Pedagogical Contexts 2020, No. 2(15)
www.kontekstypedagogiczne.pl
ISSN 2300-6471
pp. 277–298
https://doi.org/10.19265/kp.2020.2.15.282

ORIGINAL PAPER
Received: 27.04.2020
Accepted: 15.06.2020

Agnieszka Twaróg-Kanus
https://orcid.org/0000-0003-3280-1497
University of Bielsko-Biala, Poland
akanus@ath.bielsko.pl

A Low Vision Student at a Younger School Age in Public School. A Case Study

Uczeń słabowidzący w młodszym wieku szkolnym w szkole ogólnodostępnej. Studium przypadku

Keywords:
hyperopia, visual impairment, therapy, individual case

Summary: In the case of visual impairment, compensatory activities are focused on early intervention and diagnosis combined with a programme for the development of visual skills, especially in public schools, where importance is attached to educational success and the development of individual personality traits, as well as adapting the support, rehabilitation and education programme to the person with special educational needs. The challenges of cooperation with a visually impaired student are related to the equaling of educational opportunities, combining theoretical content with practical action, searching for programmes, the use of technology and communication (TiK), and working with the child's resources. Vision impairments affect school difficulties in the cognitive, social, emotional, volitional and physical field. The unadjusted refractive defect (especially hyperopia) and weakened binocular vision contribute to creating an individual model of working with the child with visual impairment. The presented case study shows supporting and therapeutic actions, with emphasis on the use of solution-oriented therapy.

Słowa kluczowe:
nadwzroczność,
niedowidzenie,
terapia, indywidualny
przypadek

Streszczenie: Działania w przypadku dysfunkcji wzroku są skoncentrowane na wczesnej interwencji oraz diagnozie połączonej z programem rozwijania umiejętności widzenia, szczególnie w szkole ogólnodostępnej, gdzie przywiązuje się wagę do sukcesów edukacyjnych i rozwoju indywidualnych cech osobowości, dostosowując program wsparcia, rehabilitacji i edukacji do osoby ze specjalnymi potrzebami edukacyjnymi. Wyzwania współpracy z uczniem słabowidzącym wiążą się z wyrównywaniem szans edukacyjnych, łączeniem treści teoretycznych z działaniem praktycznym, poszukiwaniem programów, wykorzystaniem technologii i komunikacji (TiK) oraz pracą z zasobami dziecka. Zaburzenia widzenia wpływają na trudności szkolne w potencjale poznawczym, społecznym, emocjonalnym, wolicjonalnym, fizycznym. Nieskorygowana wada refrakcji (szczególnie nadwzroczność) i osłabione widzenie obuoczne przyczyniają się do stworzenia indywidualnego modelu pracy z dzieckiem z dysfunkcją wzroku. Przedstawione studium przypadku ukazuje działania wspierające, terapeutyczne, z naciskiem na wykorzystanie terapii skoncentrowanej na rozwiązaniach.

Introduction

The sense of sight brings the most information, thanks to which the child learns, analyses and interprets the surrounding reality. Correct vision is essential for learning to read, write and use electronic devices. The treatment of eye disease depends on a medical, ophthalmic, psychological and pedagogical diagnosis. Low vision people benefit from vision, but its impairment greatly hinders their daily functioning. It happens that "the state of vision, despite standard correction, makes it difficult for such a person to plan and/or carry out a task, but it is possible to improve functional vision through optical or non-optical aids, adjusting the environment and/or sight-enhancing exercises" (Corn, 1989, p. 28). In this respect, it is worthwhile to refer to the development of visual skills (Barraga, 1964):

– the ability to see is not innate and does not develop automatically;
– visual skills are not determined by visual acuity alone and cannot be judged solely on that basis;

– the ability to see and to function visually is not determined solely by the type and degree of illness or damage to the visual system;
– the ability to see and use one's eyesight can be learned by performing properly planned exercises requiring the use of sight.

The planning of therapeutic work with the low vision child must, therefore, take into account the limitations of the individual determinants which are hereditary and innate factors. Working with the low vision child should be based on a systematic and diverse range of therapeutic tasks that improve and support vision.

Visual functioning of a low vision student with hyperopia, astigmatism and differential vision

Visual acuity is a measure of the quality of vision, which is associated with anatomical, hereditary, psychological, social and health factors. Good visual acuity is essential for the proper psychophysical development of a child. Refraction impairment adversely affects the learning process, as it causes numerous difficulties in acquiring reading and writing skills.

