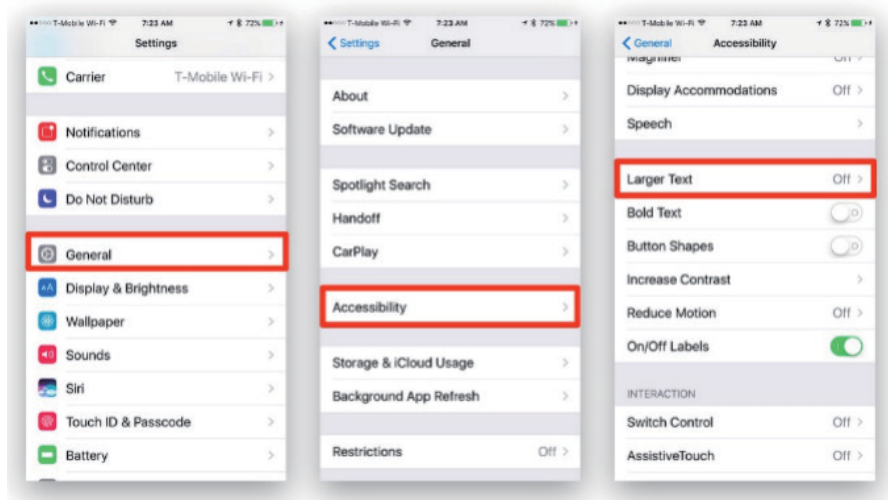



Figure 15. Turning on Magnifier in iOS operating system

Spoken Content

Hear iPhone speak the screen, selected text and typing feedback with this feature.

Change the Speech Settings

- (1) Go to Settings  > Accessibility > Spoken Content.
- (2) Adjust any of the following:
 - Speak Selection: To hear text you selected, tap the Speak button.
 - Speak Screen: To hear the entire screen, swipe down with two fingers from the top of the screen.
 - Speech Controller: Show the controller for quick access to Speak Screen and Speak on Touch.
 - Highlight Content: iPhone can highlight words, sentences, or both as they're spoken. You can change the highlight color and style.
 - Typing Feedback: You can configure typing feedback for the onscreen and external keyboards and choose to have iPhone speak each character, entire words, auto-corrections, auto-capitalizations, and typing predictions.

To hear typing predictions, you also need to go to Settings > General > Keyboards, then turn on Predictive.

- Voices: Choose a voice and dialect.

- Speaking Rate: Drag the slider.
- Pronunciations: Dictate or spell out how you want certain phrases to be spoken.

Hear iPhone Speak

- Hear selected text: Select the text, then tap Speak.
- Hear the entire screen: Swipe down with two fingers from the top of the screen. Use the controls that appear to pause speaking or adjust the rate.
- Hear typing feedback: Start typing. To hear typing predictions (when turned on), touch and hold each word.
- Or, just ask Siri: Say something like “speak screen”

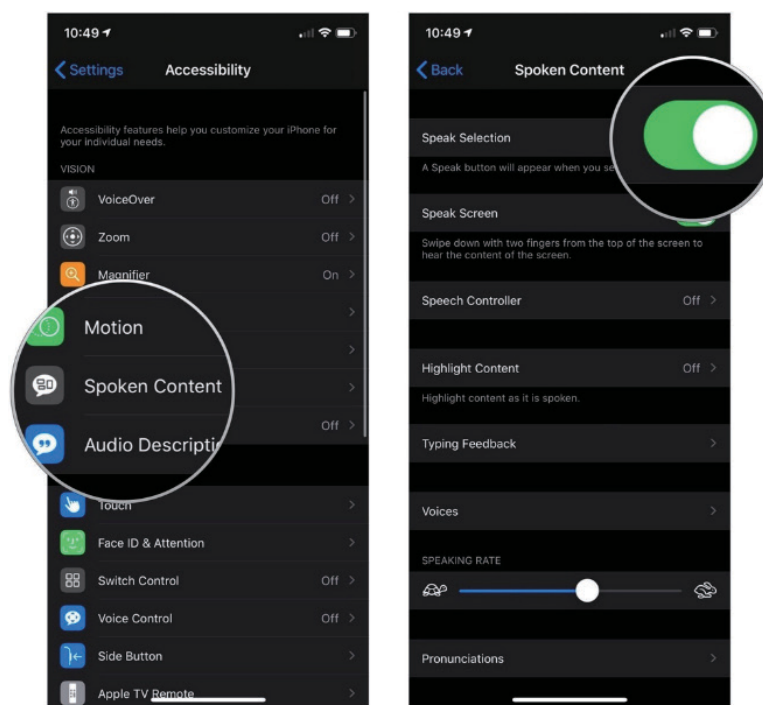


Figure 16. Turning on Spoken Content in iOS operating system

Audio Description

If you have video content that includes audio descriptions of scenes, iPhone can play the descriptions for you.


- (1) Go to Settings  > Accessibility > Audio Descriptions.
- (2) Turn on Audio Descriptions.




Figure 17. Turning on Audio Description in iOS operating system

Android

TalkBack

TalkBack is the Google screen reader included on Android devices. TalkBack gives you spoken feedback so that you can use your device without looking at the screen.

- (1) Open your device's Settings app .
- (2) Open Accessibility, then TalkBack.
- (3) Turn on TalkBack.
- (4) In the confirmation dialog, tap OK.

Talkback also has several gestures you can use to navigate your smartphone and adjust volume and other settings. Tap on the Wi-Fi icon to verify that you're connected and the battery icon to find out how much juice you have left.

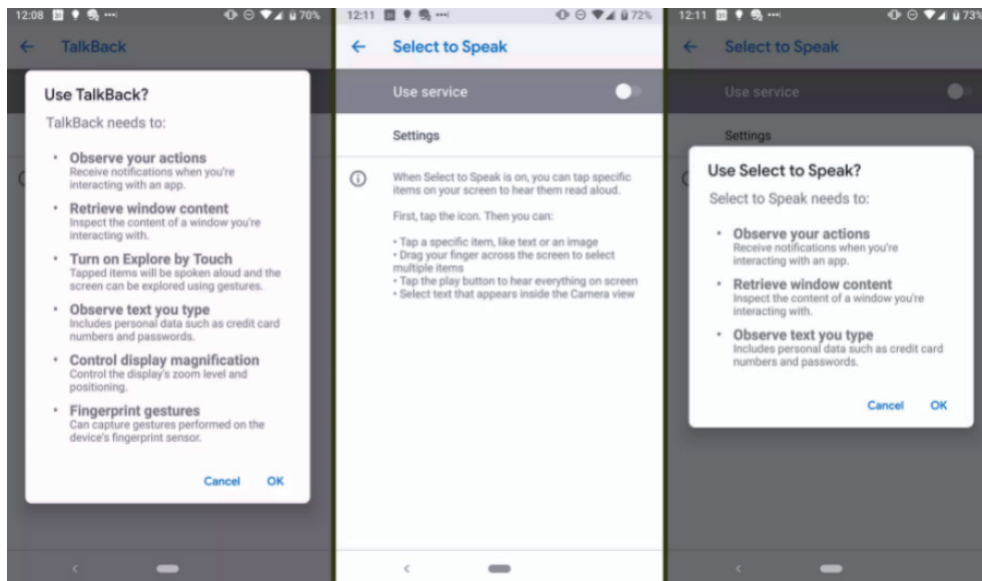


Figure 18. Using TalkBack in Android operating system

Color Correction

- (1) Open your device's Settings app.
- (2) Tap Accessibility, then tap Color correction.
- (3) Turn on Use color correction.
- (4) To change the color correction mode, tap Correction mode, then choose one of the following options: Deuteranomaly (red-green) Protanomaly (red-green)

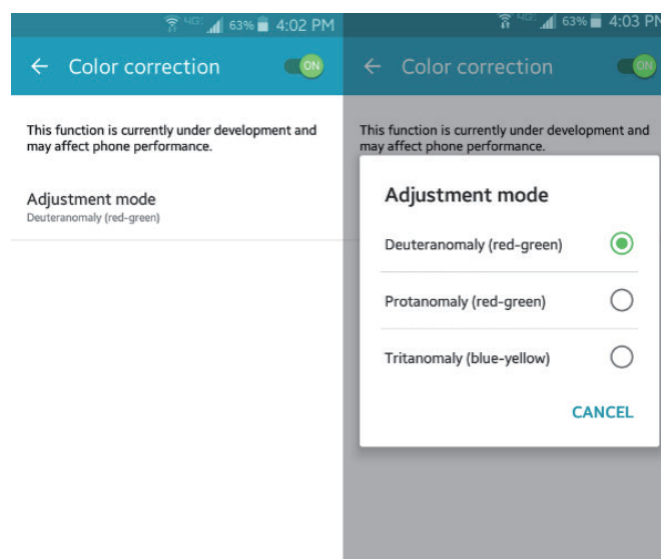


Figure 19. Correcting color in Android system

Change Font Sizes

- (1) From the Settings window, in the left pane, tap the Display option.
- (2) From the right pane, under the Font section, tap the Font size option.
- (3) On the opened Font size window, tap to select the appropriate radio button to set the desired font size.

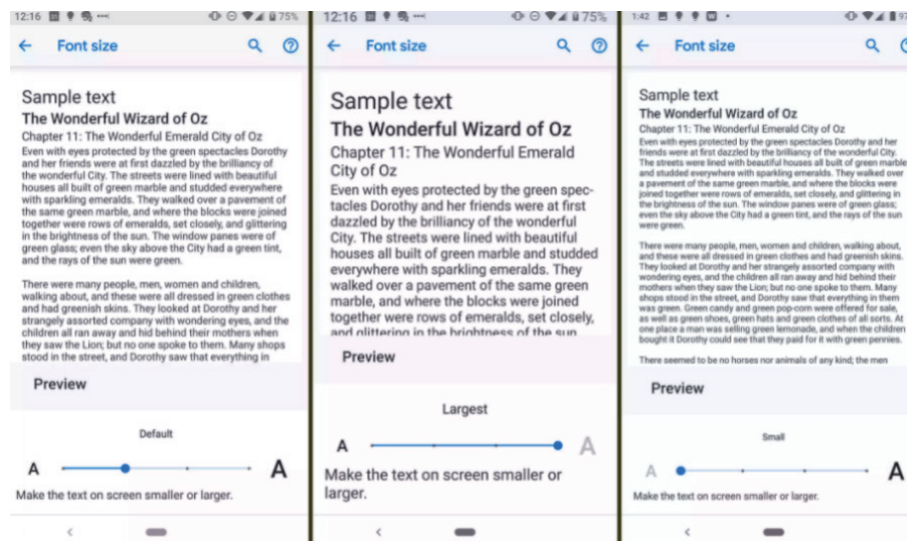


Figure 20. Changing font sizes in Android system

Magnification

Gestures can be used to zoom in on certain parts of your screen. Once you enable the feature in settings, you can zoom in by tapping the screen three times with your finger (triple-tap) or via an Accessibility button. Tap the button, then tap anywhere on the screen. Drag two or more fingers to scroll and pinch two or more fingers to adjust zoom.

Zoom can temporarily be used by also tapping the screen three times and holding your finger down on the third tap. Once you lift your finger, your screen will zoom back out. Note that you cannot zoom in on the stock keyboard or navigation bar.

