Motor competence in visually impaired persons

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Content

Preface

One of the many reasons for making this text available is the fact that there are only few literary sources addressing the issue of physical activity in visually impaired persons. This applies both to children and adults. Another reason is the fact that a number of visually impaired children are integrated in common schools. Visually impaired pupils cope well with most school subjects in cooperation with special education centres. An exception is physical education. So far, there is an insufficient number of quality teachers of adapted physical education, and traditional PE teachers are not sure if they are able to deal with this issue. Therefore, upon agreement with parents and physicians they choose to exempt a visually impaired child from mandatory PE lessons for 'health reasons'. Currently, this is usual practice evidenced by our long-lasting experience gained in seminars on integrating visually impaired children in PE lessons held for PE teachers and employees of special education centres. We all feel that this is not a step in the right direction. Form a professional perspective, this situation is absolutely unacceptable. An insufficient level of motor competence in visually impaired children can be a seriously limiting factor in everyday life as well as future professions although the child's intellectual abilities can be above-average. Let alone the negative influence of hypo kinesis on human health. A similar situation is observed in the area of physical activity and particularly physically-oriented activities in visually impaired persons.

Our findings are equally intended for parents, teachers, educators, trainers, coaches and other staff working with visually impaired individuals of all ages.

An important target group of this text are the students of adapted physical education, applied physical activity and other fields involving physical education. These persons should particularly focus on the theoretical sections of this book that should provide an appropriate insight into their future professions.

The authors

1/

Terminology

Zbyněk Janečka, Ladislav Bláha

Professional terminology underpins the clarity of any scientific text. Let us provide the perspectives of some of our authors, who are listed below in an alphabetical order.

Bláha and Pyšný: "We believe that the ***visually handicapped population*** does not have optimum conditions for maintaining let alone cultivation of health-oriented fitness, on the contrary, they are largely affected by hypokinesis as a consequence of their impairment" (Bláha & Pyšný, 2000, 8). Both authors also use the term ***visually impaired*** (Bláha & Pyšný, 2000). None of the terms is specified in more detail.

Čálek: "The importance of the mother's reaction for the development of a ***blind child*** will be…" (Čálek, 1984, 15). The same author also uses the terms ***congenitally blind child*** (Čálek, 1984), and ***severely visually impaired person,*** or ***person with severe or complete loss of sight*** (Čálek, 1986). None of the terms is specified in more detail by the author.

The defectological dictionary defined the term typhlopaedia as follows: "…scientific discipline dealing with special education of ***visually impaired persons"*** (Defectological dictionary, 2000, 367).

Flenerová (1985,11): "***Visually impaired persons*** represent a category of persons requiring special care (i.e. specific care – author's note) and are, from a special education perspective, children, young people and adults, whose defect lies in a disorder of the visual analyser that causes impaired visual perception as a consequence of a visual malfunction".

The author classifies the stages of visual impairment as follows:

Persons:

- Visually impaired
- with remaining vision,
- blind,
- amblyopic and squint-eyed.

These terms and then defined. As an example, the author's definition of visually handicapped – blind persons is provided below: "***Blind persons*** represent a category of ***visually impaired*** persons and include children, young people and adults, whose visual defect is a malfunction or disorder of the visual organ in an extent that causes deterioration of visual perception equal to blindness" (Flenerová,1985,14).

Jesenský: "…education of the ***visually handicapped***…" (Jesenský, 2002, 9). „…***the visually impaired*** are mostly limited by…" (Jesenský, 2002, 12). "…almost 2/3 of interviewees believe that ***severely visually impaired persons*** despite their ***handicap*** are motivated…" (Jesenský, 2002, 13).

Jesenský is one of the few authors who defines special education terminology without inclining to the more frequently used opthalmological specification.

Jesenský thus considers ***visual impairment*** "…more than a mere damage (pathology, defect) to the anatomic structures and a disorder of the visual analyser function. This is a condition in which such damage or disorder negatively affects all dimensions defining the quality of life of a human…" (Jesenský, 2002, 25).

As far as the frequency and use of special education terms are concerned, Jesenský adds: "The negative nature of the mentioned deviations represents a ***disadvantage – handicap*** compared with non-disabled individuals. This constitutes a reason for the second most widely used term: ***visually handicapped*** (VH) in addition to ***visually impaired (VI)***" (Jesenský, 2002, 25).

As far as the classification of visually handicapped persons is concerned, Jesenský adds that "the indicators and criteria of the opthalmological type also lie in the classification of VH groups and related terminology" (Jesenský, 2002, 27). "This is a brief definition of the generally acknowledged symptoms of visual or sight damage. In principle, the classification covers the following main groups:

- blind,
- with remaining vision (remnants of sight, virtually blind)
- visually impaired (severe, medium, light)
- binocular disorder (amblyopic, squint-eyed, single-eyed)" (Jesenský, 2002, 27).

Jesenský further adds: "…considering the future emancipation and identification of typhlopaedia, a greater emphasis might be placed on criteria that will highlight ***visual handicap*** and other related indicators instead of damaged vision. In this context, the term ***person with specific needs*** is used more frequently today" (Jesenský, 2002, 29).

Květoňová-Švecová: "The following paragraph deals with sensory deprivation that mostly affects ***visually impaired children***" (Květoňová-Švecová, 2000, 41). In order to specify the degree of visual defect, the author uses an opthalmological perspective based on visual acuity, impairment of the visual field, oculomotor issues, colour perception disorders and difficulties with visual information processing.

Ludíková: "Typhlopaedia is a pedagogical discipline that does not focus on general education but special education of the ***visually defective***" (Ludíková, 1988, 7). "To understand the current objectives and tasks of schools designed for ***children with visual defects*** it is necessary to…" (Ludíková, 1988, 25). "In this context, the socialization of the ***visually impaired*** is a process during which ***severely visually impaired individuals*** gradually grow into…" (Ludíková, 1989, 11). From a typhlopaedic perspective (Ludíková, 2005, 192) "…***an individual with visual impairment*** is considered any person that has continuing problems with visual perception and visual information processing in usual life even after an optimum correction of their visual disorder."

For a more precise differentiation of visually impaired persons the author uses a categorization system based on opthalmological perspectives: blind persons, persons with remaining vision, blind persons, persons with binocular vision disorders.

Štréblová: "During the course of life, ***a visually impaired child*** is in contact with the surrounding environment…" (Štréblová, 2002, 41). This term is adapted according to Flenerová (1985).

Vágnerová: "The attitudes to ***visually handicapped persons*** is clearly affected by generalization…" (Vágnerová, 1995, 7). "***Visual impairment*** is not only a matter of an individual but becomes a ***social handicap***" (Vágnerová, 1995, 7). "The reactions of ***severely visually impaired children*** tend to vary…" (Vágnerová 1995, 54). As far as the term ***visual impairment*** is concerned, the author adds: "…this is a general term identifying a group of diverse diseases and disorders, whose only common feature is that they limit the ability of visual perception. However, their variety is much larger, each defect has specific features that can diversely influence the development of impaired children and their lives" (Vágnerová, 1995, 12). Therefore, the author emphasises working with individual diagnoses of individual children.

To determine the severity of the defect the author again uses opthalmological terminology with a visual acuity criterion. "Visual acuity is the accuracy of visual differentiation and is measured in terms of an ability of close as well as distance vision…. Orientation in an environment and ease of obtaining information of this type depends on the extent of visual perception, i.e. on the functional visual field" (Vágnerová, 1995, 11, 12).

Vašek: "In compliance with the current classification of special education in various cultural environments we tend to adhere to the following classification: "education of physically impaired and health affected individuals, education of ***visually impaired individuals*** …" (Vašek, 1994, 216).

Let us conclude the terminology overview with several thoughts as published by Požár.

"Terminological discrepancies relating to individuals with various types of impairment have existed for a long time. We all remember the previously used pejorative term ***defective***. In our country this term was replaced by ***individual requiring special care***, which is an apt term but quite lengthy. Moreover, there is an issue related to identifying different types of impairment. In this context, how do we call a person that has problems seeing or hearing? As an ***individual requiring special visual care*****?** This is surely disputable. Therefore, the term ***impaired*** started to be used although it has a certain negative emotional connotation. Apart from that, an individual can be impaired in various ways (e.g. politically, or victim of a robbery, etc.) However, this no longer caused problems with identifying various groups – ***visually impaired***, physically impaired"… (Požár, 2002, 67, translated). Požár continues with an analysis of most frequently used terms. We adopted the American term ***"handicapped",*** which was mostly left untranslated (sometimes translated as ***"disadvantaged"***); the term is sporadically used even today… In the Czech Republic the term ***"health impaired"*** is frequently used. This provides some advantages as the term clearly denotes what caused the impairment, although it depends on what we understand by "health". Is a mentally impaired individual or an individual with a communication disorder ill? (Požár, 2002, 68, translated). As far as the use of other terms is concerned, Požár adds: "In a number of cases some apt or generally acknowledged and clear terms were abandoned because in the course of time they gained a pejorative connotation. For example instead of deaf we started to use 'not hearing' (although the term deafness as well as deaf-blind remained), instead of blind we started to use 'not seeing' (although the term blindness and some others remained), instead of invalid – health impaired." (Požár, 2002, 69, translated). Which term does Požár prefer? Wherever allowed by the context, he recommends the term pupil, child or individual with a certain type of impairment. "For example a pupil **with *visual impairment,*** not a ***visually impaired*** pupil" (Požár, 2002, 69). He further recommends that authors use a single consistent term. Various terms lead to disunity and ambiguousness.

In this context, Květoňová-Švecová add that: "the development of terminology is, or should be, in compliance with the changes in the field of special education. Currently the classification to various "paedias" is gradually being abandoned because the subject of or one of the paradigms of special education is not the impairment (handicap) but the child, pupil, client with a certain issue that occurs during their education" (Květoňová-Švecová, 2000, 9).

The term **"otherwise visually equipped *child, client, person*"** is Janečka's contribution to the discussion. This is a wide and open term. In our opinion, the term covers the whole issue of visual defects from the least to the most severe ones. Even a person suffering from presbyopia (from the Greek presbys = old, óps = eye, Defectological dictionary, 2000) is unable to read small letters without glasses under inappropriate illumination. This is not a major issue but such person is not fully visually competent without glasses, and therefore can be considered otherwise visually equipped. Moreover, this term surpasses some terms that have a pejorative connotation judged by today's perception (especially by children and young people): ***"defect, defective, blind, handicapped"***. Respecting this "unlikeness", we perceive the personality of an otherwise visually equipped person as an integral part of the whole society surpassing today's thinking represented by the term integration. However, we are aware of the fact that this definition respects rather the philosophical dimension of the issue (compare Jesenský, 2002; Požár, 2002). In scientific research studies focusing on otherwise visually equipped persons, where their visual defect has to be clearly and exactly defined using a certain degree, level, etiology, etc., the visual "unlikeness" must be complemented with opthalmological criteria as acknowledged by a majority of the mentioned authors. This in principle includes the following groups: ***blind persons, persons with remaining vision*, visually impaired, *persons with binocular vision disorders, persons with colour perception disorders***.

The area of kinanthropology frequently uses a classification system based on the IBSA standards (International Blind Sport Association) used in the field of sport. This classification is international and clearly defined for the area of sport (see specification of B_1, B_2, B_3 categories on page 12 of this paper).