A visual impairment is a deviation from the emmetropia of the eye, so it is important to define the concepts of emmetropia and ametropia. **Emmetropia** consists in the fact that light rays parallel to the axis, running from distant objects, are focused on the retina in the non-accommodating eye. The power of the measuring eye optical system corresponds to the axial length of the eyeball (Styszyński, 2011, p. 23). In **ametropia**, light rays are not focused on the retina. The imbalance between the length of the eyeball and the breaking force of the eye (corneas and lenses) is responsible for this condition. Ametropia is otherwise a visual defect, which can take the form of myopia, hyperopia, presbyopia, astigmatism, differentiality, and lobularity (Oleszczyńska-Prost, 2019, pp. 21–22).

In **hyperopia**, most often the focus of light rays behind the retina is caused by too short an axis of the eyeball or too small a curvature breaking the cornea (flat cornea). The lens of the eye has the ability to change its thickness, thanks to which we can see clearly to the distance and up close. This phenomenon is called accommodation.[1] Hyperopia often changes with the age of the child;

[1] Accommodation is an involuntary activity consisting in contraction of the circular bundles of the ciliary muscle, thanks to which the tension of the Zinna ciliary circuit fibres, on which the lens is suspended, is reduced. The elasticity of the lens makes it more convex (looking closer) and then flatter again (looking away). Accommodation is the ability to adapt the measuring

it usually decreases with age, but it also happens that its value increases. The defect is compensated for with glasses, soft contact lenses, silicone and hydrogel lenses, or hard, gas permeable lenses. The latter is the method of choice for the smallest children. In high visual impairment, over +7 dioptres,[2] contact lenses should be worn instead of glasses (Oleszczyńska-Prost, 2019, p. 26).

The emmetropic eye uses only as much accommodation tension as the fixation distance requires. Accommodation to the distance is completely relaxed, while accommodation to close vision is 2.50 dioptres. In the case of uncorrected hyperopia, for example, +2.00 dioptres, the person uses twice as much accommodation while reading and also accommodates while looking away. When working in close vision, apart from additional accommodation, large visual overloads automatically occur, which can cause eye and headaches. Increased accommodation effort is also seen in uncorrected hyperopia (Rosa, 2017, p. 121). The issues of visual acuity, refractive and accommodative impairments in the learning process are the subject of research investigations. People with hyperopia have been shown to have much more difficulty in visual perception than those with emmetropia or astigmatism (Rosner & Gruber, 1985). There is a strong correlation between uncorrected hyperopia and reading difficulties. In Rosner and Gruber (1985), 782 children from grades 1–5 with refraction measurements were observed. The obtained results were correlated with school performance. It was observed that a significant proportion of children with shortsightedness scored well in the test measuring school competence. The proportions were different in the group of children with hyperopia, where almost half of the respondents obtained low results (Rosner & Rosner, 1997). These studies allowed investigators to conclude that every child with hyperopia above +1.25 dioptres, regardless of the occurrence of symptoms characteristic for visual overload, should have their vision corrected (Rosa, 2017, p. 123). Screening of school-age children showed that 66% of those with hyperopia had a stereoscopic disorder (Pieczyrak, Kędzia Tondel & Maples 1999), which is associated with the impairment of binocular vision.

Agnieszka Rosa (2017, p. 121) points out that children with uncorrected hyperopia, even of a small degree, need to use the accommodation system to

eye to acute close up vision. Small children have the ability to accommodate up to several dioptres. The range of accommodation decreases with age (Oleszczyńska-Prost, 2019, p. 26).

[2] Dioptre, D, dptr – a unit of breaking force (gathering capacity) of an optical system, including the eye, corresponding to the focal length of this system of 1 m.

overcome refractive irregularities to see clearly. The visual system, adapting to such situations, can choose among the following compensation mechanisms: first, it can allow for the blurring of an image; second, it can reduce muscle tension, namely, it allows the eye to be tilted (esophoria), which results in a doubling and a significant weakening of the mechanisms of binocular vision; the third possibility is to maintain single vision, but with considerable accommodation tension (Grosvenor, 2007; Oleszczyńska-Prost, 2011). Therefore, any compensation mechanism will have negative effects and will make it significantly more difficult for the child to work, especially in close vision activities, and will also affect the speed of reaction of the accommodation mechanism, that is, the rapid transfer of gaze from close range to further. This, on the other hand, will make it significantly more difficult for children to copy text from the blackboard and to assess distance quickly, and may also disrupt their visual-motor coordination (Rosa, 2017, p. 121).