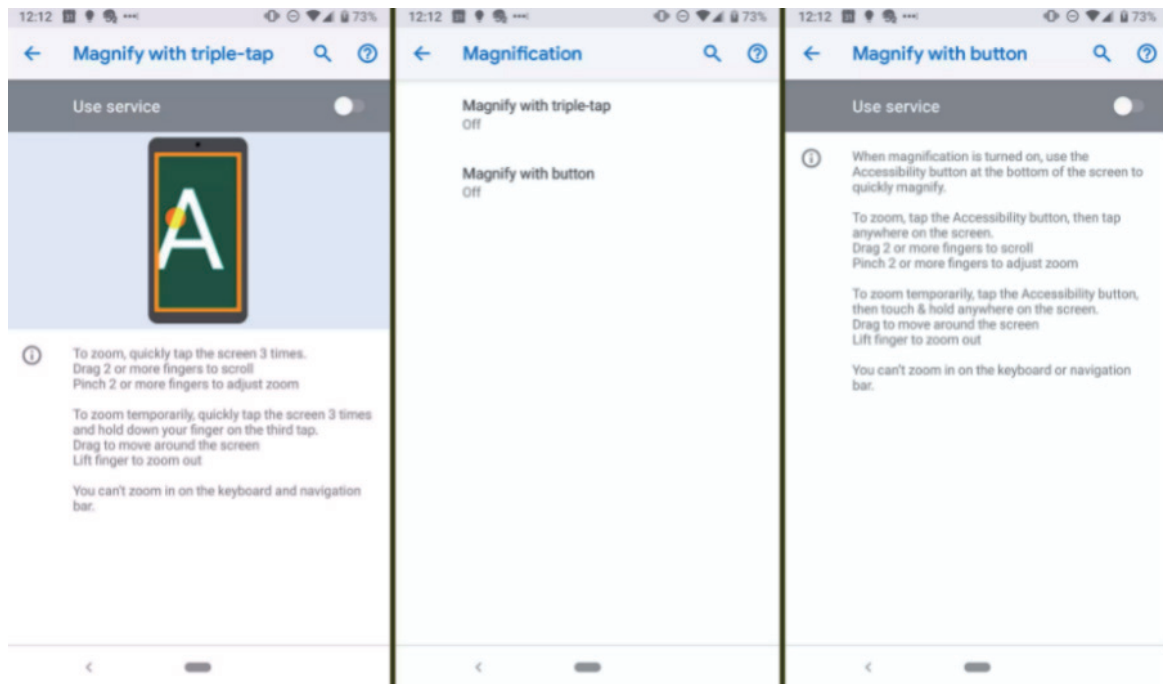



Figure 21. Three ways to magnify texts in Android operating system

Lookout

Lookout uses the camera and sensors on your device to recognize objects and text, and then gives you spoken feedback, ear-cons, and other signals to inform you about what it sees.

Step 1: Install and turn on Lookout

- (1) Download Lookout on Google Play.
- (2) Start Lookout using one of these options:
 - Say “Ok Google, start Lookout.”
 - Tap Lookout .

Step 2: Start using Lookout

Lookout automatically starts when you open the app. You'll hear a start-up tone indicating that Lookout is active.

Lookout has 4 modes that you can use while you're doing different activities:

- Explore: For daily tasks, chores, and new places. By default, Lookout starts in the Explore mode.
- Shopping: For barcodes and currency.

- Quick read: For sorting mail, reading signs and labels.
- Scene description: Hear an instant description of a single image.

To choose the Lookout mode that matches your current activity, go to the Select Mode tab. To go to the Select Mode tab from the Camera tab, swipe left. (If TalkBack is on, 2-finger swipe.)

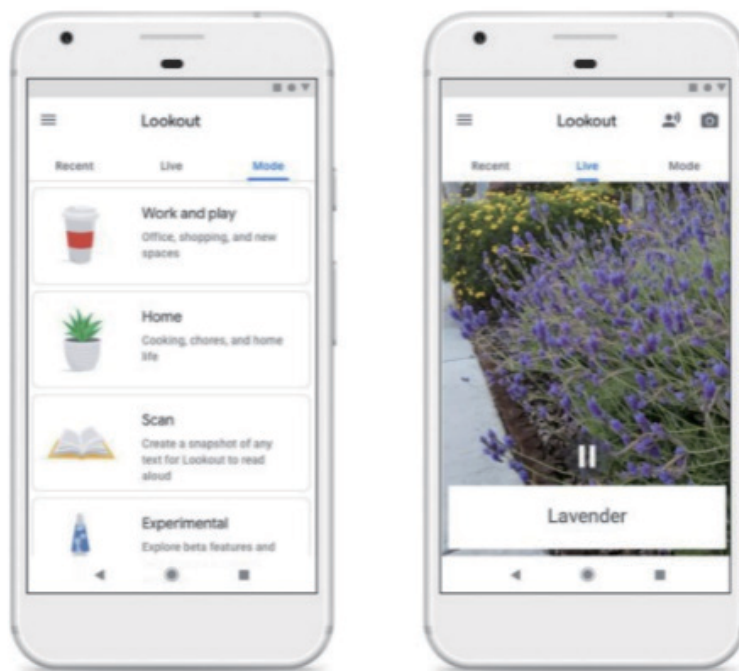


Figure 22. Using Lookout in Android operating system

3.2.Hearing Impairment

ios

The iPhone has many features designed to help people who are hearing-impaired to be able to use it effectively. These features can be enabled and configured under the Accessibility Settings screen.

- (1) On the Settings screen, tap General.

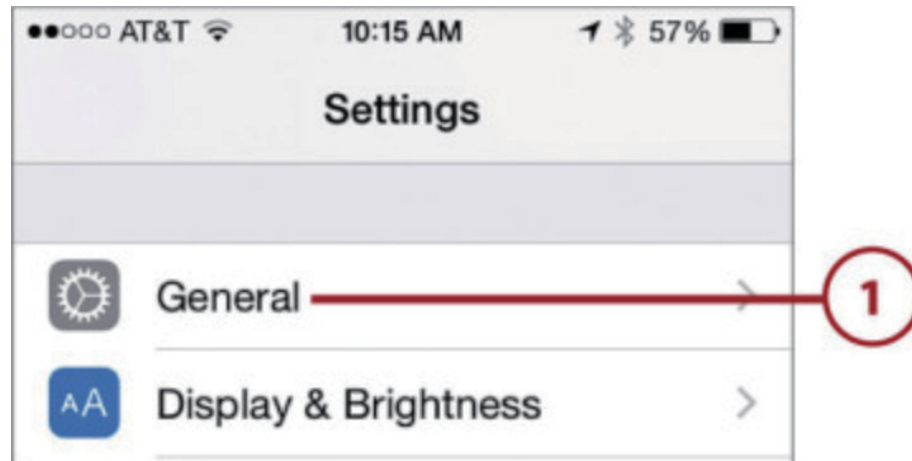


Figure 23. Find Settings in iOS operating system

- (2) Swipe up the screen until you see Accessibility.
- (3) Tap Accessibility. The Accessibility screen is organized into different sections for different kinds of limitations. The first section is VISION, which includes options to assist people who are visually impaired.

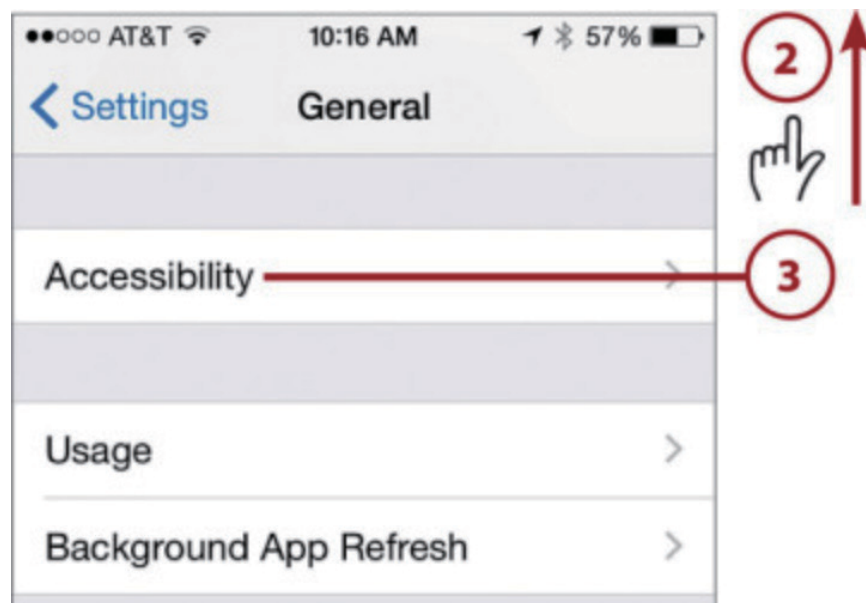


Figure 24. Find Accessibility in General in iOS operating system

- (4) Use the controls in the VISION section to change how the iPhone's screens appear. Some of the options include:
 - VoiceOver—The iPhone guides you through screens by speaking their contents.

- Zoom—This magnifies the entire screen.
- Invert Colors—This changes the screen from dark characters on a light background to light characters on a dark background.
- Grayscale—This option makes the screen to use grayscale instead of color.
- Speech—Under the Speech option, Speak Selection has the iPhone speak text you have selected, Speak Screen provides the option to have the screen's content spoken, and Speak Auto-text has the iPhone speak corrections it suggests to you, such as auto-capitalizations.
- Larger and Bold Text—These increase the text size and add bold; these are in addition to the Text Size and Bold settings described earlier. You can make the text even larger.
- Other options—You can also change button shapes, change contrast, reduce motion, and turn labels on or off.

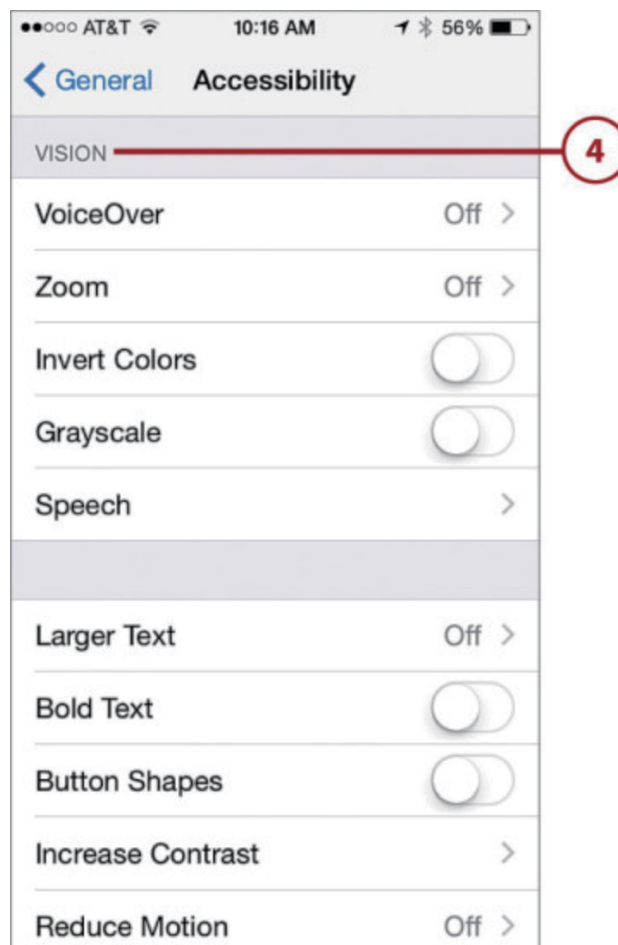


Figure 25. Using controls in Vision in iOS operating system

- (5) Swipe up to see the HEARING section.
- (6) Use the controls in this section to configure sounds and to configure the iPhone to work with hearing-impaired people. The controls in this section include:
- Hearing Aids—You can pair an iPhone to work with a Bluetooth-capable hearing aid and put it in hearing aid mode.
 - LED Flash for Alerts—When you set this switch to on (green), the flash flashes whenever an alert plays on the phone.
 - Mono Audio—This causes the sound output to be in mono instead of stereo.
 - Phone Noise Cancellation—This switch turns noise cancellation on and off. Noise cancellation reduces ambient noise when you are using the Phone app.
 - Balance—Use this slider to change the balance of stereo sound between left and right.

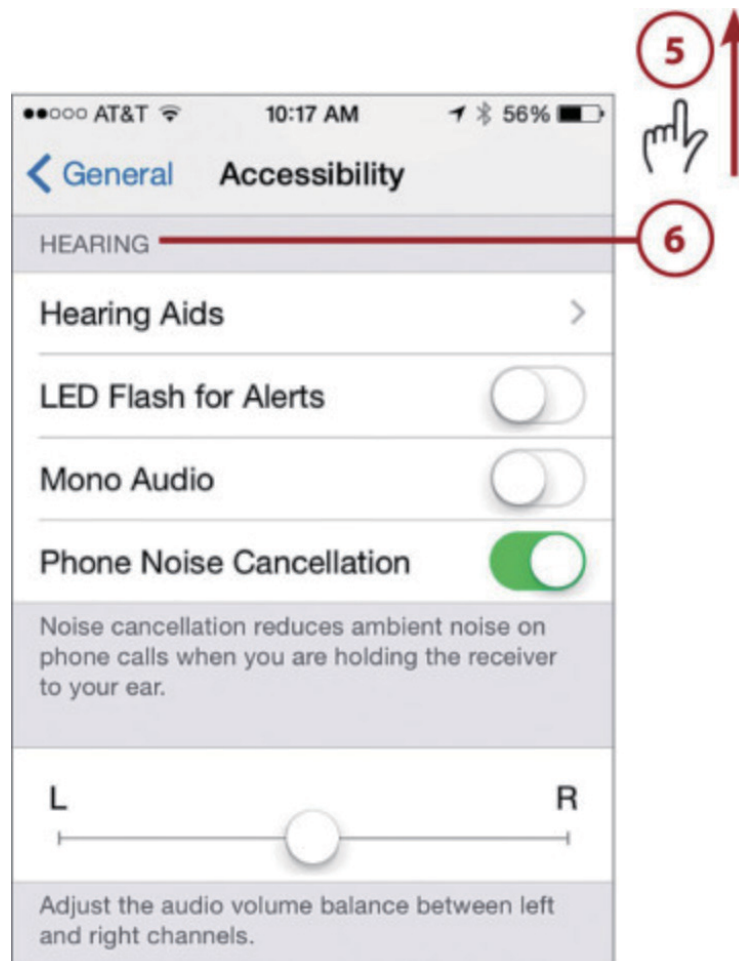


Figure 26. Using functions in Hearing in iOS operating system

- (7) Swipe up to see the MEDIA section.
- (8) Use the controls in this section to add features to video playback, including:
- Subtitles & Captioning—Use these controls to enable subtitles and captions for video and choose the style of those elements on the screen.
 - Video Descriptions—This provides descriptions of the video to be played when available.
- (9) Use the Guided Access setting if you want to limit the iPhone to using a single app and to further configure the features, such as Passcode Settings and Time Limits.
- (10) Swipe up to see the INTERACTION section.