In German-speaking countries and regions the superordinate term for visually impaired persons is **"Sehgeschädigte"** (… with visual damage). Scherer et al. (1983, 10) considers various degrees and types of damage to this particular sense, from mild visual impairment (**Sehbehinderung)** to complete blindness (**Blindheit**). A visually impaired – limited individual (**sehbehindert-beeinträchtigt**) is a person who in spite of optimum corrections of the visual defect has only strongly limited vision (**Sehvermögen**). The term **"low vision"** is also gradually being introduced. Lower degrees of blindness are marked by the term "blind" (**Sehschwäche**), higher degrees are identified as "legal blindness" and "blindness" (**gesetzlich blind und blind** – equal to practical blindness and blindness – author's note), also in relation to social security.

English terminology has the terms **"visual impairment"** and **"blind(ness)"**, which can be referred to as impaired vision and loss of vision. Visual impairment (sometimes also **"vision impairment"**) is understood as a loss of or a considerable decrease in the ability to see caused by a disease, injury or congenital defect, or as a result of degeneration that cannot be corrected in a usual way including refraction, medication or surgery.

Some texts include the term **"visually disabled"**, which translated into Czech would correspond to *visually impaired*, i.e. "persons with impaired vision". For ethical reasons this term is nowadays used in connection with "persons, pupils", etc. The terms **"visually handicapped"**, **"handicapé visuel"** (French), **"persona con discapacidad visual"** (Spanish) would correspond with the Czech "visually handicapped person" or "person with a visual handicap". We should understand however that a ***handicap*** is understood considered a ***"...disadvantage of an individual resulting from a disorder or impairment that limits or prevents certain normal roles expected from such individual"*** (European Charter of Sport for All: persons with disabilities, 1996). This is another term that is not used frequently or correctly in kinanthropology, special education or in the Czech social or health-care system.

In our practical contexts, the following terms are comprehensible and ethically acceptable: ***individuals (persons) with visual impairment*** and the ***visually impaired*** (VI). These terms will be used throughout the text.

One last comment to conclude the issue of terminology. In an effort to achieve absolute terminological "purity" the core of the issue and particularly the otherwise visually equipped person should not be left behind, which unfortunately frequently happens in practice. However, we are aware of the fact that not all terminological issues have been or could have been covered. If some of our thoughts, observations, comments and quotations of some authors encouraged your interest, our objective has been achieved.

2 /

Type of impairment and its categorisation

Ladislav Bláha

With respect to the specifics of impairment in each individual, the type and degree of impaired visual abilities must be characterized. Visual impairment can be specified from various perspectives, the core ones being visual acuity, visual field, date of onset, expected development, etiology and others. The complex issue defining the severity of visual defects is thus given by various etiologies and extent of impairment. As a result, some authors try to specify the criteria leading to a system of assessing the severity of the impairment (Annex 2). A number of countries and their functional systems currently use the definition of the World Health Organization (Table 1).

Table 1. Degrees of visual impairment according to the WHO

Degree (class)	Functional ability and visual impairment categories
Moderate visual impairment	visual acuity with the best possible correction: maximum worse than 6/18 (0.30) – minimum equal to or better than 6/60 (0.10); 3/10–1/10, visual impairment category 1
Severe visual impairment	visual acuity with the best possible correction: maximum worse than 6/60 (0.10) – minimum equal to or better than 3/60 (0.05); 1/10–10/20, visual impairment category 2
Extreme visual impairment	a) visual acuity with the best possible correction: maximum worse than 3/60 (0.05) – minimum equal to or better than 1/60 (0.02); 1/20–1/50, visual impairment category 3 b) concentric limitation of the visual field of both eyes under 20 degrees, or of one functional eye under 45 degrees
Practical blindness	visual acuity with the best possible correction 1/60 (0.02), 1/50 to light perception or limitation of the visual field around central fixation although central acuity is not affected, visual impairment category 4
Complete blindness	loss of vision from complete loss of light perception to retained light perception with faulty light projection, visual impairment category 5

Source: Visual impairment classification according to the WHO (Czech Blind United, Czech Republic, 2010).

Some scientific disciplines prefer a different type of classification that combines specific types of diseases (Table 2).

Table 2. Visual impairment and brief definitions

Identification	Other specification	Degree of visual impairment
Blind persons	Real blindness	Decrease in central visual acuity under 1/60 – light perception. Binocular visual field 5° and less even without disruption of central fixation.
	PPractical blindness	Decrease in central visual acuity less than 3/60 to 1/60 inclusive. Binocular visual field smaller than 10° but bigger than 5° around central fixation.
Persons with remaining vision	Previously identified as partially sighted or severely visually impaired	Between blind and visually impaired
Blind persons	Mild	Decrease in central visual acuity up to 6/60.
	Severe	Decrease in central visual acuity less than 6/60 to 3/60.
Persons with binocular vision disorders		The retinas of both eyes do not provide equal images on identical places to ensure spatial perception and stereoscopic depth vision. Disorders of analytic-synthetic function, localization and depth vision.

Zpracováno podle členění Ludíkové (2005, 198).

These approaches classify the types of visual impairment according to the cause of such visual impairment: functional defect (amblyopic and squint-eyed persons) or organ defect (Štréblová, 2002). We should also mention the specifics used in resocialization and education of late blinded persons and persons with combined impairment. Functional systems of health-care, social security, general education, physical education and sport maintain their own specifics of defining visual impairment and taking care of persons with visual impairment. A unifying line is given by the World Health Organization (WHO – 10th revision of the International Statistical Classification of Diseases and Related Health Problems, Chapter 7: "Diseases of the eye and adnexa"). Generally it can be stated that visual impairment is ranked among significant issues with an impact on economy and the development of the society, which frequently decreases the quality of life of impaired individuals. According to WHO estimates, 161 million people were affected by visual impairment in 2002, of which 37 million people were blind.

Insufficient perception by the visual analyser is classified by means of international universal regulations and scales in optometry and ophthalmology systems. These scales must comply with the requirements of specialists and understanding of the lay public. At the same time, the classifications must cover various types of visual impairment.

In line with Lieberman and Cowart (1996, 138) "visual handicap" is defined according to ***"angular (visual) acuity".*** This value is expressed by means of vision defined as a fraction, i.e. the ratio between the distance at which an impaired individual can read a symbol compared with a healthy individual. The principle of reading letters or characters at a distance is also used by a similar method (used in biomedicine and some social disciplines): the ***Snellen scale*** (see e.g. Office of Special Education and Rehabilitation Services – Table 3) (Lieberman, 2005).

Table 3. Degrees of visual impairment according to the OSERS

Degree (class)	Equivalent	Functional ability
Certified blind	Legal blindness	vision 6/60 (20/200), able to see at a distance of 6m (20 feet) what a healthy eye is able to see at a distance of 60m (200 feet)
Travel vision	Travel vision	vision 1.5–3/60 (5–10/200)
Motion perception	Motion perception	vision 0.9-1.5/60 (3-5/200)
Light perception	Light perception	vision less than 0.9/60 (less than 3/200) able to see a strong light, unable to detect arm movement at a distance of 0.9m (3 feet)
Total (complete) blindness	Total blindness	unable to recognize a strong light shining directly to the eyes

Note: The Office of Special Education and Rehabilitation Services does not use the degree (class) of "motion perception".

Obviously, defining visual impairment just by vision acuity and visual field extent is insufficient. It is desirable to determine more objective diagnostics, for example by obtaining data on other visual functions such as:

- contrast sensitivity (photophobia, night blindness),
- ability to distinguish colours (colour blindness),
- depth perception,
- ability to localize,
- ability to fix objects,
- ability to watch objects in motion, etc.

Similarly, it is necessary to respect other approaches to the classification or typology of visual impairment required by various scientific disciplines (Keblová, 1996, 2001; Štréblová, 2002 and others).

For the purposes of organizing physical activities the above mentioned classification methods do not appear suitable because the narrowly defined degrees (classes) of impairment would limit the number of participants. The ***IBSA (International Blind Sport Federation)*** has an own category system and widens the limits for competitions and respects various degrees of impairment where necessary. This classification (Table 4.) follows the previous classification (Table 5.) and acknowledges three categories of impairment, initially marked as A, B, C (Shephard, 1990; Sherrill, 1998), nowadays as B1, B2, B3 (Lieberman, 2005). The classification degree is assessed on the better eye with optimum correction (i.e. all competitors using contact lenses or glasses must wear them during classification, irrespective of whether they intend to wear them during the competition or not).

Table 4. Current categories of visual impairment according to IBSA

Degree (class)	Functional ability
Class I. (B$_1$	Visual acuity weaker than LogMAR 2.60.
Class II. (B2	Visual acuity between LogMAR 1.50 and 2.60 (inclusive) and/or visual field constricted to less than 10 degrees.
Class III. (B3	Visual acuity between LogMAR 1.40 and 1 (inclusive) and/or visual field constricted to less than 40 degrees.

Visual impairment classification (ČSZPS, 2013)

Table 5. Categories of visual impairment according to IBSA valid until 2012

Degree (class)	Functional ability
Class I. (B$_1$)	Defined as zero light perception (total blindness) to inability to recognize an object or its contours.
Class II. (B2)	Defined as ability to recognize an object of visual acuity up to 2/60 (6.7/200), or visual field constricted to 5 degrees.
Class III. (B3)	Visual acuity 2/60 to 6/60 (6.7/200 to 20/200) or visual field constricted to 5–60 degrees.

The IBSA sports classification is acknowledged also in the Czech Republic. In our country, category IV (B4) was also introduced. This specific category is accepted in some types of domestic competitions, particularly for children and young people. This is an "open" category and involves visually impaired individuals who are no longer in the B3 category. The classification is always performed on the better eye with best correction i.e. using glasses or contact lenses irrespective of whether they are used during the competition or not (Daďová, Čichoň, Švarcová, & Potměšil, 2008). For the purposes of competitions, the examination is performed by an ophthalmologist or optometrist. The result of the examination must be recorded in the membership card of the ČSZPS (Czech Blind Sportsmen Association) and registration card kept by the Association's secretariat. The classification of visual impairment is re-checked prior to significant competitions. In 2000 a new measure was adopted taking into account possible progression of the impairment; therefore, the classification now specifies whether the impairment is permanent or whether re-classification might be required in the future. Currently (2012) international sports competitions have international classification teams that classify all competitors from the whole world in the respective disciplines. This ensures a unified classification procedure.

