seeing the
**invisible**

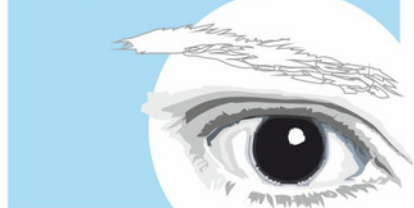# VIRTUAL COURSE FOR TEACHERS
## INCLUSIVE DIGITALIZATION IN SCHOOL EDUCATION

Co-funded by
the European Union

seeing the
invisible
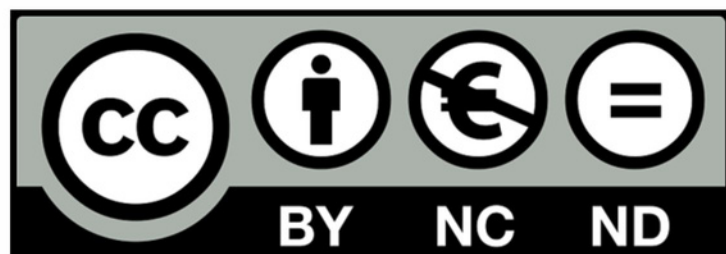
# 1.Objectives, competences, and methodology for the course

The International Convention on the Rights of Persons with Disabilities (CRPD)[1] sponsored by the UN is a resource to protect the rights and dignity of people with disabilities. The text initially approved by the General Assembly in 2006 came into effect in 2008, and has been ratified by the vast majority of member states, constituting an unavoidable frame of reference when drafting their national legislation. The Convention calls for the establishment of inclusive educational systems in all states to guarantee the right to education at all levels and stages of people with functional diversity, without discrimination and on the basis of equal opportunities.

Traditionally, it was decided that the training of children and young people who are blind or have low vision should be carried out in specialized institutions through specific training. However, some decades ago this historical orientation was changed in favor of inclusive education, maintaining in part the old educational institutions as specialized centers. Continued calls for inclusive education by various international institutions have served to guide public action and changes in educational systems.



exclusion



segregation



integration



inclusion

UNESCO reiterated in 2015 its call launched in 2008 urging the international community to *"ensure inclusive and equitable quality education and promote lifelong learning opportunities for all"* within the framework of the <u>Sustainable Development Goals and the 2030 Agenda</u>[2]. This is an ambitious goal that implies conceiving an education that answers to the diversity of the needs of students, the educational community, and society in general. The European Union responded in 2018 with a <u>recommendation</u> on the promotion of inclusive education urging member states to ensure it at all levels of education for all learners *"including those from disadvantaged socio-economic backgrounds, those with a migrant background, those with special needs and those with the most talent"* [3]. According to UNESCO, inclusive education should be understood as *"a process that addresses and answers to the diversity of needs of all learners through greater participation in learning, cultural and community activities and reduces exclusion within and outside the educational system"* [4].

The incorporation of children and young people with visual impairment together with normovisual peers integrated into standard educational centers contributes on the one hand to offer new ways for their psychosocial development, but at the same time poses challenges to the entire educational community to achieve it. In order to ensure full educational inclusion, it is necessary to cover the needs of the educational system both in terms of tools and teacher training, as well as in the adequacy of structures and devices.

The basic objective of this curricular proposal is to provide primary and secondary education teachers with the necessary training to achieve the full inclusion of students with visual impairment in the standard school environment, especially in those cases related to Albinism or Aniridia. To achieve this, they must acquire knowledge and learn methods to develop in the student the necessary social competences, and especially their self-confidence.

The complementary objectives will be used to provide basic knowledge related to low vision, which will allow the development of an inclusive educational intervention appropriate to the primary and secondary stages. These complementary objectives are:

| 1 | Knowing and properly handling the basic terminology related to low vision. |
|---|---|
| 2 | Deepening concepts and theoretical models on blindness, low vision, and visual impairment. |
| 3 | Knowing the genetic conditions linked to low vision: Aniridia and Albinism. |
| 4 | Understanding different aspects of the visual impairment produced by these alterations and their relationship with educational inclusion. |
| 5 | Understanding the challenges that arise from visual impairment in education and learning how to face them. |
| 6 | Knowing different techniques, didactic resources, typhlotechnical [5] aids, and adaptations of materials for students with visual impairment. |
| 7 | Learning to transfer theoretical principles to application in practical cases. |
| 8 | Keeping a positive attitude towards visual functional diversity and inclusion. |
| 9 | Identifying the sensory and perceptual limitations derived from visual impairment in various areas of development, as well as the real abilities of students with low vision. |
| 10 | Knowing the intervention guidelines and the necessary adaptations to the peculiar characteristics of development in youth with low vision. |

| 11 | Differentiating the needs, care, and appropriate support according to the possible remaining sight and the predominant impairment. |
|---|---|
| 12 | Analyzing ICTs as educational resources to promote the communication of students with visual impairment. |
| 13 | Selecting digital resources to improve teaching and learning processes. |
| 14 | Knowing the work to carry out from the school with the families of students with visual impairment and with beneficiary entities. |
| 15 | Understanding the importance of visual stimulation in achievements and learning. |
| 16 | Increasing the knowledge of the educational needs of primary and secondary education with visual impairment. |

This curricular proposal aims to develop the following teaching skills:
Knowing how to plan: Preparing to teach.
- Setting objectives and designing learning situations.
- Planning the learning progression.

Knowing how to act: Classroom activities.
- Managing the classroom.
- Attending to diversity.
- Educating in values.
- Using new technologies.

Knowing how to interact: Contextualizing learning.
- Working as a team and participating in the management of the school.
- Knowing the community and the school environment, involving them, and informing them.

Knowing how to be a teacher and guarantee professional success and well-being.
- Managing their own work and making improvement decisions.
- Curricular competences; Knowing one's own subject.

The methodology is based on virtual training or e-learning, so that access and acquisition of knowledge is facilitated through the use of an environment and digital and interactive content. Access to the course and contents will be open, downloadable, and of course free. This document encompasses the actions that comprise the e-learning course.

## 2.Understanding low vision

The visual system of humans consists of three distinct parts: the eye, the optic nerve, and the cerebral cortex. Vision only works properly if these three parts function and coordinate correctly. Visual perception is altered if any of them suffer injuries, lack of development, or there are discoordination in their functioning.

*VISION IS DETERMINED BY SEVERAL PARAMETERS:*
- *Acuteness.*
- *Field.*
- *Chromatic sense.*
- *Luminous sense.*
- Contrast
- Refraction
- *Focus.*

Also, vision is an intelligently exercised capability, so previous experiences affect it, not only visual but also cognitive, which help a correct interpretation of reality.
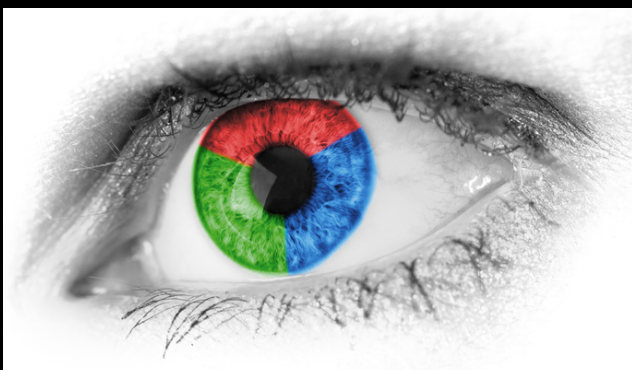
- **Visual acuity** allows to distinguish and perceive details of objects viewed at both short and long distances. With good visual acuity, one can distinguish details of near or distant objects. When acuity is impaired, details are lost and only more or less general features can be distinguished. Acuity is assessed with optotypes such as the Snellen test, consisting of rows of letters or numbers of varying size. To standardize the level of acuity, percentages or decimals are taxed, so that 100%, 10/10, or 1 mean perfect vision, while at the other end, indicators lower than 10%, 1/10, or 0.1 mean legal blindness. Depending on the causes or disease present in the loss of acuity, there may be a functional remaining sight even at very low percentages. People with Albinism or Aniridia have reduced levels of acuity, depending on their associated conditions, so the vision of the environment can be quite or very blurred. Also, although they have a certain diagnosed remaining sight, this doesn't mean that it will remain unchanged for the future, since that remaining sight can be both stable and progressive depending on specific conditions that may arise. It is up to the person themselves and their environment to preserve the remaining sight with which they were born, following the professional indications and the prescribed treatments.

The visual field indicates the angle of vision one has when looking straight ahead and keeping the head static. It is measured in degrees and directions, with an angle of about 160° of horizontal vision for each eye (60° from the focal area towards the nose and 100° towards the ear) and about 135° of vertical (60° up and 75° down) being normal, resulting in an oval area . Binocular vision covers a space of just over 180° horizontally. However, only in a central portion of that space is it possible to capture objects clearly. The highest sharpness/definition is perceived at an angle of about 3°, constituting the focal area of vision, although we use an angle of about 10° with high visual perception for special attention functions like reading. We recognize symbols in an area of about 20°, and colors in an area of about 30°. In greater angles from there we can recognize light, objects, and movements but without sharpness or color. This is what we call "looking out of the corner of the eye", an evolutionary skill that helped our ancestors to perceive predators and prevent dangers that could lurk from their sides, and that is useful nowadays in common processes like driving. In the educational environment it allows us to perceive the entirety of large spaces, such as the blackboard or the book being read.

The loss of visual fiend can impact different areas: superior, inferior, lateral, or central; or even irregular areas, for example in diabetic retinopathy. Pathologies that can reduce it can affect both the eye, the optic nerve, or act in the brain. To assess them, visual campimetry or perimetry is used, which allows to know the areas of vision and the so-called scotomas or areas of partial blindness. Everyone has a natural scotoma corresponding to the "blind spot", the area where the optic nerve connects with the retina. The brain actually imperceptibly corrects this natural scotoma by filling-in the empty space by extending what is perceived in its environment.

The chromatic sense in humans is provided by the existence of several types of cells in the retina specialized in detecting different wavelengths. These are mainly the cones and rods, which turn their light input into electrical nerve impulses. The first are responsible for the perception of color and are most abundantly located around the fovea or central point of visual focus, with about six million of them. Humans have three types of light-sensitive cones based on their wavelength, specifically those that produce reddish, greenish, and bluish colors. They are also responsible for spatial definition and not very sensitive to light intensity, being responsible for photopic or daytime vision, meaning with great intensity.

The rods on the other hand are gathered in areas farther from the fovea, they are not color sensitive, but are sensitive to the intensity of light, being responsible for scotoscopic vision or at low levels of light, therefore of the **light sense**. Its contribution to spatial definition is minor. There are close to one hundred million of this type of cells in the retina, and they contribute to the vision aspects like brightness or tone, paramount in night vision.



Human beings are born with an underdevelopment of the visual apparatus. A baby's eyes have low visual acuity. Since vision is a process in which the brain intervenes decisively in addition to the eyes and optic nerve, a period of adaptation and learning is needed, lasting until 9 or 10 years old, when the development of visual functions fully matures. Until that time, we develop modes and elements of vision: binocularity, distance calculation, contrast, sensitivity to colors, visual field, focus reflex, twilight vision, eye movements (saccades, slow movement, focusing, and vergences). Our visual process is not continuous and objective, but subjective, incomplete, and discontinuous.

We mostly process peripheral images, and only when we focus in certain points very briefly (barely 1/3 or 1/4 of a second) we truly perceive details, while being without vision during the even shorter moments of the saccadic movements (1/33 of a second). This is how we form largely subjective mental maps, very influenced by cognitive and mental aspects, making each person see differently. We actually make a low-detail representation of what surrounds us, enough to orient us, and only adding detail when we focus our interest (and vision) on something concrete.



The period of development of sight during childhood is paramount, especially because it is when the brain is getting organized to process images and shape the sense of vision that it will have from then on. This is why one must watch for the appearance of any type of alteration due to minor physiological issues, or even without them. One of the most frequent phenomena at this stage is amblyopia, which causes a decrease in visual acuity, usually unilaterally, as a result of the lack of stimulation during this critical period of visual development until six years old. This is the phenomenon commonly called *"lazy eye",* which is estimated to affect 4% of the population at some point of their lives.

A lack of understanding of the phenomena related to vision can lead to not understanding the different degrees and problems in the vision of people who are sometimes just called blind. Not all people considered blind lack 100% of their visual ability, many still have traces of vision in different degrees and shapes that allow them some more degree of autonomy.

The origin of the various visual situations may come either from development issues due to pathological or genetic reasons, from traumatic accidents, or from pathological developments subsequent to the complete development of the person. These can impact both eyes and their various protective elements, as well as the nervous system connecting them to the brain, or the one responsible for processing the neurological impulses corresponding to the final vision in the visual cortex located in the occipital area. However, sight involves other parts of our brain, located at different depths, dealing with very complex processes that involve various parts of the body, like the eye muscles or neck.

Levels of blindness can range from amaurosis (total lack of light perception) to varying degrees of visual disorders with limited residual functions qualified as low vision or visual impairment. The so-called legal blindness also includes people with very low levels of light perception (below 10 %) or visual field (less than 10°), which makes these remnants of vision mostly useless both for distinguishing objects and for spatial mobility. However, ophthalmology considers a person as totally blind or amaurotic only when they fully lack visual sensation, even before intense light sources. Amaurosis can occur only in one eye, not necessarily in both, and may in this case be simultaneous with different levels of visual impairment or low vision.

**Low vision** is understood as the personal condition that implies a significant reduction in visual capability, impossible to correct with commonly used means (glasses, contact lenses, surgery, drugs…) and that causes difficulties, sometimes disabling, due to the non-adaptation of the environment, to carry out some everyday life activities.

Its causes are very varied. They are mostly eye diseases (macular degeneration, retinitis pigmentosa, myopia magna, diabetic retinopathy, glaucoma…), but they can also be of traumatic origin, from genetic conditions, or even infectious diseases. The symptoms can also be very varied, making vision blurry or patchy, prone to glare, night blindness, limitation of the visual field, tunnel vision, loss of contrast, chromatic alterations, etc.

The World Health Organization (WHO) considers low vision to start with a visual acuity under 30% (0.3) and down to a minimum of 10% (0.1), or visual fields between 30° and 10°. Below these parameters it is deemed as legal blindness. However, there are no standards in all areas to determine the consideration of a person as a subject with low vision. In the educational field specifically, understanding and assuming the low vision of students can be quite complicated, especially when compared to the situation of legal blindness. Each case has specific peculiarities. Each person with low vision sees in a different way and has their own needs depending on the visual problem and its degree. Medical supervision is necessary case-by-case to evaluate visual functioning.

n 2019, the WHO estimated the number of people with visual impairment or blindness worldwide at 2200 million, estimating that about 1000 million could have their situation greatly alleviated with the necessary medical/ophthalmological treatments[6].

According to a ONCE study published in 2019[7] *"It is estimated that there are more than 30 million blind and partially sighted people in geographical Europe. On average, 1 in 30 Europeans lives with some kind of vision loss. There are four times more visually impaired people than blind people. The average unemployment rate for blind and partially sighted persons of working age is over 75%, and there are more blind and partially sighted unemployed women than men"*.

According to INE data in Spain, there are more than 822.000 people with visual disabilities, of which only 62.000 are between 6 and 44 years old[8].

Although it is generally and amply known that people have vision problems, the perception that a person "either sees, or doesn't see" seems widespread, and that corrective measures like glasses or contact lenses guarantee that distinction. Understanding low vision requires assuming that vision occurs in degrees, and that some are low or very low, which can limit the visual capability of people, aggravated both by the lack of adaptation of the environment and by the ignorance of others. This ignorance is often shared even by current regulations that forget that these circumstances impact a very significant number of people. To avoid confusion, the *"I have Low Vision"* badge was created:

Many years ago, vision problems were treated all the same, by making people with low vision receive the same treatment as people with full blindness, so the use of their remaining sight was not encouraged. This was the complete opposite of what is currently recommended, which is to take advantage of the remaining sight, so the person can have their maximum degree of autonomy and accessibility. Only in cases of very specific pathologies is this principle not followed.

The following are some interesting videos to interactively understand low vision:
- Low vision and the *"I have low vision"* badge[9]
- I have low vision[10]
- The range of low vision in Spain[11]
- Videos on how reality is perceived with varying degrees of low vision[12]

## 3. Low vision and rare diseases: Albinism and Aniridia

Low vision can be caused by many different reasons, including two genetic disorders: Albinism and Aniridia, which impact vision, although not exclusively.

### 3.1 Albinism

Albinism is a genetic disorder caused by the mutation of several genes, which affects humans, other animal species, and even some plants. Its most visible and known effect is the severe lack of melanin, although its most characteristic effect is actually the vision problems it causes. It is **hereditary and recessive**, which means that in order for it impact a person, they need to have the two genetic copies of the mutation. One can be a carrier of the mutation but not show it, since only one genetic copy has it. Thus, being recessive, at least one of the two copies of the gene of each of the parents must be mutated. For example, in cases of both parents being carriers but neither has manifested it, there is a 25% chance of their offspring (1 in 4) inheriting both mutations and therefore manifesting the condition. Also, one of the genes that cause Albinism, specifically the ocular variant, is located on the "X" chromosome, which is why it affects more frequently men (XY), only having one copy of said chromosome, than women (XX), with two copies.



Diagram on the recessive nature of Albinism[13]

The recessive nature of the mutation means that, if one parent manifests it (has the two copies) and the other is not a carrier (0 copies), their offspring have zero chance of developing the condition, but all of them will be carriers.
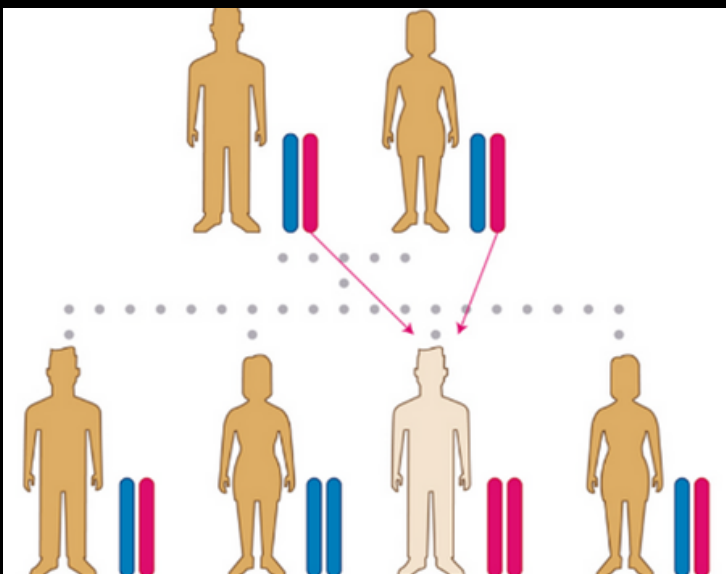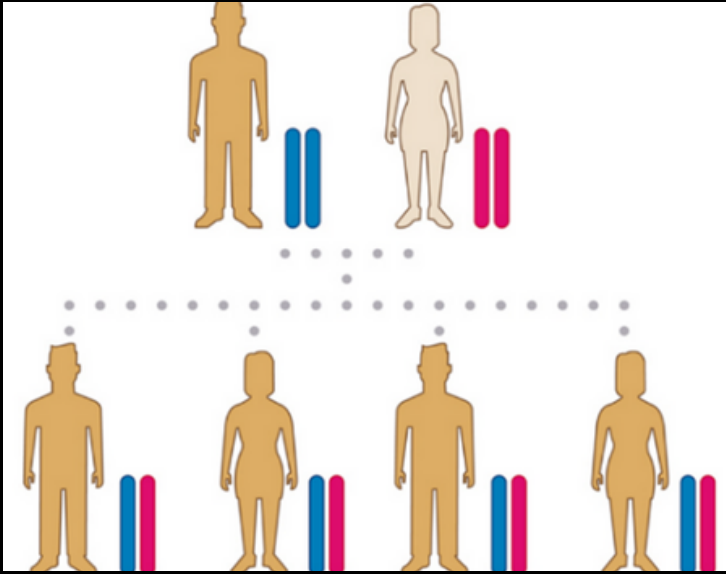
Diagram on the non-transmission of the disease to offspring [14]

Albinism is thus a rare phenomenon that occurs in approximately 1 in 17.000 births in Europe or North America, although according to UN estimates, some very specific areas of African countries have an absolute maximum frequency of 1 per 1000 births[15]. It is precisely in this continent that discrimination and even aggressions, some extreme, are frequent towards people with Albinism, constituting an execrable scourge against which we must energetically work.