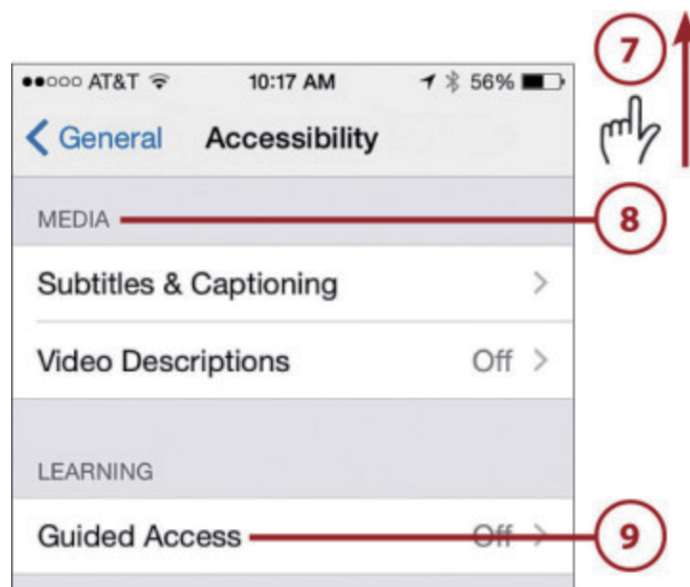


Figure 27. Using Guided access in iOS operating system

- (11) Use the controls in this section to adjust how someone can interact with the iPhone. The controls here include:
- Switch Control—The controls on this screen enable you to configure an iPhone to work with an adaptive device.
 - Assistive-Touch.—These controls make an iPhone easier to manipulate; if you enable this, a white button appears on the screen at all times. You can tap this to access the Home screen, Notification Center, and other areas. You can also create new gestures to control other functions on the iPhone.
 - Call Audio Routing—Use this to configure where audio is heard during a phone call or FaceTime session, such as headset or speaker.
 - Home-click Speed—Use this to adjust the speed at which you need to press the Touch ID/Home button to register a double- or triple-press.

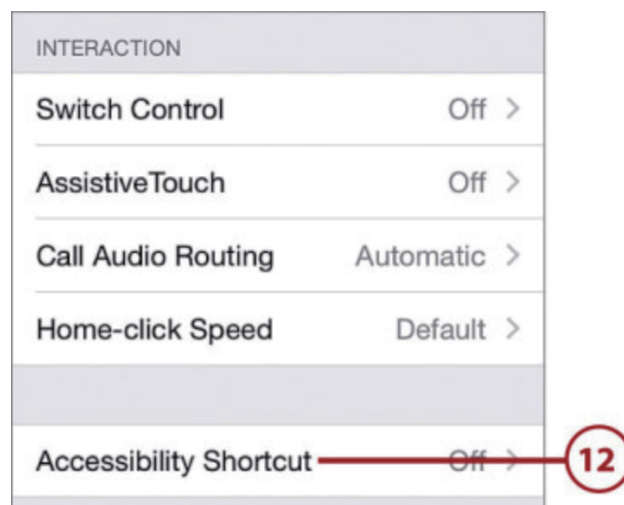


Figure 28. Using controls in Interaction in iOS operating system

- (12) Use the Accessibility Shortcut control to determine what happens when you press the Touch ID/Home button three times.

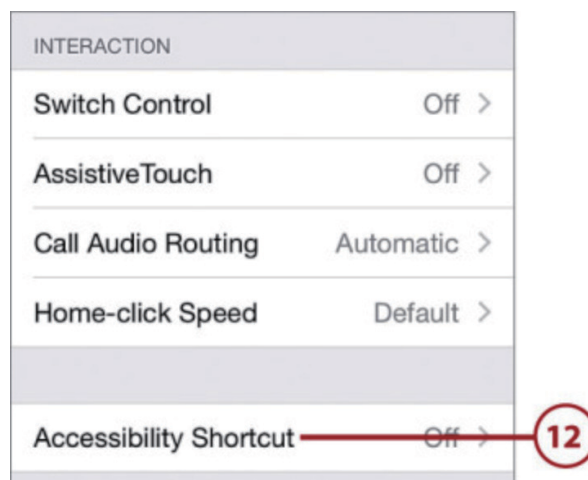



Figure 29. Using Accessibility Shortcut in iOS operating system

Android

The iPhone has a lot of features designed to help people who are hearing-impaired to be able to use it effectively. These features can be enabled and configured under the Accessibility Settings screen.

SizeLive Transcribe

- (1) Download Live Transcribe on Google Play.
- (2) Go to the Apps section.

- (3) Tap the Live Transcribe app .
- (4) Make sure that you are connected to the internet.
- (5) Hold your device microphone near the person or sound that you want to capture. The microphone is usually located at the bottom of your device.

Live Caption

With a single tap, Live Caption automatically captions videos, podcasts and audio messages—even stuff you record yourself. Here is how to enable it:

- (1) Press the volume button.
- (2) Under the volume controls, tap Live Caption.

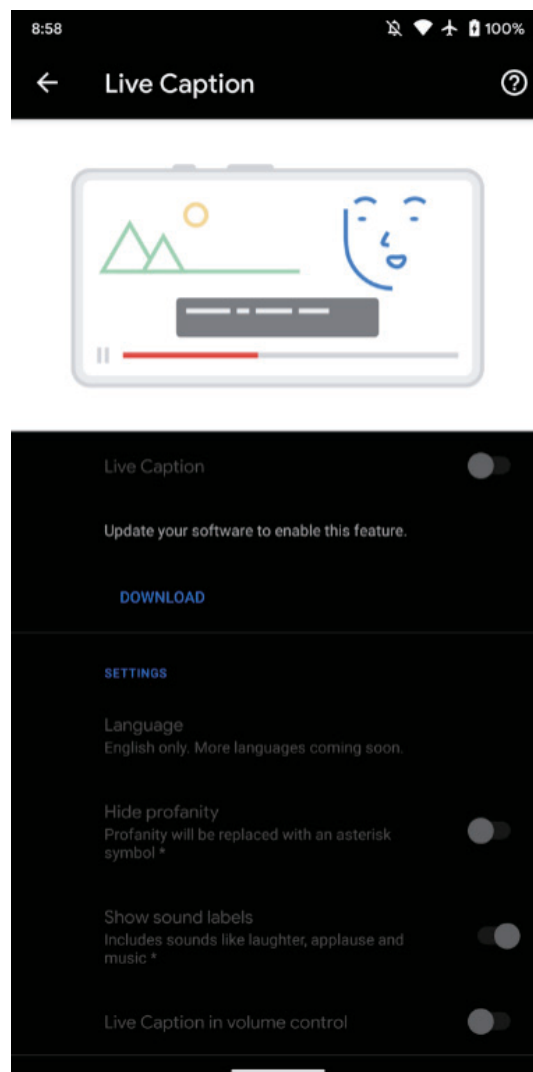


Figure 30. Using Live Caption in Android operating system

Sound Amplifier

- (1) Open your device's Settings app .
- (2) Tap Accessibility, and then tap Sound Amplifier.
- (3) Tap Use service.
- (4) To accept the permissions, tap OK.
- (5) Connect wired or Bluetooth headphones to your device.
- (6) To start Sound Amplifier, 2-finger swipe up, or tap the Accessibility button .



Figure 31. Turn on Sound Amplifier in Android operating system

3.3.Mobility Impairment

iOS

The iOS Switch Control has two modes that the user can use: item scanning and point scanning.

- (1) Item scanning scans through all the elements on the page. Sometimes elements are grouped together (for example: a drop-down menu), and by selecting the group of elements, the scan mode will drill down and start scanning the individual elements in that group.
- (2) For elements that the item scanning cannot reach, point scanning allows the user to select a position on the screen to simulate a tap. The user first selects the horizontal mouse position and then selects the vertical position. A user can switch between these modes through the Switch Control's menu.
- (3) The iOS Switch Control has a comprehensive menu with many helpful tools. Gestures allow the user to pinch or swipe, all with a simple switch. Scroll features allow the user to scroll through the screen. Hardware buttons (e.g., home button and volume control) and access to the notification center are also accessible through the menu. Siri is also accessible through the iOS Switch Control's menu for voice dictation.