Astigmatism "is most often caused by the aspherical shape of the central corneal area. In general, we deal with regular astigmatism, in which two main meridians (main sections) located perpendicularly to each other can be distinguished. In these sections, the cornea has the shortest and longest radius of curvature respectively. Due to the location of the main sections, one can distinguish: simple astigmatism; nearsighted ordinary astigmatism; mixed astigmatism; ophthalmic ordinary astigmatism when one of the focuses lies on the retina and the other behind the retina (in one section the eye is emmetropic and in the other ophthalmic); and compound ophthalmic astigmatism when both focuses lie outside the retina (in both main sections the eye is ophthalmic)" (Styszyński, 2011, pp. 23–24). In astigmatism, both close vision and far vision are blurred. Unadjusted astigmatism may not only lead to the deterioration of vision quality due to the decrease in acuity of both close and far vision, but may also be accompanied by eye fatigue from close vision activities, recurrent conjunctivitis and eyelid edge inflammation, and even strabismus (Turno-Kręcicka, Barć & Kański, 2002). The correction of astigmatism in children starting school is crucial because:

- Astigmatism in children entering school is one of the most important, although rarely detected and corrected, disorders of the visual system;
- Uncorrected astigmatism can be a key factor in reducing visual acuity, which can have a negative impact on a child's development and learning progress;

– In six-year-old children, in addition to the examination of visual acuity, an objective assessment of refractive defects should also be conducted (Perz, Buczkowska, Miśkowiak & Michalski, 2011, p. 29).

Differential vision (anisometropia) is a condition in which there is a big difference between the refraction of both eyes. The size of the image created in one eye is different than in the other, which is called aniseikonia. If the difference in refraction exceeds 3–4 dioptres, the aniseikonia is so large that it makes it impossible to create one image of the object seen in both eyes. The eye with a greater visual impairment is excluded from the vision, which leads to amblyopia. Thus, the physiological cortical process of image fusion which is the basis of three-dimensional vision, that is, stereoscopy, is disturbed. In such cases it is necessary to correct the visual impairment with contact lenses. Due to too great a difference in refraction, the use of ophthalmic lenses is not possible, as their optics do not eliminate aniseikonia and thus exclude binocular vision (Oleszczyńska-Prost, 2019, pp. 27–28).

Amblyopia is recognised when a decrease in visual acuity becomes apparent. It is

> unilateral or, less frequently, bilateral reduction in visual acuity (after the best correction of a visual impairment), which cannot be considered as a direct consequence of any abnormalities in the structure of the eyeball or visual pathways. Amblyopia is caused by abnormal visual stimulation in early life for reasons such as: strabismus; polyvision or high bilateral refractive failure (isometropia); loss of visual stimulation (visual deprivation). [...] Amblyopia associated with polyplopia develops when refractive errors, different in both eyes, cause the images produced on the retina to be chronically blurred. It is believed that the development of vision impairment is partly due to the influence of abnormal images on the development of visual acuity in the eye with a refractive error and partly due to competition and inhibition similar (but not necessarily the same) to that responsible for strabismus-related vision impairment. A relatively small degree of hyperopia or astigmatic differential vision (1–2 dptr) may cause slight visual amblyopia. [...] Often it is only in schoolchildren that vision is detected and treated, and then the prognosis about the return of vision is uncertain (Grałek, 2003, pp. 69–70).

At school age, undertaking learning and reading, which takes place with the participation of sight functions (periarticular functions, visual information reception functions, perceptual functions), will require the use of various forms

of support and adaptation to developmental needs in this area. "At all stages of education, it becomes necessary to provide visually impaired students with appropriate learning conditions to reduce or minimise the negative impact of the consequences of their disability" (Czerwińska, 2016, p. 25).

