



Children with Visual Impairments and ICT

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School with Class
Foundation

Be
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Awesome.

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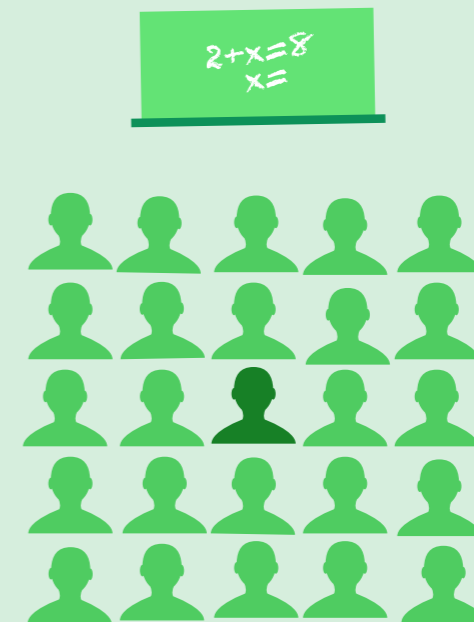
1 What are Visual Impairments?

Statistics for 2020 show that about 49.1 million people world-wide were blind, 221.4 million had a moderate visual impairment, and 33.6 million people had a severe form of it (Bourne et al., 2020). Thus, it is fairly likely that there will be individual students with visual impairment in a school classroom, or that an entire class consists of students who are blind or visually impaired. Working with both individual students and entire classes of visually impaired students poses special challenges for teachers and requires their knowledge of the students themselves, their ways of functioning in everyday life and the possibilities for supporting their development.

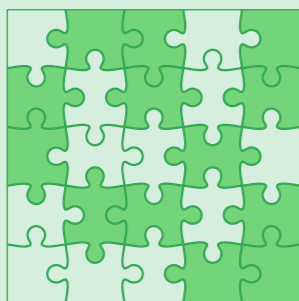
To better understand the needs of such students, it is worth looking at the main types of visual impairment. In colloquial speech, the term 'blind', as R. A. Scott (2017) notes, means 'without sight'. In the literature, it includes both completely blind and sighted people whose vision is severely impaired. By convention, ophthalmologists consider the essence of vision to be visual acuity. This is a measure of the smallest image on the retina that can be recognized by the human eye. The most popular test of visual acuity is the test introduced by H. Snellen in 1862. It uses the Snellen chart – which is well known in ophthalmologists' offices – consisting of nine lines, each containing letters (most often with the letter 'E' at the top) of progressively smaller size (cf. Scott, 2017;

Roe, Webster, 2002). Students' impairments will not always be related to visual acuity (so-called *visus*, which means that the image they are looking at is blurry or out of focus from a greater distance). There will also be students who have a limited field of vision.

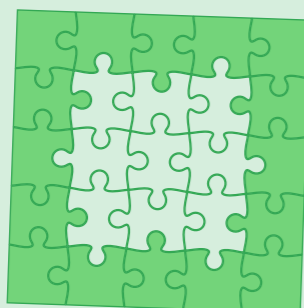
Statistics for 2020 show that more than **300 mln** people world-wide had visual impairments. Thus, 1 child in a 25-person class on average.



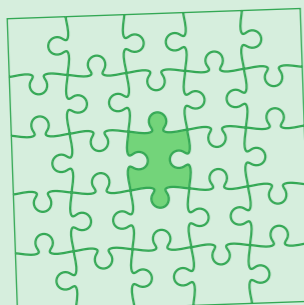
What does a limited field of vision mean in practice?



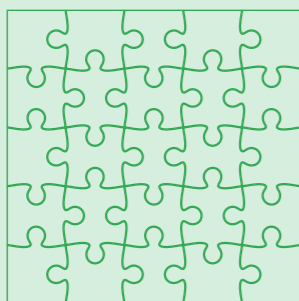
Imagine that the world you are looking at consists of a million puzzle pieces. If you have a visual defect that limits your field of vision, it's as if someone has removed random pieces from this jigsaw puzzle. If a few of them disappear, the problem is small, but if more than 50–60% of them are missing from the image seen, perception will be very difficult.



There may also be students who cannot see the edges of this puzzle image. Or, on the contrary, they can only see them. It's a bit like looking at the world through a tunnel or a telescope – and indeed, this kind of vision is simply called tunnel vision.