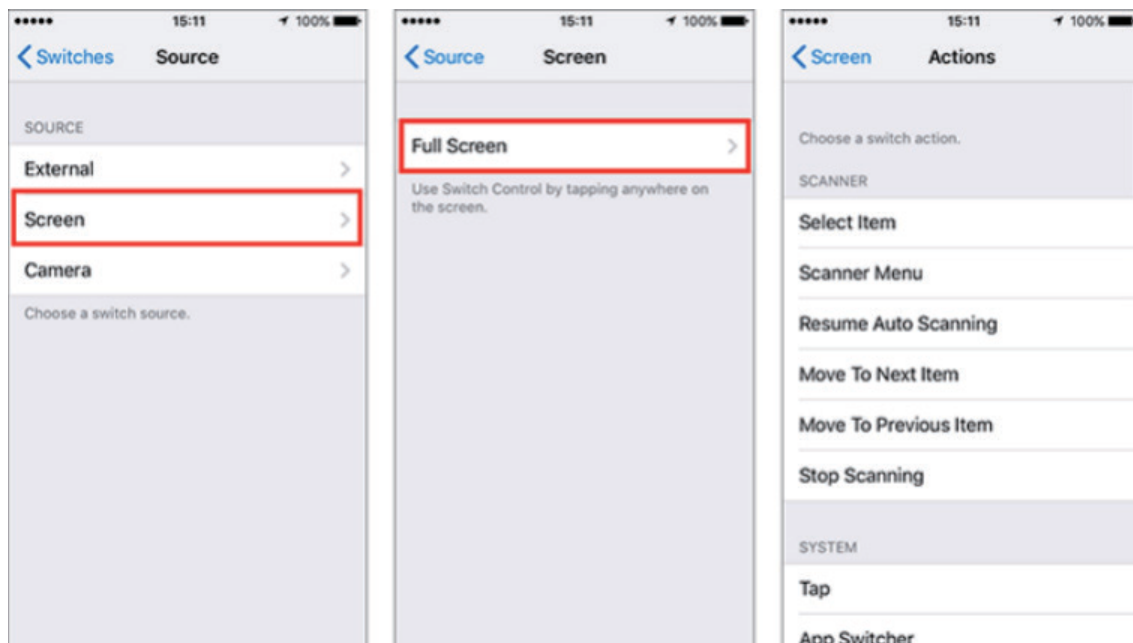


Figure 32. Using Switch Control in iOS operating system

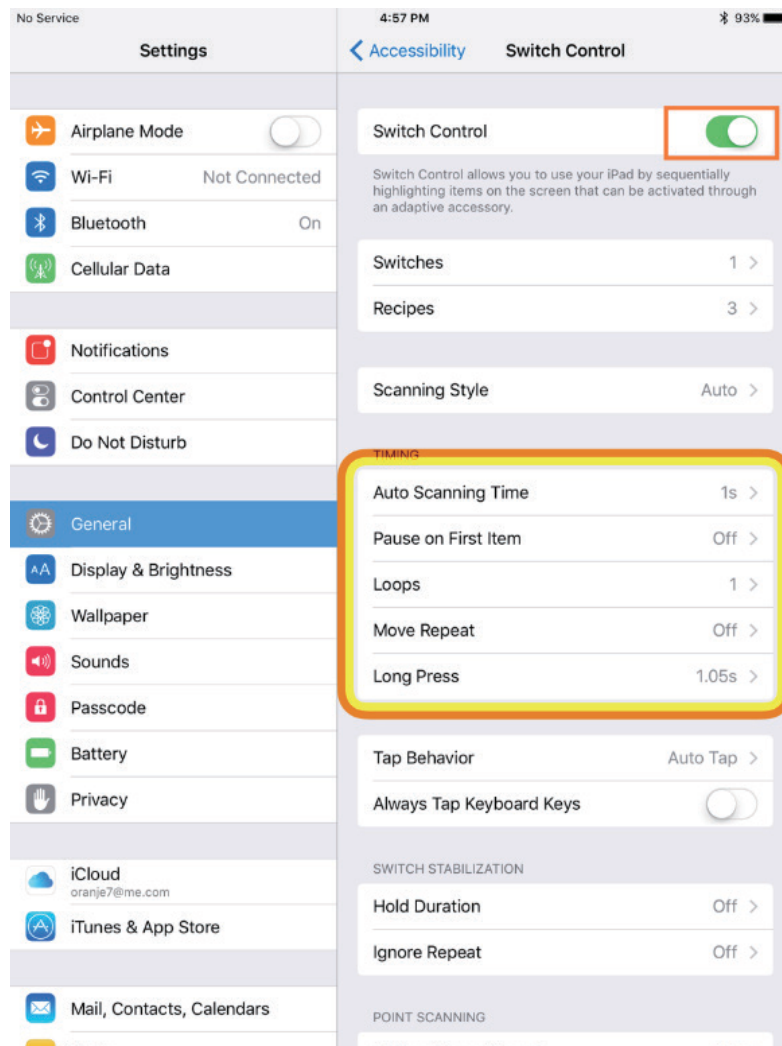


Figure 33. Adjusting features of Switch Control in iOS operating system

Besides Switch Control, iOS has many other tools for users with limited manual dexterity.

- Assistive Touch allows users to assign common tasks to custom gestures when they cannot do gestures that require more dexterity, like pinching.
- Siri/Dictation allows users to dictate text to be inserted into a text field and enables basic control of the device such as launching apps and opening device settings.
- Touch accommodations allows touch characteristics such as hold duration, repeat filter and activation point to be customized.
- Settings for hardware keyboards provides customization including: slow keys, sticky keys and keyboard shortcuts

Android

Voice Access

The Voice Access app for Android lets you control your device with spoken commands. Use your voice to open apps, navigate, and edit text hands-free.

Open your device's Settings app .

- (1) Tap Accessibility, and then tap Voice Access.
- (2) At the top, tap the On/Off switch.
- (3) Turn on Voice Access:
 - If Voice Match is on, say "Ok Google."
 - If Voice Match is not on, open your notification shade and tap the "Touch to start" Voice Access notification.
- (4) Say a command, such as "Open Gmail."

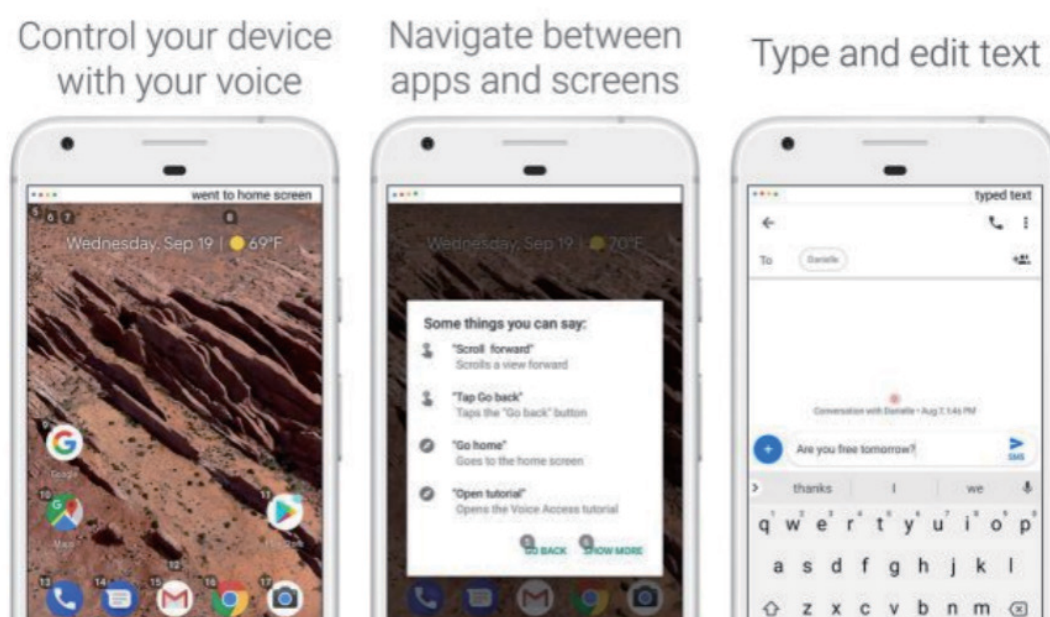


Figure 34. Using Voice Access in Android operating system

Switch Access

To use Switch Access, you will first need one or more switches. There are several kinds of switches:

- Use an external switch: A switch is a device that sends a keystroke signal to your Android device. Several companies sell these devices, such as AbleNet, Enabling Devices, RJ Cooper, and Tecla. These devices connect to your Android device via USB or Bluetooth. (Google does not endorse these companies or their products.)

- Use an external keyboard: You can configure a standard USB or Bluetooth keyboard to work as a switch device by assigning one or more of its keys to actions.
- Use buttons on your Android device: Built-in buttons on your Android device, such as the volume up and volume down buttons can also be assigned to actions. This option is intended for developers. If you are using this option, you can skip the first two setup steps in the next article.

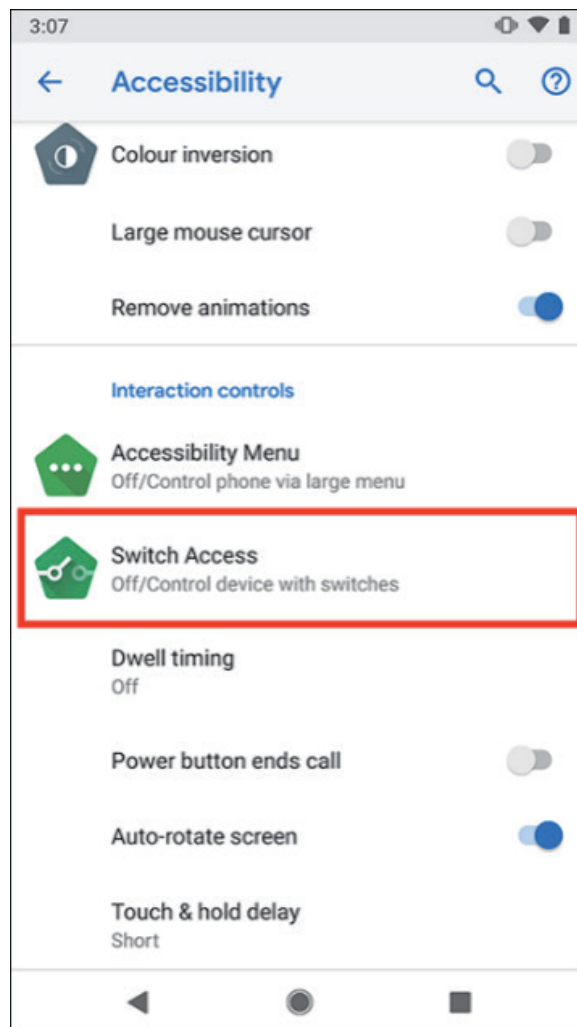


Figure 35. Using Switch Access in Android system

4.Utilizing digital resources and tools for students with disabilities

As teachers and families may not have a solid background on teaching learners with disabilities in open and distance environments or at home, Table 2 presents the following free and open learning tools that could be used in the learning process.

Table 2. Open and free educational applications and platforms for students with disabilities

| Application | Platform | Description | Link |
|---|-----------------------|---|---|
| Amazon Audible Stories | Web | Provides a collection of audible stories for kids in six languages that everyone can listen to on their device | https://stories.audible.com/discovery |
| Google Open Online Education | Web | A platform to create courses and engage students in learning. It also includes accessibility features to involve those with disability, including impaired vision or hearing, physical disabilities | https://edu.google.com/openonline/ |
| Cboard | Web | Cboard is an AAC web app for children and adults with speech and language impairments, aiding communication with symbols and text-to-speech. | https://www.cboard.io/ |
| Kid in Story Book Maker | iOS | Occupational therapists, speech therapists, and teachers can easily create their stories or engage learners in creating their stories using this tools | https://www.common sense.org/education/app/kid-in-story-book-maker |
| Children with Autism: A Visual Schedule | Web | Children with Autism: A Visual Schedule can be a digital replacement for paper-based schedules for students who need support with organization and executive function skills. | https://www.common sense.org/education/app/children-with-autism-a-visual-schedule |
| Birdhouse for Teachers | iOS Web Android | Teachers can use Birdhouse as a behavior management tool to allow caregivers at home and educators at school to collaborate on one tool. This can keep kids with disabilities on track. | https://www.birdhousehq.com/teachers-choose-your-plan/?web=teacher |

| Application | Platform | Description | Link |
|-------------------------------|----------------|--|---|
| Epic - Kids' Books and Videos | iOS Android | The leading digital library for kids, where kids can explore their interests and learn with instant, unlimited access to 40,000 high-quality eBooks, audiobooks, learning videos, and quizzes for kids | https://apps.apple.com/us/app/epic-kids-books-and-videos/id719219382 |
| SoundingBoard | | A free mobile augmentative and alternative communication (AAC) app designed for children who are unable to speak (or who have limited speech) to help them communicate. | https://www.ablenetinc.com/soundingboard |
| Sounds: The Pronunciation App | iOS | The ultimate mobile English pronunciation aid, for both students AND teachers. Sounds helps you study, practice and play with pronunciation wherever you are. | https://apps.apple.com/us/app/sounds-pronunciation-app-free/id428243918 |
| Autism MindAwakener | Android | It aims to help hyperactive kids learn alphabet and some object names in a fun and interactive way. | https://play.google.com/store/apps/details?id=com.benitez.mindawakener |
| Dyslexia Toolbox | iOS | This application features a whole host of assistive technology features for K-12 students with dyslexia. Type pads, word prediction, digital overlays and text readers are all included, along with many more neat features designed with dyslexia in mind. | https://www.educationalappstore.com/app/dyslexia-tool-kit |
| ModMath | iOS | ModMath is a free app for the iPad, targeted at helping students with dyslexia and dysgraphia do math. It was created by parents of a child with dysgraphia, and remains focused on providing a clear tool to solve math problems without ever picking up a pencil. | http://www.modmath.com/ |
| Choiceworks | iOS | This app helps kids who struggle with executive functioning, teaching them how to cope with day-to-day activities like schedules, waiting and feelings. Using pictures, checklists, storyboards and other interactive activities, Choiceworks is an essential learning tool for helping children and their caregivers complete daily routines. It can also be customized for teachers to use in school settings. | http://www.beevisual.com/ |
| Video Scheduler | iOS | The app is very customizable and allows creating both picture and video schedules of almost any complexity. The method is beneficial for ASD students and those struggling with time and task management. With the help of Video Scheduler, they will be able to work independently with little or no help from the teacher. | https://apps.apple.com/us/app/video-scheduler/id482833959 |

| Application | Platform | Description | Link |
|-----------------------------------|--------------|---|---|
| The Sounding Out Machine | iOS | This app is very beneficial for learners that struggle with decoding. It sounds out difficult words and models how to pronounce them syllable by syllable. The handy window allows isolating challenging words from the rest of the text if the entire page is too overwhelming. There is also a typing mode, where a student can type in a particularly puzzling word. | http://fizzbrain.com/ |
| AutisMIND | iOS, Android | This is an app to stimulate Theory of Mind and social thinking development in children with autism spectrum disorders. AutisMIND is a support tool to help parents and professionals work social skills in children with ASD. | https://autismind.com/en/#:~:text=AutisMIND%20is%20an%20app%20to,skills%20in%20children%20with%20ASD. |
| Presence Learning | website | PresenceLearning is the leading provider of live online special education-related services to K-12 schools nationwide. It provides direct therapy, diagnostic services and assessments, early childhood services, and consultative services. Its website provides resources ranging from eBooks to infographics in relevant fields. | https://www.presencelearning.com/resources/content-library/ |
| AR Food Bar (traditional Chinese) | Android | Utilizing AR technology, this app focuses on improving the learning interest of pre-k/students with disabilities by means of naming food, extending it to sentences, and contextualizing those concepts. | https://drive.google.com/file/d/1KDxldkG8APiFwHnbgyzft3qXbNf5j5I0/view |

5.Designing learning activities for students with disabilities

Due to the COVID-19 pandemic, the learning process has shifted from face-to-face to distance and open learning from home. However, teachers, especially those of special education, may have limited background about how to adapt their learning contents to this new learning type. Therefore, this section presents the possible learning methods to provide distance and open learning for learners with disabilities. It also presents the possible learning assessment methods that teachers can use while teaching.