In the population as a whole, it is estimated that one in 50 to 70 people is a carrier of the mutation, the vast majority of them without even knowing it. It follows that one in every 2500 to 4900 randomly formed pairs could have albino children.

The name Albinism has its origin in the Latin word *albus*, meaning *white*, due to the color in most their skin and hair for the lack of pigmentation provided by melanin (in people with Albinism, the metabolic mechanisms that help synthesize it do not work properly). Melanin is a photoprotective pigment located not only in the skin and hair, but also in other areas such as the epithelium of the retina, the iris, the inner ear, or the heart. People with Albinism have an iris with a high degree of transparency, which prevents it from fulfilling its mission of modulating the access of light to the interior of the eye, but the mutation also causes other eye problems that hinder the quality of their vision.

Humans have two types of melanin: dark or *eumelanin* (black-brown) and another lighter or pheomelanin (reddish-yellowish); red-haired people produce only the latter. The iris colors of all people are the product of the combination of both, there are no blue, green, or violet pigments: these colors are the result of an optical effect of the combination of those four. Melanin is produced and accumulates in specific compartments of cells called *melanosomes*. These are organelles in the form of membranous sacs that keep it separate, since it is actually toxic to the rest of the cell.

There are several types of Albinism, so the different effects produced by different gene mutations can be combined. The symptoms and intensity with which they occur are different depending on its type. The only shared characteristic in all cases are visual problems, since the lack of pigment may or may not appear depending on the variety and degree of affectation. It is classified as a rare disease due to its low prevalence, less than 1 in 2000 people.

HISTORICALLY, THERE ARE TWO MAIN TYPES OF ALBINISM, BY MOST AFFECTED AREA:

- Oculocutaneous Albinism (OCA), which affects the pigment of skin, hair, and eyes. This is the most frequent type.

- Ocular Albinism (OA), which only affects the eyes due to alteration in the quantity of melanin in the retina.

Each of these two categories has several subtypes depending on the affected gene. Some of these subtypes, specifically the so-called *syndromic*, have other more severe alterations in other organs, although fortunately they are less frequent than non-syndromic varieties. A recently described one is FHONDA, with visual problems without pigmentary involvement, which has caused to consider the set of Albinism to be reviewed, highlighting that the only common characteristic of the more than twenty identified varieties are vision-related problems, not the lack of pigmentation. In fact, it isn't even possible to establish a direct relationship between lack of pigmentation and visual problems. Both characteristics don't run parallel because the genetic alteration acts from fetal development, impacting the development of the visual system.
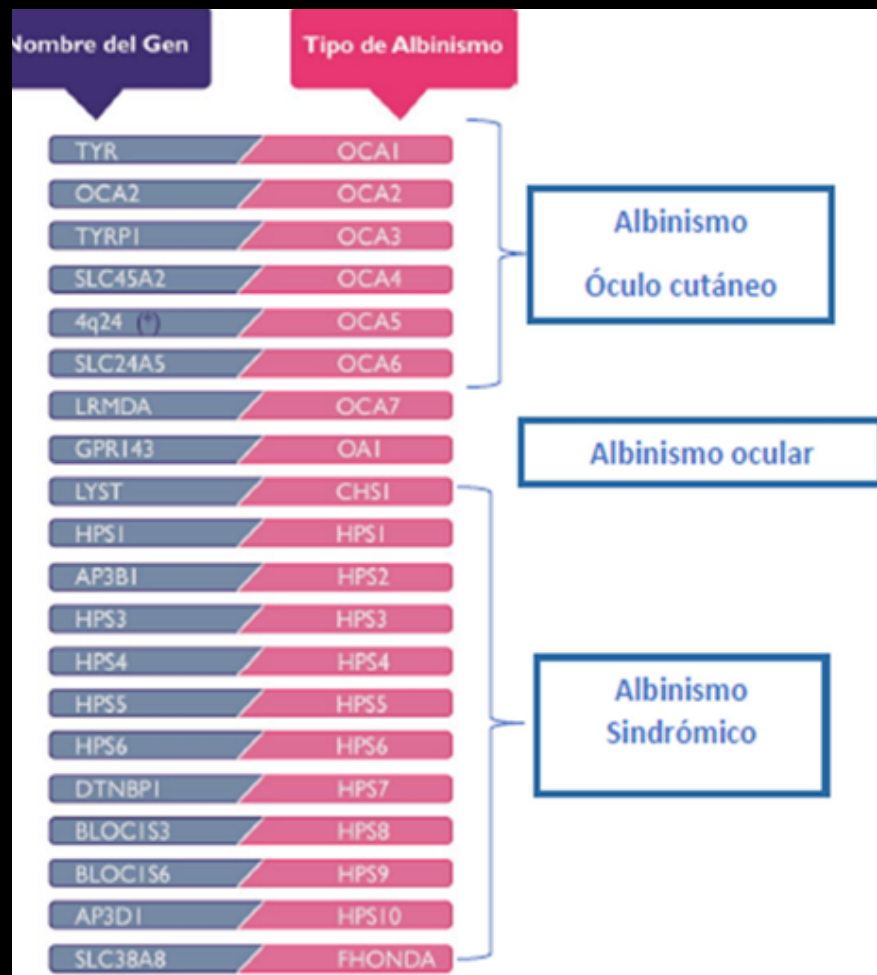


Diagram showing the various types of Albinism[16]

Varieties such as OA1 have normal pigmentation levels in the skin, hair, and eyes, and may not have even been diagnosed, but they will have the same visual alterations as the rest of the types of Albinism: nystagmus, frequent strabismus, photophobia, visual acuity decreased to 5 0-10% (0.5-0.3), foveal hypoplasia, reduced three-dimensional perception. This leads us to point out that the loss of pigmentation, which evidently has a varied series of manifestations and causes, isn't a defining characteristic of the diagnosis of Albinism. Thus, we emphasize that the common characteristic of this genetic conditions isn't the lack of pigmentation, but the alteration in visual ability.

The vast majority of people with Albinism have a clinical diagnosis, but many of them lack a corresponding genetic diagnosis. The medical confirmation of the diagnosis by the observation of symptoms, although it may be sufficient to establish the appropriate treatments, may nevertheless be insufficient to obtain other benefits, such as official recognition if the symptoms are not very evident. It can also help detect the presence of the genetic alteration in relatives who haven't manifested the condition as a way to prevent its transfer to the offspring[17]. Genetic diagnosis also contributes significantly to the scientific knowledge of this disease in particular and its possible specific therapies and human genetics in general.

People with Albinism, with in most cases an almost total lack of pigmentation, are extremely sensitive to solar radiation, so they need to protect themselves against it. If they don't, they can easily develop various pathologies related to the damage of ultraviolet radiation on the skin, such as skin cancer or to other organs like the eyes. The lack of pigmentation in the iris causes them to have very pale colored eyes (grayish, blue, reddish, or sometimes very light brown) and thus not adequately reduce the entrance of light to the eye, so they also have photophobia (rejection of direct light due to easy glare). However, they need good lighting to perceive clearly, so each person must adjust their level of darkening of the glasses they use to combine their use of sight with avoiding photophobic discomfort. They also have a visual acuity often below 10% (0.1) so in some countries like Spain they are legally blind. Low visual acuity often results in inability to drive.

People with Albinism have foveal hypoplasia, which means they lack or have very limited fovea (the part of the retina on which vision is focused), which has the largest number of cells related to color vision and visual acuity. Therefore, their vision is similar to what others perceive with their peripheral vision, with less precision and chromaticism, and also working worse with low light levels. Their vision in optimal lighting conditions is limited, specifically stereoscopic vision.

The stereoscopic, three-dimensional, or deep vision is assembled by our brain via a complex mechanism that involves the different information collected by each eye, transferred by the optic nerve to the brain after passing through the optic chiasm, which exchanges half of the signals coming from each eye. The nerve signals from the two eyes reach the two cerebral hemispheres which, communicating with each other, create the perspective of three-dimensionality. In people with Albinism the optic nerve doesn't transmit as in people without Albinism: each hemisphere only receives the information from the opposite eye, complicating the creation of three-dimensional vision in an irresolvable way, which is only created as two-dimensional, as if looking to a flatscreen. This makes it impossible to integrate near and far objects, background and close. This is one of the most important limitations, which is only partly overcome by age and experience.



This same possibility of developing three-dimensional vision increases the possibility of the eyes working uncoordinatedly, resulting in many cases in strabismus.

People with Albinism almost always show nystagmus or involuntary and random movement of the eyes, usually horizontal, although this is not an alteration only typical to Albinism. The brain gets used to the involuntary movement of the eyes and ultimately eliminates it when processing the images. Nystagmus is linked to the lack of fovea and the inability of the retina to focus vision, which causes the brain to drive small automatic movements to satisfy its need to focus the retina.

They can also have myopia, hyperopia, or astigmatism, like any other person, which can be corrected in part with prescription lenses. People with Albinism are often more likely to be nearsighted or have myopia.

On the other hand, pigment cells are also found in the inner ear, specifically in the vascular stria, a structure located within the cochlea and responsible for the production of endolymph, essential for the transmission of sound. This fact could be related to some type of hearing loss; however, this direct relationship has not been documented in people with Albinism, being a pending issue of new medical studies.

## 3.2 Aniridia

Aniridia is also a genetic disorder whose name means "lack of iris". It affects the visual apparatus through iris hypoplasia, problems in the retina and the optic nerve, not being limited only to both eyes, but also being able to impact other organs of the body. It is very rare, with an estimated rate of 1 in every 40.000 or 100.000 births[18]. It is a disease that usually causes conditions of great isolation in families in which it appears, precisely because of its very low prevalence. It is registered in _Orphanet_, the portal of reference information for rare diseases and orphan drugs, under code ORPHA77.

It is caused by a chromosomal deletion in the PAX6 gene on chromosome 11, which is responsible for the formation of the eye during pregnancy, but can also impact the formation of the urinary system, and can even cause intellectual disability. Unlike Albinism, it is transmitted by autosomal dominant inheritance. In the case of Aniridia, it is enough that only one of the parents has the mutation for it to be transmitted to the offspring with a 50% chance. The mutation isn't located on a sex-determining chromosome, so this factor doesn't influence its transmissibility. It can also appear spontaneously, and this happens in one third of cases approximately, by estimates.



unaffected parent — affected parent

unaffected child | affected child | affected child | unaffected child
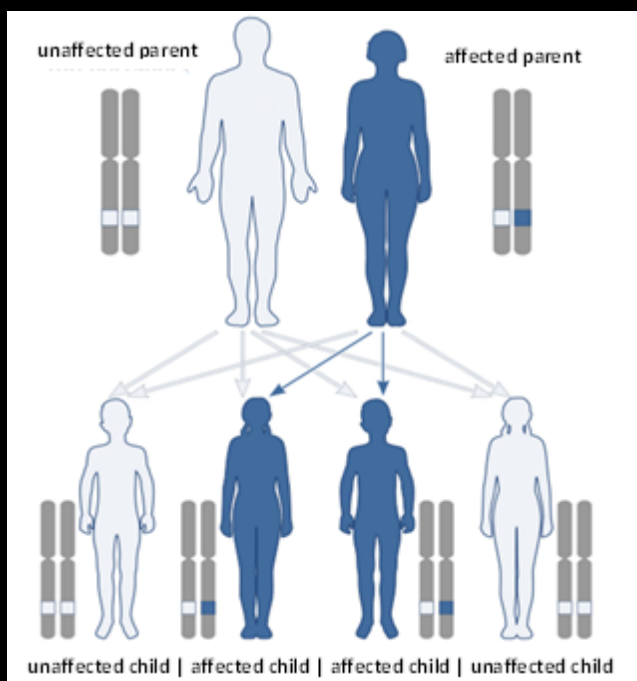
Type I Aniridia is hereditary, type II Aniridia is the one caused by sporadic mutation. This mutation can cause, in addition to Aniridia and other aforementioned pathologies, a tendency to develop nephroblastoma in children, as well as gonadoblastoma.

People with Aniridia have a low visual acuity, often below 20 % (0.2), and usually develop other associated pathologies like glaucoma (50 to 75% suffer from it), cataracts (50%), *keratopathy,* photophobia, and nystagmus due to foveal hypoplasia. The first way to detect it, in newborns, is by their photophobia. During the first years of life, a thorough medical control should be carried out on organs that may be affected by this condition (the ocular system of course, but also the genitourinary system and the nervous system). Symptoms are treated separately for each of them, since there is no comprehensive treatment. Regarding the eyes and vision, they are treated by optometric aids like glasses, tele-magnifying glasses, microscope, telescope, etc.; with pharmacological and even surgical treatment for some specific issues (cataracts, intraocular lenses, trabeculectomy, and even transplants).

Genetic research in each particular case is important to detect whether Aniridia will occur in isolation or as part of WARG syndrome[19], identifying the mutation of the PAX6 gene as much as possible.

The daily life of people with Aniridia shares many problems with other people with low vision. Nystagmus, for example, hinders eye contact and can send the unwanted message of inattention or disinterest. Photophobia makes them need to adapt and protect themselves from sudden changes in lighting conditions, with a significant sensitivity to bright lights, windows, very clear surfaces, reflective surfaces (metal, liquids, mirrors...), and the environment must usually be adapted to these circumstances. Glare causes discomfort and loss of visual acuity, and can also cause headaches or sneezing. Going outside, turning on lights, or the presence of moving lights like vehicle headlights pose a problem and cause uncertainty. Wearing sunglasses usually prevents these situations, with high protection to be outdoors even on cloudy days. Some people use contact lenses with an artificial iris with a fixed pupil that blocks light, which can also be used to correct other visual problems like myopia or hypermetropia, although this is sometimes complicated by other pathologies that can affect the cornea. People with Aniridia also tend to have eye dryness problems, so humidifying droplets can be used several times a day.

# 4. Educational needs derived from low vision

We receive almost four-fifths of the information that reaches our brain through vision. Low vision causes a drastic decrease in the same information that others perceive directly and massively. Therefore, the educational needs derived from low vision must compensate for this narrowing of the main channel of information reception by enhancing the development and use of the remaining sight and the other senses. But the widespread belief that the decrease or absence of visual capability automatically increases the perception capabilities of the other four senses is a myth. They must be trained specifically to develop, with a lot of effort and willingness to overcome.

A first profile of educational needs for the student will be determined depending on their type of visual problem, the level at which it occurs, and therefore the degree of vision. In cases of low vision not linked to genetic conditions, it would also be necessary to assess the vital moment in which the disease or cause of the visual problem occurred. However, one must add other specific circumstances to this first assessment, such as the existence of other disabilities, family and social relationships, the socioeconomic situation of the family environment... all will end up outlining a framework of actions that, starting from general concepts and techniques, will then require an individual concretion.

As we have seen, in students with low vision caused by Albinism or Aniridia, the visual condition is caused by a genetic alteration whose effects occur from birth. They have varying degrees of vision loss, from the mildest to those that leave only a minimal visual remainder, and in some cases with other parallel pathologies as well..

In the vast majority of cases, the educational needs of students with Albinism or Aniridia are related to the technical means to access the contents rather than the need to adapt them. However, inclusive education implies curricular flexibility, so that curricula are adapted to special situations and needs.

**Students with low vision generally have a series of common difficulties:**

- Problems perceiving environments, since they receive information in a confusing, distorted, or partial way.

- Difficulties in learning by imitation.

- A slower cognitive development due to the difficulty of accessing information.

- They are more easily distracted or bored, due to receiving fewer external stimuli.

- Problems in social competences, due to the lack of development of non-verbal social skills, mainly gestural and expressive.

- Possible use of echolalia and verbalism when expressing, or development of stereotypies.

**Addressing these challenges requires:**

- Stimulating and using the remaining sight through its training, regardless of its index, will always be useful and will benefit the autonomy of the student.

- Working on the stimulation of the other senses, especially hearing, to maximize the obtention of information through those pathways: learning to study through recordings, to identify sounds related to obstacles or dangers, orient oneself, identify voices and people; also identifying olfactory sensations to locate some spaces or recognize objects, develop haptic perception, etc.

- Learning adaptive behaviors to avoid stereotypies, echolalia, and verbalism, developing non-verbal social behaviors: gestures and expressions, eye contact with the speaker, etc.

- Adjusting the pace of learning, considering the greater need for time to receive information; curricular objectives must also have an adequate timing.

- Establishing the most functional literacy code for them: ink or Braille.

- Psychomotor stimulation, avoiding passivity and a sedentary lifestyle; mobility and orientation programs.

- Monitoring the use of optical and technological aids and establishing the necessary school support.

- Adapting the environments to the educational, social, and security needs, considering aspects from their location in the classroom and the requirements of lighting or spaces for optical and technological aids, to the elimination or signaling of barriers (slopes, doors, carpets...) or other elements (doorknobs, switches...), keeping the various spaces tidy, warning about changes in furniture ...In this regard, the whole educational community must be involved in achieving more accessible, safe, and inclusive environments for all.

In one of the few polls on the perception of youth (between 12 and 18 years old) with Albinism on technology and educational inclusion in Europe[20], some of its conclusions are interesting and useful for teachers who need to approach these issues.

- The inclusive use of technology is very common, and they are mostly quite common *(laptops, tablets, touch screens, interactive whiteboards, virtual platforms, digital books)*. The use of more specific technologies *(usually optical: magnifying glasses, tele-magnifying glass)* is scarcer, the use of other more specific ones like screen readers or voice synthesizers being testimonial.

- Teachers are generally receptive to the introduction of new inclusive technologies in the classroom, although measures are not implemented quickly enough, with no common cause for delays. However, the technological proposal doesn't usually come from teachers, but from entities outside schools, usually social, specialized in visual impairment or proposed by the families, and the implementation is carried out by the competent educational entities.

- As students progress in their training, they tend to use paper more often than screens to take notes, since it becomes more effective and faster.

- The use of digital platforms (more widespread after the COVID pandemic) is problematic for many, because they aren't accessible enough. They usually give problems in how they scale and enlarge texts.

- They show a clear preference for documents in PDF format *(portable file document)* since these have a great capability for enlargement without losing quality. However, in many cases, images (sometimes texts) introduced in this format have significant problems of resolution enlarged. This is why they complain that they themselves must remind teachers of the need for texts to be edited, not reproduced as bitmaps. These issues are related to the existence of gaps in the technological training of teachers and to the resistance to implement changes in educational methodology.

- Most don't refer to problems in the relationship with peers; on the contrary, these are helpful with problems of accessibility to information; normally assuming the use of the necessary technological aids, and recognizing them as useful for all students. Clearly and promptly answering to the doubts and circumstances that naturally arise when joining a new group contributes decisively to the creation of an inclusive and normalized relationship. This translates into the existence of a prevailing climate of satisfaction, only overshadowed by the need to regularly remind about implementing the accessibility measures.

- In secondary schools, the vast majority carries out evaluations in digital format.

- The priorities for action that stand out are related to the need for continuous technological training of teachers, the improvement of administrative procedures for the introduction of technological improvements, and the insufficient concern of some supply companies for accessibility in their designs and products.

## 5. Guidelines to work with primary and secondary students with low vision

Children with low vision require their visual functions to be worked on as soon as possible, so that their remaining sight can be maximized, no matter how small, making the best possible use of it. They must be taught how to look, understand what they see, distinguish what is essential from what is accessory, learn characteristics, analyze in parts… It is key to couple the process with detailed explanations that expand and help them assimilate the sensory perceptions experienced. It is essential to work on this during their first ten years of life it, since it is when the brain has greater plasticity to adapt to changes.

This stage of stimulation is located halfway through the stages of infant and primary education, and there is a series of personal factors of the student with low vision in it to consider, due to their impact on the use of their remaining sight:

- Cognitive development and problem-solving skills, directly related to their age.

- Their social skills.

- Other existing impairments.

- The attitudes of the family and the environment.
- Perceptual difficulties that influence visual development: fine and gross motor coordination (fingers and hands; trunk and limbs, respectively), spatial orientation and laterality.

- Their interests, motivations and needs.

These factors are decisive to mark the differences between minors who, although they have the same medical condition, may require personalized actions adapted to specific circumstances that must always be considered: nerves, fatigue, lack of interest… One has to evaluate the attitudes and physical postures taken by the student daily, and how they adjust to the measures taken to validate or modify the strategies adopted.

