PERCEPTION OF PEOPLE WITH VISUAL IMPAIRMENTS

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Abstract

Blindness, partial sightedness, and cortical/cerebral visual impairment pose complex challenges and are difficult to define in a single manner. In the Slovenian school system, the pedagogical definition focuses on the specific visual abilities of children, serving as the basis for adapting the educational process and creating an inclusive environment. Children with visual impairments require content that offers an alternative to visual information, enabling them to participate actively in society. The development of tactile perception has a key role in their holistic development; through play and interaction, they learn about the world around them. Extended curriculum activities should promote concrete and language-rich experiences, as this enables the comprehension of fundamental concepts. Effective strategies for working with children with visual impairments include tactile modelling and audio description, which facilitate children's exploration and interpretation of information. Audio description enhances the accessibility of cultural resources, while tactile content promotes the development of fine motor skills. Together, these elements create a supportive framework that fosters children's independence and success. The conscious design of learning content and adaptation of teaching methods are crucial for successfully including children with visual impairments in the modern education system.

INTRODUCTION

In recent decades, societal attitudes towards people with special needs have shifted significantly. Rather than being marginalized and pitied for their disabilities, they are now recognized as having an equal role in society. However, to ensure they have equal opportunities in life compared to individuals with no sensory impairments, content and materials need to be adapted into an accessible format. In school environments and everyday life, adaptations consistent with Universal Design are progressively becoming more widespread. By fostering an appropriate physical, didactic, social, and curricular environment, we can develop an inclusive society. Universal Design for Learning has proven to be an effective approach to creating accessible and inclusive learning environments. This concept is based on scientific insights into how humans learn. The main goal of Universal Design for Learning is to create a learning environment with a variety of options that allows the majority of learners to actively participate without additional adaptations (CAST 2024). Nevertheless, in the case of people with visual impairments, it is important to consider that the primary sense for discovering the world is impaired and, as a consequence, other senses need to be enhanced. Content has to be adapted primarily by using touch and sound, and less typically, smell and taste (Schmidt 2014).

PEDAGOGICAL DEFINITION OF VISUAL IMPAIRMENTS

There is no single and globally recognized definition of blindness, partial sightedness, and cortical/cerebral visual impairment (CVI); however, definitions can be roughly divided into two categories, medical (e.g. the World Health Organization definition, the Slovenian definition by the Extended Expert College for Ophthalmology) and pedagogical (e.g. the Criteria for the Definition of the Type and Degree of Deficits, Barriers and Disorders of Children with Special Needs, prepared by the Education Institute of the Republic of Slovenia). In the local school setting, the Slovenian pedagogical definition of blindness, partial sightedness,

and CVI (Stirn Kranjc et al. 2015) serves as the legal foundation for pedagogical work with special needs students and their environment. This definition differs from the medical ones as it includes CVI, a category that has not yet been defined in the medical field.

Blind and partially sighted children as well as those with cortical visual impairment are children who have reduced visual acuity, a narrowed field of vision or cortical visual impairment. The criterion for assessing the visual field is based on perimetry records.

Partially sighted child

A *partially sighted child* has a visual acuity of 5 to 30 per cent or a narrowing of the visual field in all meridians exceeding 10 degrees to 20 degrees inclusive around the fixation point, regardless of visual acuity. A distinction is made between a moderately partially sighted child and a severely partially sighted child.

A *moderately partially sighted child* has a visual acuity of 10 to 30 per cent. They require a partially adapted educational environment and, if necessary, adapted teaching and educational aids, specialized training in communication techniques and/or orientation. Under suitable conditions, they can perceive visual information. They follow the method designed for the partially sighted and can maintain the same work pace as sighted peers, provided that materials are adapted or reading aids are utilized.

A *severely partially sighted child* has a visual acuity of 5 to less than 10 per cent or a narrowing of the visual field exceeding 10 degrees to 20 degrees inclusive around the fixation point, regardless of visual acuity. They require an adapted educational environment and didactic aids as well as specialized training in communication techniques, orientation, and social skills. Most of the learning is performed through visual information, following the method designed for the partially sighted. They can read black print if materials are adapted or reading aids are utilized, although their reading is impeded and slower.

Blind child

A *blind child* has a visual acuity of less than 5 per cent or a narrowing of the visual field to 10 degrees or less around the fixation point, regardless of visual acuity.