5.1.Learning methods

5.1.1.Asynchronous learning

Asynchronous learning via different platforms, such as Moodle, Edmodo and Weebly was provided. Particularly, learning materials (videos, pictures, etc.) were tailored to individual students or groups of students in accordance with the Individual Development Education Program (IROP). Additionally, several school portals have published specific guidelines and ideas that can support remote teaching adaptation. The parents were then required to assist their children during the learning process using these materials. In this context, several training videos were also prepared for parents to facilitate their task of helping their children learn.



Story 4: The use of DAISY textbooks at Montenegro

DAISY textbooks (<http://www.resursnicentarg.me/audio-biblioteka>) were suggested to be used at home In Montenegro. They are a multimedia edition of a printed book, a combination of audio-visual text that are intended for children with visual impairments, intellectual disabilities, reading difficulties, but all other children can also find them useful, interesting and fun. This method was for literate learners and with somewhat higher ability, such as mild intellectual disability and cerebral palsy.



Figure 36. DAISY textbooks



Story 5: Developing accessible learning platforms by the Qatari government

The Qatari government during this pandemic developed two platforms: (1) an inclusive Digital Education Portal (<https://mada.org.qa/services/inclusive-platforms/digital-inclusive-education/>): this platform is developed in a short time to be accessible to support remote education as an initiative aimed at enabling the education sector to ensure the inclusiveness of education for all students in the State of Qatar and beyond, especially those with disabilities or functional limitations. The available resources are displayed on Mada's accessible educational platform to facilitate access to information for teachers and students on one platform designed to suit the needs of the current period; and (2) Inclusive Digital Culture and Community Portal (<https://mada.org.qa/services/inclusive-platforms/digital-inclusive-culture-portal/>): this platform is developed to be accessible for all and to support the culture and community sector by providing access to digital services.

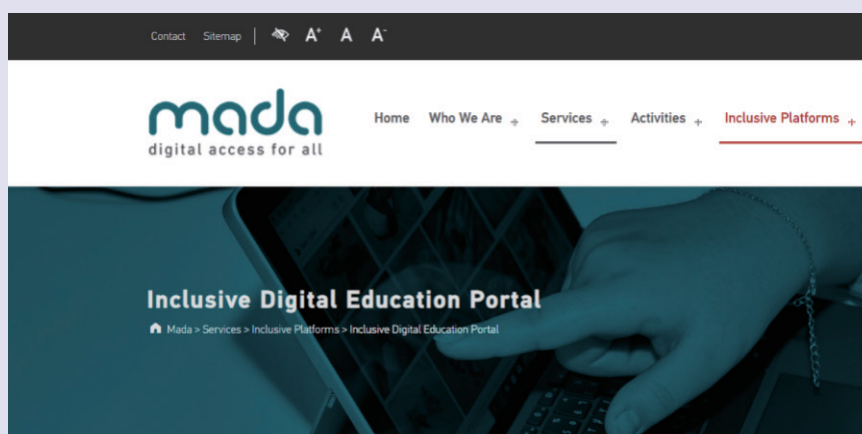


Figure 37. Mada's accessible educational platform



Story 6: Providing open training by the Qatari government to create accessible learning resources

As schools' transition to online learning during the COVID-19 crisis, it is important to provide teachers with guidance and relevant, evidence-based resources on how to deliver lessons in remote and online settings in special education. Here, through the Open Training Program of Mada (see Figure 38), several online training was provided to teachers on how to use educational platforms and how to create accessible documents (<https://mada.org.qa/capability-building/>).

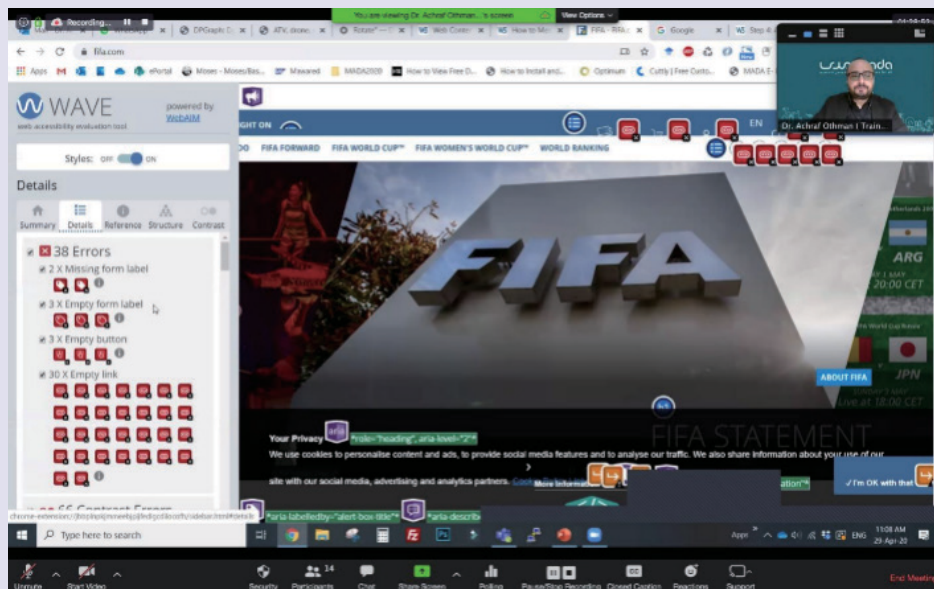


Figure 38. An online training session how to create accessible content as part of the Mada Opening Training



Story 7: Releasing guidance to adapt curricula and instructions to remote learning

Several countries issued guidance for teachers to adapt their curricula and instructions to remote learning while teaching students with disabilities. For instance, based on the recommendations of the Ministry of Education and Higher Education in Qatar, the curriculum was adapted to online platforms, such as Microsoft Teams because learning in a remote setting may differ from mainstream, classroom-based environments. This includes expectations for students and course methodology. Curricula must often be adjusted. For example, homework

can be simplified, allowing students to dictate rather than type, and audio materials can be provided for reading assignments. Similarly, The Ministry of Education of Montenegro posted several guidelines (see Figure 39) to adjust the learning content the online environment (<http://www.skolskiportal.edu.me/Pages/Inkluzivnoobrazovanje.aspx>). This was to facilitate the teacher's role, as many of them do not have previous experience in that.



Figure 39. Guidelines posted by the Ministry of Education of Montenegro

5.1.2.Synchronous learning

Synchronous learning via video conferencing tools, such as Zoom or Microsoft Teams, by making use of both audio and video to directly interact with the learners and explain some concepts. In this method, online learning groups can be made according to the learners' abilities and not by their types of disability.



Story 8: Using Zoon in the special school “Milan Petrovic” in Serbia

As shown in Figure 40, the special school “Milan Petrovic” in Serbia used Zoom to provide online courses to students with special needs. Particularly, the teacher composed a heterogeneous (i.e., learners with milder combined disabilities that include mild intellectual disabilities, visual impairment and cerebral palsy) learning class while providing online remote teaching.



Figure 40. “Milan Petrovic” in Serbia is providing special education via Zoom



Story 9: Providing Inclusive learning for learners with disabilities at the Near East University- Cyprus

At the Near East University- Cyprus, we tried to ensure inclusive learning for students with disabilities even during the COVID-19 pandemic. In this context, sign language teaching using BigBlueButton and google meeting was used. During the pandemic time, learners with disabilities have equal opportunities to access courses with the support of several technologies, such as tablets, smartphones and PC. The university provides academic and technical support through the Moodle Learning Management System platform to foster online learning for those learners. Moodle conveys a ground-breaking set of student-driven instruments and community learning conditions that enable both instructing and learning because of its adaptability and versatility. There is an open course policy of the university in which accessible courses are set within the system. How online learning is successfully implemented is crucial to question tutor support, technical support, and learners’ conditions to access knowledge construction. During the online courses, learners who have their own assistive technologies are supported to enroll in courses. Moodle offer tools like the forum, email, blogs, both asynchronous and synchronous communication, wikis, glossaries, texts, surveys, educational activities, books and videos. In addition to this, live classes were conducted through BigBlueButton and Google meeting.

Within this context, courses cover weekly scheduled lecture notes, reflective tasks, group works, reading materials and live classes with discussions. Through those opportunities, learners with disabilities find a chance to support their learning with peer learning. They find a chance to express their thoughts through discussions and presentations. Of course, orthopedically disabled ones cannot face problems on accessibility where online

platforms become an opportunity to attend classes and show inclusion and engagement like others. With web-based learning, debilitated understudies increase simple access to every single instructive material right at the solace of their home. This web-based learning set-up fundamentally expels the problem of physical fatigue for portable hindered understudies, while likewise making life simpler for the outwardly debilitated or hearing-weakened ones. This permits them to investigate the world in a lot more liberated condition, expelling the demoralization of learning and tempting them to take an interest even more effectively. However, technical support groups currently work for screen reading software, alternative input devices for other physical disabilities, voice recognition software, comprehensive software and screen magnification software to provide services during online courses. Not only for the pandemic time, but for the project group also works for all courses for everyone as a project which includes green screen technology to provide access to all courses for learners with disabilities. Currently, the project is in a process that was set before the pandemic time. In this context, learners with disabilities can enroll in online accessible courses in www.uzem.neu.edu.tr at home, can access the course as others. The technical support services are highly provided during the pandemic time to access courses for all learners.

Moreover, reflection questions were asked to the students about the usefulness of their system each week. These questions are deep learning questions for examining learning management process for each week. Additionally, all online seminars/workshops that were held during this pandemic were accompanied by sign language translators to ensure equality for all citizens. All these seminars/workshops were recorded and uploaded as OER for others to (re)use. Furthermore, we had in the university students with orthopedic impairments, therefore during the remote online learning from home time. University students with orthopedic impairment has the same opportunity with his classmates and follow up same criteria to enroll the online class. Peer support and technical support were done to facilitate effective remote online learning.

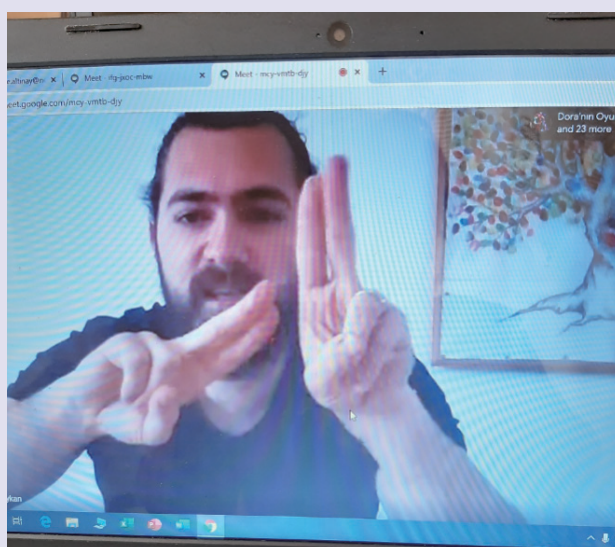


Figure 41. A teacher is using sign language for teaching

5.1.3. Telecourses

Telecourses were also provided, such as the Ucidoma program, in order to help those learners who do not have internet access learn. Specifically, fixed schedules.

5.1.4. Phones

In “Milan Petrovic” school, for a very small number of students who could not attend online classes, teachers called parents at an agreed time (once or twice a week) and told them which textbook lessons to read to children (or with children) and which skills to practice or strengthen. During the conversation, they supported and taught parents how to work with children and how to make the content obvious.