Difficulties in reading and writing require specific adaptations by using magnifying aids (optical, electronic) or increasing the font size if necessary. The reading and writing process should be preceded by preparation to facilitate the child's schooling. Annie Corn and Alan Koenig (2002) identified areas of support for the development of reading literacy through individual actions to be taken with the child with visual impairment:

- preparing the child for reading skills in earlier developmental periods by watching and interpreting the content of information in children's books together with parents, labelling various objects at home, other similar educational games;
- supporting the development of visual skills in the child's daily life, for example, by finding various visual stimuli close up and further away, interpreting the content of illustrations, searching through multi-element illustrations for specific details (developing fixation skills on small objects and the ability to make saccadic movements);
- assisting in the development of magnifying optical aids (magnifying glasses) as early as preschool age, initially by finding details in the illustration which the child cannot see without the magnifying aid, reading single letters, then short words with a magnifying glass;
- supporting the development of the ability to use optical aids for further distances (spyglass), with which the student can read street names and bus numbers;
- supporting reading literacy in accordance with the methodology of teaching the skill;
- stimulating the motivation to read by encouraging reading in everyday situations outside the classroom, for example, while playing; arranging the physical environment so that it is reading-friendly;
- supporting the development of fluency in reading (at successive stages of education) using optical and/or electronic aids (if necessary), developing the ability to obtain information from various sources such as the Internet) (after: Walkiewicz-Krutak, 2017, pp. 137–138).

The most important skill associated with close vision activities – such as writing, painting, and drawing – is visual-motor coordination. In terms of visual

functions, when controlling writing with eyes, it is necessary to make many successive fixations in the place where individual letters are placed and words are written (Walkiewicz-Krutak, 2017, p. 143). In order to write effectively, it is not necessary to follow the movements of the tip of the writing tool during the formation of individual letters (Holbrook, Koenig & Rex, 2010). In the functional evaluation of vision in the field of writing of the visually impaired student, answers to the following questions should be sought:

- Does the learner require the development of initial skills, such as eye and movement coordination or holding a writing tool?
- Does the learner require adaptations due to impaired visual abilities (bold lines, dark markers, writing window, appropriate lighting to increase contrast and minimize glare)?
- What is the size of the letters written by the student?
- Is the student able to read the text they have written?
- What size letters written by themselves does the student read without much difficulty?
- At what distance from the eyes can there be a piece of paper on which the student writes?
- Does this distance force an uncomfortable body position while writing?
- How far away from the student's eyes must the text written by them be for the student to read it?
- What is the writing speed of the visually impaired student?
- Should/Does the student use optical and/or electronic aids to write and/or read the text? (Walkowicz-Krutak, 2017, pp. 143–144).

When designing a therapeutic programme for working with the visually impaired child, it is important to assume interactive education, namely, a way of organising and conducting the teaching/learning process that maximises the learner's involvement and activity, allows for the possibility to choose methods tailored to the learner's abilities, and boosts their internal motivation. Interactive learning is dialogue and interaction with the teacher which eliminates student inactivity; it becomes a ritual during meetings where a sense of security is guaranteed. Positive experiences lead to the full development of the student in the cognitive, emotional and social areas. Individualisation fosters the arousal of cognitive curiosity, broadening of interests, and active search for information related to the didactic content, while at the same time strengthening the sense of responsibility and causality. Not all schools have suitable conditions that would enable visually impaired pupils to achieve

educational success; their inclusion in the public educational system alone is not a guarantee of meeting their special educational needs. Inclusion has an unquestionable value: it gives children with visual impairments a chance to establish social bonds and a sense of acceptance. As Stanisław Jakubowski (2005, pp. 19–20) points out, "the school, acting in an isolated environment, does not prepare its graduates for life among fully sighted people. [...] In a special school the entire environment has adapted to visually impaired pupils, while in normal educational conditions the pupils themselves have to adapt to their environment and develop not only the ways of dealing with unknown realities, but also the ability to establish cooperation with their colleagues." This ability turns out to be very important, even essential, in adult life. As Zenon Gajdzica (2013) points out, in order to ensure integration and stability of the school system, corrective mechanisms – compensatory, rehabilitation – are implemented, which often dominate over the main aspects of functioning in school roles, that is, education, upbringing, and socialisation. "Visually impaired pupils belong to the group of disabled children who have all the predispositions for effective education in the public school" (Pańczyk, 1999, pp. 79–80). The implementation of the curriculum, which is carried out with the use of expository, problem-based, and activating methods, is supported by means of various media. The functions of media (Grochowalska, 2005; Nowakowska-Buryła, 2005) include cognitive-educational function (enriching knowledge about the world, developing perceptual and intellectual processes), emotional-motivational function (learning by experience, arousing cognitive curiosity, developing interests), telecommunication function, and action-interactive function (shaping manual skills, developing the ability to convey and receive messages). Kornelia Czerwińska (2007, p. 324) emphasises that the difficulties resulting from visual dysfunction in the natural reception of information about objects, persons and phenomena through direct observation and difficulties in using teaching materials developed in the standard way, can be solved thanks to appropriately prepared media. Moreover, as the author points out, the development of modern information technologies creates an opportunity to increase access to information for legally blind people, which is an essential condition for their effective social and professional rehabilitation and normalisation.