A *blind child with residual vision* has a visual acuity of 2 to less than 5 per cent or a narrowing of the visual field exceeding 5 degrees to 10 degrees inclusive around the fixation point, regardless of visual acuity. They require an adapted educational environment and didactic aids, adapted aids focusing on communication techniques, additional didactic aids for acquiring abstract concepts and physical quantities, and aids designed for the blind to assist in orientation and daily life activities. In addition, they need specialized training in social skills, orientation, and communication techniques. They follow a combined method incorporating in part the method designed for the blind and in part the method for partially sighted. Their work pace is significantly slower compared to that of sighted peers.

A *blind child with residual vision* has a visual acuity of light projection of less than 2 per cent or a narrowing of the visual field around the fixation point to 5 degrees or less, regardless of visual acuity. They require an adapted educational environment and didactic aids, adapted aids focusing on communication techniques, additional didactic aids for acquiring abstract concepts and physical quantities, and aids designed for the blind to assist in orientation and daily life activities. Moreover, they need specialized training in social skills, orientation, and communication techniques. They follow a combined method incorporating mainly the method designed for the blind and in part the method for the partially sighted. Their work pace is significantly slower compared to that of sighted peers.

Totally blind child: perception of light negative or positive with negative projection. They require continuous specialized training for daily life activities, an adapted educational environment, adapted learning aids focusing on communication techniques, which entails the use of Braille, additional didactic aids

for acquiring abstract concepts and physical quantities, and aids designed for the blind to assist in orientation and daily life activities. In motor activities, they are noticeably slower than their sighted peers. As they do not learn by imitation, a professional approach is required for them to acquire new motor actions and skills. A totally blind child follows the method designed for the blind; learning occurs through tactile and auditory perceptual pathways.

Child with cortical visual impairment (CVI)

CVI results from a disease and/or dysfunction of the central nervous system. Impairment may be present in cases of partially or fully preserved visual acuity, either unilaterally or bilaterally, and in cases of partially or fully preserved visual field, either unilaterally or bilaterally.

CVI is characterized by: visual attention problems, visual complexity problems, gaze and fixation disturbances, delayed and slowed visual response, absent or atypical visual response (e.g. reactions to imminent danger), inadequate visuomotor behaviour (e.g. eye-hand co-ordination), inefficient visual perception, visual agnosia. The assessment of CVI requires medical results demonstrating central nervous system impairment that are obtained by objective examinations such as clinical, neuroradiological, neurophysiological, laboratory, genetic, and other examinations (Stirn Kranjc et al. 2015, 8–9).

SENSE DEVELOPMENT IN CHILDREN WITH VISUAL IMPAIRMENTS

The sensory perception and motor skills of the child are crucial for their holistic development (Anderson, Boigon, David and deWaard 2007; Roe 2008). According to Piaget's theory (Piaget 1929, 1959, 1964, as cited in Marjanovič Umek, Zupančič, Kavčič and Fekonja 2009), there are two main levels of intellectual development in pre-school children. In the first two years, children experience the sensorimotor stage of cognitive development,

during which they acquire basic concepts related to object permanence, spatial relationships, strategies for achieving desired goals, and imitation. During this stage, visual, auditory, olfactory, gustatory, tactile, kinaesthetic, and haptic sensory perceptions are extremely important, and any absence or impairment of perception attributable to a sense organ is a risk factor in development. Around the age of two, children begin to organize the people and events in their world as they develop the ability to classify by shape, colour, size, and function. In the case of children with visual impairments, it is necessary that vision-dependent concepts (e.g. facial expressions, body movements) are presented in a very explicit way using concrete material. A child with visual impairment needs concrete sensory and language-rich experiences in order to acquire information that they would otherwise obtain through vision.

Play is the primary means through which children develop their senses. Games involving the sense of hearing enable children to acquire information about actions happening in their immediate and distant surroundings, which is crucial for the development of selective perception, sound recognition, and the ability to determine the direction and distance of various sounds. Games focusing on touch expose children to information about objects in their surroundings. Games aimed at developing the senses of smell and taste are especially valuable for blind children, as these perceptions can sometimes compensate for visual information (e.g. identifying food by smell) and foster awareness related to everyday objects (Zrljić and Košta 2008).