Specific actions to stimulate the remaining sight should consider ophthalmological diagnosis and prognosis, especially when deciding on the reading and writing system: standard or Braille. It is also necessary to consider age, intellectual capabilities, and the development of tactile and auditory perceptions, not just visual. However, the decision can be reviewed and modified at any time where appropriate, and one can even choose to use both systems.

There are several methods of diagnosis and enhancement of the remaining sight for children in the stage up to 10 years (during which their visual system finishes developing): Barraga[21], Frostig[22], *Look & Think*[23], IVEY Project[24], EVO (Visual Stimulation via PC), EFIVIS[25]...

Once the visual functions are consolidated, specific training programs can be implemented for the remaining sight. In this new stage, the child is provided with optical and non-optical tools and the training to use them, to help them in their daily lives.

Children with low vision may show specific problems in their reading and writing development, with lower general performance, visual recognition problems, calculation problems, dyslexia, poor spatial orientation, dysorthography, vocabulary and poorly developed visual memory. This is why we must emphasize careful reading without omissions or repetitions, thus improving speed and comprehension. They will also have to be taught in the use of technological means and appropriate environments (with special care with lighting and ergonomic aspects) to develop this essential skill. The objective is for them to master some code of literacy, either standard or Braille, or even both. Sound code support is also very important to develop their abilities.

When training reading skills, it is convenient to use a font size twice as big as the student can perceive, with enough line spacing (so that character recognition does not require an overexertion), proper lighting, an optimal distance to the text, and an ergonomic body posture. Motivation is very important, so one must encourage success through the careful choosing of the texts to work on.

Following the recommendations of Spain's ONCE[26] for documents adapted to low vision, one must use simple fonts like "Arial" or "Verdana", not using *ornaments*, *italics*, or *condensed*. The recommended font size is 12 to 14, and **bold** should not be abused. The use of capital letters should be restrained only for single words or short texts, since lower case is better read in longer texts. The space between letters should be ¼ of the letter's height. Interlining should be between 25 to 30% of the size of the point, and shouldn't be scarce or oversized. Lines should have between 70 and 90 characters, since too long lines or short tire the eyes faster. When using columns, these must be clearly separated and without images between them. It isn't recommended to write vertically. Texts should be justified to the left, but this justification might not be recommendable in many cases, especially if the space between words is too much. It is better to use short paragraphs separated by a blank line.

The colors of the letters and the background must have a good contrast between them, and paper should not cause glare, so it should be matte and thick enough to avoid transparency. There shouldn't be any pictures behind the text, nor watermarks. If images are used, they should be simple and without a lot of details, with a good contrast with the background. It is better to place them to the right of the text, and if pictures are used, they should be made in simple and thick lines over a clean background.

During the hand activity of writing, it is better to resort to lower case letters, since these are joined and it is less visually tiring to follow the position of the pencil (ballpen, felt-tip...) each time it is raised from the page to write another letter, as is the case with capital letters. Nonetheless, resorting to capital letters in usual writing can be more comfortable for a person with low vision, by using a wide-tip tool and with high contrast with the paper or wallpaper.
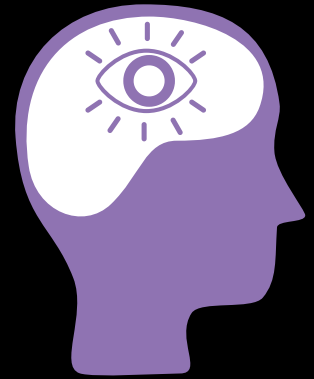
It is essential to monitor the continued and correct use of the help tools, bearing in mind the possibility that the child stops using them due to shame or rejection of other peers. In this case, it will be convenient to work both the mechanisms of self-knowledge and self-esteem of the student and in the detection of possible abusive or negative behaviors from the rest.

Reading in people with low vision will always develop more slowly, this being a factor that must be kept in mind during lessons. Anyone's reading process requires a series of skills that are gradually learned and developed. Character recognition happens through moments of focusing sight and the fovea on specific points on the reading line. Sight is focused on a few characters per stop, and it is a matter of practice to learn to use near or paracentral peripheral vision when recognizing adjacent or full words located in the vicinity of the point where sight is focused.

There are about four fixations every second, and between them are saccadic movements during which the brain interrupts direct vision, filling in visual information. The complexity of the process requires practice, since many more stops have to be made initially to recognize more characters with focused central vision, when the ability to do so with the near peripheral or paracentral vision has not yet been developed. Changing the reading line is also another skill necessary for agile reading and requires practice[27].

These processes are more complicated for people with low vision due to the problems they can have with visual focus and eye movements, so they will always read more slowly. So, while a normovisual person can skillfully read about 300 words per minute, people with low vision will probably not reach half that speed.

Reading is essential to educational inclusion. Students with low vision have less access to everyday reading of texts than any other or normovisual student. These, for example, sometimes automatically read many signs, posters, or writings, which are inaccessible to people with low vision. Also, reading is the result of a sometimes considerable effort, so they aren't easily incentivized for it.

In order to promote reading ability, it is essential to carry out practical exercises to develop aspects such as: directionality, ocular motility, shape perception, or visual memory. It is about gaining expertise regarding eye movements and their relationship with head movements, to develop peripheral vision and focus on moving objects; as well as the perception and recognition of basic shapes, increasing the degree of retention and the ability to reproduce content.





In any case, it is necessary to watch out for harmful habits, such as the recourse to point the reading point with the finger (a typoscope[28] can be used if necessary), needing to vocalize reading in order to understand it, or moving the head instead of the eyes.

As for writing, the main problem of students with low vision is the poor readability of what they write, even for them as writers themselves, in addition to the low speed and recurring errors. We recommend reviewing basic issues such as ergonomics (position and distance) the correct lighting or the writing materials used (proper contrast between background and writing, not too fine stroke, use of aids -lectern, guidelines-, avoiding glossy paper). The objective is for writing to be as legible as possible, through the correct union of letters with precise strokes and without excessive effort, performing the necessary exercises for it.

Inclusive education implies that all students must learn the same skills, exercise the same behaviors, and assume the same responsibilities. But in the work with primary and secondary students with low vision, it will always be necessary to consider certain issues, among which the most significant of them is **time**: they will always require more time for literacy than other classmates, without this impairing their ability to understand or their intellectual development. The latter will be ahead of its visual functionality, so as they mature they will be able to give more evolved visual responses, but not the other way around. Also consider that they will not always last the same time in doing the same task, since their visual capability will vary depending on the brightness of the day and the time of day as well as the existing lighting.

Therefore, special attention must be paid to the **lighting and the space** where the student with low vision is located in the classroom. Natural and artificial lighting should help avoid glare and promote contrast between elements. The situation in the classroom will be the best in relation to the blackboard and for the optimal use of the material and typhlotechnical aids they use. Mind the spaces needed both for their use and to store them when they are not in use.

It will be necessary to have an adequate balance **between personal attention and overprotection**, since the latter tends to create dependence and hinder the key objective of personal autonomy. It is not easy to establish a precise code regarding this. Encouraging their autonomy should mean getting them used to doing things they can do on their own even if the process is slower or the result is not optimal. We all have to stumble when we learn; it's better to teach to learn where obstacles are than to remove them for them. This doesn't mean that they will be totally autonomous either, they must also learn to ask for and accept help when necessary (or to reject it kindly when it isn't), just as the rest of their peers must, in terms of the limitations and capabilities each person has. This should result in an improvement of everyone's personal self-knowledge, self-acceptance, and self-esteem.
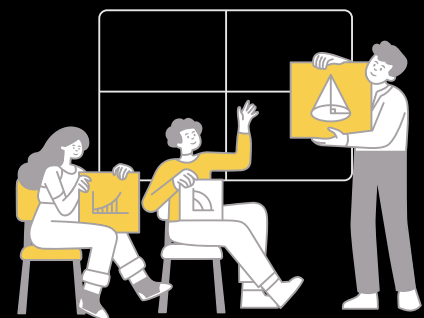
When providing help to a person with no or low vision to guide them, consider some general knowledge recommendations:

- Don't take them by the arm, but offer your arm for them to take it above the elbow or your shoulder for them to place their hand on it.

- Always walk one step ahead of the person you are guiding.

- You can succinctly describe the path, especially specifying turns, doors, or stairs, changes in slope, or any type of possible obstacle.

- If you are guiding, before starting to climb or descend a step or some stairs, stop for a moment. The person guiding must initiate the ascent or descent, always one step ahead.

- If you come to an escalator, warn of it beforehand, so the guided person can place their hand on the moving handrail; keeping ahead nonetheless and warn them of the beginning and end of the escalator.

- The person guiding will always go in or leave ahead when arriving at a door.

- ·In order to sit down, put the hand of the guided person on the back of the seat or the seat itself, while indicating its position or characteristics.

- Always give verbal indications of situation in relation the guided person, and make them precise: "in front of you", "behind you", "to your right"…

- To indicate the location of objects on a table, you can use the structure of a clock: in front and away: "at 12 o'clock"; just in front: "at 6 o'clock"; to your right: "at 3 o'clock"; to your left: "at 9 o'clock", and so on. Sometimes, and also as a game with children and young people, geographical knowledge can be used, such as the location of cities, rivers or mountains on the map of a country or region.

- If you want to ask something to a person with low or no vision, do it directly and not through their companion or guide as if they were an interpreter.

- Don't be afraid to use everyday expressions that imply seeing or not seeing. There are many ways to see, not just with the eyes.

- When talking to people with low or no vision, warn them when we address them, when starting or ending a conversation, leaving or entering the room, etc. Verbally provide the person with the visual information they cannot perceive.

In their interpersonal relationships, students with low vision must learn certain skills that may be difficult for them to develop or get used to, such as making eye contact with the person they are talking to or recognizing and using gestures and nonverbal language.

Students with low vision must learn to **make the most of their remaining sight**, to get images that fill their brains and allow them to perceive and interpret the environment; they must be adequately motivated to look, calculate distances, differentiate shapes and colors, and coordinate sight with other senses, so they understand and assume that everything is a constructive and useful challenge for themselves. They have to incorporate technical knowledge and behavioral guidelines to their day-to-day that show how to work with contrasting elements, uniform backgrounds, keep proper lighting, and use optical and non-optical aids[29]. They must also know their own visual situation and how it differs from normovisual perception, thus acknowledging their own limitations, including those involved in tasks that may be dangerous to them.

**Safety** is both a personal and collective issue that requires specific learning. Things that are not usually problematic can be complicated or even dangerous for people with low vision: half-open doors, small unmarked slopes, small carpets or carpets with edges lifting from the floor, unnoticed furniture changes, untidiness in shared spaces... these are all elements that generate insecurity and can even cause dangerous situations, so both the person with low vision must be aware of them, and the rest of the members of the educational community must be co-responsible in avoiding them (case of semi-open doors, untidiness, or unannounced object placement changes, carpets lifting up, etc.) or, where appropriate, mark them properly (with bright colors for edges of doors and slopes, switches and sockets, doorknobs, etc.).

Before different pathologies, adaptations and specific exercises must be made in the classroom:

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|---|---|
| **SCOTOMAS** | They prevent vision in certain areas due to injury to the macula. One must use the remaining areas of vision. If scotoma is central, when focusing on an object one won't be able to see it, but instead focus around it to perceive it with the available areas of vision. The remaining perception is diffuse, without defined contour, and little or no color. Vision will improve from afar, making it very difficult to look closely. The process of reading or writing will be very difficult and must be worked on by learning to focus not on the point we want to perceive, but on another, so the objective to be perceived appears in the area of vision available. It will be convenient to enlarge the characters, highlight contours, increase contrast and illuminate correctly without dazzling or causing shadows or reflections (point of light in front and on the opposite side to the dominant hand to avoid shadows). |
| **NISTAGMOS** | It is an involuntary movement of the eyes, usually horizontal, when trying to systematically focus vision, but not succeeding due to different conditions such as problems in the fovea. This causes reading problems because of the difficulty in making the necessary eye fixations and saccadic movements. It requires an additional and sometimes exhausting effort due to the difficulty in recognizing words or changing lines, complicating comprehension. It is necessary to exercise a new way of reading, trying to counteract involuntary eye movements, with movements of the head or text, looking for the blocking position of the eye, decreasing those uncontrolled movements. |

| | |
|---|---|
| **CLOSED VISUAL FIELD** | Peripheral vision is lost and only a central part is perceived. It is also called tubular or tunnel vision. This causes many problems when moving due to the difficulty of perceiving the spatial environment. They also have trouble seeing in low-light conditions (night blindness). They also have problems seeing symbols or large objects located nearby, since it is more complicated to cover them entirely, as well as to perceive the movement of objects, sets of things, location of specific objects. In literacy, they won't need text enlargements, since they will only perceive the characters included in a narrow field of vision. This will cause speed problems due to making more fixations. They will also have problems skipping groups of letters and changing lines. They will need adequate lighting and good contrast, as well as prior examination of the location area and workspace, which they will need to memorize to compensate for the absence of peripheral vision. Guided paper for writing will be of great help. |
| **BLURRED VISION** | Several conditions can cause poorly defined vision that is not possible to correct by optical aids, both in far and near sight. This is usually coupled with photophobia and a propensity to glare. The shapes and colors will be perceived with difficulty. They should regularly use glasses that filter the luminosity that reaches the eyes and that try to correct in part the lack of definition. Lighting must be adequate, not in excess, but allowing contrast between the objects. Writing is better with thick strokes in dark ink on a paper which contrasts highly with it, but does not dazzle as much as white paper, using, for example, yellow or light blue paper. |

# 6. Actions of the educational center against low vision

The structural and identity documents of the educational center, i.e. both the educational project and the curricular project, must reflect in a specific way the commitment and the measures adopted to promote an inclusive education. In addition to placing this concept as a basic objective of the center, it will be necessary to establish how resources of all kinds are organized and coordinated to achieve it. The linkage and measures will impact all material resources (infrastructures, facilities, spaces...), all human resources (teaching and non-teaching staff, their training and schedules...), students in general (rules of coexistence, conflict resolution, extracurricular activities...), their families, and of course the curriculum and evaluation.

Coordinating efforts and establishing specific intermediate objectives are essential milestones to achieve the educational and social inclusion of all students.

The inclusion of a new low vision student in an educational center may initially raise some doubts among teachers, who may question themselves about their own abilities and knowledge in this regard. Although these concerns are common, the day-to-day makes them lose importance and shows their inconsistency. The efforts and work carried out to prepare the framework and achieve inclusive education bear fruit when day-to-day functioning shows the gradual inclusion of students. The classroom tutor has a key role in this process, since he/she is the driving force of the use of the various resources and educational methods available. However, they will be supported by other professionals to carry out work that must be properly coordinated.

Students must be informed and their awareness raised on the peculiarities of having classmates with special needs and everything related to inclusive education. It is necessary to value the efforts made by students with low vision, the characteristics and importance of taking care of the materials they use, and the specific characteristics of their visual problems. It is the students themselves who should tell their classmates about all of this, and specifically about their needs related to lighting, optical and non-optical aids, the best ways to guide and help them daily, etc. This information is part of their personal sphere, which when told to their new peers, will help them socialize in the group. Classmates must know in which issues they need help, precautions to take regarding collective security (tidiness of common spaces, warning about changes in the furniture location, half-open doors...). They must also know and assume values of understanding, respect, solidarity, and appreciation of differences, and must learn to provide help when needed. The role of peers in the social and academic inclusion of students with low vision is paramount.

**Teacher training** for inclusive education shouldn't only be a concern of the teacher, but an objective of both the school and the educational administration. Many materials for this specific training are available online: open resources created by specialized entities with experience in this field or by the educational administration itself. The **exchange of experiences** between teachers in the field of inclusive teaching is also a very positive framework for teacher training.

Having **support professionals**, preferably with specific technical knowledge in low vision and the optical and technological aids available and applicable is an essential resource to implement an inclusive education. Having specific and personalized reinforcements for these students helps compensate for the greater efforts they must make to acquire the information and knowledge taught, while serving as an effort-motivating factor.
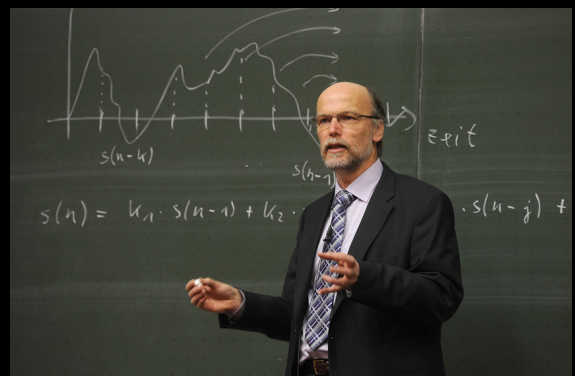
The **school guidance teams** are in charge of determining the support actions aimed at students in general, and in particular at those with special educational needs for any reason. They must actively collaborate with teachers and the educational community, coordinating actions with social and health services. They must pay special attention to the prevention and psycho-pedagogical evaluation of students with special needs and, in the case at hand, those with low vision. They must have the necessary technical staff to carry out their preventive, dispositive, coordination and monitoring functions, specialized in educational guidance, therapeutic pedagogy, functional diversity, social work, high intellectual capabilities, psycho-pedagogy...

In addition to an organizational method, **student groups** are also a learning strategy. Schools have autonomy to organize groups of students. The criteria mostly used (age and surnames) usually guarantee a diverse group, which can be reinforced with corrective mechanisms that specifically strengthen this diversity by avoiding the creation of ghetto-like groups. The model of separating students by levels of achievement, trying to configure homogeneous groups with the alleged purpose of favoring standardized teaching (which has been carried out in some countries like the US and the UK) has shown serious issues[30]. In order to promote equity, equal opportunities and inclusive education, groups must be configured in diverse compositions, avoiding any type of segregation and keeping a certain factor of flexibility to allow permeability between groups.

Within the classroom, **group work** is a key tool for inclusive education. Groups increase the capability of knowledge between people by allowing closer interaction. Varying the ways of grouping to some extent according to the specific objectives pursued at each moment is a good strategy to promote the appreciation of diversity and inclusion, offering all students the possibility of working and interacting in both large and small groups with the rest of their classmates. Consider especially the more or less heterogeneous nature of the groups formed, in order to avoid undesirable effects like the exclusion of specific students. The use of methodologies like peer mentoring, which will be developed later, also yields positive results.

The question of support inside and outside the classroom for students with special educational needs is also controversial. The most inclusive criterion is for this support to be developed inside the classroom via teachers specialized in therapeutic pedagogy or hearing and language, for these students specifically. This support outside the classroom only seems an inclusive practice if it is a reinforcement outside of school hours. The least inclusive practice is removing the student from the classroom while their classmates continue their standard activity, since this contributes to general segregation spaces. This issue has both a clear economic component, due to the human resources dedicated to it, but also organizational, since it affects the schedule of special support teaching staff. Other solutions include properly coordinating the standard teacher with the support professional so that the latter's work can be carried out in the classroom, thus meeting the real and concrete needs of daily and common lessons.

Lastly, some reflections must be introduced regarding certain possible attitudes in educational centers that don't favor an inclusive education at all.

On the one hand there's the tendency of some educational groups of raising their inability to assume diversity if the higher education administration doesn't provide the necessary means. Although the demand for the human and material resources necessary to meet the specific educational needs of diverse students is a positive issue in itself, an argument of this type taken to the extreme can become a way of freeing from responsibilities, placing them outside the school. Beyond the fact that the competent educational administration may neglect the provision of means for inclusive education, this is primarily the responsibility of the school, which has the obligation to implement it with the means at its disposal, even if they are not sufficient.

On the other hand, certain schools that do have the human and material resources necessary to meet the peculiar needs of diverse students, argued and even put into practice that the best way to use them is by dedicating them exclusively, and even in separate spaces, to students with special needs. Dedicating specific or reinforcement teaching staff to a segregated student or group of students, with all the necessary technological means, may seem at first sight a more effective way of using resources (some families will even share this opinion), but this doesn't contribute to an **inclusive education** but to an **integrated education**, different and incompatible concepts.

## 6.1 Psychological support and use of language

Regarding psychological support, the first thing to note is that young people with low vision aren't a special category of people with their own psychology. On the contrary, among the studies carried out over many years on a fundamental question of human psychology such as self-concept and self-acceptance among young people with low vision or blindness, there are no absolutely conclusive results[31]. Having low vision doesn't necessarily lead to the development of psychological problems, nor a worse self-concept than among other teenagers. In fact, there are studies that seem to show that self-concept is even better in teenagers with blindness than among the rest[32]. According to other studies, teenagers with low vision show a less critical position towards themselves than the rest of teenagers. (33)

Students with low vision require psychological support to the same extent as the rest of their classmates depending on their personal circumstances. Depending on the etiology of their vision loss, specific circumstances may occur, since it is evident that if it has been derived from traumatic episodes, they will have to face a process of acceptance and adaptation to the new circumstances, something that young people with Albinism or Aniridia who have lived its effects since birth do not experience. . However, the evolution of any disease can lead to changes that also produce traumatic situations, which may lead to the need for specific psychological care.