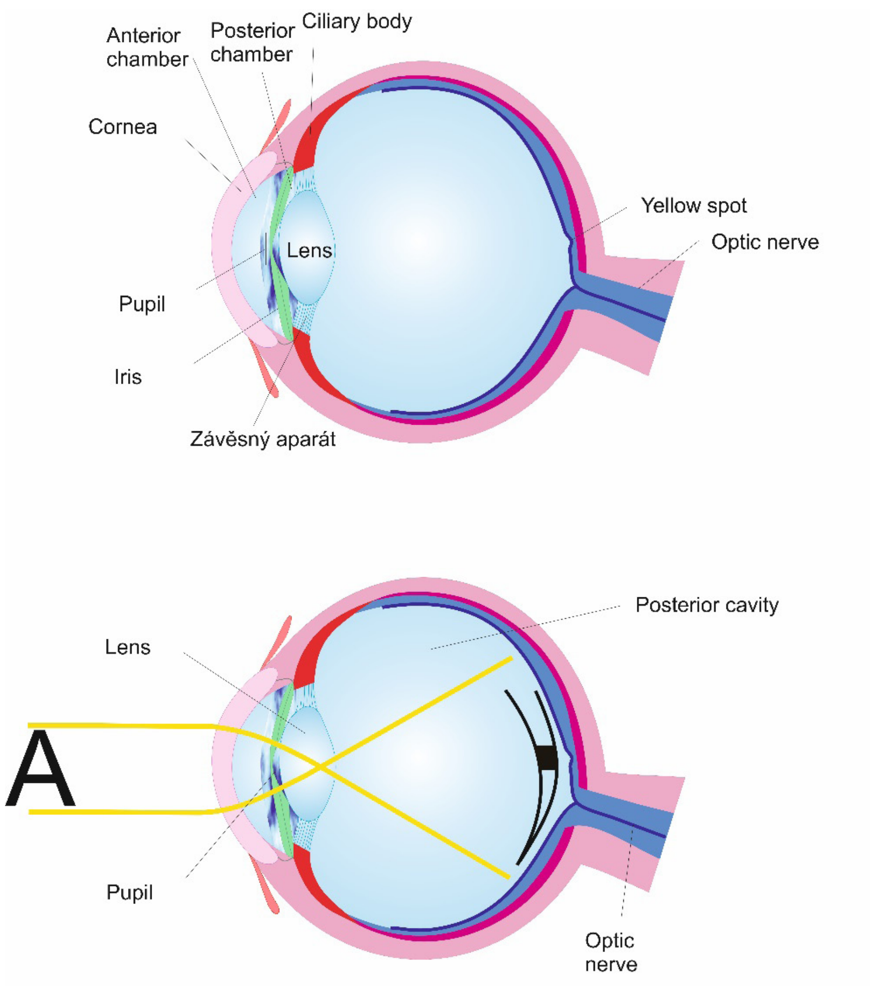
3 /

Vision

Zbyněk Janečka

The eye is often compared to a photographic instrument. The lens is represented by the optical system of the eye, the aperture by the iris with the changing pupil, and the sensitive film layer by the retina. Focusing on various objects at various distances is ensured by the ciliary muscle by affecting the refractive power of the lens. Objects located in the outside environment produced an inverted, real and lessened image on the retina. The image is relatively precise despite the fact that the components of the optical system have numerous deficiencies from a physical and optical perspective. The retina is 24 mm from the outer edge of the cornea and lies in the focal point of parallel beams that enter the eye in case of relaxed accommodation.

Figure 1. Diagram of the human eye and simplified principle of projection on the retina.



3.1 Vision (visual acuity)

Assessment of distance vision

The basis for determining the **vision** is the resolution ability of the eye. Resolution is the ability of the eye to identify two spatially separated objects as two. This is identified as **minimum separabile**. The image of the two objects on the retina must be separated by at least one unlighted cone, which represents the space between the two lighted cones. In the foveal area of the retina the diameter of the cones is between 2–2.5 µm. Respecting the principles of geometric optics it can be calculated that one minute of arc in the space of the object corresponds to a length of 5 µm on the retina. This means that a single cone images an object of an angular size of 0.5–0.4´. This size is also a measure of the **minimum angle of resolution** (MAR). This quantity needs to be analysed in determining vision. Vision is then a reciprocal value of MAR expressed in minutes of arc: $V = 1/MAR_{(min)}$. If MAR = 0.5 then V = 2. Recently the obsolete Snellen type charts have been reviewed and replaced with "logMAR charts (**logarithm of minimum angle of resolution**)" (Kraus et al., 1997). In expressing vision using the Snellen fraction (e.g. 6/24) the numerator represents the distance at which a proband is tested, whereas the denominator represents the distance from which the critical detail of the optotypes of this line forms an angle of 1 minute of arc. The reference value is derived from correct determination of an angle of 1 minute of arc from a specified distance (e.g. 6 m). In this situation V = 6/6 and logMAR = 0. An inverted value of the Snellen fraction equals the size of MAR. Vision is also frequently expressed by means of a decimal conversion of these fractions. As a matter of fact, distance vision is represented by vision at a distance close to infinity. However, the most frequently used examination distances (6.5 or 4 m) are not in infinity and require some accommodation effort. For the purposes of precise determination of correction, the refraction correction of 0.25 D must be subtracted from the identified spherical component. The basis for determining vision is identifying the smallest angle of vision of a critical detail of an optotype that the examined person is able to see. This is also the definition of the threshold stimulus. The definition expresses the size of MAR that the examined person answers correctly in 50% and incorrectly in 50% (after correction of random correct answers). In determining vision using the whole-line method, MAR must be answered correctly in 100%. If this table method is complemented with "log MAR", the whole-line result can be used to assess threshold vision, which is approximately by two normalized lines higher, i.e. about 58%. In the case of the Snellen optotype charts, which do not have equidistant line intervals, obviously this estimate does not apply (Kraus et al., 1997). If a person is unable to read the largest optotypes on the table, the distance between the eye and the table must be shortened to as little as 0.5 m. Practical blindness is a condition when a person with visual difficulties is affected by decreased vision and is unable to use vision in an active way. This typically occurs for V = 3/60–2/60. Vision of 6/60–3/60 is considered legal blindness. A lower degree of vision is defined by perception of a moving arm in front of the eye and another lower degree by differentiating light and dark – light perception. This low degree of vision must be complemented with data on light projection from various places of the visual field. Another lower degree is the presence of light perception without any correct projection. Only an eye without light perception is identified as amaurotic; V = 0 (Řehák et al., 1989). Distance vision is examined using optotypes. The Snellen charts consist of letters or numerals. The Plűger hooks are variously oriented letters E. The Landolt rings have the shape of the letter C disconnected in various quadrants. Children who cannot read are tested by means of picture optotypes. The following figures show some examples.

Figure 2. Optotype table of logMAR type with Landolt rings. Adapted from (Hamadová, Květoňová, Nováková, 2007, 16), in review (Hrbáčková, 2013)

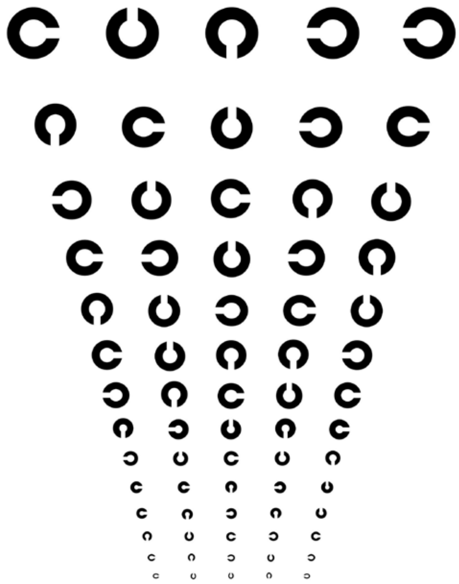


Figure 3. Optotype table of Snellen type with letters or numerals. Adapted from (Hamadová, Květoňová, Nováková, 2007, 15), in review (Hrbáčková, 2013)

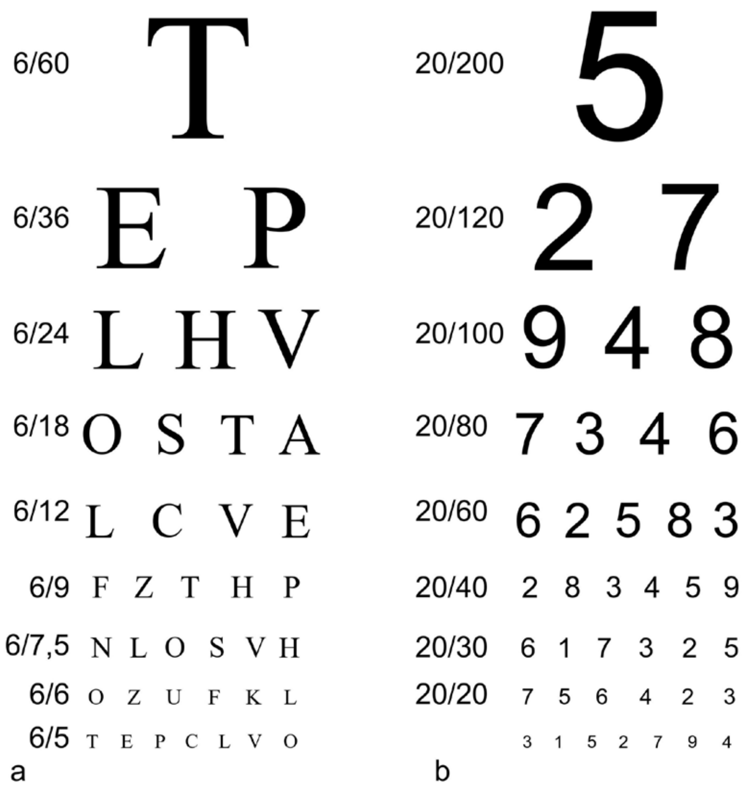
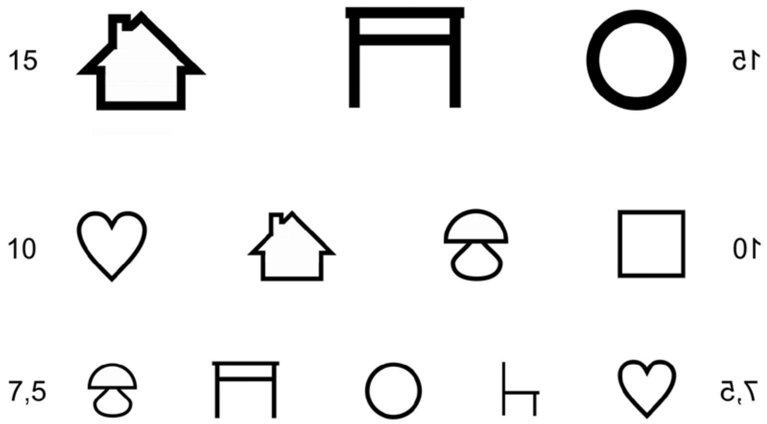


Figure 4. Optotypes for children. Adapted from (Hamadová, Květoňová, Nováková, 2007, 16), in review (Hrbáčková, 2013)



Assessment of close vision

In testing close vision the same conditions as for distance vision might be used, only the angular size of the optotypes must be adjusted with respect to the examination distance of 30 or 40 centimetres. Such charts are commercially available (Topkon, Oculus, & Rosenbaum etc.) and mostly contain the Landolt rings. The main objective of close vision examination is to assess the probands' ability to read and perform work with fine details. For this purpose charts with continuous text are used, where the paragraphs are printed in various sizes and identified with numbers (e.g. Jäger charts) (Kraus et al., 1997, 41). A similar principle is used by diagnostic charts for close vision examination type Zeiss, LH optotypes with numbers or symbols.

Close vision is examined at a distance of 30 cm. The following table shows an example of the Jäger charts.