FOSTERING THE DEVELOPMENT OF TACTILE PERCEPTION IN PEOPLE WITH VISUAL IMPAIRMENTS

Studies (e.g. Brambring 2001, 2006, 2007) have shown that children with visual impairments tend to have lower levels of physical fitness and less developed motor skills compared to their sighted peers. There is a connection between motor skill development, which includes tactile perception, and the presence of emotional

and behavioural disorders in people with visual impairments. Motor skills have a preventive effect on emotional and behavioural issues. Unlike teaching groups of sighted children, one-to-one instruction proves most effective for students with blindness and partial sightedness. Techniques such as physical guidance and tactile modelling play an important role in enabling people with blindness or visual impairment to form a mental picture of movement (O'Connell, Lieberman and Petersen 2006). Tactile perception can be analytical or synthetic. In analytical exploration, the child analyses individual components to construct an image of the object. Conversely, in synthetic exploration, the child first takes hold of the entire object and then identifies it based on this interaction. As the majority of learning occurs through the synthetic approach, blind children, who frequently adopt the analytical approach, require additional time to comprehend the world (Zrljić and Košta 2008). People with CVI need the opportunity to perceive others' actions by touching the body parts or objects involved in these actions. Teaching through touch is one of the most common methods for instructing students with visual impairments. The effective implementation of tactile strategies necessitates a comprehensive consideration of each learner's specific needs, the learning environment, and the specific tasks. It is crucial to dedicate enough time to present the tactile information and to systematically evaluate the adaptations, which contributes to a successful learning process. Miniature models serve as a useful tool in tactile modelling. Their small size contributes to the ease of use, but it is important to consider that they may not reflect the actual reality when explored through touch. For instance, a small plastic dog does not have the same tactile characteristics as a real dog. When designing tactile adaptations, it is therefore important to avoid misconceptions. People with visual impairments primarily need accessible tactile information. As touch offers only a fraction of the whole, the individual must integrate a series of tactile impressions to comprehend what the sighted perceive through vision (Downing and Chen 2003).

TACTILE PICTURE BOOKS

Children acquire knowledge and explore the world through play and imagination. Picture books have a significant role during the pre-school period. While there is an abundance of picture books available on the market for sighted children, their illustrations are often less suitable for children with visual impairments. Consequently, children with visual impairments are deprived of the visual experience they should gain from images during reading. Tactile picture books are therefore particularly important for children, as they stimulate their sense of touch, preparing them for learning Braille (Kermauner 2014). Illustrations are crucial for familiarizing children with unknown information, facilitating their comprehension of the text and enabling them to learn about the realities beyond their direct experience, such as tropical animals or historical figures (Lamb 1995, as cited in Tajnikar 2019). Schmidt (2014) defines tactile picture books as books containing illustrations designed to be perceived by children through touch. These books typically include Braille and enlarged text. By using tactile picture books, children learn to recognize and interpret various shapes. This contributes to the development of their fine motor skills and tactile perception, which are crucial abilities for people with blindness. Furthermore, these books serve as aids that prepare younger children for Braille learning and can be considered a preliminary step in gaining literacy. The technology used to produce tactile pictures has changed over time, as have the materials. Tactile pictures continue the tradition dating back to the late 19th century. Initially, these pictures featured relief figures printed on heavy paper, using a variety of cut-out wooden moulds. Later, materials evolved, allowing for a more pronounced relief. In the 1960s, paper was replaced by plastic in the thermoforming process, enabling the creation of similar moulds. Tactile pictures are simple outline drawings consisting of raised lines or surfaces with various textures, creating a perceptible relief. In tactile pictures, details are eliminated as light, shadows, and perspective are not representable.

A tactile picture is thus any visual element that is accessible to tactile perception; the information each individual can extract from the image depends on the tactile threshold, which is an individual-specific ability. Tactile pictures are important for the development of children with visual impairment. They should not exceed A4 size and should feature generalized motifs to ensure unambiguous recognition. Tactile pictures should present strong colour contrasts for individuals with residual vision, and the proportions should correspond to real life. Materials should evoke the actual image of the object and be safe to use. The utilization of tactile pictures is intended to enhance sensory acuity, train motor skills, promote the understanding of shapes, and gain new experiences related to daily life. It is crucial to add texts in media that visually impaired children can read. When creating a tactile picture book, the size of the surface should be suitable to accommodate two outstretched hands, allowing the child to easily reach the entire image. The information in the tactile picture should not be smaller than the size of a Braille cell, and the books should be in A4 landscape format. When portraying natural objects, such as animals and trees, the correct size proportions have to be respected. For example, a cat should not appear larger than a wolf, and the size of a flower should not exceed that of a tree. All limbs of animals and people have to be visible, meaning that figures are to be depicted either from the front or from the side. When choosing colours and materials, it is recommended to use strong, contrasting colours that children with residual vision can still perceive. Soft objects should be depicted with soft materials and cold objects with smooth materials. When using materials, it is important to ensure safety: sharp parts of the tactile picture should be protected, smaller parts should be firmly attached, and materials should be non-toxic and easy to clean (Kermauner 2014, Kermauner n.d.). Schmidt (2014) further explains that a tactile illustration is an abstracted image featuring lines of varying thickness and solid planes with different patterns and textures. The image can be

divided into several pictures, which combined form a whole; however, it is still an obvious abstraction of the world presented in two dimensions.