5.1.5. Printed learning materials and assessments

Printed learning materials and assessments were sent each week to the learners who do not have computers, where their parents had to help them learn these materials and solve the provided assessments. The parents had then to send back these assessments to be corrected by the teachers. This was done for instance, by the special school “Milan Petrovic” in Serbia.

5.2. Learning assessment methods

Additionally, since assessing learners during the learning process is important, and since unlike face-to-face learning, learners with disabilities are located in an environment different from where the teacher is, investigating the potential learning assessment methods that can be carried out remotely with learning with disabilities is important. The participants mentioned several assessment methods that they used during this remote teaching experience. These assessment methods were ordered from the most used (mentioned) method to the least mentioned method.


- Real time communication and interaction: This was the most used method where the participants stated that they assessed their students with disability daily, based on the real-time communication with them, such as, via Zoom. For instance, the teacher can ask questions and see how each student respond. Also, the participants mentioned that they also kept an eye on students’ while working on the learning platform in order to see how they learn and behave, then provide more learning content accordingly.
- Simple projects/assignments: Teachers used WeChat parents group to assign homework for children (such as dressing, making bed, etc.). Parents are responsible for uploading videos of their children after finishing these assignments. Meanwhile, teachers gave encouragement or suggestions, so that children can continue learning during this special situation.
- Quizzes: Several teachers mentioned that they created simple quizzes via Kahoot application in order to provide interactive and easy learning experience to their students.
- Open book exams: Several teachers also use the open book exam method where assignments are provided online and the students can refer to their learning materials (e.g., courses) to find the answer. This method can make students more active and indirectly practice their literacy skills.



6. Developing learning materials based on universal design


Thanks to the development of technology and science, universal access to education in the 21st century is increasingly present both in the field of inclusive education and in the field of social inclusion in general. The principles of universal design are related to respecting human diversity and enabling accessibility (e.g., ramps serve not only wheelchair users, but also parents with baby stroller). Since each person learns differently, by relying on individual preferences, information should be accessible to everyone. People with developmental disabilities and disabilities can depend entirely on how flexible the content is presented to them. In order to access certain content, individuals will achieve this by adjusting certain parameters of the media in which the content is presented, while other users may request completely different media. Educators can improve access to education by respecting the diversity of child / student needs.


However, obstacles to the full realization of accessible learning content most often lie in the lack of information and guidelines on how to make digital content fully accessible to everyone especially in open and distance learning environments. Thus, Table 3 aims to present guidelines on the ways of creating and adapting teaching materials (especially in electronic form) to be accessible for learning to every child and student based on the principles of universal design. These recommendations are made in accordance with the concept of universal design, according to the recommendations of the European Agency for Special Needs and Inclusive Education, standards for interoperability of the European Interoperability Framework and in accordance with the Convention on the Rights of Persons with Disabilities.


Table 3. Guideline for creating and adapting teaching materials




| MEDIA | FORMAT (recommended) | WAYS OF ADJUSTMENT | PURPOSE |
|--|-------------------------|--|--|
|  SOUND | .mp3 | <ul style="list-style-type: none"> the audio is equivalent to video and text provide volume control provide visual equivalents for audio signal (for deaf and hard of hearing people) provide different alternatives for media resources (video, movies, slides, audio recordings ...); for example, a video shows how to assemble an object; the animation has no sound, but includes a series of numbers that represent each step in the process, as well as arrows with details that illustrate how the object is assembled. In this case, an alternative text describing the content of the video is provided instead on relying on audio. You can learn more about this topic at the following address: https://www.w3.org/TR/WCAG20-TECHS/G159.html Avoid automatic playback of audio or video Provide control over the playback of content using the keyboard Try always to provide these functions "fast forward", "rewind" and "pause" Give the user the ability to insert bookmarks <p>You can learn more about audio customization resources at the following address: http://www.ict4ial.eu/guidelines/makingaudio-accessible/resources-help-make-audio-information-accessible</p> | For visually impaired and blind people, deaf people and people with dyslexia |

| MEDIA | FORMAT (recommended) | WAYS OF ADJUSTMENT | PURPOSE |
|--|---|---|--------------|
|  PICTURE | .jpg .gif .bmp .png .tiff .geotiff .svg | <ul style="list-style-type: none"> • avoid images that do not provide any additional, meaningful or important information • avoid images that consist only of textual information • add alternative text to the pictures - a description that conveys the same message as the visual material, state what is shown in the picture and avoid descriptions that start with "Picture ..." in the alternative text • provide alternative text for each non-textual element • avoid using red, green, yellow and lighter gray tones • a sufficient degree of color contrast between the text and the background should be taken into account • avoid unnecessary backgrounds with too many images, shapes and colors • avoid hyperlinks or hidden text behind other objects, such as images • enable the change of image dimensions on the Internet in accordance with the needs of users <p>You can learn more about image customization resources at: http://www.ict4ial.eu/guidelines/makingimages-accessible/resources-help-make-image-based-information-accessible</p> | For everyone |
|  TEXT | .doc .docx .rtf .xls .csv .pdf | <p style="text-align: center;">GENERAL NOTES</p> <p>Textual information is organized by logically marking various elements within the text, such as the successive use of headers, titles, and tables. Properly structured text can be easily converted to a format that meets the needs of users (using a text reader and other assistive technologies).</p> <p>The more complex the visual appearance of the text (tables, footnotes, boxes, icons, etc.), the more important it is to take into account the logic of the structure.</p> <p>Recommendations:</p> <ul style="list-style-type: none"> • use the simplest language that corresponds to the document • whenever possible, use positive sentences instead of negative ones ("Follow the order of the slides / questions / tasks" instead of "Don't skip slides / questions / tasks"), active ones instead of passive ones (For example: "I will evaluate your works" instead of "Papers will you will be evaluated"). • use sans-serif fonts, such as Arial, Helvetica or Verdana as well as for texts on the Internet. • enable the user to change the appearance and font size in texts on the Internet • align text to the left (Align Text Left) instead of both margins (Justify) • state the full name or title when it first appears in the text, and then use abbreviations and acronyms • the text needs to be structured using pre-defined styles for headings and body text / content offered by the software; the title structure should follow a logical order | For everyone |

| MEDIA | FORMAT (recommended) | WAYS OF ADJUSTMENT | PURPOSE |
|---|---|--|--------------|
|  TEXT | .doc .docx .rtf .xls .csv .pdf | <ul style="list-style-type: none"> • use heading styles only to define the structure, not to emphasize the content • use the "Bullets and Numbering" function for lists • specify the primary natural language of the document in the metadata for the document • formulate and enter keywords • add short summaries of content or chapters where possible • create a keyboard navigation system in electronic texts • text and background should be in contrast • text and graphics should be understandable when viewed without colors, and all information transmitted through colors should be available without them; when emphasizing different contents, one should not rely only on color • provide non-textual equivalents of text (for example: images, videos and pre-recorded sound), as such display of information is suitable for individual users, especially for people who have difficulty reading • footnotes and links that are relevant for clarifying the information in the main elements of the text structure should be numbered. <p style="text-align: center;">MS Word</p> <p>Font:</p> <ul style="list-style-type: none"> • use clear and legible fonts such as Arial, Helvetica or Verdana • avoid handwriting and other decorative fonts, shadows and similar effects on the text • The font should be at least 12 points in size • use italics to highlight individual words, not whole blocks of text • avoid typing only capital letters (ALL CAPS); they can be difficult to read in continuous text, but can be used for labels or titles • Limit the use of bold and italic formatting when highlighting text. <p>Text boxes:</p> <ul style="list-style-type: none"> • they should be avoided, they are often used to position text in a Word document, and it happens to overlap the layout of the image and text; even with alternative text they are unavailable, screen readers cannot "enter" these text boxes, the content in them is invisible to them • instead of a text box, an image can be inserted and formatting used to match the text around the image, for which alternative text is added; this will allow the screen reader to "see" the image and continue with the text; also, you can adjust the way the text will flow around the image. | For everyone |

| MEDIA | FORMAT (recommended) | WAYS OF ADJUSTMENT | PURPOSE |
|---|---|--|--------------|
|  TEXT | .doc .docx .rtf .xls .csv .pdf | <p>Tables:</p> <ul style="list-style-type: none"> the screen reader will read the table from left to right and from top to bottom, and this information should be organized accordingly Tables should only be used to display tabular data, not as an aid to positioning text on the screen. <p>Pictures / charts:</p> <ul style="list-style-type: none"> Images in the document should be provided with a title, alternative text and a description of the content of the image using predefined styles <p>Adobe Acrobat (PDF)</p> <p>A document in PDF format can contain many types of information: text, graphs, markers, links and other elements of an electronic document. In addition to the content, PDF files include a "structure" - a name for a set of instructions that define the logic associated with the content of the file - the correct order of reading as well as the presence and meaning of elements such as lists, tables, and so on. Tagged PDF files work better with screen readers, devices used by many blind and partially sighted people, and other users with disabilities.</p> <p>Learn more about tagging, setting languages, adding alternate text for charts, setting reading order, checking accessibility, and more. you can find out at the following address: http://www.adobe.com/content/dam/Adobe/en/accessibility/products/acrobat/pdfs/acrobat-x-accessibility-checker.pdf</p> <p>Images in the document should be provided with a title, alternative text and a description of the content of the image.</p> <p>MS PowerPoint</p> <p>Each version of PowerPoint contains a variety of forms for arranging content on a slide. PowerPoint is designed to encourage the use of these layouts on a slide, especially in newer versions. Using these forms will ensure that the files have correctly defined and placed titles and lists, the correct order of reading, etc.</p> <ul style="list-style-type: none"> Slide design should be high contrast, ideal: black and white, no background image The text should be entered in the fields provided in the appropriate form, and not in the text boxes that the user arranges on the slide | For everyone |

| MEDIA | FORMAT (recommended) | WAYS OF ADJUSTMENT | PURPOSE |
|---|---|---|--------------|
|  TEXT | .doc .docx .rtf .xls .csv .pdf | <ul style="list-style-type: none"> In PowerPoint, there is a way to add alternate text to an image. If the presentation contains decorative images that do not convey information relevant to the content of the presentation, it is recommended that the alternative text box be left blank. If the image has no altt, the screen reader usually skips it. The WordArt option in Office 2003-2007, as in all subsequent versions, is converted to images, and alternate text needs to be added. Alternative text needs to be added to charts, but sometimes there may be too much alternative text in the chart content. If the presentation contains numerous diagrams or charts, the solution may be to add a hyperlink to the original PPT file. Select Outline View (instead of slide show) to make the video text available to the screen reader. Text boxes, pictures, and speaker notes do not appear in this view. <p style="text-align: center;">Alternative text and content</p> <p>For pictures: When writing an alternative text, take into account what the picture or graph conveys from the basic information, and it is related to the task or lesson to be learned; for example, if there is a person in the picture, it is important to identify that person or what he or she is doing in the picture.</p> <p>For charts: For example, if the diagram is in the form of a "pie", write what each piece means and a percentage. In some cases, you can only write what the chart means.</p> <p style="text-align: center;">MS Excel</p> <ul style="list-style-type: none"> use clear and meaningful labels for rows and columns create and / or provide an electronic document with a list of all relevant formulas and / or macros provide alternative texts for charts and graphic data provide chart descriptions in the comment area mark important cells in the data to help learning users locate relevant data more easily define parameters for data sets (for example, lowest and highest values, rows / columns that define data boundaries) use clear and specific language for marking cells, values in cells and other relevant information when presenting | For everyone |

| MEDIA | FORMAT (recommended) | WAYS OF ADJUSTMENT | PURPOSE |
|---|---|--|--|
|  TEXT | .doc .docx .rtf .xls .csv .pdf | <p>Excel spreadsheets and / or data</p> <ul style="list-style-type: none"> • use clear and specific language to describe diagrams and graphs • provide alternative texts for the description of the chart. <p>Regardless of the format, the teaching material should be checked with accessibility tools (e.g., Accessibility Checker). You can learn more about text accessibility resources at the following address: http://www.ict4ial.eu/guidelines/makingtext-accessible/resources-help-make-textual-information-accessible</p> | For everyone |
|  VIDEO | .mp4 | <ul style="list-style-type: none"> • attach to the video either equivalent text or subtitles. The goal is that the subtitles are not just transcribed words spoken in the video, but also a brief description of what is happening. • ensure that the equivalent text / script or subtitle is synchronized with the video material (subtitles are an alternative way to show what is heard in the video material; the script contains all the information presented in the video material) • ensure that the user can control the video: volume, video pause, fast forward, reverse and pause functions <p>You can learn more about video accessibility resources at: http://www.ict4ial.eu/guidelines/making-video-accessible/resources-help-make-video-media-accessible</p> | For everyone, and especially for blind, visually impaired, deaf and hard of hearing people |
|  MULTIMEDIA | A combination of video, graphics, sound and animation | <ul style="list-style-type: none"> • follow all relevant suggestions for improving accessibility for text, sound and images, because multimedia content can combine all these elements • provide audio content and a textual description describing the basic elements of visual video content | For everyone |

7.Role of parents for active learning at home

The move to remote learning due to the pandemic has been particularly difficult for students with disabilities. While educators are obliged to present as equitable education as possible, parents also play a vital role in instructing, guiding, accompanying with and safeguarding learners during their learning at home. Below are suggested guidance for parents to better perform in different contexts.