An important element combining supporting and therapeutic activities, influencing the effect of cooperation, is therapy focused on solutions and on the strengths of the student. Solution-focused therapy consists of conversations

and interactions during which one searches for the student's strengths, focuses on overcoming difficulties (educational and developmental), and looks for possible and real solutions to named problems; thus, it is oriented towards the future and action. It does not analyse the causes or essence of a given difficulty/problem; it does not refer to past experiences (temporal past). The focus is on the child – their resources and talents – not on problems and difficulties.

Support, therapy and rehabilitation for a child with amblyopia, hyperopia, astigmatism and polyvision. A case study

The aim of the research was to indicate therapeutic actions that optimise the visual functioning of a child at early school age with amblyopia, hyperopia, astigmatism and differential vision, and condition the quality of their learning. The following research problems were formulated:

1. How does a child at a younger school age with amblyopia, hyperopia, astigmatism and differential vision function in the school environment?
2. What is the effectiveness of support measures – therapeutic and rehabilitation – in working with the child with amblyopia, hyperopia, astigmatism and differential vision in order to improve their visual functioning and thus learning efficiency?

Child characteristics. Michał, 7 years old – a student of the first grade of a public primary school. The boy was diagnosed with left eye blindness, hyperopia of both eyes, astigmatism of the left eye, and differential vision. The boy is under constant ophthalmic control. From the interview, information about the scope of the visual impairment was obtained. Full refraction defect: OP +2.0 dioptre; OL +7.5/-1.5, axis 75 degrees, PD (pupil distance 55 mm). Eye correction used: OP +1.5; OL +7.0/-1.5, 75 degree axis, PD 55 mm.

The results of psychological research contained in the boy's documents indicate an average level of intellectual development, with a statistically significant predominance of verbal and conceptual functions over perceptual and motor functions. The above-mentioned difference between the scales is influenced by his inborn visual impairment – the boy achieved weaker results in functions requiring analysis and visual synthesis, perceptiveness and spatial imagination. The boy also achieved a lower result in tasks based on the identification of cause and effect relationships on the basis of picture material containing social context. The rate of learning new graphic skills under visual control is above average for his age. Lower performance has also been observed as regards

arithmetical thinking and operations on numbers based on aurally processed data. The student has difficulties in responding to distractions.

The boy was in constant contact with the researcher during the testing. He asks questions and seeks confirmation as to the correctness of his answers to the tasks. He is not disturbed by the presence of an adult while performing tasks that require great commitment and concentration. The student analyses the instructions, shows independence, and has an adequate level of knowledge of both Polish language and mathematics. However, the boy does not believe in his skills and abilities – he requires supporting messages, raising his self-esteem. There are spelling mistakes (fundamental) in his writing. Graphical notation: unshaped, retaining legibility. Reading technique mastered at a medium level with fluency and good pace. The boy does not remember all details but understands the content and is able to give correct answers to the questions asked. Further development is required of his stylistic and linguistic proficiency. The student tends to use single sentences when making oral statements on a particular topic. The boy's strengths include the area of verbal reasoning – above-average general knowledge of the world, good ability to categorise concepts and abstract features, as well as the ability to correctly interpret the rules and conventions that organize social life. A lexical resource adequate to age.

The student has been included in the public classroom education and receives individual revalidation classes on the premises.

In accordance with the recommendations found in documentation (special education needs assessment, observation sheet, interview with the boy's mother):

- the educational requirements of the curriculum have been adapted to the individual abilities and psychophysical and educational needs of the student;
- he has been given the right place in the classroom – in the first row, in the middle place, with a left-handed natural light source (right-handed child)[3];

[3] The role of light as a tool to make it easier for visually impaired people to see is significant given that there are several conditions for seeing (Grzonkowski & Dybczyński, 1992, pp. 82–83):
- Sufficiently intense illumination of objects or background (sufficient illumination): that the light coming from them on the retina produces at least threshold responses from photoreceptors;