Table 6. Example of a chart for close vision assessment

The princess with the golden star
No. 12
A merchant climbed a hill and looked around
No. 11
Ships from all over the world were moored in the port
No. 10
In each village school there were a lot of children from
No. 9

Because of the roaring engines at the start of the rally we could not hear
No. 8
Children like flying a kite in autumn
No. 7
This year shop keepers were very early with St, Nicholas and Christmas goods.
No. 6

Visual field

According to Moravcová (2004), the visual field represents a sum of all dots that are projected on the retina with motionless eyeball looking forward. In a physiological condition the visual field reaches 90° temporally and 60° nasally. Upper reach is 60°, lower reach is 70°. The visual field of both eyes overlap by about 60° around the fixation point. This enables stereoscopic spatial vision. Autrata and Vančurová (Autrata & Vančurová, 2002, 93) claim that "binocular vision is co-supported by three functional components of the visual organ. The optical component moderates the flow of beams through the refractive environment of the eye so that the retina receives an acute image. The motor component sets the eyeballs into a position so that the image is projected in the optical centres of both eyes. The task of the sensory component is to lead the excitations from the retinas of both eyes into the cortical centres. There the excitations merge and we perceive them".

Vision is mediated by two eyes; however, both retinas function as a single organ under physiological conditions. Correct functioning of binocular vision is subject to congenital coordination of eye movements in all directions, identical (corresponding) positions of the retinas of both eyes and eventually to fusion of the sensory impulses from both eyes. Disparate (non-corresponding) retinas positioned a short distance apart allow spatial vision (Panum's space) (Syka, Oldřich, & Vrabec, 1981).

Degrees of quality of binocular vision:

- **Simultaneous vision** is the ability to see the surrounding environment by each eye separately.
- **Fusion** is the ability to perceive the image of the surrounding environment by both eyes as a single perception.
- **Stereoscopic vision** is the ability not only to perceive the surrounding environment as a single image but also three-dimensionally, i.e. with acuity depth.

Peripheral vision (especially rod vision) allows spatial orientation and adaptation to low illumination. It is colour-blind. From the central fovea (fovea centralis retinae) towards the periphery there are fewer cones and more rods. In the periphery of the retina there are only rods (approximately 120 million in the retina). Peripheral vision is scotopic and is characterized by a central scotoma in case of complete adaptation in night vision. Adaptation to dark does not engage cones, as they are situated in the centre of the visual field. Orientation in a space depends on the extent of visual perception, i.e. on the functional visual field. As a result of some types of eye diseases the visual field can be limited in the periphery, central area or overall. Spatial vision is very significant; therefore, a person with a concentrically constrained visual field in the better eye under 10° even in case of normal central vision 6/6 = 1.0 is legally considered practically blind, so is a person with central vision in the better eye equal to or worse than 3/60 (Syka, Oldřich, & Vrabec, 1981).

Oculomotor skills

The movement of the eyeball is ensured by six striated muscles. These muscles ensure looking up (elevation) and down (depression), left (nasal adduction) and right (temporal abduction) and circular eye movements (intorsion and extorsion) in the case of the right eye.

Eye movements can be classified as follows:

1. Involuntary – automatic
   a) conjugated (version)
   b) disjunctive (vergence)
   c) saccadic eye movements
   d) smooth watching movements
   ad a) Conjugated movements represent a mutual movement of both eyes when watching an object that moves right or left in the visual field.
   ad b) Disjunctive movement is performed when watching a movement in the sagittal plane. Again, the eyes move at the same time but in the opposite direction.

In case of a symmetry disorder of the eyes movements, squint-eye (strabismus) occurs.

   ad c) Saccades ensure quick directing of the most acute vision spot on the retina to the contrast object moving in the visual field. These movements are exceptionally fast; their angular speed reaches around 700°/s.
   ad d) Smooth watching movements ensure that the object is maintained in the visual field, which is then captured by the saccade provided that its speed does not exceed 25–30°/s. Saccadic and smooth watching movements can be observed in the so-called optokinetic nystagmus.

2. Volitional

Volitional eye movements are always conjugated or disjunctive with one exception. In clinical medicine they are identified as looking (Králíček, 2004).

Colour perception

Colour perception is another factor that characterizes vision quality. Perception of colours is an ability of the eye to distinguish various lengths of electromagnetic waves and perceive them as colours.

Colour perception is a complex psychological process. A human is able to perceive about 150 colours in the visible light spectrum. In total, a human is able to distinguish over 2,000 shades (Autrata & Vančurová, 2002). The vast numbers of colours are made of a combination of the three basic colours – blue, green and red.

Kraus et al. (1997) state that colour perception testing is performed in the range of 380–760 nm. The following three factors are crucial:

- colour tone
- colour intensity,
- brightness.

According to Moravcová (2004) a colour perception originates by excitation of the retina by the energy of visible light of various wavelengths. Colour vision is ensured by means of cones that contain visual photopigment of three various types (**S, M** and **L**). Each of them reacts to a different wavelength of sunlight. **S** (short wave) is most sensitive to the blue colour, **M** (middle wave) to the green colour and **L** (long wave) to the red colour. According to the trichromatic theory, the colour code is defined by the mutual ratio of generator potentials on the mentioned three types of cones. Their specific combination can result in any colour in the sunlight spectrum.

Colour perception examination is performed on colour samplers. According to Kraus (1997), an example could be the Farnsworth and Munsell 100-hue test, which contains 85 coloured discs positioned in four sections, or the internationally acknowledged Lanthony 40-hue test with only 40 discs.

Sensitivity to contrast

The distinguishing ability of the eye is defined by the level of vision. Kraus et al. (1997) states that the assessment of vision requires a high degree of contrast (0.85 and higher). The resolving power of the eye is directly proportional to the level of contrast. Contrast is defined by subjective assessment of the difference in brightness of two surfaces seen simultaneously in the visual field of both eyes or gradually assessed unequal stimuli (Moravcová, 2004). Decreasing brightness (i.e. the amount of reflected or emitted light energy) causes a decrease in the resolving power of the eye. As mentioned above, this is conditioned by physiological mechanisms of receiving light of various wavelengths and is caused by a transition from photopic to mesopic and eventually scotopic vision. A change in brightness also induces a reaction of muscle fibres of m. dilatator papillae, i.e. by mydriasis (pupillary dilation) in case of decreased brightness or miosis (pupillary contraction) in case of increased brightness.

The most widely used examination procedure is the VCTS (visual contrast test system). These circular charts of 7.45 cm diameter have five lines and nine columns. The level of brightness should be between 69–240 cd/m^2.

Adaptation to darkness and dazzling

Considering the wide wavelength spectrum, the eye is able to perceive only a small section of electromagnetic waves from 380 to 780 nanometres /nm/. An eye adapted to light perceives various wavelengths as colours – photopic vision (daily colour vision). Photopic vision is mediated by cones concentrated in the central area. This is the area of the most acute vision. Scotopic vision (low light) is peripheral vision ensured by rods. Scotopic vision is colour-blind with an approximate vision value of 1/60; on the other hand, scotopic vision allows orientation under significantly low-light conditions. In case of a lower degree of brightness we speak of mesopic vision, which is considerably inaccurate and involves both rods and cones. The ability to orientate is worse and vision is less accurate compared with a higher degree of brightness (Syka, Oldřich, & Vrabec, 1981).

Adaptation is the ability of the eye to accommodate to various light conditions. The functional extent of the eye is exceptionally large. The eye is still able to see in the darkest night although the ratio of the illumination compared with a bright sunny day is 1:100 billion. The time that the eye needs to adapt is proportional to the differences in light intensities (Syka, Oldřich, & Vrabec, 1981). Adaptation to light occurs immediately. Adaptation to darkness is longer and has two stages (Trojan et al., 1999). Quick adaptation involving the pupil and cone adaptation, which takes about 5 minutes; after five minutes slow adaptation begins, this is a matter of rods only. After about 30 minutes the eye is fully adapted to low illumination (scotopic vision). Darkness to light adaptation takes only 0.15 s; full adaptation is achieved after 6 minutes. (Syka, Oldřich, & Vrabec, 1981).

3.2 Visual defects

A visual defect influences the development of an individual with visual impairment depending on the nature and seriousness of the defect, stage of life during which the defect occurred and its etiology. Each visual defect has specific features that influence the development of visually impaired persons in their future lives. Damages and disorders can affect most parts of the vision system, through which our visual functions are effectuated.

Visual difficulties in persons with VI of all degrees of impairment present a significant complication in physical education, sport as well as physical activity recreation. For this reason we need to know:

- How a child or adult with VI sees.
- What are the medical risks associated with a specific visual defect and potential dangers ensuing from inappropriate or inappropriately performed activities.
- Whether a visual defect or impairment is stationary or whether there is a risk of progression.

For this reason it is necessary to perform comprehensive diagnostics of a visually impaired pupil. This results in defined indications and contraindications in the area of physical activity for various visual defects. Visual defects can be classified in two categories:

a) without a risk of deterioration of or damage to vision,
b) with a risk of deterioration of or damage to vision,

ad a) This group involves visual defects and diseases that can significantly limit physical activity but have no negative effects on the deterioration of visual functions. These include e.g. limitation of the visual field, ability to distinguish colours, limited spatial perception, worse visual acuity, etc.

ad b) This group involves disorders and diseases, where inappropriate physical activity could lead to an irreversible damage to the eye. However, the physical activity limitations need not be absolute. This can affect only certain types and groups of activities. The risk of damage to the eye can also be eliminated by activities that considerably limit the risk of eye damage. These activities are performed at a slow pace in a lying, upright sitting or knees bent position.

The last note concerns progressive defects. Most of us have a tendency to classify a child with VI into a specific category. In case the defect gradually worsens and this fact is neglected, after a certain time the visual capabilities of such individual might be underestimated. This could lead to an injury. Therefore, these cases have increased attention and their diagnostics is regularly referred to.

3.2.1 Refraction defects

The association between the refractive power of the optical system of the eye and the distance of the eye axis, or more precisely the distance between the outer edge of the cornea from the retina, is identified as eye refraction (Syka, Oldřich, & Vrabec, 1981). The condition of eye refraction depends on the degree of visual acuity. Visual acuity is the ability of visual differentiation, where close and distance vision is measured. Any positive or negative deviations from refraction define the degree of visual impairment. A condition when parallel beams are refracted by the eye so that they converge directly at the retina is called emetropia (refractive power corresponds with eye length). A condition when beams converge off the retina is called ametropia (refractive power of the eye is bigger or smaller than the corresponding eye length) (Kraus et al., 1997). The degree of refraction and the strength of glasses needed to correct refraction defects are measured by dioptres (D). One dioptre corresponds to refractive power of a lens, whose image focal length in air is one metre.

An ametropic eye has one of the following defects:

- hypermetropia (long-sightedness),
- myopia (short-sightedness),
- astigmatism.

3.2.1.1 Long-sightedness (hypermetropia)

Long-sightedness (hypermetropia) is caused by an imbalance between the length of the eyeball and refractive power of the eye. In case of hypermetropia the eyeball is too short with respect to its refractive power. Therefore, parallel beams from a more distant point reach the retina before they are concentrated in the focal point. The focal point lies behind the retina. This type of defect is called axial hypermetropia. Usually it does not exceed +6 D. In pathological cases (tumour, microphtalmus, oedema) hypermetropia can achieve +20 D or even more.

Curvatory hypermetropia is caused by insufficient curvature of one of the refractory functions. Usually the cornea is insufficiently arched. A flat lens is a rare cause of curvatory hypermetropia.

Index hypermetropia is caused by a decrease in the refractive index of the lens tissue.

A surgical removal of cataract results in aphakia. This type of hypermetropia is characterized by +10 to +12 D.

Practical recommendations: Long-sightedness usually does not present any risks as far as physical activities are concerned. There might be limitations however if another eye disorder occurs at the same time. Appropriate correction by means of glasses is very important in PE lessons.