7.1.Role of parents during open and distance learning

As learners with disabilities are usually at home during this COVID-19, their parents can further play an important role in their daily life, including education. Based on the participants' inputs, the following three parents' roles were identified during this remote learning experience.

- **Motivators of the learning process:** Parents can encourage their children to learn and help organize their learning schedule. This can make the children motivated to learn, even without face-to-face learning. In this context, Kang (2010) stated that students with disabilities have low capacity in regulating their motivation, which is one of the important factors that affects the learning performance.
- **Facilitators of the learning process:** Since many special needs children might lack assistive technologies at home to use their devices for learning remotely, their parents can be a facilitators of the learning process by helping them access their devices or use the online tools to learn with the teachers.
- **Teachers of the learning process:** Since parents are in a direct contact with their children at home, they can also act as teachers, by downloading the learning materials sent by the school-teachers and using it during the learning process.

7.2.Guidelines for parents on helping their children learn

During students' learning process, parents should fulfill their responsibilities cooperating with teachers and school administrators, taking care of both physical and mental health of their children. In this context, the following guidelines are presented for parents to help their children learn.

- It is important that parents cooperate with teachers, agree on common goals, and listen to their instructions on how they can help children with disabilities learn at home during quarantine.
- Leave only a few necessary icons on the desktop. This will make it clearer to the child which icon to click on.
- Children learn everywhere and from everyone, not just when they are in school. Use daily activities as exercise situations. (counting, naming, expanding vocabulary, correct pronunciation) through daily routines (helping to set the table, counting plates or cutlery, packing and putting clothes in the closet, naming colors or objects, telling fictional stories, etc.).
- Ensure your child's safety online, such as bullying.
- The possibilities of ICT are great and should be used wisely (El Ghoul, O., & Jemni, M. 2009). Accessibility options - customize and simplify access to your computer, tablet or smart phone so that your child can engage in zoom or Skype class or use learning platforms with as few clicks as possible.
- Regardless of the dynamics of distance learning (every day or once a week), whether the teaching materials are delivered as individual lessons or lesson packages by mail, online, establish the time during each day when one of the parents can support the child in learning and consistently sticking to those schedules /schedules from day to day, in order to create a habit
- Take frequent and short breaks in learning, practicing or doing homework. Change activities often if the child is hyperactive. Do simple exercises together, sing, solve a task, draw or do something else.
- Help children to use books and worksheets as independently as possible. Explain to them and mark what they need to do.
- If they are wondering why they learn something when they do not go to school and do not get grades, explain to them that knowledge is important, and that grades will come later
- Always praise hard work and will, not just success.
- Instead of going to the bookstore, use the old things you have at home that you no longer need to learn and practice. On the unused side of the paper, you can draw, practice writing or practice fine motor skills - chopping, bending, gluing. Find ways to use old fabrics, cardboard, boxes or plastic packaging in a new way. There are no rules, no boundaries. Children learn through play and fun. If you are missing ideas, look them up on verified websites.
- If the child is illiterate, the lyrics of the song or any other text that needs to be learned, parents can record with free web tools or applications (for example vocaroo.com) or generate a QR Code for some content so that the child can access with one click and listen as many times as needed. It will be fun for the child, and it will reduce the number of repetitions for the parent and save time.
- Parents can support and motivate the child to learn with praise and "grades" similar to teachers. For example, using children's stamps (bees, flowers), rather than rewarding and supporting them with sweets or food.

7.3.Guidelines for parents on ensuring the safety of their children at home

Parents or guardians are in the most important place to ensure children's safety, since children are spending much more time at home due to the pandemic. By learning and acting, parents or guardians are able to provide a safer space for children to live and study. See related guidelines below:

- Be well informed so that you can protect yourself and your child appropriately. It is enough to hear updated information about corona virus (or Covid -19) once a day.
- Establish a new daily schedule for the whole family so that it suits everyone (time to sleep, eat, play, study, exercise, make phone calls or hang out with friends online). The structure provides a sense of security and certainty at uncertain times for everyone, and it is especially important for children with elements of autism.
- Follow the WHO recommendations. Read brochures and picture books about Covid – 19, to children or together with children. Teach them to wash their hands or use disinfectants; explain to them why they cannot play with other children now, but that they will be able to do it soon if they stay healthy. Explain to them that no one goes out, that kindergartens, schools or gathering places do not work. Talk to your child using short and simple sentences.
- Be an example for your child. Demonstrate desirable behaviors, because just words are not enough.
- Do everything you can together. Disinfect surfaces that are often touched and toys at home - together.
- Make reminders to maintain hygiene for the child (stick a hand wash symbol near the front door; put a mask symbol on the door at the level of the child's eyes). Always praise the desired behavior. Occasionally reward - with a sticker, a stamp, a little thing that means to the child.
- Peer contacts are important, so you can arrange regular phone or video calls to keep your child in touch with friends.
- Spare your child from embarrassing and traumatic scenes about people who are very ill or have died from Covid-19. Pay attention to the TV content that is available to the child and can further upset or frighten him.

7.4.Guidelines for communicating between parents and teachers to facilitate learning

For parents who have children with disabilities, there is a fear that their children will be left behind during the shift to remote learning, since it poses more learning challenges. However, keeping up with teachers can be useful to distress both parents and children in that teachers are trained professionals who know about conditions of students. More communication between parents and teachers is helpful for the development of disabled children. Some guidelines are presented in the following:

- Teachers should share children's progress with parents frequently.
- Teachers should give directions to parents where children can be improved.
- Teachers invite parents to make children's study plans and implement them together.
- Parents share their children's growth and changes after learning with teachers regularly.
- Parents can put forward their children's personalized needs to teachers according to their understanding of their children.
- Parents should implement the plan together with the teacher and communicate with the teacher initiatively.

8.Challenges, recommendations and implications

- (1) Learners with disabilities lack ICT skills: It is seen that learners do not have the needed skills to work on digital devices, such navigating on the internet, accessing platforms and tools or even simply opening electronic learning materials. Therefore, the remote learning experience was challenging for most teachers.
- (2) Parents lack ICT skills: Just like the previous challenge, parents did not also have the basic ICT skills to further assist their children during this remote learning experience.
- (3) Low family income: most learners with disabilities are from poor families, therefore most of them do not have digital devices or assistive technologies at home (computers or mobile devices) which can help them learn remotely at home. Additionally, internet access and reliability is a big issue as well. For instance, one of the participants, who is working as a teacher for deaf learners, mentioned that due to low internet connection the video conferencing was not very clear, hence she could not understand her learners while using sign language to communicate.
- (4) Lack of accessible tools: Several teachers reported that the online provided tools and platforms are not fully accessible for all learners with disabilities. Therefore, some of them could not be used to learn online.
- (5) Lack of accessible learning resources: Several teachers highlighted that due to the unexpected critical situation of COVID-19 pandemic, most teachers did not have prepared learning resources to fit the remote learning. Additionally, these teachers further mentioned that there is a very limited number of accessible learning resources online. Therefore, providing remote teaching was very challenging.
- (6) Absence of guidance and training for teachers: Another challenge that was raised by the teachers during this remote educational experience is the absence of guidance and guidelines that can help them adapt their learning contents to the online and remote teaching. This hindered teachers from easily adopting this remote teaching experience and delayed its starting date, as it was confusing to them.
- (7) Low learning motivation and self-regulation skills: Several teachers mentioned that the learners are not always following the prepared learning schedule, hence they skipped several of courses online. Additionally, several teachers mentioned that learners with disabilities have low self-regulation skills, therefore they need someone to keep an eye on them so they can learn.
- (8) Absence of engaging pedagogical approaches: A pedagogue mentioned that one of the challenging tasks is how to deliver the learning content online in a very interactive way in order to keep learner motivated during the whole learning process. Additionally, the pedagogue mentioned that some hands-on classes (e.g., painting

or gardening) were very hard to deliver online.

- (9) Home safety: Several teachers mentioned that they were worried about the safety of their learners at home from the coronavirus (COVID-19), as they might not have enough information about how to protect themselves. Also, the teachers mentioned that the learners might stay safe by also doing some physical & social exercises that they usually do at school.

Figure 42 summarizes this section and presents a framework of challenges that could be faced during remote teaching/learning for students with disabilities. Specifically, this framework is composed of three layers. The first layer, considered the back bone of remote special education, is related to policy makers as stakeholders and covers guidelines, guides and policies that can directly affect (in a good or bad way) the work of other stakeholders, including parents and teachers, presented in the second layer, who work directly with students with disabilities. Finally, the third layer covers students with disabilities, which are represented as the core of this framework.

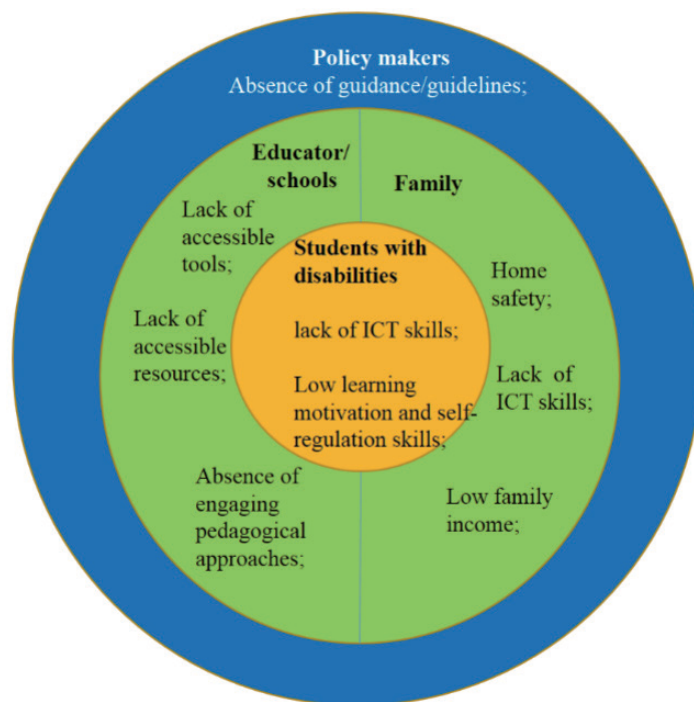


Figure 42. Challenges framework of remote special education



Story 10: Challenges and solutions for students with disabilities during COVID-19 at the Open University of China

My name is Liu Xiaobao, physically impairment suffering from ankylosing spondylitis. I am an undergraduate student who is majored in social work at Shenzhen School, School for the Disabled, Open University of China (OUC) in autumn 2019. In late January 2020, China was affected by the COVID-19 pandemic and as a result the school started providing online courses for all subjects in the spring semester. The online classes are open to all students and can be accessed through computers, mobile phones or other mobile terminals.

As a student who enjoys face-to-face communication with teachers and students, online learning was a challenge for me, since I will have to adapt to the learning atmosphere of online classrooms and distant communication between teachers and students. In order to be able to participate in the online classes, I adjusted my routines and rearranged other activities. In addition to taking online classes while school was closed, as a class monitor, I also insisted on posting messages on our class QQ group, including class schedules, links to live streams, etc., in order to remind my classmates to attend the online classes on time (see Figure 43).

I encountered many difficulties during the online learning process but I managed to overcome each of them in turn. Although the online classroom platform supports interactive dialogue, communication is limited to the written word. Sometimes I did not understand a knowledge point but was not able to ask the teachers for immediate help. What was I supposed to do in this case? My solution was to take a screenshot and then try to figure it out after class. I also printed out the important knowledge points being taught in the classes. With the screenshots saved on my mobile phone, I can review the courses at any time. I also installed the Open Cloud Bookstore app on my mobile phone, from which I downloaded the textbooks of each subject as a standby reference for times when printed textbooks are not available.