There are not many works related to specialized psychological care for people with low vision, although it is possible to find some examples related mainly to the treatment in traumatic cases[34].

However, studies are being developed on the psychological impact both in people with Aniridia and WARG syndrome, and among their relatives[35], in which the existence of alterations related to a traumatic perception of the future stand out overall. It is interesting to note that the people participating in these surveys show many fears about the future of the evolution of both their own situation and that of their affected children; placing these fears as the main cause of situations of anxiety, frustration, guilt, doubt, irritability... shared by both patients and their families. In the specific case of frustration, it is also linked to the impotence felt by people with Aniridia compared to the rest of the population, in addition to the misunderstanding suffered or the lack of progress in the efforts undertaken, both by patients and relatives. In the case of feelings of guilt, these are mostly related to parents, due to a poor understanding of the etiology of the disease, and self-demanding, obsessive psychological mechanisms or low self-esteem. To all this we add the perceptions that derive from the specific behavioral or psychiatric problems of people with WARG syndrome, who can also show development disorders, autism, ADD, OCD...

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The issue of insomnia requires specific comment, since it is recurrent in situations like those described above, but in the case of patients with Aniridia acquires a new dimension, with studies relating this alteration with low levels of melatonin in relation to pineal hypoplasia[36].

Primary and secondary students will go through the life stage of adolescence during their school period. This stage of self-affirmation and deep changes affects students with low or no vision somewhat specifically. This characteristic usually leads to a delay in both the start and the end of this life stage[37]. Along with the chronological delay, another of the key characteristics that affects their psychological development is the overexertion that they continuously have when compared to their peers, which should be compensated by working on additional motivating elements. Adolescence will cause changes in the type of relationships that they have with their family and social environments. Regarding their direct family, they will make advances towards personal independence that will reaffirm their self-concept, which could come into direct clash with the overprotective tendencies that can be developed by parents. Regarding the social environment, there are changes that will impact, among other issues, the development of their sexuality, an issue that requires specific treatment, to provide and receive the information that most boys and girls usually receive visually, and to which students with low or no vision don't have the same access. The different role that haptic perception has in people with or without vision in the development of sexuality and the stages of knowledge and relationship with other people are issues on which to reflect and work. If physical contact using the sense of touch is an advanced step in relationships for normovisual people, for people with low or no vision, it is also acceptable as a first approach[38].

Lastly, the issue of **the language of daily use** is worth mentioning specifically, and how it can translate erroneous or unwanted concepts, which may at first even go unnoticed. Language is not neutral and can convey things that may not be intended to be said. This entails a very concrete risk of transmitting undesirable values and misconceptions to students through inappropriate use of language. We educate while expressing ourselves. Terms such as "deficiency", "handicapped", "disability", or "abnormality" imply a pejorative treatment when applied to a person, since no person deserves to be told that they are worth less than another, that they are characterized by being incapable, or that they are deficient. Each capability is peculiar for each person, and different from those of others, with this not meaning that they have to be evaluated or placed on a plane of superiority or inferiority. This is why it is more convenient to use the term "functional diversity", because it refers more accurately with the concept of the peculiarity of the capabilities of each person without adding an evaluative or utilitarian nuance.

An appropriate use of language should never be attributed either to a third person's desire to limit free speech, nor to an alleged self-censorship in the background imposed by others. On the contrary, it should be understood as an improvement in the more judicious use of the terms we express with the concepts we want to express.

There is a concept as used as it is misleading, that of "normality". It is often used as a synonym for "usual" (which can indicate "customary" or "statistically abundant") or "natural" (another concept almost as elusive and sometimes misleading), and yet its tightest meaning is that of something that conforms to a pre-established norm: "normative" rather than "normal". The negative application of these concepts to people as "not normal" or "not natural", often implies a pejorative treatment, more or less understood and even assumed by those who use them. In any case, it is convenient to use terms that are more in line with the objective facts that we intend to express and don't lend themselves to value judgments. In the field at hand, it is better to speak of "people with normal vision" than of "normal people", in the same way that it is preferable to speak of "person with low vision" or "person with blindness" instead of "blind".

We must routinely incorporate a non-discriminatory or stigmatizing use of language. A specific characteristic does not define a whole person, and although it isn't important to say that a person "is blonde" or "is tall", our way of expressing ourselves must be careful with characteristics that can involve discrimination or stigma.

# 7. Inclusion in equality within the classroom

The inclusive classroom is an essential pillar to build a new culture for people with *specific educational support needs* (SESN) that recognizes and values the diversity and heterogeneity of all students. Inclusion implies rethinking attitudes by teachers, families, and the educational community, starting from the premise that *diversity* is a universal concept, beyond a partial vision symbolized by *"normality"* being able to integrate *"the different"*. Its ultimate goal is to provide quality education to all students on the basis of *adapted frameworks not adaptations to the framework*.

Inclusion is re-signified to rebuild the educational culture and identity of schools, meaning their vision, mission, and philosophy, as well as their educational strategies and practices. We must consider a different way of approaching attention to diversity, designing and implementing mechanisms and procedures that identify, locate, and break down existing obstacles. This strategy goes beyond a simple reform that provides special resources for students with special needs. In practice, the concept of inclusive classrooms must refer to the whole educational system, which aims to guarantee basic general education to all the population, regardless of their initial situation (their needs, obstacles, and risks). This implies facing with the same tools diverse situations and problems, like school failure and dropout, or the inclusion of multiple situations of diversity, both capacitive, cultural, social, intellectual, perceptual, ethnic, identity, etc. However, the strategies followed in various educational systems have failed to achieve the desired objectives, probably due to a lack of the necessary parallel pedagogical and curricular renewal.

A paradigm shift is thus promoted: the educational system as a whole must be inclusive, guaranteeing quality education to the whole diversity of students, thus breaking with the normal/special dichotomy. In this sense, this challenge can be addressed through **the Universal Design for Learning (UDL)**: a basic theoretical tool to build this new way of understanding inclusion in the classroom.

The DUA is based on the principles of Universal Design, developed by north-American architect Ronald Mace (1941-1998), which were gradually collected by the legislation on constructions in the USA from the 70s of the last century. These principles, inspired by the fact that there are *disabling environments* rather than *disabled people,* meant that solutions initially intended for some people proved to be useful for others due to different reasons. Thus, a ramp initially planned for people with reduced mobility is also useful for people who carry strollers or drag suitcases. These principles have been transferred to other fields, such as the design of many products and applications, for example, subtitling has served both people with hearing loss and anyone wanting to follow them in noisy environments. Taking this to the educational environment provides a new way of facing inclusive education that represents a change of educational paradigm: it isn't necessary to think and design for a standard student and making the appropriate adaptations for people with special needs, but that it must be done the other way around, thinking and designing for a diversity of abilities, preferences, interests, motivations, languages, cultures, socio-economic situations, identities, and orientations.

The UDL was developed by north-Americans Anne Meyer, David H. Ros, and David Gordon[39] with a primary objective: to design curricular proposals that take into account diversity in the classroom, with the extremes of its variability as a reference. It also references Howard Gardner's theory of multiple intelligences and Lev Vygotsky's constructivism and his concept of the proximal development zone.

Following Carmen Alba Pastor[40], the model is based on the existence of three brain neural networks and their link with the learning process:

- **Affective networks**, which determine personal involvement in the different tasks and learning, so they are linked to **"why"** we learn.
- **Recognition networks**, specialized in the recognition and integration of information and the assignment of meanings, linked to **"what"** we learn.
- **Strategic networks**, linked to the generation and control of mental patterns and executive functions, meaning the planning and execution of tasks, so they relate to **"how"** we learn.

The methodology is based on the principle of providing multiple options organized into three levels: **principles, guidelines, and checkpoints**. Thus, the principles corresponding to each neural network are:

- **Providing multiple ways of involvement** (affective networks)

Each student has their preferences and motivations for learning and for their various actions (lessons, practices, tests...). Affective networks regulate these aspects. We influence the different ways of getting involved to the extent to which the varied actions reflect the diversity of interests.

- **Providing multiple ways of representation** (recognition networks)

Try to identify some strategies and teaching resources to ensure that all students access information as an essential part of learning, based on diverse abilities, perceptual preferences, previous training, and cultural and linguistic preferences. To this end, the different formats in which information can be transmitted must be used. There is no optimal way, diversity is what's optimal.

- **Providing multiple ways of action and expression** (strategic networks)

It involves the strategic and emotional mental networks directly related to the learning process and the transmission of what has been learned. Each person has their preferences, rhythms, and skills. It's about planning the processes by adapting them to this diversity through a diverse methodology, not only in the learning process, but also in its evaluation and expression, not closing the latter to a single way.

Each principle has in turn three associated guidelines, which are categories that group the didactic strategies that activate different learning processes:

- WAYS OF INVOLVEMENT
− **Providing options to spark interest;** alternatives of the same task according to different preferences, which result in a positive reinforcement of self-concept.
− **Providing options to keep effort and persistence;** maintaining interest goes hand-in-hand to adjusting the difficulty to the student's level. A task too easy or too difficult will not maintain the tension of making an effort to achieve a goal. The balance between challenge and support is very important.
− **Providing options for self-regulation;** so they can recognize emotions and learn to control moods and reactions. It is preferable for these mechanisms to be learned, since they are not acquired naturally. This encourages self-knowledge.

- WAYS OF REPRESENTATION
− **Providing options for perception;** the difficulty in the perception of information implies distortions and overexertion. To avoid this, the same information can be shown other formats to facilitate access, regardless of physical, linguistic, or formal barriers.
− **Providing options for language, mathematical expressions, and symbols;** signifier and meaning are not necessarily connected for all people, and shouldn't be taken for granted. Providing various associations and ways of understanding meanings and their relationship with signifiers (symbols, graphics, musical notes, formulation, common language, and mathematics…) will provide avenues of understanding to different people with different abilities.
− **Providing options for understanding;** information, in addition to being perceived, must be turned into useful knowledge, assimilated, and connected to what has already been learned. Activating previous knowledge and its relationships with new one through concept maps, individual or group activities designed for it, memory exercises through various sensory impulses and mnemonic resources, or practical exercises are all ways to promote this process. The objective is for all students to develop this process through various ways.

- WAYS OF ACTION AND EXPRESSION
− **Providing options for physical action;** restricting the processes of learning and expression of what has been learned to the literacy channel is detrimental for students who have an easier time doing so through alternative routes. One must enhance the variety of work options by benefiting from support technologies.
− **Providing options for expression and communication;** beyond reading and writing, digitalization imposes a new concept of literacy. There is no optimal means to reach all students, but multiple possibilities to adapt the message to the needs and preferences of each individual.
− **Providing options for executive functions;** regarding the metacognitive skills that regulate impulses and decisions to act in a strategic and planned way after goals or objectives. The difficulties that many students have in this regard can be alleviated both by providing direct resources to support planning (guides, templates, lists…), as well as posing collective challenges that promote collaboration and shared learning of strategies in pursuit of a specific goal.

On the other hand, the UDL defines a series of basic principles:

- Equality: the design must adapt to the diversity of users and capabilities.
- Flexibility: it must adapt to the plurality of preferences and skills.
- Simplicity: easy to understand and intuitive.
- Accessibility: information should be accessible regardless of physical or sensory barriers.
- Resistant: it must have high tolerance for errors without unwanted consequences.
- Manageability: it shouldn't require high efforts to be understood and handled regardless of the user's conditions.

Failure to consider these principles leads to creating disabling rather than inclusive objects or environments. When adapting the principles of the DUA for students with low vision, keep in mind that it is best to organize information as structured and clearly as possible. Poor organization, small elements, too close together, or unnecessary hinder accessibility. Also consider the contrast of colors used, trying to avoid glare, overlaps, transparency, etc.
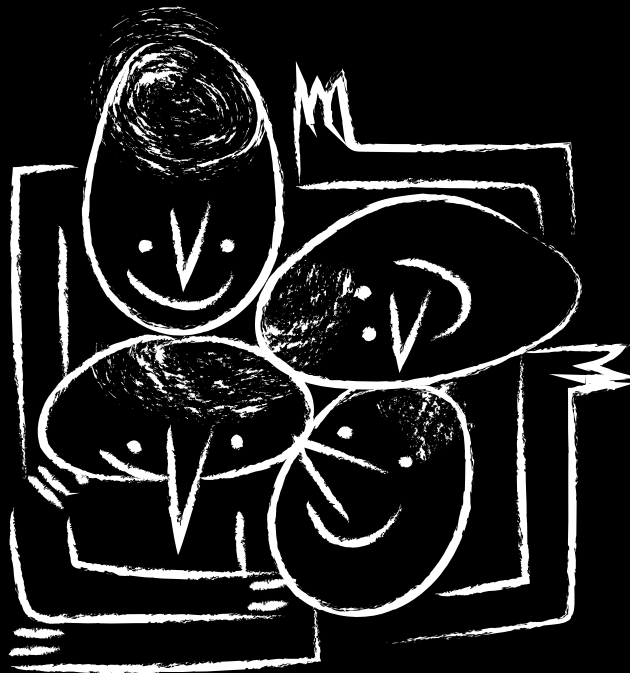
## 8. The role of the teacher in inclusive learning in equality

In an environment in which information and content are at our immediate disposal on devices that are already essential and to which we dedicate many minutes of our time daily, the figure of the teacher is a key element for two basic learning objectives: on the one hand, awareness of the importance of acquiring, assuming, and using knowledge and data despite the fact that we have the facility to access them immediately; and on the other, providing the tools so that the acquisition of information and knowledge is carried out through skills developed according to the criteria of *critical thinking.*

The figure of the teacher as the maximum depository and sole transmitter of knowledge has already been left in the distant past. They are now in charge of facilitating the learning possibilities of students by generating the necessary conditions in the classroom for them to learn to use the available technologies with benefits to know, create, and communicate. That is why the challenge of continuous and updated teacher training is essential before the speed of innovations and technological and methodological changes. All educational systems should strengthen the structures and formats of continuous training and update the knowledge of their teaching staff. This initiative must run parallel to the will and concern of these staff to stay at the forefront of their own updating. Preparing for the optimal use of technologies and knowing how to use them in the educational process are basic and necessary skills of the teacher.

On the other hand, technological resources are a key element for accessibility and inclusion. Teachers must gather the necessary knowledge to manage those most appropriate for this objective. In the case of patients with low vision, you should follow some recommendations:

- Clearly identify the needs of students.

- Decide on the best technologies to meet those needs.

- Manage the use of technology inclusively, with the rest of the students.

- Promote the autonomy of students with low vision in the use of inclusive technologies.

- Know and respect the pace derived from the use of these technologies.

- Apply the most appropriate educational methodologies to an inclusive use of the technical means adopted.

- Encourage group work via this technological inclusion in the classroom.

- Remove existing obstacles to real and effective inclusive education.

Teachers are also the reference and coordinators of the actions derived from the individual plans that impact students with special needs, and in the case that concerns us, those with low vision. All European educational systems plan for the development of these plans under various names[41] as a key tools to guide the adaptations and actions to be implemented with each student with special needs. Although these are tools collectively created by the technical teams of different specialties, it is teachers who are responsible for their implementation and improvement, coordinating the interventions and their follow-up with other professionals. This is why the actions must be developed with maximum autonomy from the teacher, always counting on the help and advice of the necessary technical staff (health, social services, psychological…). Experience shows that the school inclusion of students with low vision is usually effective and not excessively complex.

On the other hand, the figure of **specialist teachers** is worth noting, who serve to address a series of varied and complex issues that impact students with low vision:

- Coordination with the rest of the teachers to meet the special educational needs, informing about the disability of specific students and their needs for effective inclusion.

- Teach certain techniques, such as Braille, typhlotechnological and optical aids, visual stimulation, etc.

- Develop and supervise personal autonomy programs, providing the necessary support for their implementation.

- Provide advice on curricular adaptations and make the corresponding follow-up.

- Collaborate actively in the adaptations of materials and activities.

- Provide support and advice to the families of students with low vision to complete at home the activities carried out at school, consolidating their own autonomy.

## 9. The role of classmates in inclusive learning in equality

*"…Not long ago, a primary school teacher told me that she had a blind student in her class. It turns out that course was the best language course she ever had." "Why?" the journalist asked. And so Marta Mata answered: "Well, because, with that blind classmate, everyone strived to speak to him in such a way that it would fill-in for what he did not see. They learned to play with words, perfected vocabulary accuracy, and developed their language. And, besides, they learned to be blind."[42]*

In order for a school year to develop a in such a positive way with a group of students, as stated in the previous quote, the model used needs to be inclusive education in which group learning is developed, a collaborative or cooperative type, not under competitive criteria, and in which the teacher-student relationship does not exclude the centrality of the relationship between the students themselves. This is a teaching method in which the heterogeneity of teams or work groups, project work, and the assumption of diversity as a positive and enriching value are central points of implementation. Assuming diversity and differences must be undertaken from a perspective that is both plural and collective, understanding that each person is different, with different abilities, characteristics, limitations, tastes, hobbies… avoiding as much as possible to individualize the differentiating fact in a specific person of the class. It is not about a group of "normal" people integrating those "different" but, from our own individual specificity, to assume the plurality and diversity that actually exists, while acknowledging the positive and enriching character they have for any society.

Unfortunately, situations of social exclusion and rejection still happen in various social spheres. Education in inclusive values and ways (plurality, diversity, tolerance, respect, resilience…) is a key tool to fight exclusionary ways of understanding human relations. It is also important to teach how to combat inequality, exclusion, and injustice by encouraging **critical thinking**[43] to help question prejudices, stereotypes, and biases, which are all almost always the point of origin of intolerance of all kinds. At all stages of education, an effort must be made to intervene and eradicate any problem of intolerance and exclusion that arises in the educational environment[44].
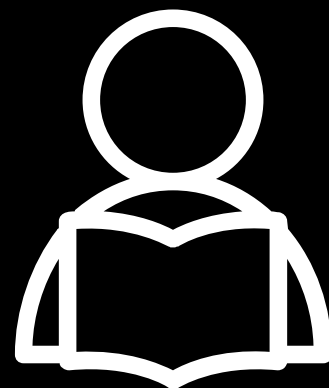
In the classroom, social relations between students are developed, and the teacher must know this microcosm to tackle and act against any behavior that denotes discrimination or exclusion. Its early detection is a basic issue, especially at the beginning of the school year, to work on its elimination through strategies and mechanisms that question the root of exclusionary and supremacist thinking. Identifying the role each student plays in this small world is essential to establish the best ways of action.



The educational center is an area in which young students learn to relate to very different people, which will imply personal enrichment. This is the vision that must be promoted together with values and behaviors like friendship, learning to share, conflict resolution, temper control, exercising understanding, resilience, etc., all of them essential issues in a world in which the influence of the internet and social networks on interpersonal relationships is increasing, and sometimes conditions them in an unfortunate way, by promoting on the one hand physical isolation in favor of virtual hypercommunication, and on the other, being the scene of inappropriate behaviors fostered by anonymity and impunity.

The main objective is to achieve fully inclusive educational centers that use a high quality and comprehensive education that respects the rights of everyone. To this end, interventions should be carried out to highlight the importance of inclusion, proposing and exercising measures that promote it, and discovering biases, prejudices, behaviors, and obstacles that may imply the origin points issues like exclusion or discrimination. To propose this strategy, it's necessary to know the social and family reality in which the students live, the values and rules they learn and assume at home or in the neighborhood. Thus, each school must have a specific plan adapted to the reality lived in its close environment, which incorporates action strategies for the real promotion of the inclusive values contemplated in its *school plan*.

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In the classrooms of an inclusive school, educational models should be promoted that favor cooperative learning structures among students, as opposed to competitive structures. The latter hide the perversion of the need to settle one's own triumph over the failure or inferiority of others, even indirectly. However, cooperative learning bases success on collective triumph, thereby favoring inclusion and positive socialization.