3.2.1.2 Short-sightedness (myopia)

Short-sightedness (myopia) is characterized by an image projected at a point in front of the retina after passing the refractive elements of the eye. A myopic eye is too long in the sagittal axis. Most myopia cases are caused by an increased sagittal diameter. This myopia cause is called axial myopia. If an eye has a larger curvature of the cornea or lens, this is called curvatory myopia. Kraus et al. (1977, 292) sates that „a decrease in the radius of the cornea curvature by 1 mm leads to myopia of approximately –6 D. Increased curvature of the cornea is observed in keratokon and other ectactic diseases. Increased curvature is usually accompanied by astigmatism. Index myopia is observed in beginning nuclear cataracts".

Physiological myopia is a lower degree of myopia. It includes myopia simplex and myopia modica. „Myopia intermedialis is myopia of medium severity, whose development significantly decelerates after 20 years of age. Progressive (pathological) myopia is characterized by degenerative changes in the retina, vitreous humour and choroid. Another type of myopia is myopia congenita. Typically, myopia congenita has a value of –10 D during the first year of life". (Autrata & Vančurová, 2002, 50)

Myopias are classified by the number of dioptres according to Kraus et al. (1997):

a) myopia simplex up to –3 D,
b) myopia modica from –3.25 to –6 D,
c) myopia gravis more than –6 D.

ad a) This defect typically occurs during later school age or adolescence and does not exceed –3 D. It has no serious consequences on the function of the eye only if appropriate glass correction is performed and is usually not accompanied by degenerative changes. After twenty years of age this defect does not usually progress.

Practical recommendations: The only risk is represented by wearing glasses, which could cause an injury if broken. However, glasses can be replaced with contact lenses.

ad b) This degree of short-sightedness usually occurs in childhood and reaches the final stage in adulthood. Participation in physical activities is possible upon consultation with an ophthalmologist.

Practical recommendations: Myopic defects require regular ophthalmologic examination at least once a year. In case of satisfactory results all types of physical activity are allowed. However, activities requiring extreme physical effort should be eliminated.

ad c) This defect is usually hereditary. During the stage of maturing the defect typically deteriorates. In a single year the defect can worsen even by several dioptres. The eye is subject to pathological changes as the length of the eyeball axis extends. In case of severe forms (myopia gravis), bulging of the rear eye pole and atrophy of the choroid might occur. The yellow spot (vitium maculae luteae myopicum) is frequently damaged. This results in a considerable decrease in visual acuity. Further complications in myopia gravis include liquefaction of the vitreous humour, which can together with degenerative changes in the retina result in retinal detachment. Irrespective of these complications, myopia gravis has a progressive nature. In case of pathological changes in the eye fundus, Kraus et al. (1997) suggest that adjektivum degenerativa might occur as well. Therefore, eye examination must be performed at least twice a year. Some ophthalmologists frequently advise to limit physical activities after reaching a short-sightedness threshold of –6 D. However, the condition of the eye fundus must be considered as well. Short-sightedness of –4 D combined with changes in the eye fundus might result in a necessity to protect the eye much more as opposed to short-sightedness of –8 D without these changes.

Practical recommendations: If degenerative changes in the eye fundus are confirmed, it is necessary to limit all types of physical activity with hard landings, forward bends and holds in reversed positions. The head must be protected against shocks and impacts. Strength exercise, extreme physical effort and endurance runs are should not be pursued.

3.2.1.3 Astigmatism

Astigmatism is a visual defect in which light beams from a dot stimulus do not create a dot image on the retina but usually an ellipse. The cause is uneven curvature of the corneal surface. Astigmatism is corrected by means of cylindrical lenses, which are convex and level with the meridian of a smaller curvature. Astigmatism with mutually perpendicular meridians is called regular (regulatis). According to Autrata and Vančurová (2002) regular astigmatism can take the following forms:

- simple (simplex) – one meridian is either hypermetropic or myopic,
- compound (compositus) – both meridians are hypermetropic or myopic,
- mixed (mixus) – one meridian is hypermetropic, the other is myopic.

Astigmatism with axes that are not perpendicular is called irregular (irregularis).

Practical recommendations: Increased safety must be ensured in all sports and activities that require precise acute vision. These include volleyball, basketball, handball, football. As far as athletic disciplines are concerned, these activities are primarily jumps and hurdle runs. Also the following: archery, shooting, acrobatic gymnastics, alpine skiing and ski jumping, figure skating, ice-hockey, fencing, diving, table tennis, tennis, ringo, etc. If astigmatism is not associated with another visual defect, there are no risks that would lead to a risk of damage to the eye.

3.2.2 Most frequent visual diseases and disorders (Janečka)

3.2.2.1 Glaucoma

„Glaucoma is not a single disease but rather a group of pathological conditions, which cause a damage to the optic disc (papilla n. optici, optic disc, optic nerve head, OHN), mostly in a longer period of time. This damage to the nerve fibres result in typical changes in the visual field. In a majority of these conditions the main cause is a higher intraocular pressure. There are also factors however that can induce typical changes in the optic nerve head even under statistically normal pressure (Kraus et al. 1997, 161)".

Various types of glaucoma changes are listed by Kraus et al. (1997) as follows:

- Glaucoma with an open angle – type of glaucoma, in which the intraocular pressure is increased as a result of an incorrect flowing capacity of the trabecular system, which the intraocular fluid accesses without barriers.
  Primary glaucoma with an open angle is the most frequent form of glaucoma. Intraocular pressure increases gradually and is usually not associated with another eye disease.
- Glaucoma with a closed angle – in this case the outflow channels are closed and the intraocular fluid does not flow to the trabecular tissue.
  Primary glaucoma with a closed angle occurs in an anatomically predisposed eye by creating a chamber closure – in the front part the base of the iris leans against the cornea, which creates a papillary block by blocking the trabecular tissue of the chamber angle.
  Similarly, secondary glaucoma with a closed chamber angle is caused by pathological material of a different eye disease.
- Congenital glaucoma – according to Kraus et al. (1997) this is a special form of glaucoma in which hereditary anomalies of the front segment increase intraocular pressure by hampering the outflow of the intraocular fluid. This type of glaucoma can be primary as well as secondary.
- Mixed forms of glaucoma – combination of angle closure with an outflow barrier in the trabecular tissue.

A typical feature of all glaucoma diseases in a very adverse prognosis (Kraus et al., 1997).

Practical recommendations: There are many reasons to believe that correctly performed dynamic exercise is useful. Contraindications include isometric exercise, forward bend exercise and holds in these types of exercise. Also activities during which the head could be strongly hit. Unsuitable activities further include all types of extreme strength exercise, diving, falling and activities of a long endurance nature. Rapid temperature changes (e.g. going from a room to freezing weather) should be avoided.

3.2.2.2 Cataract

Cataract causes partial or complete clouding of the lens.

- Congenital cataract (cataracta congenitalis) has two clinical forms. Partial cataract has clouding in the central part, front, rear or both poles of the lens. Minor cloudings can also occur in the cortical parts of the lens and one layer around the core can be completely clouded. Total cataract is typical complete clouding of the lens, which can be observed macroscopically as grey-coloured pupil (Moravcová, 2004).
- As far as incidence is concerned, acquired cataract is the most frequent cause of lens clouding. The reasons can be various inflammatory or chronic diseases of the eye (uveitis, glaucoma), inflammatory diseases of the cornea (keratitis) or post-injury cataract as a result of lens damage. Cataract can also be triggered by a long-term disease, such as diabetes mellitus.
- Secondary cataract originates on the lens capsule after cataract operations.
- Senile cataract (cataracta senilis) occurs after 60 years of age. This can include partial as well as total forms.

If the clouding blocks light beams on their way to the retina, the lens must be surgically removed, i.e. aphakia. In the optical system of the eye the refraction is decreased by approximately +20 D and accommodation is virtually lost.

Practical recommendations: Cataract in itself is not a reason for limiting physical activities. The visual field and vision might be decreased, which leads to poorer spatial orientation proportional to the extent of lens or capsule clouding. A different situation applies to post-operative conditions. In these cases, precise restrictions must be defined by the physician. Natural central vision of an aphakic eye, which is otherwise normal, is 1/60, i.e. practical blindness, even though such eye allows basic visual orientation in space (Řehák, 1989).

3.2.2 3 Optic nerve atrophy

Optic nerve atrophy is the resulting condition caused by various pathological processes of the second order neuron of the visual pathway. This can be caused by an injury, inflammation, damage by tumour pressure, or ageing and arteriosclerosis (Vágnerová, 1995).

Practical recommendations: Physical endeavour is forbidden only in cases of acute inflammations. However, attention should be paid to visual field disorders associated with worsened orientation. Perimeter examination is recommended to determine the extent of these disorders.

3.2.2.4 Optic disc atrophy

According to Vágnerová (1995, 19) "atrophy of the optic nerve papilla is degeneration of the respective nerve tissue, and second order neuron of the visual pathway, represented by the optic ganglion. The resulting condition is caused by various pathological processes. Regarding the fact that these nerve cells have been permanently in the Go phase since their origination, degenerated fibres cannot be replaced with new nerve tissue (calls cannot replicate)". A typical clinical feature common to all types of atrophy is a change in the colour of the papilla, i.e. optic disc. A whitish colour means that the nerve fibres have been replaced with less transparent non-functional glial tissue. If only a part of the nerve fibres is damaged, the papilla is pale. A change in the appearance of the optic disc points to a severe functional disorder, which results in a decrease in (or complete loss of) visual acuity. Nothing is visible on the outer eye. There are numerous causes of optic disc atrophy. This impairment can be hereditary but can also be caused by exogenous factors – prenatal, perinatal and postnatal. In terms of etiology, this disorder is a complex with a relatively high probability of combined impairment, particularly with a CNS defect (DMO, LMD, epilepsy and mental retardation). In the Czech population the prevailing form is the hereditary autosomal dominant form, which usually affects one of the parents. However, this can also result from a new mutation (Vágnerová, 1995).

In this type of impairment, visual acuity is decreased from birth. Impaired individuals can have better vision than 5/50 but a much larger functional damage can occur. As many as 50% of persons with this disorder have vision of only 1/50. Obviously, vision can be decreased in various ways, the variability of the impairment is enormous. The defect is usually double-sided. The decrease in visual acuity tends to be stationary. Throughout the course of life, there are typically no changes. This damage is frequently associated with nystagmus, which points to a more serious damage to visual functions.

The optic nerve can also be damaged at a later stage, after birth, mostly as a result of a disease or brain injury (Vágnerová, 1995).

Practical recommendations: Optic disc atrophy usually includes a stationary decrease in visual acuity of various degrees. During physical activity, the actual vision must be respected and physical activity conditions adapted accordingly.

3.2.2.5 Degenerative disease of the retina

„This category includes a number of impairments that have a common feature. This is non-inflammatory progressive damage to the nerve elements of the retina, usually double-sided. Deterioration typically occurs in childhood or adolescence depending on the type of disease. Degenerative changes can be central or peripheral and limit vision accordingly“ (Vágnerová, 1995, 22).