There will be students who can see images placed centrally in front of them, and there will be those who can only see them out of the corner of their eye and have to turn their heads to see anything. Finally, we may have to deal with students who can't see anything at all – it's as if we were functioning in total darkness. Among them may be those who can see something in a particularly bright environment – the shadow of an object or figure. These are people with a so-called sense of light.



When starting to work with students with visual impairments, one needs to familiarize oneself with the degree of this disability and try to understand what it really means for this particular child and the options that teachers have. For that purpose, the most common terms that appear on student disability certificates come from the International Classification of Diseases, ICD 11 (WHO, 2019), which divides visual impairment into two groups: long-distance or short-distance vision impairment.

Long-distance vision impairment can occur in the range of:

1. **mild** (visual acuity from 6/12 to 6/18),
2. **moderate** (visual acuity from 6/18 to 6/60),
3. **severe** (visual acuity worse than 6/60 to 3/60),
4. **total lack of vision** (visual acuity worse than 3/60).

This visual acuity is the record from the Snellen chart mentioned above. In addition to visual acuity problems, the above-enumerated visual field problems (tunnel, constricted, other field loss) may be present.

Visual impairment can affect the quality of life for both children and adults. Young children may experience delayed motor, language, emotional, social and cognitive development. In addition, school-age children with visual impairment may (but not necessarily) experience lower educational achievement, have difficulty forming social relationships, and are more likely to suffer from depression and anxiety (WHO, 2021). A lack of vision may impede learning about new people, their locations and activities, making verbal connections with others, and initiating joint activities (Hollins, 2021; Dods, 2013).

2 Students with Visual Impairments and the Internet

Websites, social media and smartphone apps have become ubiquitous and are widely used by people of all age groups. However, it is worth noting that current digital media are primarily visual: they contain images, animations or movies (videos). This makes it more difficult for visually impaired students to fully function on the Internet, and as a result, they may be excluded from their immediate environment, such as their peers. When it comes to exchanging simple text messages, visually impaired children and adolescents have little trouble with this. They communicate through sound-enabled smartphones or computers, and the challenge is only how to listen to instant messages without unwanted people (such as family members or bystanders) hearing them. Fortunately, a sense of privacy or intimacy in listening to text conversations can be provided using simple solutions, such as headphones. It is important to provide conditions for young people to actively participate in online conversations, while giving them the privacy they developmentally need.

Visually impaired students also participate in social media. They use Facebook (e.g., update statuses, post comments and apply reactions such as likes) just as much as the general public and, on average, receive more feedback (i.e., comments and likes) on their content. Above all, they share their experiences and problems related to visual impairment (Wu, Adamic, 2014).

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It is worth emphasizing here again that social media posts by sighted people are primarily visual (especially on Instagram or TikTok). The ubiquity of smartphones with cameras has meant that it is now extremely easy and fast to take and share images on one's profile. And while official websites, such as those of newspaper publishers or public institutions, are governed by WCAG standards, allowing (at least by assumption, because standards are not always respected) blind people to access all information, this is difficult to enforce on social media. Blind users therefore apply solutions using machine learning and artificial intelligence to automatically recognize the content of illustrations, though these algorithms are quite imprecise and often contain a lot of generalizations (Morris et al., 2016). This means that algorithms can recognize what is in the picture (for example, they tell you that there's a tree and a lake), but they don't tell you about the context or the colour scheme (which for many blind people is an abstraction),

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and thus they only provide basic information about the photograph. Sometimes blind people also develop their own specific strategies for recognizing images, such as opening a mobile page in a computer browser, and inferring the content of photos based on text clues and community responses. When these strategies fail, blind people turn to trusted friends for help or avoid certain functions (Voykinska et al., 2016).

3 Risks and Opportunities

Specific Risks

Among the most important challenges for blind and visually impaired young online users, incomplete accessibility should be highlighted. This can result in (Wu, Adamic, 2014; Morris et al, 2016; Weigand et al, 2013):

- **limited opportunities for full social interaction** (e.g., lack of understanding of the context of an online conversation, misinterpretation of an image message, lack of access to image-based cultural messages);
- **difficulty verifying risky content**, such as vulgar, false, violent or pornographic (content that is discernible 'at a glance' to an ordinary online user and can quickly be rejected and blocked);
- **difficulties in verifying the veracity of a given profile** (distinguishing between official and fake profiles);
- **becoming victims of cyberbullying** (an aggressor may, for example, use and offensively alter photos in which a visually impaired person is depicted), but also cyber aggressors;
- **downloading illegal software** (software piracy), accidental access to pornographic content or online gambling.