Learning partners have a key role to play in inclusive education, which is why natural support networks need to be encouraged as an essential element in the design of teaching strategies and activities. Cooperative learning systems, peer tutoring, and others like circles of friends (concentric circles around a new student with special educational needs to help him/her and raise the awareness of their classmates), support networks between peers (peer support strategies to facilitate the inclusion of others), peer and friend systems (support networks generated from a circle of volunteer friends tutored by a teacher, in support of pupils with relationship or adaptation difficulties, aimed mainly at extracurricular activities), collaboration groups between peers (which include several possibilities: student cooperatives, local initiatives... creating spaces to meet the demands of other peers), or peer support committees (which incorporate students in turns to analyze how to improve mutual support in the classroom) must be promoted, since all of them contribute to exploring forms of support to achieve a more inclusive classroom.

In order to achieve an inclusive environment, it is also necessary to define the rules applicable in the classroom as clearly and understandably as possible, which should reflect with a certain flexibility, both rights and obligations to achieve an inclusive classroom. Students should participate in its development and review, in order to reflect and approach the equal exercise of their own rights, the fulfillment of their obligations, and the mechanisms of social relations among them, and in an outstanding way those of conflict resolution. Also remember that some preconditions for the development of cooperative methodologies among students must be a series of conditions related to feelings and relationships of union, equality, interdependence, non-competition and affectivity/friendship.

Cooperative teaching methodologies tend to facilitate inclusion and also enable better levels of learning, since group discussion and debate, i.e. cognitive conflict with diverse points of view, helps to ignite new positions and postulates by rectifying or reaffirming what has already been achieved. In these methodologies, group work is essential, but groups must conform and also learn to work together, which requires a specific parallel teaching process. Social skills are also learned, not innately. Two issues to consider when forming work teams among students are, on the one hand, the heterogeneity or homogeneity of its members, and on the other the durability of the group.

Regarding the first question, it is best for work groups to be heterogeneous character, meaning that the tendency to group students by their affinity or shared characteristics must be broken. Diversity is a value in itself also in the configuration of working groups. On the other hand, regarding the duration of the groups, once they have consolidated their operation it may be most convenient to maintain their composition throughout the course or even the entire educational cycle. However, it is not strictly necessary to keep the groups stable at all times, being able to introduce variations to work in other group structures at specific times or for specific tasks or subjects.

In any case, the group has to generate a positive interdependence in its functioning and purposes, making each member have the double task of learning on their own and facilitating that the rest of their companions do so too. The diversity of each student must be addressed to the teacher to adapt and adjust the contents to the possibilities of each one. In each group cooperation is key, so that everyone learns. When that goal is achieved, they must obtain some kind of reward that positively feeds the dynamic, such as extra activities of playful content, a framework that will further encourage socialization.

The groups must learn to coordinate their efforts, distribute tasks, and take advantage of the particular skills and hobbies of their members to improve collective results. They will also have to learn to do it in a balanced way, so everyone participates in the efforts and results, so no one is left out by individual or collective action or omission, and no one is relegated to marginal or dispensable work. This also implies exercising individual responsibilities to comply with the obligations arising from the distribution of work and responsibilities. Everyone must know that the final objective of the group is not to obtain the best possible results or product (which is typical in competitive dynamics between groups), but that the best possible result is that the learning obtained is shared by all members of the group.

I N C L U S I O N
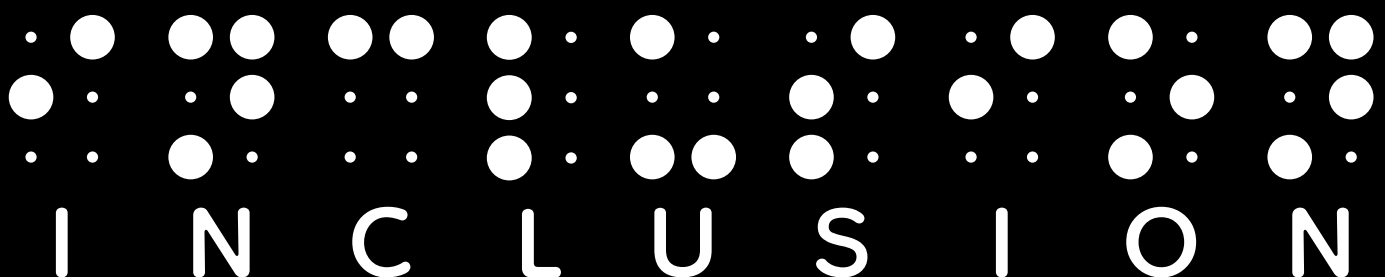
Groups can work with different techniques, through the distribution of roles-charges-responsibilities, or distribution of parts of the research-work by projects, so the final result is achieved by joining efforts and personal results and effectively fulfilling the assigned functions. It is important that in the assignment of roles or parts of the work, there is rotation among the members, since the objective is for everyone to learn from everything, not that specialization produces fragmentary learning. Group work shouldn't turn into a mosaic work, meaning a series of individual tasks that only have meaning or purpose when the parts are put together and the final vision is obtained. Cooperative group work requires exercising collective elaboration, debate, and confrontation of ideas and transmission or clarification of knowledge. As said before, cognitive conflict is positive for learning. Also, cooperative group work will foster interpersonal relationships, affectivity, empathy, and *stimulating interaction* that provides motivation for learning and personal improvement. This is why it is convenient for each group and the classroom as a whole to reflect periodically on how cooperative work is working and the issues that need to be strengthened, corrected, or improved.

But, although the classroom is structured in cooperative groups with the characteristics that have been developed, teachers must keep an adequate supervision, so everyone always assumes the key concept of the objective not being competition, the improvement of other groups, or even that everyone reaches the same levels of learning, since each student has their own appropriate personal objectives: the objective is collective learning, in which each and every member of the class, regardless of the group with which they have worked, its characteristics, and specificities, acquires the objective knowledge, skills, competences, and attitudes individually adapted to that level of education, and the teacher must forget that the achievement of the objectives sought must yield the corresponding reward!

# 10. Other external factors that help the adaptation of visually impaired pupils to school life

The various European educational models, within their own specificities, have in common both the assumption of the principle of inclusive education and the establishment of external measures to support students with special needs. In each country, the responsibility is to meet these external support measures are attributed to authorities and entities at different levels, whether local (in Nordic countries), regional (in Germany or Spain), or state-level (in France or Bulgaria), and including shared funding competences (in Italy)[45]. In each country there are also educational resource centers, specialized in collaborating with and supporting the common educational system, including in certain cases schooling pupils with special educational needs, originating from the specialized centers of the old model of segregated education, now obsolete due to the widespread inclusive education.

With these and other structures in each national or state educational system, complementary support is provided in the different European countries to educational centers for the effective inclusion of students with functional diversity, providing specialized resources and specific devices. In the case of students with low vision, the former educational centers for the blind have been transformed into external resources to provide technical advice, psycho-pedagogical support, human resources, and technological materials to the inclusive educational system. These external centers aim to:

- ·Contribute to the real effectiveness of inclusion in the educational system in coordination with the rest of the parties involved in the process.

- Detect the educational needs of students with low or no vision and provide specialized and quality responses, collaborating with and complementing educational centers, especially in instrumental technology, specific didactic resources, personal autonomy, specialized techniques, and curricular areas that require specific support due to its special difficulty for low or no vision.

- Contribute to the training, advice, and exchange of experiences of teaching staff in the field of educational inclusion and attention to the needs of students with low vision, facilitating research in this area also benefitting from the didactic experience accumulated by their own specialists.

- Attend, support, and advise the families of students with low vision, promoting their specific training and participation at all levels in educational, extracurricular and recreational activities.

- Support and promote experiences, both in school and extracurricular, that are inclusive for students with low or no vision and contribute to their personal autonomy. Intervene the same with all students to promote the enriching vision of diversity.

These external resources are implemented by tracing a path that begins with the detection of the situation, the interdisciplinary assessment of needs, the establishment of a personalized plan for the student, and culminating with the monitoring and assessment of the actions undertaken. The individualized plan is concretized considering the specific parameters of the student terms of:

- Visual functionality: remaining sight.

- Prognosis of evolution of visual functionality.

- The existence of other physical or psychological circumstances to be considered.

- Maturity and functional performance.

- Difficulties in accessing the school curriculum.

- Educational support needs.

- Instrumental and technological support needs.

- Existing resources in the school and needs that arise to the school itself.

- Resources and capabilities of the family environment complementary to educational inclusion.

- Changes in schooling.

The interventions of external resources are especially important in certain areas that strictly exceed the educational field, such as:

- Personal autonomy: travel, orientation, and safe mobility, daily activities of personal hygiene, food, clothing, use of resources and specific materials, visual stimulation…

- Instrumental techniques: learning and mastering literacy and calculation techniques in ink or Braille. Adaptation and management of technical and digital media.

- Access to technical and digital media: specifically in the family and extracurricular environment, since the competences must be assumed by the system itself in the educational environment.

- Social skills and competences: non-verbal behaviors of social interaction, looking at the interlocutor, gesticulating to emphasize and imply that an argument is understood and followed, participation in group activities…

- Support and monitoring of personal adaptation: reduce negative emotions, learn to assume and see the situation, available support, necessary mental adaptations, covering stressful situations, depression… care to self-evaluation and self-concept, attention to problems of motivation both for the study and for social and personal relationships, added problems in adolescence, assertiveness, need for special reinforcements…

- Extracurricular, vocational and work orientation: know and value the diversity of possibilities of vital development, preparation for labor insertion, use of leisure time, participation in leisure activities, socialization…

- Awareness of the educational community: promotion of inclusion, characteristics and needs of students with low or no vision, needs for universal adaptation of the educational environment, promotion of joint work, sharing of the characteristics of the technical and technological aids to be used…

- Family counselling: both for the inclusion of young people with low vision, and to facilitate their personal autonomy, favoring acceptance and knowledge of situations and consequences, as well as aids and possibilities, to function in everyday life. Establish social networks and participation in support and help associations.

Resources outside the school can also help students with low or no vision through combined and transitory schooling formulas. These are modes by which a part of the curricular and extracurricular training is carried out in specialized centers outside the school, although coordinating with it. This training can be similar to the standard, in hours other than teaching ones, to learn extracurricular subjects or complement curricular ones **(combined schooling)**, or occupying the entire school day in curricular subjects during a certain stage of the student's training **(transitory schooling)**[46]. Both options can be done both individually and in groups to complement and reinforce necessary learning justified by organizational issues or higher needs. These are formulas that don't connect directly with inclusive education, since they imply separating students from their standard school for a while, so this type of measure must be adopted in a justified manner.

However, it offers many possibilities in short periods to reinforce curricular areas of greater difficulty, motivate, or meet special needs of students with low or no vision, especially those related to personal autonomy, instrumental techniques, and typhlotechnical tools
.
The duration of these combined or transitory schoolings must be adopted at the proposal of the multidisciplinary team that attends students with low or no vision. Once this period has ended, the effectiveness and fulfillment of the objectives set and the subsequent actions must be assessed by them, bearing in mind that inclusive education implies separating the student as little as possible from their environment, meaning from their usual school and the standard educational system.

# 11. Inclusion in equality through digitalization: Educational methodology

New technologies have long since burst into the classroom as part of a process of pedagogical renewal that isn't uniform throughout Europe, nor has it always been accompanied by a necessary updating of the training of teaching staff. However, the technological resources in schools have been growing and are expected to continue in this direction, while the applications and open educational resources available increase day by day. All these changes have important consequences for the learning processes and the role of teachers: they must be partners in the planning of new technologies in the classroom, since they are essential elements in the learning process. The central question isn't so much how to incorporate new technologies in the classroom, but how to adapt educational processes to the general digital and interactive context.

The educational process is aimed towards the achievement of the pedagogical objectives the students are expected to achieve, thus acquiring the key competences established by the Council of the EU in 2018. For this, schools use various pedagogical methodologies *(inductive, deductive, dialectical, analytical, synthetic…)* combined with different strategies *(collaborative, project-based, problem-based, discussion, research-based…)* and technical (masterful –presentation, conversation, explanation…–, autonomous –problem solving, independent work, essays…–, or group –debates, forums, panels, roles, gamification…–). In any case, the processes will be organized in concrete didactic sequences in structured frameworks (more rigid following the route traced by the teacher) or regulated (which give room for variability in a normative environment). Whatever they are, the use of new technologies in these methodologies contributes to their greater and better development, since it facilitates on the one hand access to knowledge and information through a diversity of formats, while on the other diversify communication channels and collaboration between all the actors involved in the educational process, as well as the possibilities of producing new productions, also in very different formats.

On the other hand, the use of new technologies in the educational framework is key for the process of digital literacy and the promotion of one of the key competences essential for lifelong learning: learning to learn. The teacher has a key role in this process by establishing scaffolding that enables students to:

- Use information technologies in a conscious, constructive, and varied way.

- Search, analyze, and evaluate with autonomy and critical spirit information and new knowledge.

- Solve problems autonomously and make reasoned decisions.
- Use tools for creation and production with full capabilities and in a creative way.

- Collaborate and communicate assertively and constructively.

- To become competent, autonomous, and informed citizens capable of contributing socially from a critical perspective.

All this implies that the teacher must be prepared and updated to use technology and to know how it contributes to the learning of the student in an inclusive and accessible framework. The latter implies a specific level of training and information that relates more general knowledge to the specificity of students with special needs, to whom technology offers pathways for inclusion and training that must be incorporated into the classroom on a daily basis within the framework of the UDL *universal design for learning.*
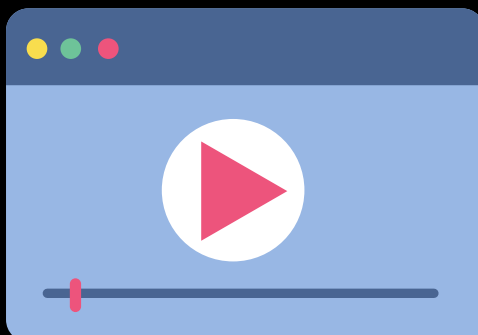
Education for inclusion in equality requires teachers a series of actions and perspectives:

- It is necessary to identify the needs of students, in our case those with low vision, to decide which technological means best adapt to the needs detected, favoring their autonomy.

- Consider when deciding on technological means those that best suit the educational objectives shared with all students in the classroom.

- Explore various methodologies, strategies, and techniques thanks to the versatility provided by technology with the aim of adapting the educational process to the plurality of personal situations existing in the classroom.

- Encourage group work and contact among all students, generating situations and opportunities for collaboration, common reflection, and collective learning.

The Russian psychologist Lev Vygotsky (1896-1934) wrote that *learning is a social phenomenon by which new knowledge is acquired through processes of interaction between people*[47]. This social reality supports the potential of participatory and group methodologies due to their interactivity based on negotiation and dialogue processes in both formal and non-formal contexts.

To promote inclusive education, this type of methodologies and techniques must be used, among which the following stand out:

- ·Peer tutoring.

- Learning by projects/problems/challenges/cases: research strategies and tasks.

- Cooperative learning.

- Collaborative learning.

- Learning communities.

- ·Dialogic learning.

- *Flipped* classroom.

- Support groups.

- Circles and clubs of friends, homework, practices...

- Coexistence and/or mediation programs.

- Collective problem-solving strategies.

- Intergenerational learning.

- Dialogue techniques: gatherings, interviews, debates, group discussions, debriefing...

- Gamification, role-playing games, dramatization, body expression, social entertainment...

- Collaborative projects in various formats.
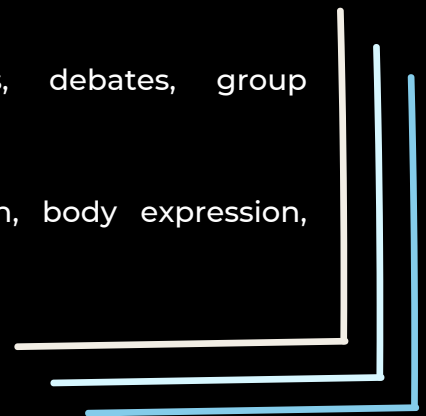
The methodology in the classroom must be the same for all students, so that only the basic adaptations related to language and communication are necessary. It is important to narrate what is done and seen, so that students with low vision can follow the detail of the lessons, which will also be useful to the rest of the classmates. Empty or meaningless expressions should be avoided, using ways to spatially situate and explain the content of visual information. Obviously, it is necessary to plan to deliver the materials for school activities in formats suitable for low vision.

On the other hand, students with low vision will carry out the same tasks as the rest of their classmates. By using the adapted means and tools, they will take notes, write, do exams, and draw when appropriate. However, it will be good to know study techniques and adapted work routines, to exercise in summarizing, making schemes, synoptic tables, underlining (either with fluorescent markers or with stickers...). The tools used or the Braille system itself can also become another educational resource for the rest of the classroom, not only for knowing its existence, but for learning specific characteristics and even the literacy system itself. This will help all students know and respect differences and adapt to encourage participation.

In order to complete the application of participatory and group methodologies and techniques, flexible and adaptable evaluation techniques must be implemented in parallel: oral tests, dialogues, self-evaluation by using guidelines, observations, team evaluation, learning exhibitions, evidence qualification... However, the exams and tests will be very similar for all students, with the logical adaptation measures for a greater slowness when reading or writing, so it is natural to grant them more time. The grades and notes of progress sent to the home of the student with low vision must also be adapted.

Teachers must consider the social aspect of learning within the scope of their responsibilities outside the classroom through working groups and support between teachers, which allow both the exchange of experiences and collaborative work. The planning and programming of all these processes is also a key issue, since they must be developed matching the basic objective of contributing to the personal and diverse formative development of each student within the framework of an inclusive education. Therefore, it is necessary to emphasize the need to identify the needs of each student to define specific objectives, necessary times, and the corresponding techniques.

# 12. Inclusive virtual education: digitalization processes

The principle of accessibility is of paramount importance to guarantee the right to inclusive education. In this regard, the *International Convention on the Rights of Persons with Disabilities* (CRPD)[48] establishes the need to *"promote the access of people with disabilities to new information and communication systems and technologies, including the internet, and the design, development, production, and distribution of accessible information and communication systems and technologies at an early stage, so these systems and technologies are accessible at the lowest cost".*

There is no doubt that new technologies have enormous advantages in the educational environment to bring content closer, favor a wide variety of ways of expression and communication, and meet the needs and pace of each person. It is also tools that facilitate the work of teaching professionals, but sometimes they are configured for people without any issues in their sensory, physical, or intellectual abilities. That is why it is essential to consider personal diversity when planning and implementing digitalization and updating it in the school environment.

The United Nations has continued to show its concern about these issues in their General Comment N° 4 (2016)[49], *"on the right to inclusive education"* in which it urges Member States to the *International Convention on the Rights of Persons with Disabilities* to invest in the development of digital resources and formats in the educational environment using innovative technologies. This impulse to the digital transformation of the classroom implies a broad approach to the concept of digitalization that must contribute to overcoming exclusion barriers of all kinds, not only in the field of functional diversity.

The *inclusive* digitalization of the classroom must be considered from the concept of *universal accessibility*, and central strategy of the universal design or design for all people, and more specifically of the *universal design for learning* (UDL) [50]. This implies foreseeing any element so it can be used by the vast majority of people without the need for adaptations or special designs. This concept doesn't exclude the existence of supporting elements when necessary.

Digital *accessibility* involves the principles and techniques to design, build, maintain, and update websites, APPs, and virtual contents to be used by people with functional disabilities, with support tools like voice reading, subtitling, sign language, color contrast, easy reading, pictograms... accessibility is based on four principles:

· Perceptibility.
· Effectiveness.
· Comprehensibility.
· Robustness.

THESE PRINCIPLES MUST BE CONSIDERED FROM A THREEFOLD PERSPECTIVE:

- **Human diversity:** the diversity of personal situations must guide accessibility, so materials and contents must be adapted to these many modes of use and diversity of functions.

- **Technological diversity:** the diversity of media and capabilities that people have the possibility of accessing means that materials and contents must adapt to multiple ways of access, configurations, connections, and accessories.

- **Environmental diversity:** the diversity of contexts in which contents and materials can be accessed must make them adapt to this many specific situations (noise, luminosity...), allowing to adjust parameters and have tools to avoid problems that may arise.

In order to self-gauge the situation of the use of digital technologies in schools, the EU has a "free tool designed to help schools integrate digital technologies into teaching, learning and assessment" called SELFIE.[51] Through a series of anonymously questions about the use of technologies in a given school, the tool generates an instant report (a *"selfie"*) on its technological aspects. It is available in several languages for any primary, secondary, and VET school in Europe.