Stargardt macular juvenile degeneration, as the name suggests, is a central degenerative disease of the retina in childhood. Difficulties in visual differentiation typically start around the beginning of school attendance. The first symptom is decreased central visual acuity, the child suffers from paracentral and central scotomas (visual field losses) and colour perception disorders. The disease affects both eyes and slowly progresses. Visual acuity in this type of impairment in school-aged children tends to be severe visually impaired to remaining vision 2–4/50. The pace of visual function deterioration is variable. Central limitation of the visual field must also be taken into consideration. The disease is exclusively hereditary, in most cases in an autosomal recessive way, i.e. siblings in a family might be affected while their parents are healthy carriers. A common feature of all degenerative diseases is the certainty of their progression and negative prospects, which act as a stressor. A certain advantage is that the disease spans over a long period of time and the child has enough time to adapt (Vágnerová, 1995).

Practical recommendations: Limited spatial orientation is caused by decreased visual acuity and constricted visual field. Perimeter examination is recommended to determine the extent and shape of visual field constriction. This gives us a precise idea of the location of blind spots and the width of the visual field.

3.2.2.6 Tapetoretinal degeneration

„This is a hereditary disease of the retinal periphery. Degenerative changes usually occur during the first decade of life. Subjectively, the visual field gradually constricts, at a later stage, only tube central vision might remain“ (Vágnerová, 1995, 24). An individual affected by this disease has more difficulties to orientate in an environment. A typical feature is darkness adaptation disorder and night blindness resulting from a loss of retinal rods and cones. Central vision in older school-aged children tends to be severe visually impairment to remaining vision 2–4/50, plus limitations resulting from constricted visual field. The frequency of tapetoretinal degeneration is between 1:4000–1:20000, depending on the population. The disease is hereditary, with all three types of genetic transfer (Vágnerová, 1995). „In the terminal (last) stage a frequent complication is cataract. During the 4th-5th decennium the disease results in blindness“ (Kraus et al., 1997, 149).

Practical recommendations: This disease has a progressive nature. From early childhood the main symptoms are hemeralopia, reported changes in the eye fundus and changes in the visual field. Exercise under bad illumination might present a risk of injury. In low light, the adaptation ability is considerably decreased. Typical changes in the visual field correspond to the image and development of changes in the eye fundus. A risk of injury increases with visual field constriction from a ring scotoma to tube constriction of 5–10°, which is the cause of practical blindness because a person with this type of impairment has insufficient information about the surrounding space.

3.2.2.7 Leberer congenital blindness

„This is an exceptionally severe form of tapetoretinal degeneration and is characterized by autozonal recessive inheritance, congenital practical or complete blindness, severe hypermetropia, enophtalm, wandering eye movements, digitoocular symptom“ (Kraus et al., 1997, 149). Individuals affected by this disease, if they see at all, have considerably decreased visual acuity in the zone of remaining vision, 1/50. The disease also affects the visual field, which becomes constricted; colour perception disorders also occur.

Practical recommendations: Spatial orientation is considerably decreased as a result of impaired visual acuity. Educational or personal assistant is a necessary condition to ensure safety of physical activities.

3.2.2.8 Retinopathy in the premature

Retinopathy occurs in premature children with a birth weight lower than 2,200g, who need to be placed in incubators with a high supply of oxygen to maintain vitality. After these children are placed in a usual atmosphere, their pathologically developed vessels start bleeding into the retina and vitreous humour. As a result, the retina clouds in the periphery, detaches and adheres to the connective-changed vitreous humour to form a single retrolentar membrane containing vessels. In most cases the disease is double-sided and very often results in blindness (Řehák et al., 1989). The degree of impairment is assessed on a five point scale, the smallest being myopia and the highest representing complete blindness.

Practical recommendations: There are no limitations in the first two degrees. Contraindications in the other degrees include shocks and hits of the head, jumps, hard landings, holds in a hanging position head down and lifting heavy objects. With the deteriorating vision and constriction of the visual field, spatial orientation worsens as well. If scarred retina is diagnosed, there is a risk of retinal detachment. Regular examination by an ophthalmologist is required at least once a year.

3.2.2.9 Diabetic retinopathy

Retinopatia diabetica is the most frequent complication in diabetes. It occurs after about 8–10 years of the disease and causes as many as 18% of cases of acquired blindness. Only in young people the disease can occur earlier. Crucial subjective symptoms include losses of the visual field, and decreased visual acuity if the central area is affected (Kraus et al., 1997).

Practical recommendations: During the first two stages of development there is no need to limit physical activities. Only after proliferation, minor bleeding and retinal detachment occur, all types of exercise with jumps, hard landings and lifting heavy objects must be excluded. Cooperation with an ophthalmologist is required (regular examination of vision and eye fundus).

3.2.2.10 Achromatopsia

Achromatopsia is inherited genetically transmitted aplasia of the retinal neuroepithelium. The origin of this defect is unknown. „A child has decreased visual acuity, nystagmus, colour perception disorder and is photophobic. This means that they are dazzled by usual daily light, they have better vision in low light conditions“ (Vágnerová, 1995, 13). The vision in these persons is identically decreased to the zone of severe visual impairment (i.e. distance vision 4–5/50). The close vision of individuals suffering from this defect is sufficient for Jagr‘s number 14–15. However, this is not the size of usual print, so persons with achromatopsia are limited in using traditional print. „The variability of visual acuity is relatively small. After diagnosing achromatopsia in the early age it is possible to precisely predict future visual abilities of such child, and work with the child accordingly. Other visual and other complications associated with achromatopsia do not usually occur“ (Vágnerová, 1995, 13).

„With respect to photophobia, these children turn away from light from birth because of irritation. Under bright illumination these children can be considered functionally blind without exaggeration. Children suffering from achromatopsia permanently require sunglasses (usually 50% shading), which improves their ability of visual perception“ (Vágnerová, 1995, 13).

Practical recommendations: This defect does not have a progressive nature. Contraindications that could lead to injury include working under inappropriate light conditions. In strong light these individuals can be considered practically blind. From birth these children turn away from dazzling light sources. Under strong light conditions self-darkening glasses are recommended. Physical activities do not present any risks for the eye. Decreased orientation ability might be an issue. Nystagmus decreases the ability of precise focusing on a subject and causes incorrect estimation of distances.

3.2.2.11 Aniridia

Aniridia is a visual defect apparent at first sight. „As the title suggests, i.e. iris missing completely, this does not apply in all cases because very often a rudiment of the iris root is developed“ (Vágnerová, 1995, 13). „In terms of the primary disorder this is a stationary condition although visual functions might deteriorate but as a result of other deviations that complement aniridia and can have a common cause. Progressive deterioration of visual functions in a patient with congenital aniridia is usually caused by a secondary glaucoma, which is usually a complication of aniridia“ (Vágnerová, 1995,15). Aniridia is also frequently associated with cataract and foveal dysplasia. Another possible complication is retinal detachment. „The vision of the affected eye tends to be largely decreased by the mentioned complementary pathological changes; sometimes even complete blindness might occur (this is mostly caused by glaucoma)“ (Vágnerová, 1995, 16). If these complications do not occur, vision tends to be decreased on average to the zone of severe visual impairment, i.e. 4–5/50. The frequency of aniridia in the Czech population is 1:27000 (Vágnerová, 1989). In almost all cases aniridia is inherited. Aniridia is not typically associated with mental impairment and if such combination exists, it is a pure coincidence.

Practical recommendations: Serious aniridia contraindications for physical activities include combinations with glaucoma and conditions with a risk of retinal detachment. In these cases consultation with an ophthalmologist and regular examination of actual condition is required.

3.2.2.12 Albinism

„Albinism is a congenital amino-acid metabolism defect, which is caused by a defect of tyrosinase in melanocytes, the consequence of which is a melanin (i.e. pigment) production disorder. Albinism is a relatively frequent disorder, which occurs not only in all races but also in most animal species. In humans this enzyme disorder can have several forms, this leads to various types of albinism“ (Vágnerová, 1995, 17). The most frequent form is total albinism and also oculocutaneous albinism affecting only the eyes and skin.

The impairment is apparent from birth, especially in the case of total albinism. Individuals affected by albinism are strongly photophobic because the lack of pigment in the iris causes too much light entering the eye. Regarding the fact that the function of the macula (i.e. the place on the retina of the most acute vision) depends on pigment development, albinos tend to suffer from macular fixation, which leads to a decrease in central vision. Vision is in the zone of serious visual impairments of 5/50 (Řehák et al., 1989). The disorder is not progressive though, visual acuity does not change throughout the course of life. From birth children are photophobic and their working environment must be adapted so that visual perception does not present unpleasant feelings that would discourage them from using vision. Strong illumination and staying in direct sunlight is not recommended. A decrease in visual acuity is not serious to prevent normal development but appropriate light intensity conditions must be ensured.

The overall frequency of albinism is between 1:10000 and 1:30000 (Vágnerová, 1995). „Albinism is not associated with intelligence disorders, if an association with mental retardation exists, it is a pure coincidence“ (Vágnerová, 1995, 18).

Practical recommendations: Under strong light conditions illumination should be avoided. Self-darkening glasses are recommended.

3.2.2.13 Coloboma complex

Coloboma complex is a complex of congenital disorders that can include cleft of the whole uvea up to the ciliary body, cleft of the lens, retina or optic nerve (Vágnerová, 1995). „Iris coloboma originates as a result of an imperfect closure of the foetal fissure during intrauterine development. Isolated coloboma of the iris, typically in the inferonasal position, has no effect on vision“ (Kraus et al., 1997, 124).

„Coloboma of the choroid is a developmental anomaly. There are round defects of the choroid inferonasally from the optic disc. Large colobomas, if they affect the macula or papilla, cause vision deterioration“ (Kraus et al., 1997, 126).

„Retinal coloboma (Colobom retinae) with various retinal aplasia is usually associated with coloboma of the choroid, ciliary body and iris. Coloboma is usually located in the lower nasal quadrant and frequently reaches the optic disc in the macula. This is a result of foetal eye fissure closure. Foetal toxoplasmosis must always be considered in the case of isolated coloboma of the macula“ (Kraus et al., 1997, 138).

„Affection is a consequence of imperfect foetal eye fissure closure with a large number of symptoms from incomplete rudimentary forms to severe changes, sometimes including a combination of coloboma of the retina and choroid. The disc tends to be larger with a wider and atypically positioned vascular hilus, sometimes filled with greyish mass, with atypical branching of retinal vessels, possibly with a lower cone. Changes mainly occur in the lower half of the disc. The disorder ranges from virtually normal functions to severe losses, particularly in the upper quadrants of the visual field. Affection may influence one eye or both eyes, hereditary cases are also known“ (Kraus et al., 1997).

Practical recommendations: The extent of visual function impairment caused by the coloboma complex is very wide. A more serious visual impairment is usually caused by other complications, e.g. cataract, secondary glaucoma or retinal detachment leading to losses of the visual field and decreased visual acuity. Therefore, consultation with an ophthalmologist is always recommended in order to determine the types of physical activity.

3.2.2.14 Aphakia and pseudophakia

Phakia is understood as the presence of the lens in the eye. Aphakia means that the lens is missing in the eye, e.g. after operational removal as a result of cataract. Pseudophakia is a condition in which aphakia is permanently corrected by an artificial intraocular lens (Kraus et al., 1997). „From an optical perspective, pseudophakia is an optimum method of correction of aphakia“ (Kraus et al., 1997, 297).