Specific Opportunities

The use of digital media provides a number of opportunities for visually impaired children and young people. Among them, the most important should be pointed out (Walter, 2007):

- **educational opportunities:** access to open educational resources (primarily e-books and audiobooks, thematic podcasts and textbooks),
- **social opportunities:** communication with peers and family, as well as with teachers and other students, active participation in the life of a peer group (establishing and maintaining relationships) and social support (access to support groups),
- **cultural opportunities:** access to museum and library resources, concerts, recordings, films with audio description and others.
- **health opportunities:** searching for medical specialists, the use of health-promoting apps and websites
- **opportunities for spatial orientation:** interactive talking maps, locators, apps that recognize places and objects.

4 Recommendations

Media (digital) education of visually impaired children and young people should be carried out from the stage of elementary education. For this purpose, it is necessary to provide students with appropriate technical equipment (available in sufficient quantity, up-to-date and trouble-free), while ensuring that the same equipment is available to all students (identically configured workstations). The computer workstation of a visually impaired person should consist of the following elements (Walter, 2008):

- **a computer with a monitor (or laptop), speakers/headphones, basic software;**
- **a network card**, providing access to the Internet;
- **a screen reader and a speech synthesizer** (reads aloud what the screen reader has recognized) or a **braille monitor** (displays what the screen reader has recognized in braille);
- **an enlarger for the visually impaired;**
- **a black and white and/or braille printer** (depending on the user's needs and predisposition);
- **scanner** (along with OCR software for recognizing printed text).

Mobile devices (smartphones, tablets) should be adapted to the perceptual capabilities of visually impaired people and include (Weigand et al., 2013):

- **audio-enabled software** (such as voice-over or TalkBack);
- **standard applications** (instant messaging, maps, etc.);
- **innovative applications**, such as a magnifier, colour ID, money reader (e.g., Cash Reader), orientation applications (e.g., Lazarillo) and object recognition (a camera together with an application like Lookout or Envision AI).

Equipment is not the only condition for effective media education. Support from well-trained teachers (both sighted and blind) who are familiar with all the electronic solutions used is essential here. In addition, teachers need to be aware of the ways in which children and adolescents they work with use technology – in terms of mobile devices and apps, as well as activities in social media.

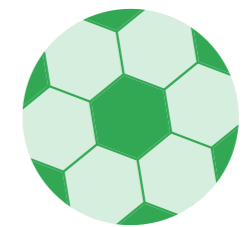
It is essential to develop **digital competencies** in blind and visually impaired students, giving them full access to network resources and social interaction. Thus, in practice, one should:

- **teach classes about open educational resources**, while checking how accessible they are to the students in question and talking to them about it;
- **show how to create media messages** (e.g., podcasts, texts, etc.) and the purpose of creating them;
- **analyze with students new mobile applications** that can be used in their daily functioning;
- **remember to prepare materials printed in a larger font with high contrast or use an overhead projector or interactive whiteboard to enlarge the content** for the visually impaired students.

One should also not forget that studies show that visually impaired young people are prone to the risky use of the Internet and often engage in electronic aggression. Thus, it is key to work with students on their offline social relationships:

arrange meetings, team-building activities, trips and sports activities. In addition, teachers should try to develop their students' ability to initiate and maintain social contacts, including through instant messaging and social media. For this purpose, educators can organize workshops, online meetings, initiate forums or social profiles, inviting their students to participate.

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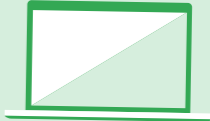


At the same time, teachers should take care of the **technical competence** of their students, including: proficiency in using the computer keyboard (the ability to write in black and white, not just Braille, and to use keyboard shortcuts that replace the computer mouse); the ability to use the devices and software that make up the so-called assistive technology (AT), such as a screen reader, OCR software, speech synthesizer, braille ruler, screen enlarger (for the visually impaired) and other peripheral devices such as speakers, scanners and printers; the ability to use mobile devices, including the ability to select and modify assistive applications.