– the fatigue of vision has been taken into account, as was the possibility of getting acquainted with new visual material prior to lessons (additional time to take a look, sending the didactic materials – additional work cards – to the parents' e-mail address);
– the working time on the lesson material has been extended; the amount of homework and the amount of text to be written down during the lesson has been reduced;
– slower work pace has been taken into account, especially when writing or copying text;
– information has been given in a multimodal way, the visual aspect has been supported by verbal translation;
– crafts and technical work, as well as skills in geometry, geography, etc. have been assessed taking into account the student' problems;
– the grades for the graphic side of handwriting or the aesthetic side of the notebooks and written works were not lowered because the handwriting was legible;
– stylistic and linguistic skills have been developed;
– auditory concentration has been supported by calling the pupil by name and directing his activities on the right track;
– the student has been allowed to use educational materials (texts, illustrations) on a multimedia board;
– whenever there was such a need, the pupil has been tested orally;
– emotional support and motivation were given to the child, as well as the strengthening of his sense of value and the development of coping skills in difficult situations;

– Sufficient variation of the objects to be illuminated in terms of their reflective properties (reflection coefficient) and/or selective illumination of objects or backgrounds: ensuring sufficient contrast between the object – background – achromatic (varying grays) or chromatic (varying colours);
– correct structure and operation of the retina (presence of "normal" light-sensitive photoreceptors in the yellow spot area);
– the correct optical system of the eye which guarantees the correct geometrical course of the rays forming sharp images of the viewed objects on the retina in accordance with the laws (damage to elements of the optical system of the eye, e.g. the lens, as a result of an accident or a disease makes it impossible to reproduce images on the retina correctly and to see sharply even when the retina operates normally).

The more the condition of the eye is different from the ideal one, the more attention should be paid to creating optimal lighting conditions, and this applies to all visually impaired people, both children and adults.

– individual tutoring lessons aimed at improving the visual analyser were conducted.

The main objectives of the tutoring lessons:

– developing mechanisms to compensate for visual deficits;
– strengthening self-esteem and self-confidence and boosting motivation to overcome difficulties.

Supporting the development of the child's visual functions. In accordance with the principles of difficulty grading (from the simplest to the most difficult), individualisation, the concreteness and visualness of teaching, and in accordance with the priority of the revalidation of the organisation of the educational process and adapting the requirements to the individual abilities of pupils, the following rehabilitation,[4] support and therapeutic measures have been taken with regard to the boy:

1. **Vision rehabilitation** included exercises aimed at: stimulation of looking and seeing; development of basic visual skills related to controlling eye movements (locating the stimulus, fixation, tracking, convergence, transferring the gaze, leading, searching); shaping and improving the perception of three-dimensional objects, two-dimensional forms (illustrations); developing concepts (identifying and naming objects); improving visual memory; achieving greater visual efficiency (among other things, identifying objects in pictures, selecting objects and pictures according to specific features, finding details in simple and complex pictures, visual complementation – distinguishing and identifying relationships taking place in pictures, abstract signs and figures). The following exercises were used:
   – stimulation by light sources in a darkened room; the aim of the exercises was to strengthen the location and fixation of vision on the light stimulus, to transfer the gaze to light stimuli, to provoke the eye to follow the moving light stimulus. Following visual objects in different directions using light sources and flickering stimuli in different directions of the field of vision and distances;

[4] Vision rehabilitation includes: stimulating vision; developing basic visual skills related to controlling eyeball movements; shaping concepts and visual memory; achieving higher visual skills. These activities are undertaken in relation to people who were born with limited visual performance or whose impairment occurred before the age of six (Adamowicz-Hummel & Mendruń, 1991).

- fixation and location of vision on visual objects appearing at different distances and areas of the field of vision using illuminated, highly contrasting, flickering objects: Marsden balls (red-green) were used as a recognised tool in visual therapy, strengthening and integrating visual, tactile and kinaesthetic stimuli. This tool is also used in suppression training;
- a light box containing transparent, colourful objects which are placed on a transparent plate and illuminated from below. The box provides insights on two levels.[5] The use of the box focuses the child's attention by tying up activity and vision as well as using variable contrasts and shapes.