Practical recommendations: A 30% increase of an image by aphakic glasses is a serious barrier to precise coordination and eye – hand coaction”. “In monocular aphakia corrected by means of glasses anisometropia leads to severe aniseikonia…“ (Kraus et al., 1997, 296). An increased image combined with previous experience leads to a faulty spatial estimation. During the first weeks after aphakia young people tend to have problems with coordinating visual perception with the movement of their extremities. Adaptation takes place after several weeks or months (Kraus et al., 1997). Any physical activities should be adapted to the difficulties caused by the limited visual field as a result of a spheric defect of strong glasses. Moreover, the edge of the visual field is affected by a "blind angle" causing a ring scotoma. To a great extent, these problems can be corrected by contact lenses.

3.2.2.15 Physiological nystagmus

Physiological nystagmus is a process in which the eyeball naturally reacts to stimuli coming from the environment. This group includes fixation, optokinetic and experimental vestibular nystagmus. Eye movements in this group are classified as involuntary. Under normal conditions, fixation nystagmus is imperceptible. Optokinetic nystagmus exists when watching a moving stimulus and has two components. The slow component watches the movement; the fast component jumps fixation to a new object. This type of nystagmus can be observed on the eyeball when travelling by car and trying to fix e.g. electric line poles along the road. Experimental nystagmus (in clinical medicine known as vestibulooculomotor reflex) occurs during a fast movement of the head which is suddenly stopped. This causes a movement of the endolymph in the semi-circular channels and reaction of the eyeballs. The purpose of this reaction is to maintain an observed object in the visual field after a sudden change of the head position. A proof that this reaction is not caused by the retina is its presence even with eyes closed.

3.2.2.16 Pathological nystagmus

Nystagmus can be classified according to the origin as eye, vestibular or neural. It can be both congenital and acquired. Congenital nystagmus is conditioned by a sensory or motor defect. In case of a sensory defect, oculent nystagmus occurs. Apart from physiological optokinetic spasm nystagmus, this includes swaying or irregular nystagmus of blind and severely amblyopic eyes. Its origination is subject to development within the first two years of a child‘s life. The most frequent causes of swaying oculent nystagmus are choreoretinal macular scars, agenesion of the macula, albinism, aniridia, total colour blindness, severe congenital myopia and clouding of the optical environment (congenital cataract) (Kraus et al., 1997).

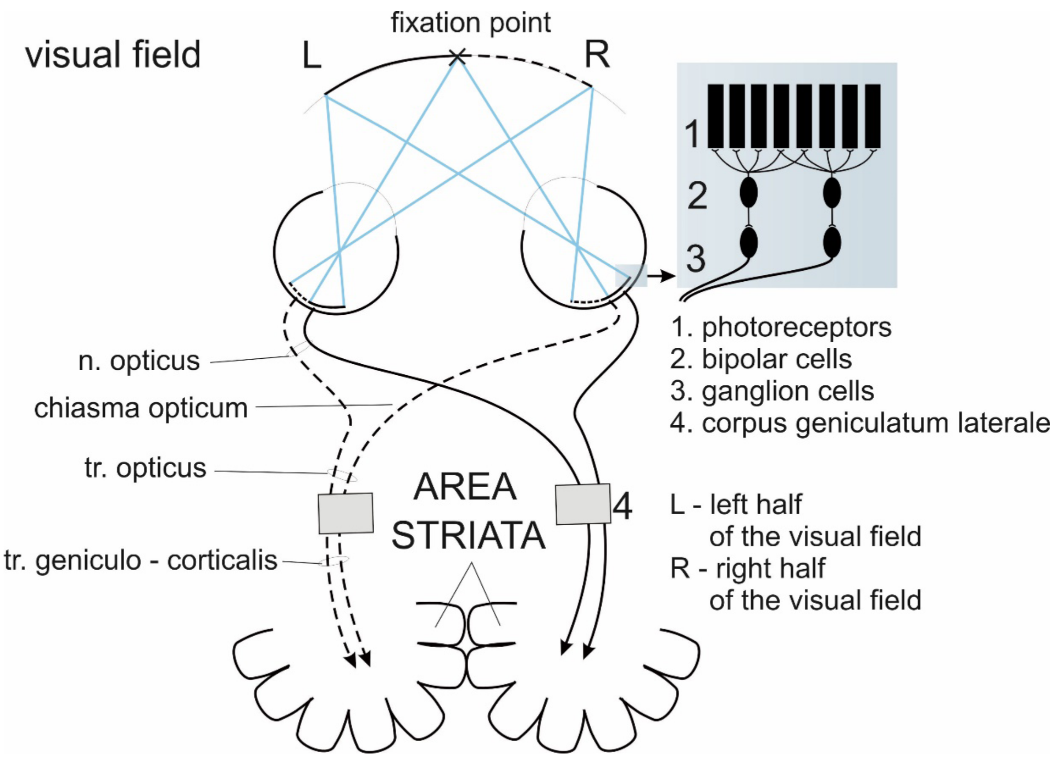
Central neurogenic nystagmus is caused by lesions in vestibular cores and pathways, which connect them with the cerebellum and the cores of oculomotor nerves. This is a type of spasm nystagmus. It originates as a result of affections of the brain stem and cerebellum after inflammatory, tumorous, degenerative, vascular and other conditions (Kraus et al., 1997). According to intensity, three types of spasm nystagmus are known. Based on the plane of the movement, nystagmus spasms are horizontal, vertical or circular. By combining these movements nystagmus can be slanting or circular.

Practical recommendations: There are two important considerations in the case of nystagmus. One is unintentional rhythmical movement of the eye, which decreases the fixation abilities of the eye, the other is etiology of origination. Etiology then defines possible contraindications. Therefore, consultation with an ophthalmologist is required.

3.2.2.17 Visual pathway disorders and central vision disorders

Transfer of visual information through visual pathways and its subsequent processing in visual centres is a relatively complex procedure. This process is complemented with stimuli from association areas, which are than integrated in other sensory centres. As a result, a comprehensive image of the surrounding environment and our existence in such environment develops.

Figure 5. Visual pathways. Adapted from (Králíček, 2004, 35), in review (Hrbáčková, 2013).



Visual function disorders significantly influence spatial orientation. It should be noted that visual information presents as much as 80% of all perceived information. The text below describes the effects of the disorders in specific areas of visual pathways and individual visual centres.

Interruption of the optic nerve (n. opticus) causes complete blindness (amaurosis) of the eye on the side of the interrupted nerve. Damage to the whole chiasma causes complete blindness of both eyes. Partial damage to the chiasma leads to a typical loss of opposite halves of the visual fields of both eyes. This loss takes the form of binasal or bitemporal hemianopsia. „Unilateral total damage to the visual pathway behind the chiasma, i.e. optic tract, corpus geniculatum laterale and tractus geniculocorticalis, eliminates the fibres coming from the halves of both retinas of the same side. This results in a loss of identical halves of the visual fields of both eyes on the side opposite to the lesion. The condition is identified as contralateral homonymous hemianopsia" (Králíček, 2004, 37). In most cases a partial damage occurs, which is caused by extensive spatial distribution of tractus genicolocorticalis. This leads to quadrant losses in the visual field on the side opposite the lesion. This is identified as contralateral quadrant hemianopsia (Králíček, 2004). „As a result of damaged tr. opticus near nucleus geniculatus lateralis, visual information can get to the tectal pathway and through there to the cortical centres, but only in the dorsal stream towards parietal functions relating to the perception of microspace and visuomotor functions" (Moravcová, 2004, 69). Total damage to the primary visual cortex results in bilateral blindness. Total damage to just one half results in contralateral homonymous hemianopsia. „Contrary to lesions of tr. opticus, corpus geniculatum laterale and tr. geniculocorticalis, in this case central vision, i.e. central part of the visual field, is retained. This phenomena is called macula sparing" (Králíček, 2004, 37). Unilateral incomplete damage to the primary visual cortex leads to contralateral quadrant hemianopsia with retained vision. Damage or changes to the areas of higher visual analysis lead to a loss of specific functions rather than a loss of the visual field. Impairment in the area of the temporal stream of visual pathways leads to the above mentioned agnosia and other disorders of various recognition functions. Damage in the area of the dorsal stream leads to changes in visuomotor functions and spatial orientation (Moravcová, 2004). The author adds that the function of the ventral stream of the visual pathway informs us about what we see, and the dorsal stream informs us about where we see it. Overall, a combination of these possibilities supported by information from our visual memory, develops an image of what we see and its understanding.

For better clarity, below are figures indicating typical locations and related specific losses in the visual field (Králíček, 2004). See Figures 6, 7.

Figure 6. Typical losses in the visual fields correspond with lesion locations. Adapted from (Králíček, 2002, 36), in review (Hrbáčková, 2013).

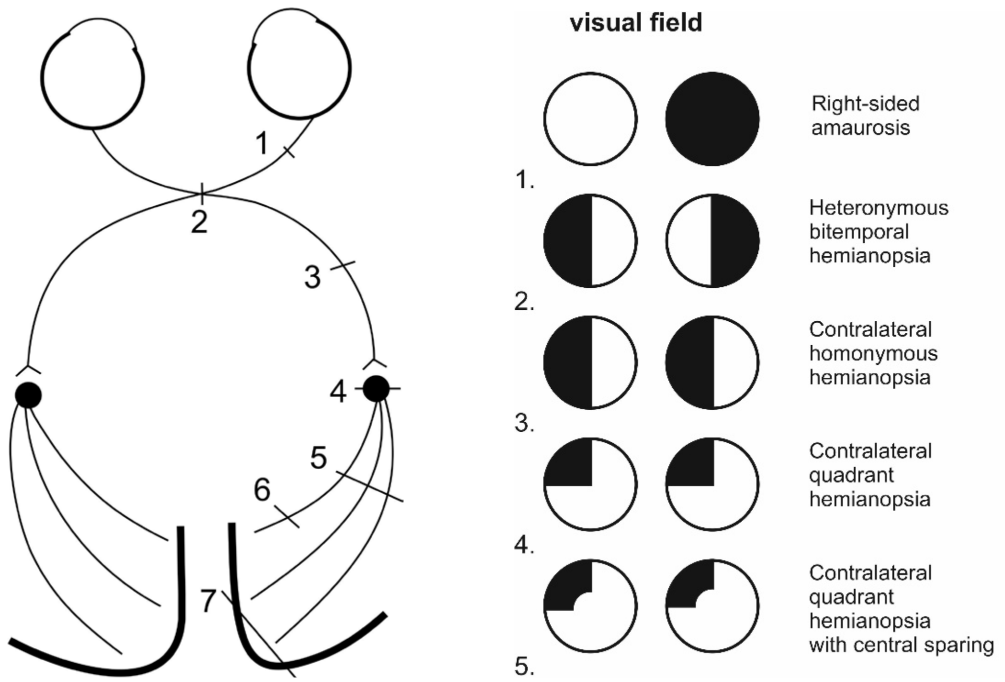
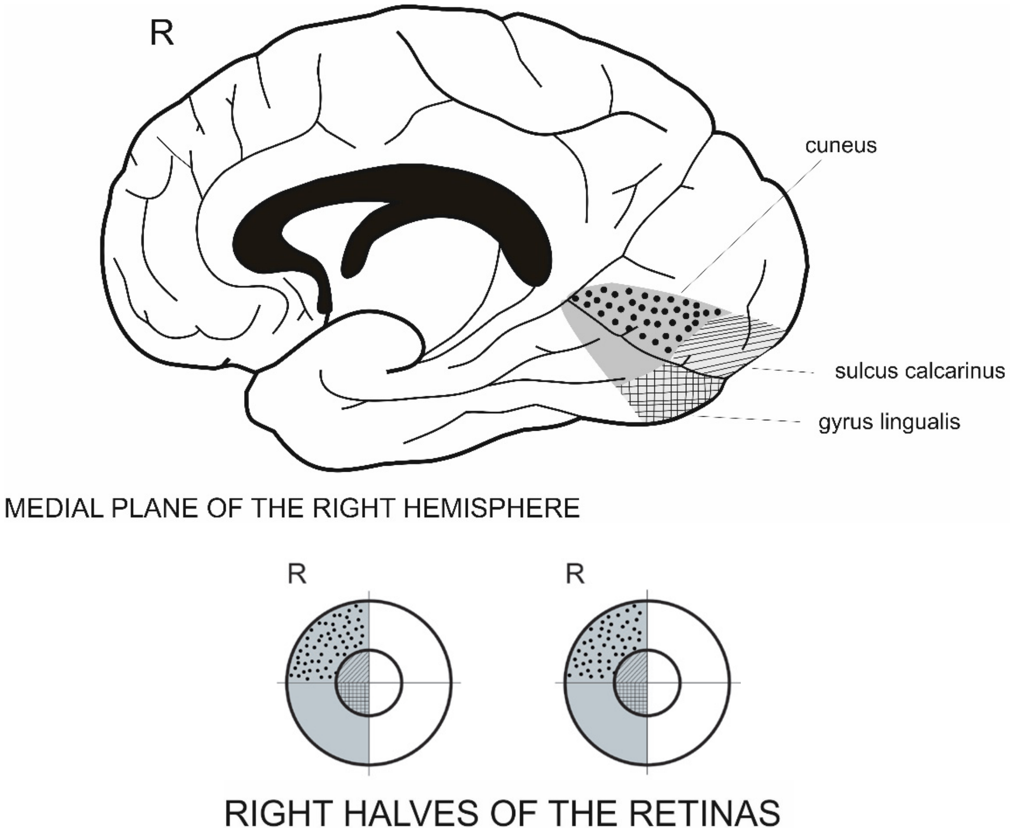