Creating tactile content for people with visual impairments requires adherence to guidelines to ensure effective perception and interpretation through touch. Küssel (2019) prepared a set of recommendations that are also applicable to the creation of tactile maps, which can be considered tactile pictures of a higher level.

① Universally accessible formats: When designing tactile content, it is important to consider universally accessible formats, ensuring ease of use for all. Braille and relief shapes are essential for adapting information to people with visual impairments. It is also important to consider the size and shape of the font to ensure good legibility.
② Tactile marks and symbols: The standards for adapting tactile content also include certain tactile marks and symbols that aid in understanding of the territorial conditions on the tactile map. Brock et al. (2015) highlight the importance of implementing uniform tactile symbols to simplify the interpretation of geographic information.
③ Use of contrasting materials: Contrasting materials help to distinguish between different parts of the tactile map. Contrasts between relief surfaces, colours, and other materials enhance the clarity and distinctiveness of information.
④ Systematic organization of information: Tactile map preparation for people with visual impairments requires a systematic organization of information to enable logical reading and comprehension of spatial relationships.
⑤ Incorporating technological innovation: Modern technologies such as graphics embossers, 3D printing, and other technologies offer additional opportunities to improve the quality of tactile maps. New technology is driving increased accessibility and usability of tactile content.

Downing and Chen (2003) highlight the following steps that need to be performed when communicating through touch:

- → Select the message that you want to communicate to the child (e.g. greeting, reassurance, encouragement, praise, redirection, demonstration).
- → Decide how best to communicate that message through the type of touch (i.e. duration, pressure, movement) and where to touch the child (e.g. back of hand, shoulder, or knee).
- → Identify how you will let the child know that you are close (e.g. by saying their name) before touching them (e.g. on the elbow).
- → Discuss with the child whether and how to tactilely examine an item (e.g. a turtle).
- → Decide whether and how to use tactile modelling (e.g. by asking a classmate to show how to blow up a balloon).
- → Observe the child's reactions to your tactile interactions and modify the interaction accordingly.
- → Identify how you will end the interaction (e.g. let the child know that you are leaving by giving them a double pat on the shoulder).

TACTILE MODELLING

In tactile modelling, the child decides when to touch the teacher/peer/aide/object. Tactile modelling gives the child the opportunity to feel and explore another's or a model's body in the direction of a particular movement. For example, the child feels the movement of the instructor's legs during each dance step. If the instructor is much larger than the child, a peer can act as a model, provided that they have consented to this role beforehand. Tactile modelling is beneficial as it often clarifies the mechanics of the movement more comprehensively than explanation alone. In addition, tactile modelling gives the student control of the learning process by providing a choice of the specific components of a performance to focus on. Instead of being manipulated, the child can take the lead, feel the movement, and control the information input (O'Connell et al. 2006).

ADAPTATION INTO BRAILLE

Braille is a standardized script designed for the blind, composed of Braille dots as the fundamental elements of the Braille cell. In Slovenia, two size standards are in use: Marburg Medium and Marburg Large. A Braille cell is a space accommodating either six Braille dots or eight Braille dots in eight-dot Braille, also referred to as computer Braille. Individual letters, numbers, and symbols are represented with a combination of Braille dots. In six-dot Braille, there are only 64 possible combinations within the cells, therefore Braille prefixes are used to avoid a double meaning of a single character. The size, height, and proportions within the Braille cell and between the Braille dots are precisely defined in order to facilitate reading with a single finger pad (Gregorc et al. 2016). Sighted children can easily identify the location of the text on the page, therefore the text position is not crucial. On the other hand, Braille readers benefit from being able to find the text in its expected location. Braille text should be printed on stiff paper, and words should not be divided or arranged as individual units. When designing texts for children with blindness, particular attention has to be paid to the choice of adhesive, as glue can diminish the sharpness of Braille dots. For children who are not yet literate in Braille or read black print, it may also be advantageous to include a high-quality printed version of the text. This allows parents, teachers, peers, and others to read the story to children with blindness (Lewis and Tolla 2003).