2. **Vision therapy VT** (cf. Czaińska & Dubas, 2015, pp. 43–56) is an individual programme of visual exercises aimed at improving, rehabilitating and developing the process of vision, in which the sequence of performed exercises is important (cf. Grzech, Budzik & Herman, 2009, pp. 4–13):
   - general motor and coordination exercises (standing or moving balance exercises along a pattern, line, on a balance beam. To coordinate the eye and hand movement, toys (balls and bags) were used to aim;
   - accommodation exercises were performed using a flipper with four lenses of different powers. For the exercises, the text of the book with a larger font was used. Exercises of the near-accommodation point were carried out simultaneously with the use of different types of fixation sticks;
   - eye movement exercises consisting in stimulating tracking, saccadic and regenerative movements with the use of glowing blocks, lasers, torches, Marsden ball and standard Wolff wands;
   - fixation training: exercises to stabilise correct fixation and eye-hand coordination. These kinds of exercises were performed simultaneously with the use of straws, sticks, pencils, aiming sheets with pictures, as well as letters or numbers;

[5] Level I: seeing a light source; determining the direction of light; observing a light source; observing and locating objects; observing objects; visual-motor coordination; finding objects; simple differentiation by form, colour, size; assigning and segregating objects; comparing objects; assigning objects. Level II: visual-motor coordination; comparison and segregation; spatial orientation; visual cognition and recognition; visual memory; series and pattern recognition; part to whole ratio (Walthes, 2007, p. 117).

- amblyopia training: appropriately constructed paper tests were used such as Ann Arbor Tracking, *e*, *a*, *o*, circle drawing test, line splitting test. Apps for smartphones, laptops and tablets were used – the Look to see app for visually impaired children and LuLu app;
- Anti-suppression training (attenuation): made using red-green filters (e.g. anti-suppression masks) and anaglyphic games (dominoes, memos, playing cards), lasers and tranaglyphs with the use of red-green glasses, which allow exercises at different observation distances. Exercises were performed using polarized filters (e.g. vectograms) which made it possible to control attenuation in conditions quite close to natural.

3. **Use of programmes:**
   - the Fostig and Horne programme, which includes graphic exercises aimed at developing visual perception, eye-motor coordination, differentiation or recognition of objects in images in their entirety or exposed parts;
   - Let's See (American Printing House, APH)[6] using two suitcases filled with fluorescent materials (blankets, scarves, toys, blocks) and two binders with detailed instructions and exercises to shape visual perception. The programme consists of two parts: the first, sensory part, used to learn simple visual patterns and movements and fixation, and the perception part (exercises take place in a darkened room);
   - BAR (Beyond Arm's Reach) programme by Audrey J. Smith and Lizabeth M. O'Donnell designed to exercise visual performance without optical aids for children from 6 to 12 years old. Supportive for visual perception indoors (distant vision) with different choices and types of play.
4. **Supporting literacy.** The following methods were used:
   - 18 verbal structures;
   - elements of exercises from the publications by Teresa Gąsowska and Zofia Pietrzak-Stępkowska *Praca wyrównawcza z dziećmi mającymi trudności w czytaniu i pisaniu* [*Compensatory Work with Children with Reading and Writing Difficulties*] (1994);

[6] The APH program assumes that the instructor will modify the commands. It is necessary to use UV glasses for the child and the instructor. The division into two parts assumes a hierarchical development of the visual system (Walthes, 2007, p. 118).

- a series of *Ortograffiti z Bratkiem* [*Orthograffiti with Bratek*] by Izabela Mańkowska and Małgorzata Rożyńska;
- "Reading in instalments" (or reading with an adult in turns) by Marta Bogdanowicz;
- a simultaneous and consistent method of learning to read by Jagoda Cieszyńska from the series of booklets *Kocham czytać* [*I Love Reading*].

Reading support exercises for children with astigmatism:

- recognition of printed letters in isolation;
- recognition of the letters printed in the text and their missing elements;
- analysis and visual synthesis of words;
- arranging words from syllables; arranging sentences from syllables;
- reading a simple text with a newly learnt letter;
- reading a sentence with understanding and matching it to an illustration;
- reading with punctuation marks;
- distinguishing affirmative statements, imperative statements and questions.

Suggestions of writing support exercises for children with astigmatism:

- graphic representation of linear shapes (additional patterns);
- matching upper and lower case letters;
- matching printed and written letters;
- distinguishing letters in words, highlighting them, discussing their characteristic appearance;
- marking elements connecting letters in words;
- making charts, albums illustrating the letter;
- paying attention to the letter elements;
- completing words with missing letters and syllables;
- writing letters by tracing lines; writing words by tracing lines;
- connecting letters in a word;
- transcribing words and sentences;
- paying attention to word endings.

Suggestions for reading support exercises for children with hyperopia:

- "exchange of letters" exercises;
- adding letters so that new words are created;
- repetition of syllables, putting together new words;

- paying attention to affirmative statements, questions and exclamations;
- distinguishing letters in words, highlighting them;
- filling in missing letters in words;
- completing missing syllables in words;
- jumbled words and syllables.