Based on my experience, I created some course-specific learning tips. For example, I laid out the learning content for each theoretical course in a word document, copied it to a text-to-speech app, converted the resulting content into an MP3 file, and then saved the audio file on my mobile phone. I can then listen to the content even when I am off the computer. This has made my learning much more effective. Since then, I have passed this method on to my fellow classmates and it has proven to be especially helpful for visually impaired learners.

During the epidemic, teachers and students were not able to meet with each other, so how could we discuss the problems rising from the studies? Social Statistics is a course that launched at the end of April. During the online class, teacher discussed a number of important, hard-to-understand concepts such as averages, median, mode, group median, variance, standard deviation, and discrete coefficient. However, Cong Jing, a classmate of mine, failed to understand these concepts. She was very worried and came to me to seek help. I scheduled a time to explain the concepts to her via QQ voice call, and I explained the concepts and knowledge points in detail and taught her the steps and methods needed to solve an example question.



Figure 43. Leading my classmates to study the “First Lesson of the New Term” given by OUC

Through the results of the survey and based on the shared remote teaching and learning experiences by the participants, the following recommendations can be identified to improve educational opportunities of students with disabilities during remote learning.

For policy makers:

- Develop cheap and affordable technologies, including assistive ones, to reduce the digital divide issue and facilitate students’ online and distance learning.
- More initiatives should be launched to equip families with special needs with these technologies at home, as well as provide them specific funds to further support their children with disabilities.
- Promote ICT competency development for teachers working with students with disabilities.
- Develop policies aimed on ethical, secure and non-discriminative use of online tools in education.
- Support the evidence-based research and communities of practices on education of persons with disabilities by means of ICT.

- Empower collaboration between schools, families with special needs and government agencies, especially in crisis context (such as this COVID-19 pandemic).

For teachers and tutors:

- Provide parents and students guidelines and trainings on how to use online educational tools.
- Use Open Educational resources (OER) since Unlike commercially published materials, OER that are adapted to meet accessibility requirements can be retained and freely shared with communities, reducing duplicative work at and across institutions.
- Adopting the use of ICT and online tools in all areas of curriculum development. A key principle of addressing the learning needs of all students in curriculum design is universal design for learning.
- The inclusion of students with disabilities in online education classrooms (“mainstreaming” with appropriate supports when necessary).
- The use of peer-mediated instruction (often peer tutoring) and collaborative or team teaching in which one instructor is the content specialist and the other is trained in instructional methodologies for students with disabilities.
- Instructional and curriculum adaptations, including instruction in learning skills and strategies and the use of advanced organizers.
- Adequately train and supervise children to protect them from exposure to risks pertaining from online activities (e.g. bullying).
- Create alternative indoor/house activities by planning a routine together emphasizing in everyday activities, such as learning opportunities for family members, age-appropriate TV/online programs, exploring new skills and sports/fitness regimen, etc.

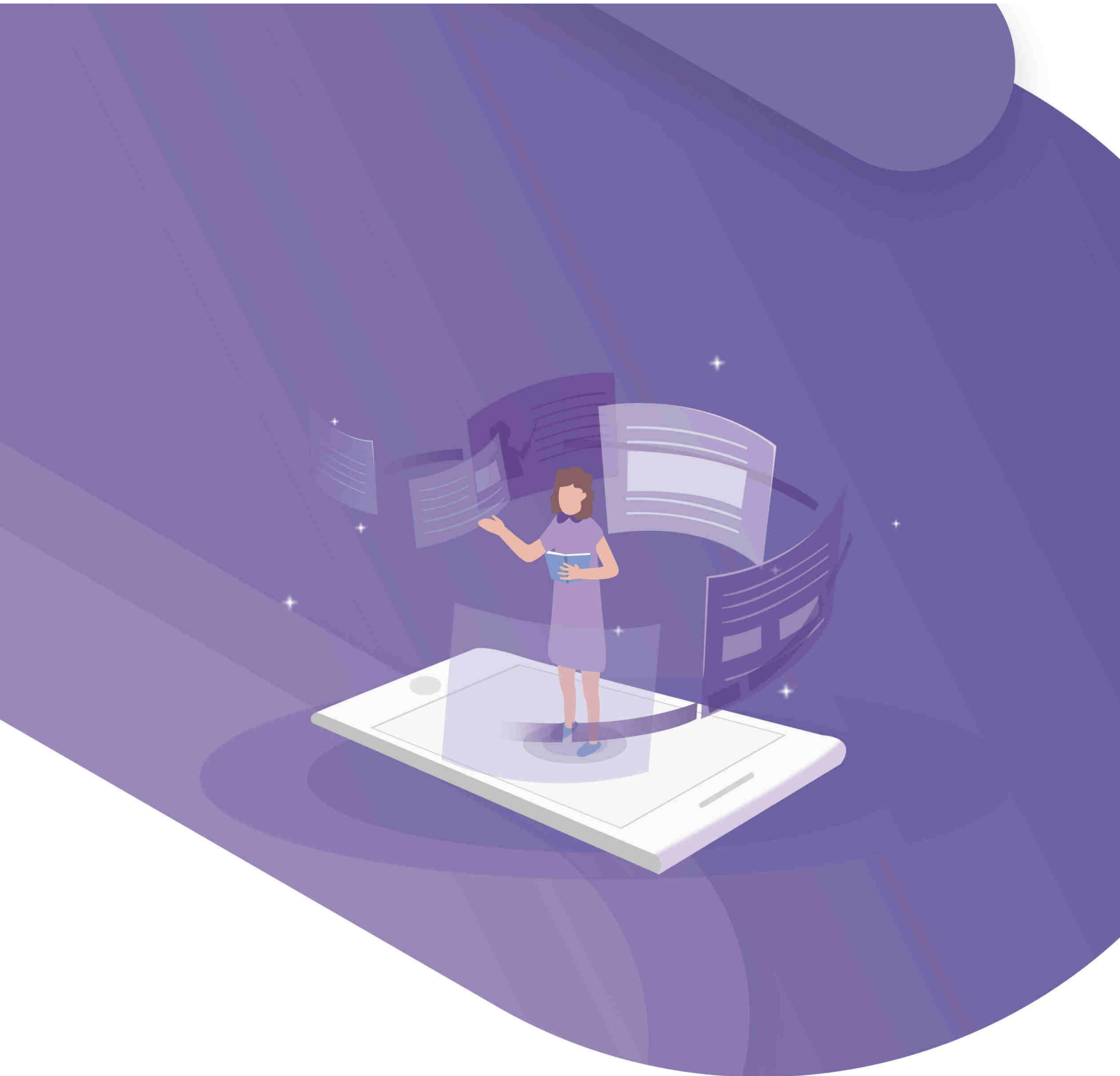
For designers and quality assessment agencies

- Develop a quality assessment framework of open and distance learning. This framework could cover several dimensions, including learning content, learning environment and instructional methods.
- Raise awareness about the accessibility guidelines that should be considered while developing online platforms, tools and devices, such as Web Content Accessibility Guidelines (WCAG), as well as Universal Design for Learning (UDL).
- Collaborate with both teachers, and schools to create learning assessment methods that facilitate assessing the open and distance learning experience of students with disabilities. For instance, in the era of big data, it is possible to use learning analytics to analyze the interaction data of students to extract insights about the learning process, hence enhance it.

Reference

- Chambers, D., Varoglu, Z., & Kasinskaite-Buddeberg, I. (2016). Learning for all: Guidelines on the inclusion of learners with disabilities in open and distance learning. UNESCO Publishing.
- COL. (2015). Open and Distance Learning: Key Terms and Definitions.
- Committee on the Rights of Persons with Disabilities. (2016). General comment No. 4 on article 24: Right to inclusive education.
- CRPD, U. (2006). Convention on the Rights of Persons with Disabilities.
- Gaskell, A. (2017). Open distance learning. *Encyclopaedia of educational philosophy and theory*, 1-6.
- Guide, T. (2010). The convention on the rights of persons with disabilities.
- Hodges, C., Moore, S., Lockee, B., Trust, T., & Bond, A. (2020). The difference between emergency remote teaching and online learning. *Educause Review*, 27.
- Huang, R., Tlili, A., Chang, T. W., Zhang, X., Nascimbeni, F., & Burgos, D. (2020). Disrupted classes, undisrupted learning during COVID-19 outbreak in China: application of open educational practices and resources. *Smart Learning Environments*, 7(1), 1-15.
- Inclusive City Maker. (2019). Disabled People in the World in 2019: facts and figures. Accessed from: <https://www.inclusivecitymaker.com/disabled-people-in-the-world-in-2019-facts-and-figures/>
- Perenboom, R. J., & Chorus, A. M. (2003). Measuring participation according to the International Classification of Functioning, Disability and Health (ICF). *Disability and rehabilitation*, 25(11-12), 577-587.
- Stracke, C. M. (2019). Quality frameworks and learning design for open education. *The International Review of Research in Open and Distributed Learning*, 20(2).
- UNICEF. (2007). A human rights-based approach to education for all: A framework for the realization of children's right to education and rights within education. United Nations Publications.
- UNICEF. (2017). Inclusive Education including children with disabilities in quality learning: what needs to be done. Malaysia: UNICEF Malaysia.
- UNESCO. (2020). Another COVID-19 Front line: Parents of children with disabilities. Accessed from: <https://en.unesco.org/news/another-covid-19-front-line-parents-children-disabilities>
- UNESCO. (2020). Global Education Monitoring Report 2020: Inclusion and education: All means all. Paris, UNESCO.

- UNESCO. (2019). UNESCO Recommendation on Open Educational Resources (OER). Accessed from: <https://en.unesco.org/news/unesco-recommendation-open-educational-resources-oer>
- UNESCO. (2002). Open and distance learning: Trends, policy and strategy considerations. Paris: UNESCO. Retrieved from <http://unesdoc.unesco.org/images/0012/001284/128463e.pdf>.
- UNESCO. (2015). Open and distance learning. Retrieved from <http://www.unesco.org/new/en/unesco/themes/icts/lifelong-learning/open-and-distance-learning/>
- UNESCO. (2016). Digital empowerment: access to information and knowledge using ICTs for persons with disabilities.
- UNICEF. (2020). Protecting children and adolescents with disabilities from the pandemic: COVID-19 and children with disabilities in Europe and Central Asia. Accessed from <https://www.unicef.org/eca/protecting-children-and-adolescents-disabilities-pandemic>
- UNESCO. (2016). Digital empowerment: access to information and knowledge using ICTs for persons with disabilities. Accessed from: <https://unesdoc.unesco.org/ark:/48223/pf0000244543>
- Wiley, D. , & Hilton, J. L. (2018). Defining OER-enabled pedagogy. *International Review of Research in Open and Distributed Learning* , 19(4),133–147. <https://doi.org/10.19173/irrodl.v19i4.3601>
- World Health Organization. (2020). Disability considerations during the COVID-19 outbreak (No. WHO/2019-nCoV/Disability/2020.1). World Health Organization.
- Zhang, X., Tlili, A., Nascimbeni, F. et al. (2020). Accessibility within open educational resources and practices for disabled learners: a systematic literature review. *Smart Learning Environments*, 7, 1. <https://doi.org/10.1186/s40561-019-0113-2>.
- UNICEF. (2011). The right of children with disabilities to education: A rights-based approach to inclusive education in the CEECIS region. Retrieved May, 20, 2015.
- El Ghoul, O., & Jemni, M. (2009). Multimedia Courses Generator for Deaf Children. *International Arab Journal of Information Technology (IAJIT)*, 6(5).
- Laabidi, M., Jemni, M., Ayed, L. J. B., Brahim, H. B., & Jemaa, A. B. (2014). Learning technologies for people with disabilities. *Journal of King Saud University-Computer and Information Sciences*, 26(1), 29-45.



北京师范大学智慧学习研究院
Smart Learning Institute of Beijing Normal University



United Nations
Educational, Scientific and
Cultural Organization



International Research
and Training Centre
for Rural Education



IASLE
INTERNATIONAL ASSOCIATION
OF SMART LEARNING ENVIRONMENTS



ALECSO

unir

UNIVERSIDAD
INTERNACIONAL
DE LA RIOJA



NEAR EAST
UNIVERSITY



Ministry
of Education
of China



edmodo

Website: <http://sli.bnu.edu.cn/en/>

Address: 12F, Block A, Jingshi Technology Building,
No. 12 Xueyuan South Road, Haidian
District, Beijing, China

Email: smartlearning@bnu.edu.cn

Phone: 8610-58807219

Postcode: 100082



<http://sli.bnu.edu.cn/en>