AUDIO DESCRIPTION

Audio description is a common approach to adapting content for people with visual impairments. Various authors (e.g. Snyder 2010; Snyder 2023; Le linee guida di DescriVedendo n.d.) are relatively unanimous in their definition of audio description and the identification of elements practitioners should consider. They define audio description as a process that enables people with visual impairments to better understand visual content, such as films, theatre performances, or exhibitions. It is a form of narration

that describes what a sighted person naturally perceives, bringing visual content in theatre, television, films, and other art forms closer to people with visual impairments. This narration is incorporated into the soundtrack to describe important visual details that cannot be understood solely from the main soundtrack. The narration illustrates the visual content, which is essential for its understanding, and provides information about actions, characters, scene changes, and other visual content. Using concise, vivid, and imaginative expressions, describers convey information that is inaccessible or only partially accessible to some individuals. Audio description can also benefit individuals who prefer using audio equipment to obtain information or can access only the audio recording of an event or production.

The audio describer should approach their task like a journalist, providing a faithful account of the facts. They can describe who is in the image and what they look like, including age, hair, body structure, and clothing, and characteristics such as ethnicity and race, if relevant. It is also essential to provide an account of what is happening. The describer's decision about what to describe is based on their understanding of the needs associated with blindness. The description progresses from the general to the specific, as the describer integrates information about colour and direction and focuses on essential elements that enable the viewer to understand the image.

In addition, it is important to identify the time and place of the actions as well as describing the weather conditions and location. The audio describer should use clear, concise, and relaxed language and avoid the expression "we see". They should be mindful of the audience, use a variety of verbs, and avoid ambiguity. Moreover, they should objectively summarize the visual aspects of the image and use metaphors and similes to describe shapes and sizes. The audio describer's voice conveys meaning, as messages are mostly communicated through non-verbal cues such as gestures and facial expressions. It is important for the pronunciation to be correct, clear, and understandable, and for the voice to match

the pace and energy of the material. When describing works of art, the goal is to make them accessible, which requires the use of precise and coherent expressions. The description should begin by emphasizing the dimensions, detailing the technique and materials, and defining both the subject of the work and its perspective. It is also important to agree on the descriptive sequence and location of the parts as well as to accurately describe postures, shapes and features, light, and colour.

CONCLUSION

Blindness, partial sightedness, and CVI pose complex challenges, rendering them difficult to define in a single manner. The Slovenian school system utilizes a pedagogical definition that focuses on the specific visual abilities of children, which allows for a more efficient adaptation of the educational process. This approach is essential for creating an inclusive environment that acknowledges the diverse experiences and abilities of individuals, ensuring that everyone has equal opportunities for learning and development. People with visual impairments require content that is adapted to meet their needs and provides an alternative to visual information, enabling them to participate actively in society.

The development of the senses, especially tactile perception, has an essential role in the holistic development of children with visual impairments. Children learn about the world around them by gaining experiences through play and interaction with different materials. These activities enable the development of motor skills and the acquisition of cognitive concepts, which are often linked to visual information. Therefore, it is particularly important that the extended curriculum for people with visual impairments includes activities designed to promote concrete and language-rich experiences, which enable children to acquire fundamental concepts and understanding of the world around them. One of the fundamental strategies in teaching children with visual impairment is the application of tactile perception. Sighted individuals can use tactile modelling and adapted teaching aids to enable children with visual

impairments to explore and comprehend concepts through touch. Tactile picture books, tactile pictures, and other tactile content are essential for fostering the development of children's fine motor skills and tactile perception, enhancing their ability to efficiently perceive and interpret information through touch. Through realistic and accurate tactile content, children with special needs can comprehend and navigate the world they live in.

After developing an acute sense of touch, a person with blindness can acquire information through Braille, which virtually eliminates limitations to tactile learning about the world. In addition, the technique of audio description is another key tool that enables children with visual impairments to experience content that would otherwise be difficult to access. Audio description involves interpreting visual content "in real time", making it impossible to be thoroughly prepared in advance. This increases the accessibility of cultural and educational resources, promoting children's active participation in various activities.

While smell and taste are among the first senses to develop, they play a secondary role compared to touch and hearing in the education of individuals with visual impairments. Nonetheless, these senses serve as important complements, enhancing the overall experience and contributing to its precision.

The adaptations provided by professionals are crucial for fostering children's independence and success in education as well as in their everyday lives later on. Understanding the specific needs and challenges faced by children with visual impairments is a prerequisite for creating a learning environment that is not only accessible but also challenging, empowering them to reach their full potential and to actively participate in society.

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