Suggestions for writing support exercises for children with hyperopia:

- performing graphic exercises;
- searching for a given letter;
- matching lowercase and uppercase letters;
- searching for letters in words drawn on flashcards;
- marking elements connecting letters in words;
- analysing different ways of combining lower case with lower case letters, and upper case with lower case letters;
- conversion of letters, for example, *l* into ł, *t*;
- graphomotor exercises taking into account the following letters: mid-linear (*u*, *m*, *n*), sub-linear (*j*, *g*, *y*), superlinear (*k*, *l*), contained in three lines (*f*) – taking into account the place of adding elements of letters – and letters with diacritical marks (ż, ś, ą) (Twaróg-Kanus, 2020, p. 103).

5. **Support for technology and communication.** A multimedia whiteboard and educational programmes supporting the learning of reading and writing were used during the classes. Applications for visually impaired children – Look to see and LuLu – were also used to support the development of visual functions. From the interview with the mother, it can be concluded that the child had used educational programmes at home and performed visual exercises three times a week working with VR goggles.[7] The individual programme of improving visual functions was aimed at improvement of basic visual functions, development of higher visual functions, and eye-motor coordination exercise. Thanks to the variety of exercises, it proved attractive for the student, as evidenced by his positive feedback during the meetings. Information and communication technologies (ICT) represent an improvement in teaching and

[7] Thanks to virtual reality, the child performs specific visual exercises and can play. The scenarios proposed are varied: they present the world from the perspective of a submarine or the Arctic landscape. The child, exercising at home, is in contact with the specialist through an online panel; the specialist checks the patient's progress and remotely plans and supervises the therapy.

learning quality. Modern technologies (tools and materials) are more effective when used depending on a specific activity (Polish, mathematical, linguistic, and artistic) (Twaróg-Kanus, 2018, p. 68).

Conclusions

Abnormalities in the functioning of the organ of sight are one of the most common causes of problems in learning to read and write in younger children and result in the lack of fluency in reading in older children. Properly carried out early rehabilitation allows for the equalling of children's school start, their better intellectual development and better social position. Moreover, the teacher influences the pupil with their personality, hence their knowledge, skills and attitudes in the field of diagnosis and therapy constitute the essence of educational and didactic activities undertaken by the teacher in the school space (Twaróg-Kanus, 2019, p. 102).

The proposed conditions and forms of support enabled the student to acquire knowledge and skills, and to overcome the limitations resulting from visual impairment. By taking into account individual needs, the student participated effectively in the educational process, overcoming difficulties related to visual impairment, and continued improving his social and emotional development.

The following conclusions can be drawn from the studies:

1. The factors that reduced the functioning of the pupil with amblyopia, hyperopia, astigmatism and differential vision were: aversion to close vision activities, irritability, slowing down of visual work, frequent rubbing of the eyes and the crooking of the head while looking; reduced focus time; difficulties in reading (confusing words with a similar structure, moving letters, incorrect reading technique, lack of understanding of the text as a whole, slow reading speed) and writing (confusing letters with similar shapes, moving letters, lowering letters, spelling mistakes, bad layout of the text on a piece of paper); significant difficulties in analysis and visual synthesis; disturbances in perceptiveness and spatial imagination; problems with interpretation of the content seen in multi-element images and situational context; reduced self-esteem and unwillingness to engage in social interaction with peers, especially during team games and plays.
2. The undertaken supporting, therapeutic and rehabilitation actions have contributed to the improvement of visual functioning of the child with amblyopia, hyperopia, astigmatism and differential vision and have

significantly influenced the quality of his learning. The high effectiveness of the undertaken actions contributed to a significant improvement in the visual functioning of the boy, at the same time, conditioning the improvement of learning efficiency and success in the educational and social space. Functional vision, binocular vision, concentration of sight on activity and manual activities under visual control have been significantly improved. Better effects were obtained in the area of visual and motor memory. The technique and speed of reading has improved, the number of mistakes made during writing has decreased. Self-esteem and internal motivation (the feeling of satisfaction with properly performed tasks, which favour undertaking further, even more difficult activities) of the boy increased significantly.

The presented conclusions prove that activities based on a personalised selection of supporting, therapeutic and rehabilitation activities significantly improve[8] visual abilities of a child with visual impairment, according to the principle that "the eye likes movement and action."

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[8] A study published by Natalie Barraga in 1964 showed for the first time that vision in visually impaired children can be improved with a well-planned exercise programme.

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