There are several tools that regulate the accessibility standards applicable to ICTs, developed and proposed by various international entities like ISO, ETSI, CEN, or Cenelec.

Regarding web technology, the Web Content Accessibility Guidelines (WCAG)[52] established by the World Wide Web Consortium (W3C) apply.

At European level, the technical standard to consider in any ICT service is the EN 301549 Accessibility requirements for ICT products and services[53] .

It is also interesting to know the ISO 9241-171:2008 Ergonomics of human-system interaction. Part 171: Software accessibility guidance[54].

Other standards, in this case from Spain, directly related to the digitalization of the classroom and teaching are:

UNE 66181:2012: Quality of virtual training[55].

UNE 71362:2020: Quality of digital educational materials[56].

And UNE 153101:2018 EX: Easy reading. Guidelines and recommendations for the preparation of documents[57].

When working on inclusive virtual education, it will be important to:

- Have a statement of the requirements to accessibility applied and a channel for anyone to transmit accessibility barriers that still exist.

- Require compliance with the accessibility requirements established in current legislation in the specifications for contracting suppliers.

- Both the institutional website of the educational entity and the tools of the educational process and APPs must comply with accessibility standards. They must also be fulfilled in the daily process of content management.

- Offer alternatives for different operating systems should be.

- Applications for synchronous communication must be accessible and multiplatform, with functions and options to activate subtitles, sign language, identify the speaker, or communicate via chat.

- Hardware must be accessible, with monitors of enough size for people with low vision, high-contrast keyboards, and larger keys.

- Diversify social media platforms since not all of them are accessible, to allow users to choose which ones they will follow. Take care of the accessibility of the messages that are disseminated by sound description of images, or audios subtitling.

- In printed educational materials, use font size larger than 12, and keep an optimal contrast with the background, although it is always better to provide access to the same material in digital format.

- Offer contents of easy reading.

- Facilitate training in digital accessibility for all staff in the educational community, not only teaching staff.

- Regular and continuous availability of digital resources such as subtitling, hearing aid, simultaneous voice to writing translation, sign language, accessibility to Braille devices...

- Continuous assessment of students, personalized and competence based. Adapting formats to individual needs and skills.

- The materials should allow carrying out the exercises in the same support, preferably digital.

- Audiovisuals must always be subtitled with adaptation to be understood even without sound and accompanied by description of images and actions in audio. Use sign language.

- It is positive to collaborate with the functional diversity associative movement.

- Accessible channels of communication with families.

- Bank of loans of materials and assistive devices.

- Universal guarantee of quality internet connection.

- Use of accessible technologies not only in teaching but also in informal meetings.

- Promotion of collaborative spaces through inclusive digital tools for extra-curricular activities.

- Intense and fluid coordinated communication between school, teaching team, and families of students with functional diversity. Promotion of family reconciliation and respite.

## 12.1 Conceptual and linguistic adaptations

The initial incorporation into the inclusive virtual classroom can mean a series of important changes for the student that we must consider carefully. What for other students is usual and understandable, may be strange or incomprehensible for students with low vision. Certain expressions used to define actions in computerized environments don't have to be easily understood by everyone. Thus, the simple expression of *"up"* or *"down"* changes depending on whether we are acting or thinking about a screen placed in a vertical position or a tablet placed horizontally in which it is more appropriate to indicate *"forward"* or *"backward"*. It even changes when using a mouse that moves a pointer on the screen: *"forward"* with the mouse becomes *"up"* on the screen. Expressions such as *"before"* or "after" are more useful. The same goes for other expressions such as *"paste"*, *"drag"*, *"click"*, or *"cut"*, or the empty concept of visual perspective for a blind student. We must review our conceptions and applications of visual language to students with low vision.

On the other hand, the inclusive digitalization of the classroom must be a basic tool to facilitate the accessibility and autonomy of students with low vision. We should keep in mind that technology is a facilitating means and cannot become another burden imposed on students with low vision, from whom we should not demand greater or better skills than the rest derived from the use of adapted technology.

The use of specific technological resources for students with low vision necessarily implies an overexertion both for the student regarding what was done by the rest of the classmates, and by the teaching staff. Nor should it be forgotten that overexertion is also carried out by the education administrations that must provide the necessary digital resources, whose cost is usually high; and also by families, since the part of the training to be carried out at home usually requires the duplication of devices. However, all these considerations must not imply a new obstacle.

For students with remaining sight, it is necessary to consider a series of adaptations to be assumed on a daily basis, based on the knowledge of their pathology, functionality, experience, and available resources. Thus, an effort will have to be made to **distinguish the essential from the accessory**, avoiding unnecessary distortions of information. Materials must have a **substantial contrast with the background**, using alternatives such as black letters on white background or vice versa, and may also resort to yellow or light blue backgrounds to avoid the glare of the white paper. In any case, backgrounds must be as clean as possible. It is also important to **prevent distorting elements such as shadows**, letters with effects, and any non-essential element that leads to blurring the outlines, or **superimposed figures.**

Evidently, it's always necessary to consider font size of texts so they are directly readable or through the available enlargement tools, while considering that it isn't always the best to expand things excessively, since some pathologies prevent from appreciating elements in a global way. In any case, we must insist on contrast, especially if there are different colors close to each other. It is essential that the substantial elements can be easily differentiated. When working with maps, pose each element on a separate map: river systems on the one hand and communication routes on the other. The combination of tactile elements with visuals can also be very convenient.

## 12.2 Conceptual and linguistic adaptations

The technological resources that can be used in the classroom for the development of inclusive education are both specific and generic. Generic media must regularly have adaptations and compatibilities that make them fully accessible, so computers, tablets, and screens must have operating systems and applications that allow to zoom-in or magnify the content of the screen or a part of it, and to modify color, contrast, size, and shape attributes.

These utilities are necessary[58] for people with low vision for allowing to magnify the contents of the screen as you move the mouse cursor in a wide range of magnifications. They also allow you to invert colors, customize the cursor using a more or less large circular area, change zooming mode to full screen, and even incorporate a screen reader, which makes written content audible. The most widespread operating systems have this type of adaptation, although they don't always answer to the necessary ranges. There is also specific software for these purposes, like MAGIc or ZoomText developed by _Freedom Scientific_[59].
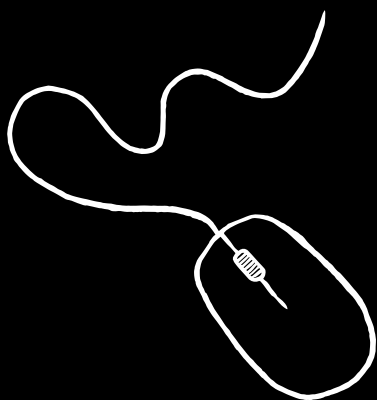
The accessibility of online contents can be corrected through the use of specific reviewers who verify if they meet the standards according to WCAG's categories of A, AA, or AAA[60]. According to the four principles of web accessibility (perceptibility, operability, comprehensibility, and robustness) the three levels determine the degree of accessibility of a web space. The A rating is the most basic, meaning that the main requirements are met, but it doesn't guarantee full accessibility. This is determined by the existence of alternative text for unwritten content, audio subtitling, full adaptation of content to various formats, minimizing the use of color, enough reading time, navigable spaces, readability, etc. Level AA confirms the elimination of substantial barriers through direct audio subtitles, change of orientation of viewing, extraordinary enlargement of texts, etc. In some countries this is the mandatory legal level for the web spaces of public administrations. The maximum level is AAA, with also other requirements like using sign language, extended audio descriptions... There are different APPs to check the accessibility of a website, like: Taw, Hera, Wave, ARC Toolkit...

We advise to use PDF format (portable document format) for educational materials, since it allows reading without problems and to expand its contents without loss of quality, even allows writing on it.

On the other hand, it is convenient to have products that facilitate to monitor lessons, with the aim of enabling students to follow them by receiving audio and video signals in real time in their own devices, like in the case of _Bemyvega_.
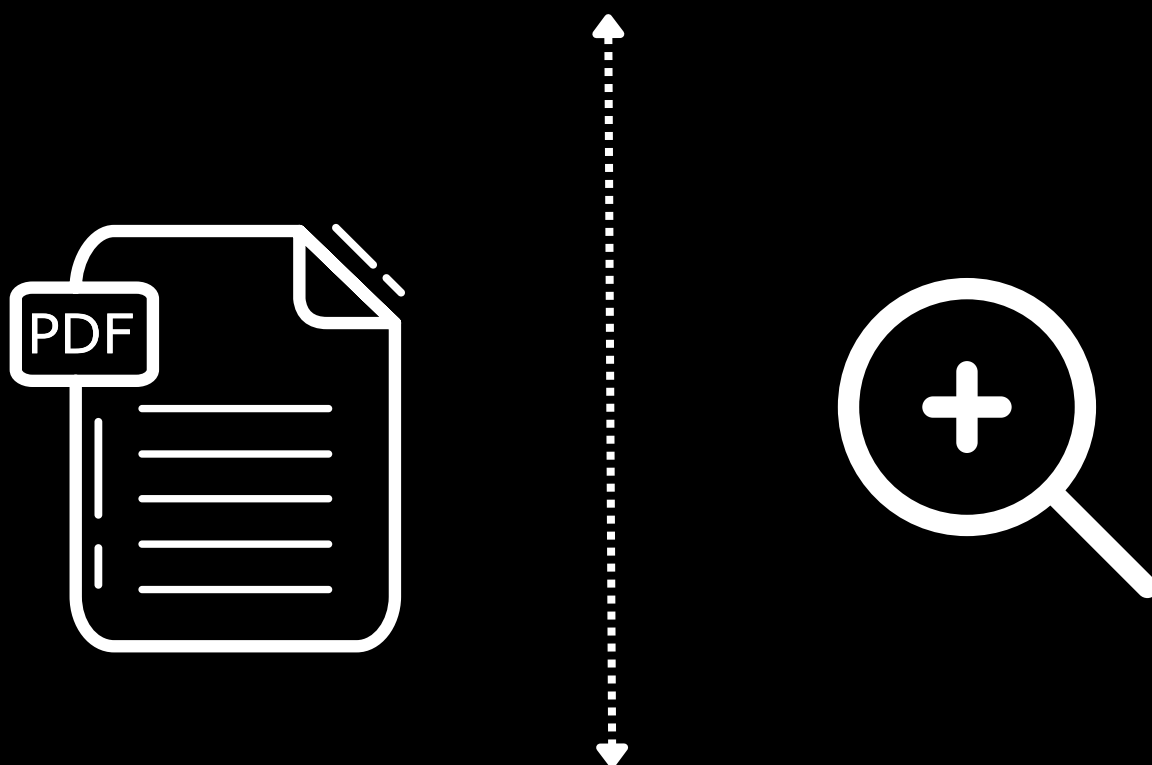
**PCs** should have large enough screens, between 17 and 21 inches. Small screens are not recommended, since they are not operational for the needs of low vision.
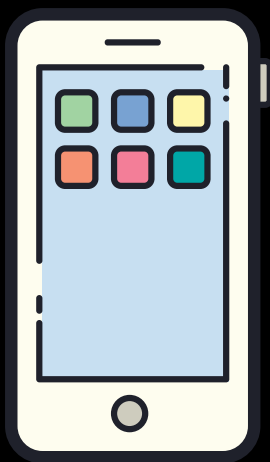
**Tablets** are a good option, since they not only allow various adaptation measures, but one can also work on the screen itself with adapters like mouse pens, which facilitates its handling, improving eye-hand coordination and increases motivation. In this sense, **touch and interactive screens** are very practical for students with low vision, since they add to the previous advantages that it allows to follow lessons from the student's place, and the work on the personal screen can be sent to the classroom's. The connectivity of the screen to the teacher's own PC must allow access to what is projected on the whiteboard, and they also make it easier to record the lesson, so students can replay it at any other time.

**Virtual platforms** have been an important advance in many schools, of widespread generalization, especially since the confinements due to the COVID-19 crisis in 2020. However, these platforms have significant limitations in accessibility, especially due to their reduced capabilities of text enlargement. This must be considered, and still have materials in PDF.

**Scanner pens**, equipped with OCR (optical character recognition), allow for manual and wireless use, to recognize written texts and either read them or transfer them to the computer for later use or modification, thus being an extremely practical tool for people with low vision. A larger **scanner** allows graphic representations and maps to be translated into digital format so that they can be later transferred to relief sheets.

**Smartphones** have various accessibility options that include reading the contents of the screen, either through the operating system itself or with adapted installable applications. They also allow to record and reproduce sounds, avoiding the inconvenience of continuously taking notes, and facilitate the subsequent review of the information, although for this purpose it is preferable to use **digital voice recorders**, which have better quality and recording options than smartphones.



PENS SCANNER
Image credit: Atendiver

**Digital books** or eBooks are a good option for reading, since they have a wide versatility regarding font size, zoom, and configuration of aspects and colors of backgrounds and letters.

**Digital whiteboards** should allow projected contents to be sent to the individual devices of students with low vision, making them accessible to them. Lesson monitoring can also be carried out through systems like <u>Vega Compact</u> or <u>AbleCenter</u>, with more features than the digital whiteboard, since they allow both local and streaming monitoring. The system allows to transmit both the view of the lesson and the contents of the digital whiteboard, with the possibility of zooming in totally or in a partial area, and changing the appearance of the image by passing it to binary mode, thus being able to change background colors and letters.

Beyond all the previous resources, quite common otherwise, we find options framed in the strict framework of *typhlotechnology,* a concept that encompasses the techniques, resources, and knowledge aimed at providing visually impaired people -and specifically blind people-, the means for the correct use of technology, thus contributing to their personal autonomy and full social inclusion. Although students with low vision who retain a significant remaining sight have enough with the means mentioned so far, students without operational remaining sight or fully blind need typhlotechnological adaptations, among which are the following:

τιφλο

DIGITAL PADS
Image credit: ONCE



FUSER OVEN
Image credit: ONCE

**Digital pads** are also useful in cases of non-functional remaining sight. They are connected to the computer as a peripheral and work with a magnetic pen as a mouse, to navigate, write or draw. These pads allow adaptations in relief of the computer screen, which allows interaction in sensitive areas or that house options or commands using the sense of touch, as if working with the mouse on the computer screen. The adaptations in relief are made by the so-called **Fuser oven**, which uses heat applied to a special photosensitive plasticized paper to highlight what is printed in ink or toner in it by a printer or photocopier.

The **Braille line** and **Braille screens** are a desktop electronic tools usually located immediately in front of the *qwerty* keyboard, for use when the student's remaining sight is not functional. Connected to another device, it converts messages to Braille along a physical line that can have between 40 and 80 characters or Braille cells, in one or more lines, and which changes when it has been read. It also has action keys, and each character consists of a cell composed of eight, sometimes six[61], movable rods that configure the code using raised dots. There are also **Braille printers** that transcribe this code to paper by means of raised dots with up to 42 characters per line, and **Braille noteholders** that allow to write in this code with a **specialized Perkins keyboard**, storing the information in electronic format and incorporating other utilities, among which is a translator, which allows for quick communication with people who don't know this type of writing.



BRAILLE LINE
Image credit: Wikipedia
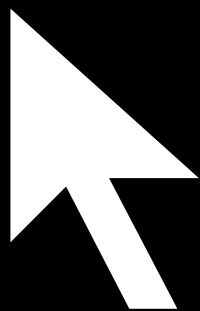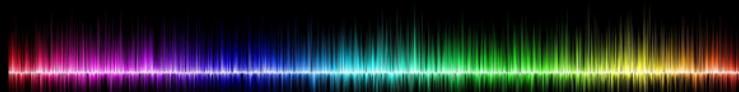
**Screen readers** are software that allows to translate the contents of the PC screen into sound or characters in a Braille line and interact with the various applications of the PC. The sound or Braille output can be customized with various options. Interaction with the computer is done through the keyboard, using the cursor movement keys and key combinations for actions or to activate functions. This software requires both knowledge on basic PC concepts and prior learning to be used effectively. Depending on the operating system, one can use different screen readers; the most widespread one for Windows is JAWS, and the best known open source one is ORCA.

A classroom with digital technology accessible to students with low vision should include, for example, LAN computers and an interactive whiteboard. PCs (either desktop or laptop) or tablet devices should be in the same network as the teacher's PC, from which one can select what is sent to the interactive whiteboard. The PC or tablet of students with low vision must also be connected to the rest, also with the digital whiteboard, so one can view its contents and interact in it.

## 13. Access and non-significant curricular adaptations for low vision

Curricular adaptations are the adjustments and modifications of the general educational proposal to adapt it to the characteristics and personal situations of a given student. They are classified into three sections:

- <u>Significant curricular adaptations</u>: they involve the adaptation of the curriculum, the syllabus, or the general programming to a specific student, by eliminating, replacing, or adding essential elements of the official curriculum . They are designed individually, and one must try, conversely, for them to be as less significant as possible.

- <u>Non-significant curricular adaptations</u>: they are adaptations related to the circumstances in which the curriculum and official syllabus are taught. They refer to times, methodologies, materials, aids, evaluation instruments... and they are a tool to customize teaching.

- <u>Curricular adaptations of access</u>: they do not impact the curriculum or official agenda; they attend to the specific needs of the students that allow them to access the spaces and means of the school.

Significant and non-significant adaptations are considered to be of an individual nature. For its implementation, a prior written and individualized document must be drafted, especially for significant curricular adaptations, including issues like:

- School and personal data of the student, and of the technical staff involved.

- Multidisciplinary reports and assessments on their curricular competences and levels of development (psychomotor, intellectual, emotional, linguistic...).

- Determination of special educational needs.

- Determination of the modifications included in the adapted curriculum (objectives, contents, methodologies, activities, schedule, calendar, and evaluation criteria).

- Monitoring of adaptations.

- Specification of necessary human and material resources.

## 13.1 Curricular adaptations of access

In order to ensure their own safety and autonomy, students with low vision must know the general layout of the school and the routes needed to move around. It's important that they know how to locate the various services and spaces. They must know the classroom in detail, with the situation of doors and windows, blackboard and screens, the teacher's desk, and other objects or minor or auxiliary furniture like cabinets, coat racks, shelves, plugs and switches... Changes in the location of services, furniture, or common elements in the school, and especially in the classroom, must be communicated to students with low vision, so they can memorize them.

**Architectural barriers** should no longer exist in newly built schools according to the principles of universal design, but may however still exist in older schools. In this case, they should be eliminated as quickly as possible, avoiding any **disabling environments.**



Certain adaptations will have to be made to all spaces of the school. In the **dining room**, for example, it is positive to use high contrast and smooth designs for crockery, cutlery, and tablecloths, especially in self-service spaces, so the tablecloths contrast with the kitchenware. It isn't necessary to use many colors, but for used ones to have high contrast, to facilitate locating them. Younger students may need support staff in the dining room, a need that decreases as they age and their autonomy increases.

In the **auditorium,** it is necessary to have the inclusive technologies available in the classrooms, so all students can know what happens on the stage or screen, preferably without separating students with low vision from the rest.

When accessing the **courtyard** it will be necessary to keep in mind the need to adapt to the change of luminosity, the use of sunglasses, and sun protection where appropriate, also supervising that the student doesn't abandon these measures due to shyness or embarrassment, strengthening their autonomy in all cases.

The school must have the **material and technical resources** necessary to meet the various needs of students with low vision. It must plan to have necessary materials like screen magnifiers, PCs with large screens (17 to 21 inches), tablet devices, touch and interactive screens, scanners and stylus, digital voice recorders, digital books, digital whiteboards, typhlotechnological materials (Braille line, Braille printers, Braille note-taker, pen tablets, Fuse oven), screen readers and screen reviewers... all of them with the necessary software and connections to work correctly in the classrooms. Collectively reflect on some issues directly related to these means:
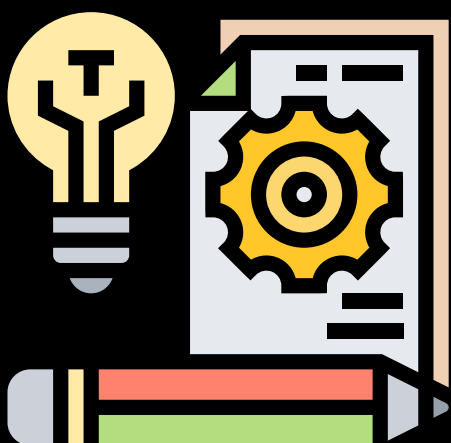
- The location shouldn't imply separating students with low vision in classrooms or spaces different from those used by their classmates.