Having said that, the educators should bear in mind that the most important issue for visually impaired students is to be able to fully participate in online activities. For this to be possible, it is necessary to draw the attention of sighted students to the presence of blind people in the Internet space and to ensure that the rules of content sharing are followed. It is necessary that young people remember what their blind peers may have difficulty with. This does not mean having to stop publishing photos or videos, but attaching short text descriptions or comments to them, for example. Increasing the awareness of sighted young people on this subject should be one of the priorities of media and digital education.

To this end, educators should also work with **sighted students**, introducing elements of empathizing during media education classes – it is crucial for students to understand that **blind people** may be among the current or future recipients of their online communications (their social media posts, videos or memes). Thus, teachers are looking together for an

Technical Competence



- proficiency in using the computer **keyboard** (writing in black and white, and using keyboard shortcuts that replace the computer mouse)
- use of **assistive technology** such as: a screen reader, OCR software, speech synthesizer, braille ruler, screen enlarger (for the visually impaired)
- use of **peripheral devices** such as: speakers, scanners and printers
- use of **mobile devices**, including the ability to select and modify assistive applications

answer to the question of how to design content in a way that is universal, i.e. accessible and understandable to everyone. Universal design should become a permanent part of media education, especially when students are encouraged to create their own digital content. This applies not only to people with visual impairments, but also to other audiences, such as those with individual educational needs. For more on universal design, see the last link in the Further Reading section.

5 Lessons from Emergency Remote Education

With the lockdown resulting from the COVID-19 pandemic, schools began remote education in March 2020 – a situation that was entirely new for both teachers and students in most countries around the world. Children with disabilities, including those who are blind and visually impaired, have been the most affected by such a dramatic change, in terms of both their daily routine and the way they learn.

The digital platforms commonly used in schools were not designed to include visually impaired children. A significant number of visually impaired children have faced enormous obstacles, especially in obtaining assistive devices, due to the high cost and scarcity of specialized equipment, the inaccessibility of learning spaces, language barriers, lack of awareness, and the inadequate training of teachers (Kapote, Srikanth, 2021).

A significant number of visually impaired children have faced enormous obstacles, especially in obtaining assistive devices, due to the high cost and scarcity of specialized equipment, the inaccessibility of learning spaces, language barriers, lack of awareness, and the inadequate training of teachers.

Gothwal et al. (2022) identified six main areas of difficulty faced by visually impaired students, their parents and teachers. These are:

- **technology accessibility issues** (e-learning technologies are often not accessible to visually impaired students, or are unknown to many teachers and parents);
- **parental beliefs/concerns** (the harmful effects of technology, teachers' prioritization of sighted children, online activities considered distracting);
- **lack of ongoing direct support** (peers, parents, teachers and tutoring);
- **limited socialization and physical activity** (students had no direct contact with their peers, did not meet in person, and could not be active outside);
- **problems resulting from low socioeconomic status** (lack of resources to provide learning space and assistive technology); and
- **problems resulting from the need to constantly stare at screen media at close range** (lack of other visual stimuli and lack of rehabilitation).

The pandemic has shown that it is necessary to make greater use of information and communication technologies in the education of visually impaired children and adolescents, including the use of applications for mediated communication, both with teachers and peers. It is also necessary to organize technological support points on the premises of schools or boarding schools so that students are well-prepared for independent learning in a crisis situation of remote education.

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6 Further Reading

The following four readings can be helpful for educators willing to deepen their knowledge and find inspiration for activities involving students with visual impairments:

- [How do teenagers with visual impairments use digital technologies to negotiate the world?](#) – Lancaster University blog post by Sue Cranmer [!\[\]\(2824aab9645d9fab95bae27ff6828dab_img.jpg\)](#)
- [How Technology for Visually Impaired is Helping People Get An Education](#) [!\[\]\(0fbf3ad74a6c8dc44ba9ea17fc2aca5e_img.jpg\)](#)
- [Ideas for remote lessons with blind students](#) [!\[\]\(c42d0234b47eca423823087b9f2f5716_img.jpg\)](#)
- [Further reading on universal design](#) [!\[\]\(0a4e27b70a7e12aa1778c291185d94b0_img.jpg\)](#)

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