- All students must share the same classrooms and spaces regardless of the technical means they need and without their use creating sections or segregated spaces.

- The use of these materials needs enough space both to work with them and to store them after use.

- The location of students with low vision in the classroom should be understood as the means for an end, in no case as a privilege, much less a punishment.

Regarding the **didactic materials**, the school must consider the accessibility of its virtual learning platform. Although they usually have certain levels of inclusivity, they often also have important limitations. Therefore, its level of accessibility must be reviewed by internationally recognized parameters (WCAG's A, AA, or AAA categories[62]). It is also highly recommended to always develop teaching materials in the most accessible format possible since, according to the principles of universal design, this will not only benefit students with low vision, is also useful to others in various circumstances. In order to facilitate accessibility, use the PDF format (portable file document) in the didactic materials, since it allows to zoom-in the contents without losing quality, and do not enter texts as bitmaps (OCR programs are very practical to convert these into editable text). Pay special attention to the images used, so they have good definition (not losing too much resolution when enlarged), and above all to describe them with alternative texts.

Tidiness in common spaces of the school is not only a measure of general adornment but also of **security**, especially for people with low vision. Any out-of-place object in a corridor (a chair, table, book, backpack...) can become an element to trip over. Tidiness becomes a common goal, as much as removing obstacles and/or warning of their presence. Half-open doors can also be a hazard, since it can be difficult to appreciate them with low vision, so keep them either open or closed to avoid scares or crashes.

## 13.2 Non-significant curricular adaptations

In an inclusive educational model, teachers must adopt these non-significant curricular adaptations for the diversity of the personal situations of any group of students. In the case of students with low vision, the most significant adaptations refer to issues like:

- <u>Changes in times</u>, reading or writing always requires more time to for students with low vision, due to them requiring specific instruments.

- <u>Adapt methodologies</u>, especially materials and activities, through extensive explanations or descriptions that consider low vision. It's better to say "the second-grade equation to solve is on the left side of the board" than "solve what's on the board."

- <u>Prioritize some learning over others</u>, first those most useful to students with low vision (spatial orientation, management of technological means of adapted literacy...), or postponing or minimizing those that inaccessible or of little interest and which pose challenges that are not very assumable.

- <u>Adapt the evaluation</u>, through specific techniques comfortable to the personal circumstances of students with low vision.

- <u>Include specific learning in the official curriculum</u>, like stimulation of the remaining sight, sensory stimulation, ink or Braille literacy, orientation, mobility, social skills...

The adaptations made for students with low vision are also of use for the rest. The goal is to focus on the help needed for their development and learning, on what they can do, their possibilities, rather than what they cannot do. Their needs must be determined to know what aids they need. They are youth like any other, with a potential to develop, but perceiving the world differently, without the integration provided by sight or only with partial, and therefore fragmented or sequential. Teachers have to demand the same from them as from others, to form their character and learn to face frustrations. Congratulations and reprimands should be the same for everyone, always considering the way to transmit them, since they don't perceive the visual information provided by gestures, looks, or postures the same as others, one must get used to explaining, telling, and verbalizing. Physical contact is important when showing and helping, always in a respectful manner, in the broadest sense of the term, and firm.

Methodology and didactics must be the same for all students, with the necessary adaptations of access. Students with low vision must participate in all classroom activities, find a way for them to do so (that is the function of the teacher), avoiding in any case that they get marginalized. Textbooks must be the same as those used by the all students, adding any help they need and translating them into Braille if necessary.

Don't abuse zooming; they must read comfortably and effectively with the prescribed optical aids. Most materials they will find in daily life are not expandable, and so they need to practice to become as autonomous as possible. If difficulties with technological means are still unassumable, it's advisable to change the literacy code to Braille.

Braille books take up much more space, making them difficult to transport and store. They should not be stacked, as this reduces the relief of the points. A single ink book may require several volumes in Braille, which should be considered when working with different parts of a book, which may be in different volumes in the Braille version. Localizing a page or topic is more complicated in the latter case.



Image credit: Freepik

Books can also be adapted to sound format, especially literary contents. Having these materials is good to promote inclusion, not only of students with low vision but also of other students with specific needs. The difficulty and hardship reading may require in certain cases makes audiobooks a way to approach literature and knowledge in general in a more relaxed and appealing way. These formats being used by other students without low vision is also a significant factor of inclusion.

Illustrations and pictures, basic and essential elements of learning, must be adapted and verbally described as far as possible. Some may be replaced by elements in relief, but there will always be difficult issues to transfer, like colors or the idea of perspective. Describing the contents of a picture or photograph doesn't have to become a burden, on the contrary, it can be used for students as a whole to exercise functions of recognition, vocabulary, and verbal expression. Students with low vision should understand that there are images to which they will only have access through the description made by others, and must also learn to ask for that help in such a cases.

Regarding the teaching materials, you can find online, and on the website of this project, a large number of them adapted for students with low vision; also, the tutor teacher has to know how to adapt those they will use in the classroom. All materials handed to the students must be adapted.

When creating adaptations and interacting with students with low or no vision, it is advisable to consider a series of basic issues that affect them:

- For their own self-knowledge, they must know the characteristics of the disease and the remaining sight they have, as well as the optical and non-optical aids they need. You have to check that they use them and they don't stop doing so out of embarrassment or discomfort. They must be aware of their capabilities and limitations. In this way they can inform their classmates and teachers, of their situation and the help they need -which they must learn to ask for when necessary- without abusing it or rejecting it when they are necessary. They will learn that they can reciprocate by also providing help to others.

- Inform all students of the implications of low vision or its absence, and do so with the student with low vision, since it has a positive socializing effect and shows all guidelines to improve interpersonal relationships. In the same line, it is necessary to value in all students the special efforts they make and the work this requires.

- They must be shown the environment and common spaces, describing them (not only visually but also by other non-visual characteristics) and establishing reference points. They must learn to move effectively autonomously and safely. Regularly describing objects and environments doesn't only help students with low or no vision, but also contributes to improving the language skills of other students.

- lace them near the blackboard and without light sources in front that can dazzle them. When using the blackboard, verbally describe what you are writing, both contents and specific location. It's convenient to alternate tasks that involve seeing near or far to avoid eye strain. It's not a problem that objects are too close to the eyes, since it's their way of perceiving them with the remaining sight, on the contrary, it's good that they do it to develop the cognitive-perceptual process by expanding their visual memory.

- You have to teach them, like the rest, appropriate personal habits: when sitting, when asking to speak, when addressing other people, when respecting the turns… They must correct inappropriate or socially incorrect postures or for work, both when sitting and when moving.

- When addressing them, identify yourself by name. Not doing so contributes to isolation and non-inclusion. Talk to them before touching them so as not to scare them. To know and identify the rest of the companions, they must introduce themselves and speak to recognize the voices. Also identify yourself when entering or starting a conversation, and when finishing it or leaving. You also have to indicate it to avoid the person ending up talking alone. Also indicate if you are talking in a group. You have to get used to reporting things that are obvious for the sighted.

- They must be taught and get used to standard meaningful gestures: nodding and denial with the head, shrugging, looking at the speaker, raising their hand to ask questions… It is also necessary to let them know of their tics or recurrent movements so they try to avoid them, since they won't usually perceive them.

- It is necessary to use daily verbal expressions regarding sight or the concept blindness as always. The student must get used to common language, although "seeing" actually means "touching" for them.

- Promote tidiness and warn of all changes in the location of furniture or objects. It's also necessary to keep noise in the classroom under control, so verbal messages don't suffer from excessive distortions.

- If they use Braille, you will have to value quality over quantity in practical exercises, compared to the rest of the students.

- They must have enough space to store their materials.

In some curricular areas, specific adaptations should be made for students with low vision. For example, consider that low vision doesn't influence linguistic development in the area of **languages and oral and written expression**, on the contrary, it becomes a key and compensatory tool for information that cannot be perceived through sight. However, it's easy for them to use verbalisms (expressions directly related to the experience of sight that are meaningless for them or lead to erroneous use). These are concepts such as colors, sky, clouds, transparency, opaque, perspective... You should relate them to personal experiences to avoid inaccurate or improper uses.

Side effects in the language of low or no vision is that they may have egocentric language, or with problems in the use of personal pronouns (sometimes speaking of themselves in the third person), problems in the use of prepositions and conjunctions, or fewer communicative resources and social relationship.

If you opt to teach the Braille system, it will have to be implemented with the same methods and pace as it is taught to the rest of the students. If traditional writing is taught, it's necessary to use patterned paper, not white if possible to avoid glare (but of soft colors) and thick tip pencils and markers, all depending on the remaining sight and the pathologies the student has.

Regarding other language learning, often based on drawings, mimicry, or pictures, it's necessary to adapt the materials used, either by having them in relief (although it can still be difficult to recognize it) or in another way that perceptible by students with low vision. In any case, it's good and necessary to described it, also turning this verbalization of the images into a collective exercise of the class to improve vocabulary[63]. Spelling words regularly when learning other languages is essential for the student to learn the differences between writing and pronunciation, regardless of whether they use Braille or ink.

**Mathematics** is the area that requires a greater number of curricular adaptations[64]. While there are aspects in which there are no significant differences with normovisual students (like mental calculation, in which students with low vision actually have an advantage by avoiding written calculation), others like geometry require greater adaptations. However, the main adaptation is the teacher's awareness that words are their main working tool, and that one can go very far through descriptions and the ability to work in mental images[65]. Significant adaptations are also required in other areas like experimental sciences[66].

$$ax^2 + bx + c = 0$$

For students without remaining sight, the Perkins automatic writing machine in Braille is an essential tool that allows to calculate mathematical operations by writing numbers (omitting the number sign, not necessary in this case since it isn't combined with text) and replacing the lines (stripes) with blank lines, placing the result below, typing it from right to left. It can be used for various operations and even for graphic representations such as diagrams or tables, always replacing the lines (stripes) with blank lines or columns and placing the intersection points with Braille signs. The same can be done with rubber foil and drawing tools.

There are certain materials that help with mathematical learning to students with low or no vision. These are the Japanese abacus (an abacus adapted to avoid the pieces sliding on their own), the arithmetic box (to compose operations on the left while storing numbers and mathematical signs in Braille on the right), the talking calculator (it verbalizes entered numbers and results), drawing materials: compass, ruler, cardboard, square, toothed ruler, goniometer, rubber (relief writing surface), relief graph paper, rulers with relief numbers... all these adapted tools must be used with methodological criteria common to all students; for example, using a calculator must be authorized for everyone or not, regardless of the visual ability of a student.

When teaching geometry, it is essential to use three-dimensional or two-dimensional models, to tactilely understand everything related to space and volumes. At the same time, take special care to make detailed formal and spatial descriptions. It's good to use the measurements of parts of the human body for these concepts and the relationships between measures: span, feet, fingers...
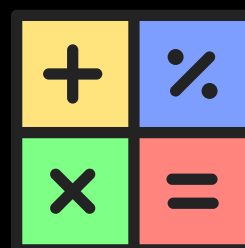
In subjects related to **natural and social sciences** there are many materials adapted to make information accessible to students with low vision[67]. Three-dimensional models, relief maps, and of course natural elements are examples of these adapted materials that are also useful for all students, and many of them are currently used in schools: models of the human body and its organs, animals and plants, natural elements, machines, architectural and artistic elements, globes, relief maps, etc. Schools and entities specialized in low vision and blindness also provide teachers banks of materials adapted to teach these subjects. It's also possible to have enough tools adapted to touch or sound response to develop experimental work in natural sciences, which allows measurements of all kinds, like meters, thermometers, chronometers, compasses, etc.

There are specific subjects in which the adaptations will be more complex or inconsistent, such as painting, art history, or dance. However, an explanation of the contents, forms, and historical contexts (substantial part of these subjects), added to any other possibility of approaching the objects of study to the student with low vision through touch or sound, will provide him with the possibility of accessing, understanding, and contextualizing these contents. There are other artistic disciplines, like music, for which almost no adaptations are necessary, being only necessary to know musical notation in Braille, or the enlargement of the scores.

[

The principle to follow in any case is that **there's always some way to adapt** and thus approach the contents and experiences to student with low vision, also having to work on aesthetics and creativity as forms of expression and personal growth. If they cannot perceive colors, we can always try to relate them to textures, smells, flavors, objects, materials... If shapes cannot be perceived, description and contextualization become essential, along with the use of models and three-dimensional sheets that enable haptic perception[68]. If they have to participate in a theatrical dramatization, they can do so by accessing the text through Braille or zooming, and with the necessary instructions to know the stage space and orient on it[69].

The application of this principle has led to deep changes in the participation of people with low or no vision in physical and sports activities, which almost always require direct visual orientation, spatial location, and movement. Until a few years ago, they were excluded from these activities, but thanks to specific adaptations, participation in many sports disciplines has become common, thus contributing to their inclusion and a higher quality of their physical and mental health[70].

The adaptations in this area go first of all through the knowledge and mastery of sports and physical activity spaces, which must be accessible and orderly. Many activities can be carried out in pairs, so students with low vision have the visual aid of one of their peers. There are also elements that can be adapted, such as lighting or contrasting colors and textures, sound of various materials, elements, and sports spaces. Adaptations don't always have to be hard to do or expensive, sometimes one can just replace or supplement visual information with sound information with positions and directions of movement. So, in activities like races they need a guiding partner, while in cycling they need a tandem. Other sports are carried out with sound aids, like the sound ball in adapted football. Some like weightlifting or judo don't need any adaptation. There are even sports like goalball, in which those who adapt are the normovisual players, by using a blindfold. Paralympic sports are a benchmark for adapted sports, and can provide many examples to use in the educational field[71].
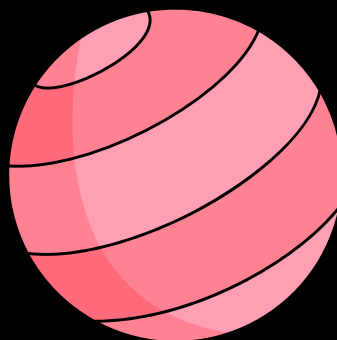
# 14. Creation of Didactic Programs adapted to low vision

The **didactic programming** is a tool to plan and organize teaching and learning in a coordinated way with the rest of the documents and human resources that frame the didactic activity. It must contain at least:

- Didactic objectives.
- Didactic methodology.
- Specific competences and key competences.
- Knowledge, skills, and abilities.
- Evaluation and qualification criteria and tools.
- Initial evaluation.
- Didactic units. Learning situations.
- Didactic resources.
- Measures to address diversity.
- ·Reinforcement and recovery measures.
- Cross-cutting contents.
- ·Complementary and extracurricular activities.
- Indicators of achievement, adequacy, and improvement of the educational process.

**Learning situations** involve activities carried out by the students to learn and develop curricular competences. They are structured with the approach of problems or situations to be solved, or final results to yield. They are approached interdisciplinarily, in a globalizing spirit, with students becoming the protagonists of their learning process thanks to solving problems, tasks, and activities that, placed in known contexts, pose motivating challenges that spark their will and curiosity to solve, build, and ultimately learn. These learning situations must have characteristics that allow to evaluate the achievement of the didactic objectives pursued.

A **didactic unit** is the way to plan the learning process of students and manage the teaching method to be implemented by the teaching staff, so the learning is optimal. This planning is the cornerstone to guide the process of training students at different educational levels. The priority when designing it is to pose the current and future challenges of society, and that students are able to solve them.

All didactic units must be carefully planned in advance, and must include key aspects with such relevant approaches as children's rights, gender equality, 2030 Agenda's Sustainable Development Goals, and the development of digital competence.

They must include specific topics to capture interest and motivation, but must always be adjusted to the age of the students and other aspects like their educational needs, their sociocultural environment, and their family environment. Even to the available resources of the school, considering the diversity of the students to allow their active participation in the classrooms and promote inclusion in it. So, the educational needs of the student must match their social, personal, and other circumstances.

Didactic units must ensure that educational and training opportunities are increased and improved, and inclusive capability is strengthened.
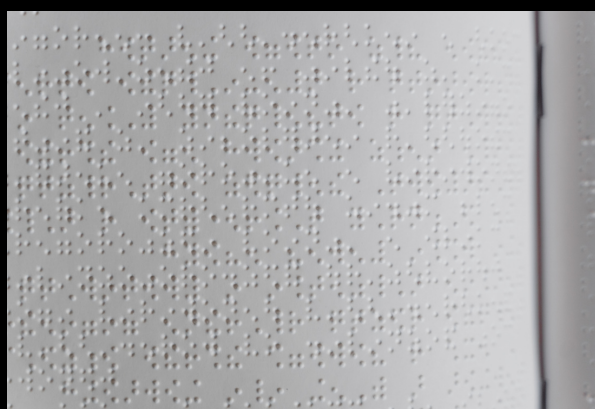
Any approach must aim to improve the results of students through a customization of learning. Individualized learning ensures that every child is offered the right learning opportunities through achievement, which must be raised considering the development of students, offering and designing activities and tasks that work on basic knowledge. Key performances or competencies that are considered essential should also be recorded. These will be essential for students to advance and progress, guaranteeing success in their training itinerary.

Any didactic unit must include general objectives that refer to the achievements that students are intended to reach in their educational stage, must match those established by law, and must also include specific objectives of each area or subject, which are those collected in the regulations of each educational administration. These laws reflect the basic knowledge necessary for learning to be internalized, which is the knowledge, values, skills, and attitudes that any student must acquire in their educational process.

Before creating a didactic unit, describe the topic to be addressed, justify why that particular one has been chosen, and show the relationship it has with the rest of the units. Although they are designed and created individually, they must answer to a whole.

The structure of a didactic unit should include:

**1** **Description:** with a title (it must be clear, brief, and appealing if possible) and the topic at hand (describing it and showing the areas involved), the previous knowledge required by the students, the number of sessions, and where they fit in the didactic planning, relating it to the rest of the programming.

**2** **Didactic objectives:** the achievements intended for the students to reach after the learning process. They are the attitudes, skills, and results that teachers expect once the educational process concludes. They can match the stage and be general or tied to a subject and be specific. They are stated in terms of competences, knowledge, aptitudes, and skills to achieve by students. They must be adapted to the diversity of students, so all can achieve them in one way or another. They include cross-cutting topics.

**3** **Contents:** they refer to the basic knowledge of an area or field whose acquisition is necessary for optimal learning; the attitudes, skills, and knowledge necessary for a student to learn. This basic knowledge will be distributed throughout the educational stage and will be sequenced in the educational units of each level. We advise to distribute this knowledge in blocks of contents. The learning contents refer to all the material to be used throughout the unit and will be related to the didactic objectives. A good content will have different types and procedures, being adapted to the diversity of the individual situations of the students. They will try to link the contents of different areas.

**4** **Learning sequence:** These are learning situations, activities that teachers propose so students show the strategies learned through the acquired competences and how to put them into practice. They are the exercises, tasks, activities, projects, experiences, problem solving, experiments, observations, deductions, and any didactic approach offered to students. Learning situations are the link between the different elements of the curriculum and the subsequent assessment of students.

The activities will be planned by establishing a sequence indicating how they are linked, forming a learning chain. They must be well related to each other, not a mere succession. The learning sequence must consider the diverse educational needs in the classroom.



In order to configure the timeline of a didactic unit, establish the order and priorities of the activities, which in turn should meet some characteristics:

- Raise relevant contexts of interest.
- Motivate participation.
- Diversity of content.
- Resolution through different approaches.

Each activity or task programmed must have an indicator of achievement to allow evaluation or self-evaluation at different moments of the learning process. In the didactic units, the learning situations must be specified.

The accessibility of the activities depends to a large extent on the age of the students. This way we can differentiate two types of activities:

- **Guided:** intended up to fourth year of primary school. The activity guides the student during all its development and in the tasks to be carried out. They must have a clear and contrasted audio or illustration that offers the precise information so students with low vision can easily understand its instructions. Access shall be easy, by procedures and routes leading directly to the start.

- **Not guided:** for levels from fifth year of primary education onwards. They can be used with the help of a screen reviewer. The elements that integrate it must have their label for the reviewer and be accessible through the keyboard, establishing a logical and coherent order of navigation.

The activities must be able to be managed both with a mouse and from the keyboard and must start full screen without toolbars or scrolling. Time should be increased due to the special needs derived from low vision. Important information on the screen about the development of the activity, like the number of attempts or the time invested, must also be provided by audio.

Graphics and images must be easily recognizable, clear, contrasted, and differentiated. Much better if, like texts, they are scalable without losing definition. Initial font size 14 is ok, with a simple font like "Verdana" or "Arial". Always with high contrasted against the background used.

Texts must be editable, so they can be read by typhlotechnical aid software or screen readers. If a text is entered as an image, it must have a text transcribing it.

The messages must be well differentiated by type (initial, final) by using colors, size, or luminosity.

The initial screen of an activity must include a voiceover as an introduction, informing of how it works, especially how to access the toolbar and return to the activity. Screen changes should be accompanied by audios with instructions for the new exercise. The active maintenance of an application or the time to finish an activity must be announced by sounds or warnings, which should be low in volume, ensuring that they don't interfere with the locutions or other sounds of the activity or application. Each action and event must have a sound linked to it to inform the student. Messages must also be audible.

5 Didactic methodology: themethod used is defined, with the principles and strategies used to develop the educational process. In educational regulations in force in Spain, a **didactic methodology** is defined as a set of strategies, procedures, and actions organized and planned by teachers in a conscious and reflective way, to enable student learning and the achievement of the objectives. Thus, the didactic methodology is the with which teachers plan their lessons, using different tools, to ensure that students achieve the objectives and competencies defined in each educational level. Any primary school teacher must know the different methods existing to teach and ensure that students learn and enjoy[72].

**6**

**Resources, materials, and organization:** state the specific resources needed to develop the unit: bibliography, audiovisual, computer, conferences, school trips... It also details all the concrete materials necessary to carry out the planned activities. Along with the materials, information is provided on the organization of spaces and times for its delivery and development, if it consists of several sessions, or its structure regarding the course or cycle. This goes down to basic descriptions such as the arrangement of tables, organization of groups, use of spaces, and use of materials and resources.

**7**

**Curricular adaptations:** given the diversity of situations in the classroom, the adaptations and strategies planned to ensure that all students can develop the learning process and achieve the didactic objectives are detailed[73].

**8**

**Evaluation:** There are several modes of evaluation, from multiple choice to long written answers, even oral. The activities planned must be recorded to know the levels of performance expected in students in different learning situations, even if they are self-evaluative. The evaluation criteria, timing, and methodology of their implementation is also established. Evaluation must be planned by defining the aspects to evaluate, the tools to collect data, and its subsequent analysis.
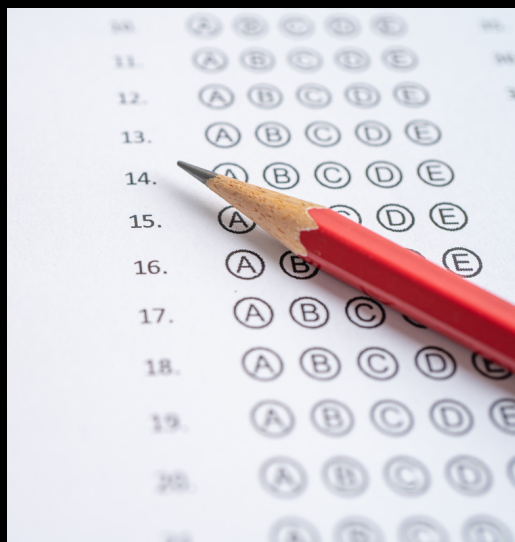
## 15. Creating the Low Vision Lesson Plan

The lesson plan is a basic and necessary planning tool. In the educational environment, improvisation must be limited, so it is advised to plan and prepare teaching sessions properly. In short, this involves setting objectives from a given context, means to be used, and evaluation procedures to verify whether the objectives have been achieved. Always have a lesson plan before teaching.

It is a tool that must use an adaptable perspective when setting objectives, methods of achieving them, and tools to verify them, so we can update the forecasts to reality without excessive rigidity. It starts from the **context of the starting situation**, which not only considers the previous knowledge of the students, but also other situations and circumstances relevant to set objectives or determine methodologies and tools for learning.

We must keep in mind the general diversity of the students, knowing that we include students with low or no vision, so we assume inclusive principles daily when planning classes. Contextualization is absolutely necessary at the beginning of the school year or cycle, and must be updated as substantial changes occur, especially since the concrete knowledge we have of the students will grow as the teaching activity progresses.

After the context, the **learning objectives** must be set; these are the skills, knowledge, attitudes, and values we expect to be acquired by the students after the implementation of the plan. When establishing the objectives, we can also synthesize the main ideas that will guide the teaching session, which will identify the basic contents we want the students to learn. These objectives should include specific adaptations to be considered due to the intrinsic diversity of the group of pupils and existing individual plans.
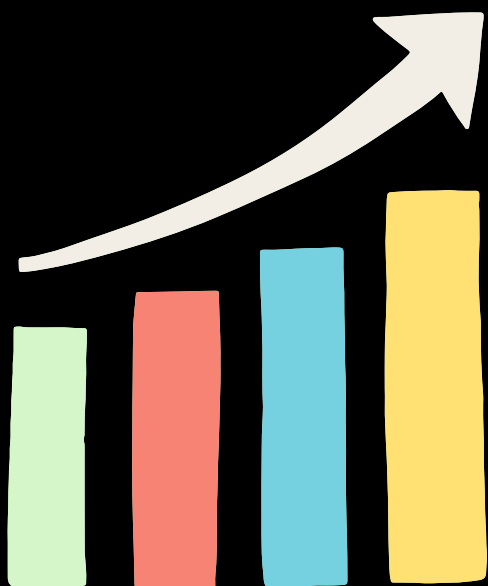
After setting objectives and contents, it is necessary to detail the **procedures**, meaning the **activities and resources** that we intend to develop throughout the lesson. Setting procedures has a triple meaning in: **what** we want to do, **how** we want it to develop, and **when** we plan to do it, all responding to the learning objectives. This is why we must define and specify the activities to propose, the resources to use, and the time when to take each step, both in terms of the order and internal coherence of the processes, and in the length of each step. The specific needs of students with low vision must be kept in mind, since the materials used, the activities proposed, and the times to carry them out must be adapted.

Planning times is a basic and absolutely necessary issue to meet both the specific objectives of a lesson and the general objectives of a course or stage. That is why an ideal lesson plan should foresee several levels of planning: general, in stage or course; intermediate, in relating to the school period; and basic, matching each individual lesson. When planning time, keep in mind that students with low or no vision always require more than the rest for certain activities like reading.

It's always important to know how we are going to start a lesson and try to do it effectively and impactfully. This fulfils several functions: reviewing previous knowledge, knowing what students already know about the subject, for each one to reflects on what they know or ignores, get their attention, motivate them, guide them... This beginning, the breaking of the ice, can be approached from issues seemingly far from the learning objectives, through the use of questions, examples, anecdotes, current issues, or particular interests of students. A good start is always a big step. This moment is a good opportunity to value diversity and plurality.

Also establish work strategies and alternatives, by having more didactic resources than strictly necessary, or planning for various outputs in initially unforeseen situations, to use them if necessary. Having complementary materials and a supporting bibliography should be aimed not only at meeting exceptional circumstances, but will in any case serve to make them available to students, to complement and deepen the learning objectives. In any case, watch for these complements not becoming segregation routes (only for those "smart" or the "different").

Questions, readings, videos, objects, models, presentations, images, plans, and maps, diagrams, idea maps, online resources… these are all tools that can be used to implement learning processes. In addition to those classic and traditional, ICTs provide many resources that allow guided exercises and practices of all kinds. When deciding which to use more, consider your environment on the one hand (the characteristics of students, which are studied in the contextualization of the lesson plan, their concerns, motivations, experiences…), and on the other look for and choose those that are more appealing or "hook" the students. Always assume that all the tools have the necessary adaptations for the specificities of low vision students: zooming, contrast between background and text, anti-glare measures…

The final part of the lesson plan deals with general evaluation mechanisms of the session, allowing both to synthesize the basic questions addressed regarding the didactic objectives and to verify if they are achieved. If the objectives are to be feasible, the results obtained must be qualitatively or quantitatively measurable. We must ensure that the key points are covered and assumed in the lesson session to assess whether we have succeeded in promoting the learning sought, thus obtaining information on how to proceed in subsequent sessions the lesson plan, its necessary adaptations and in which direction they should go. This evaluation must have an inclusive approach developed below.
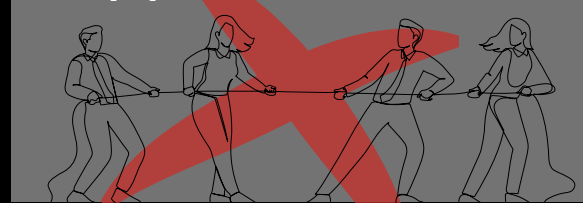
# 16. Inclusive evaluation

Evaluating involves a triple process that starts from collecting information systematically to later recognize an existing situation and make decisions based on the data obtained. In an inclusive educational model, this process must start from the premise that every person has the capability to learn and potential to develop, and it must culminate with the objective that the decisions adopted cannot turn situations of personal diversity into obstacles that crystallize into insurmountable inequalities. Inclusion means working with diversity by offering equal opportunities for all.

The project "Evaluation in inclusive environments" was developed between the years 2005 and 2008 by the European Agency for Special Needs and Inclusive Education[74], with the objectives of knowing the evaluation policies and practices of the 25 participating European countries and spread guidelines for evaluation in inclusive settings. Within this framework, a work definition of the concept of "evaluation" was developed as:

*"The ways in which teachers and others involved in the education of students systematically collect and then use information about the students' level of achievement and/or development in different areas of their (academic, behavioral, and social) educational experience."[75]*

Lastly, inclusive evaluation is defined, an essential objective of all education administrations, as:

*"An approach to evaluation in standard schools where policy and practice are designed to develop student learning as much as possible. The overarching objective of inclusive evaluation is that all assessment policies and procedures should support and encourage the inclusion and participation of all students who may be subject to exclusion, including those with special educational needs."[76]*



Inclusive evaluation should become the general way of evaluation, preventing segregation and trying to avoid categorization. However, this clashes with the tensions between the implementation of inclusive evaluation models and the use of student assessment data to monitor national and international educational standards; or with the centrality of the concept of "competitiveness" in the design of those same standards, something contradictory to the equality of opportunities of an equal system. Regarding this, the European project rightly points out that "the evaluation of students can be based on a competitive system or it can be geared towards promoting inclusion through cooperation and shared learning experiences".[77]

The initial phase of the study concluded that inclusive evaluation should be general, aimed at reflecting on improving learning opportunities for all students. At the end of the project, the Limassol conference adopted the so-called "Cyprus Recommendations"[78], which reflect the principles that support inclusive evaluation:

- *All evaluation procedures should be focused on informing and promoting learning.*

- *All students have the right to be informed of the procedures of the evaluation in which they participate.*

- *All students have the right to be part of evaluation procedures that are reliable, valid, and adapted to their particular needs.*

- *All evaluation procedures should be based on universal design principles, so that all students are given the opportunity to demonstrate their success, skills, and knowledge.*

- *The demands of students with special educational needs must be considered in the regulations on evaluation of both standard and special education.*

- *All evaluation procedures must complement each other and be connected.*

- *All evaluation procedures should aim to consider and also highlight diversity, detecting and assessing the progress in learning and successes of all students.*

- *All evaluation procedures should be coherent and coordinated to support teaching and learning.*

- *Inclusive evaluation explicitly seeks to prevent segregation by avoiding "labels" as far as possible, moving towards a practice in teaching and learning that promotes inclusion.*

Some final recommendations were that both students and their parents should be involved in the evaluation, being able to influence both plans and objectives. On the other hand, repeated references were made to the need for all actors in the educational process to be involved in making evaluation more inclusive, in favor of the diverse needs of students, specifically those at risk of exclusion.

In inclusive evaluation, the concept of evaluation for learning emerges to identify a qualitative and continuous type of evaluation process whose objective is to provide teachers with information about the learning process of students, to guide teaching planning. This concept opposes the evaluation of learning, which involves a specific procedure aimed at accountability through concrete evidence. On the contrary, evaluation for learning aims to offer information to stimulate new advances in a continuous process that includes teachers, students, and parents through observations, self-evaluation, peer evaluation, debates with students and among teachers, comments, dialogues, surveys, feedback, portfolio, etc. The participation of students in the evaluation of the learning achieved is an essential part that favors both self-reflection on how they have achieved it and the feedback of the process.
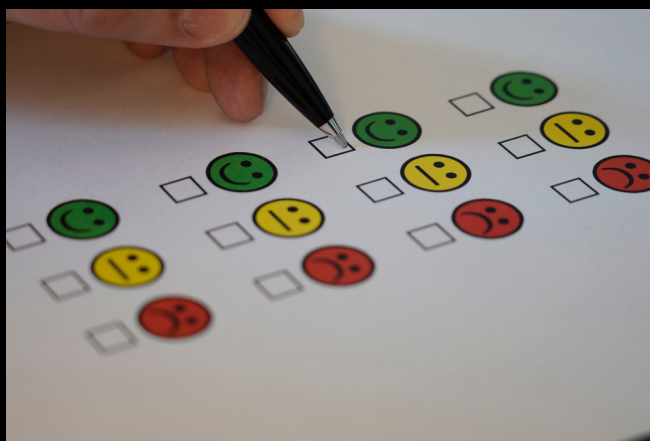


Inclusive evaluation presents a series of indicators for each sector involved in the educational process. Thus, for students, there are mechanisms to involve them in their own evaluation on which they can influence, as well as on their learning objectives. For parents, it establishes mechanisms to enable their involvement in the evaluation of their children. For teachers, it uses inclusive evaluation as a means of improving learning opportunities, establishing objectives to improve teaching through new strategies, but also having the support and training necessary to develop the corresponding practices. Learning is focused with a generalist treatment that considers academic, bejavioral, psycho-social, emotional, and contextual aspects. Schools are responsible for developing evaluation plans based on the inclusive purpose. For their part, the multidisciplinary evaluation teams and the set of educational policies focus their efforts on promoting inclusion and eliminating barriers through the use of "universal design", ensuring that evaluation procedures are accessible to all students regardless of their specific needs, without separating continuous evaluation of the official curricula, but making it more flexible and adapting it to the circumstances of each student, while favoring cooperation with other services that affect students and their families (social, health, etc.).

Inclusive evaluation becomes a key element of the educational process, conditioning its evolution and the set of decisions that must be adopted both by teachers (for the general regulation of the process) and by the students themselves (to self-regulate it). It is a process that affects the entire educational community and must have its collaboration and responsible agreement based on an inclusive conception of education. It must also be a continuous, dynamic, and flexible process that considers and respects personal diversity. It must provide information to guide and adapt the educational process according to the characteristics and personal needs of the students, to ensure their acquisition of skills, competences, and curricular knowledge. Evaluation should serve to identify and remove existing barriers to learning, making it accessible to all.

The evaluation process involves a prior reflection on what is going to be evaluated and how it is going to be done, considering that it is an individual procedure on what a person has learned, but that it must necessarily also consider the group as a whole in order to assume what the educational process is developing in general parameters. Being a continuous process, it must have various elements both programmed and random, with differentiated characteristics and rules according to the plurality of concepts and processes to be evaluated, and that also incorporates observations on aspects not only competence-wise but also emotional and social.

Students must know what is expected of them in the educational process, meaning the objectives regarding competences, knowledge, and skills (including social skills) that they are expected to acquire. They should also know the procedures, methods, and circumstances with which the evaluation will be carried out. In an inclusive evaluation process, both students and teachers must be aware that the evaluation criteria must be adaptable both to the different needs and situations -including family and environmental situations- of each individual and to the results of all. This is why evaluation processes must raise different levels in the participation and resolution of tests and activities, so that success has an equative component beyond an equal basis, or because the objective of primary and secondary education is not establishing the height of a barrier that some students will reach, and others won't. On the contrary, the objective is allowing everyone to reach their optimum levels of personal development of knowledge, skills, and abilities.

**EQUALITY**



**EQUITY**
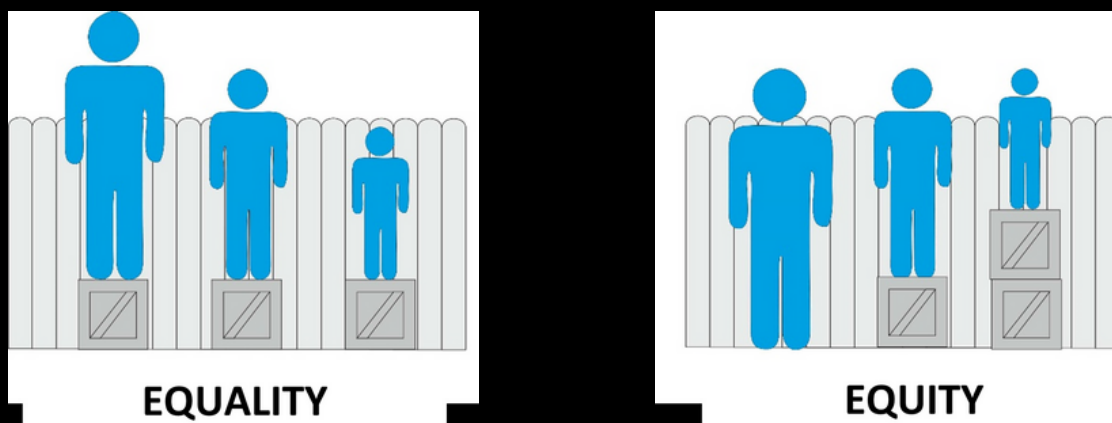
Attending to diversity implies using different resources, formats, languages, and times to present and solve evaluation tasks. To achieve this, the teacher must know how to identify the potential and abilities of each student. These issues make it little or unadvisable to focus evaluation exclusively on traditional and bureaucratic one-off quantitative methods. On the contrary, the autonomy of each school and sharing diverse inclusive experiences by teachers in the use of informal evaluation processes will be important elements detrimental to the obsolete bureaucratic tradition of exams as a basic and sometimes the only method of evaluation.

The evaluation process culminates with the communication of results to the student's family environment, which must be directly related to both the previously developed criteria and to the curricular competences adapted for each student, and presented in terms of process evolution.

When planning the inclusive evaluation of students with low vision, keep in mind that the limitation in the reception of visual stimuli makes them have different itineraries from normovisual students, in terms of their **cognitive development,** since touch is analytical (with a slower assumption) while sight is more deductive (faster to process). As long as the acquisition of concepts and skills depends more on the sense of touch and less on sight, differences in pathways will imply delays at some stages, although the ultimate level of development achieved will be very similar.

Low vision has hardly any impact on oral **language** development, although it obviously does have an impact on **literacy** processes. As for **social relationships**, the difficulties in development are marked not so much by the problems with personal autonomy, as by the attitudes of their environment towards them, which both by excess (overprotection) and by default (isolation), are what can cause most problems. Regarding their **affective development,** people with low vision tend to show greater dependence on certain figures, which also hinders social relationships, adding the risk of traumatic ruptures of personal ties in critical stages like adolescence. Their **academic performance** is always conditioned by the additional effort they must make in many daily activities, so their motivation suffers more than their peers', and must be reinforced.

The ways to evaluate must be adapted to the physical possibilities of the students, without adding difficulties to them to express their learning achievements. They must also be adapted from the specifics of each subject taught according to the common learning objectives adapted to the circumstances of the students. Assessment techniques should be adapted using a wide variety of formats for various purposes in a diversified and flexible manner:

- Questions, tests, and exams, both oral and written, scheduled and unforeseen, or random to evaluate the learning of contents and competences.

- Works, exercises, projects, both individual and group, to continuously evaluate learning and the acquisition of skills and competences.

- Observations, dialogues, self-evaluation (including the use of templates), evaluation of evidence, to evaluate the evolution of the predisposition to learn, the willingness to participate, and other emotional aspects of the personal growth process.

All of this has the ultimate goal of everyone learning, being able to perceive the progress and the acquisition of knowledge and skills, correcting the deficiencies of the teaching processes and planning the next steps attending to the needs of diverse students.

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[13]Image credit: *What is albinism? Lluís Montoliu and Ana Yturralde (ALBA, 2018)*

[14]Image credit: *What is albinism? Lluís Montoliu and Ana Yturralde (ALBA, 2018)*

[15]*International Albinism Awareness Day, June 13*

[16]Image credit: *What is albinism? Lluís Montoliu and Ana Yturralde (ALBA, 2018)*

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[61]Traditional Braille onfigura as an encoding system representing the characters individually by means of cells containing up to Six points Embossed sorted in two columns of Three points. Braille of eight points or computerized is an adaptation Computing that Using Eight points in two columns of four allows the representation ofl code ASCII through 256 characters different Braille.

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