Figure 7. Corresponding locations on the retina and visual centre. Králíček (2002, 36), in review (Hrbáčková, 2013)



Practical recommendations: Depending on the lesion location we should know the location and extent of visual field losses. In case of cortical blindness we should know which part of the associative areas is impaired in a child or adult. This should be reflected in the overall arrangement of conditions, in which a child moves during physical activities. Cooperation with an ophthalmologist and a neurologist is recommended. In this context, very inspiring is the work by a Finnish ophthalmologist and neurologist L. Hyvärinen. Reference to her work www.lea-test.fi.

3.2.2.18 Colour vision disorders

Previous chapters describe physical and physiological mechanisms of colour coding. We will now take a look at the consequences of a changed ability to perceive a colour component of the colour spectrum.

There are three types of cones with various visual pigments (S, L, M) that have maximum absorption capacity in certain areas of the spectrum. Normal colour perception is trichromatic. Weakened perception of any of the colours is called anomalous trichromacy. Partial disorders are considered anomalies; complete disorders are anopias. Impaired perception of just one colour is called dichromacy. If only grey shades are perceived, this disorder is called monochromacy (achromacy).

A red colour (L) perception disorder is called protanomaly, protanopsy, green (M) deuteranomaly, deuteranopia, and blue (S) tritanomaly, tritanopia.

Monochromacy (achromacy) affects mainly men (around 9%) compared with women (0.4%), this is called daltonism.

Practical recommendations: Generally speaking, a changed colour perception ability does present a serious barrier to physical activities. If coloured equipment is used or colour based differentiation of teams in team games, colours that are simple to distinguish should be used. In case of daltonism, contrasting shades should be used. In case of combinations with other visual defects, the etiology of individual impairments should be taken into account.

Eye medication

Regarding the fact that PE teachers, educators, coaches and other staff accompany their pupils on various trips outside their homes, and often without a physician or nurse, it is recommended that these employees learn about eye medications of their pupils in advance. Failure to take medication could result in serious complication for the child. Detailed information about medications in ophthalmology is beyond the possibilities of this publication. We would like to refer to the following publication „*Kompendium očního lékařství*" (Kraus et al., 1997, 49–60).

4 /

Basic anthropometric indicators and introduction into motor competence in visually impaired persons

Zbyněk Janečka

Body height is the basic indicator of growth and well informs about the pace of growth. According to Riegerová and Ulbrichová (1983), somatic growth is an indicator of the medical condition of an individual as well as the whole population, an indicator of social as well as economic aspects in the past and in present. It is primarily governed by the genetic code, influenced by hormones and factors of the external environment. The factors of the external environment include maternal, geographic, social and economic factors and the health condition of an individual. A significant aspect, through which other factors become important, is nutrition. A significant role is also played by physical activity.

Movement is naturally associated with the existence of each living organism. Although we might not be fully aware, motor skills permeate all areas of the human life (Svoboda & Hošek, 1992). Common motor skills ensure physical activities of everyday life and all related functions. Specific activities are performed by special-purpose motor skills. The whole physical spectrum of a human can be included under a common term motor competence as described by White (1959), Vermeer (1990), Sherill (1998), Válková (1998), Bláha (2000) and others. In a wider context, motor competence is understood not only as a set of internal preconditions of a human as traditionally perceived by Měkota and Blahuš (1983) but rather, as claimed e.g. by Válková (1998), as a motor capacity to perform physical activities typical for all areas of human activities within the possibilities defined by ontogenetic development in a certain social context, as a unity of kinanthropological, developmental, psychological, medical and other aspects. In a detailed perspective, we consider motor development of an individual from early childhood into late senior age. In childhood we investigate reflexes, development of locomotion, motor quotient, normality, abnormality and adequacy of development with respect to age. As far as medical disciplines are concerned, we rely on diagnosing normality, abnormality, or anomalies and use diagnoses to monitor any deviations in terms of etiology and symptomatology, and formulate prognoses. All this is closely associated with physiotherapy and ergotherapy, which are used to search for treatment and therapeutic procedures and alternative physical solutions. In terms of psychology of work we observe motor skills (manual skills, movement coordination, strength parameters, individual locomotion characteristics) as work performance parameters, while maintaining movement safety and economy. This is related to ergonomics in the context humans, their working environment and working equipment in searching for appropriate devices and alternative physical solutions.

In a similar complex framework, this issue is understood in the area of adapted physical activity. Motor skills are not considered “normal, non-normal” or “abnormal” but rather as “unlike”, and we try to find ways to address this “unlikeness” from the perspective of the individual and the environment. In this context, the term “motor competence” is understood as a capacity or ability to perform adequate movements in a wide movement range from daily motor skills and self-attendance (using available compensatory aids) to physical activities. Válková (1998) understands motor competence as a capacity to perform movements in an adequate way in relation to the indicators actual or perspective in lifelong individual development. Motor competence is one of the relevant indicators of individual development with a significant social dimension that considerably influences the acceptance of an individual by the surroundings.

In the past the issue of the development of motor competence in children and youth was not addressed in detail. Renowned authors who addressed this issue include e.g. Bunc (1997), Bláha (2000), Janečka (1998, 1999, 2000, 2001, 2002), Kábele (1976), Srdečný (1977), Šafaříková (1999), Škvára (1977), Štanceľ (1966) and Wiener (1986, 1998). Apart from Kábele (1976) and Škvára (1977), who also addressed the issues of physical education in visually impaired persons, other authors rather focused on partial issues. Renowned foreign literature includes works by Blash et al. (1997), Cratty (1971), Dziedzic (1969), Winnick (1985, 1990), Block (2008) and others. The introduction of the field of study Applied physical education presented a requirement for a more comprehensive view of the issue of disabled persons and encouraged a need to perform an extensive research project that would help define the priorities and strategies in the area of education of visually impaired children and youth during the period of compulsory school education. The problem was however that there were no standardized motor skill tests for this population segment, there were no descriptive characteristics of their motor competence that would be underpinned and proved by research. Initial pilot studies were carried out by Macháček (1992), Bečičková (1994), Poráčová (1996) and others. During these years we verified the applicability of tests and other research methods and techniques. These had to be suitable not only for visually impaired children of B_{2-3} group but also completely blind children of group B_1. This stage was followed by the “Child” project (Válková et al., 1994; Válková & Janečka et al., 1998). Currently there are numerous studies also addressing the issue of motor competence in visually impaired persons (Bláha, 2010; Bláha, Janečka, & Herink, 2010; Bláha & Pyšný, 2000, 2004; Bláha, Pálková, Ženíšková, & Machačová, 2009).

4.1 Assessment of the level of basic anthropometric indicators and motor competence in visually impaired children and youth

In our survey we monitored a population of visually impaired children and youth in two developmental stages. In the prepubescence period we investigated whether visually impaired girls and boys who start school attendance are comparable with sighted population in terms of height. The above described issues can be summarized in the following research question:

Research question No. 1

Are there any differences in selected anthropometric indicators between the visually impaired population and sighted population in the period of prepubescence and pubescence?

We were interested in the height of these children also because a number of authors claim that the development in severely and congenitally blind children is hampered in the first months and years of their lives (e.g. Říčan & Krejčířová, 1997; Andelson & Fraiberg, 1974; Fraiberg, 1977; Riegerová & Ulbrichová, 1983). We investigated whether these facts apply to anthropometric characteristics in visually impaired girls and boys. If yes, we will try to demonstrate whether this delay is obvious at the beginning of prepubescence. We also investigated whether any differences fade away with increasing age.

The investigation of anthropometric indicators is closely followed by determining the level of motor competences, i.e. another set of questions (Janečka, 2004). In the second area of our investigation we addressed the level of motor competence among the categories of visually impaired children and youth and compared the data with the sighted population.

The following research question can thus be formulated:

Research question No. 2

Are there any differences in the level of motor competence between visually impaired persons and sighted population in the period of prepubescence and pubescence?

The objective of the research was, using selected anthropometric indicators, to characterize developmental tendencies in visually impaired prepubescent and pubescent individuals, and, using motor skill tests, to map the level of their motor competence throughout the whole period of compulsory school attendance in comparison with non-disabled population.

The reason that led us to this survey was the following. Should we work with visually impaired youth, we need to have general knowledge of developmental trends that apply to both somatic characteristics and the level of motor competence. Only after that can we set adequate objectives and tasks in the area of physical education, sport and physical recreation in the visually impaired population.

In the context of the survey we defined a number of partial hypotheses, whose full definition is in the results section for the purposes of better orientation in the text, and are summarized under the following related hypotheses:

Related hypotheses (height assessment)

$H_0$1 r: Between six and eleven years of age in the groups of B_1, $B_{2–3}$ of visually impaired and sighted girls (boys) of our test sample there are no differences in body height in a majority of age categories.

$H_0$2 r: Visually impaired and sighted girls (boys) in our test sample between six and fifteen years of age do not differ in the probability distribution of body height from a standard by Moravec (1990) in a majority of age categories (Table 2).

Related hypotheses (weight assessment)

$H_0$1 r: Between six and eleven years of age in the groups of B_1, $B_{2–3}$ of visually impaired and sighted girls (boys) of our test sample there are no differences in body weight in a majority of age categories.

$H_0$2 r: Visually impaired and sighted girls (boys) in our test sample between six and fifteen years of age do not differ in the probability distribution of body weight from a standard by Moravec (1990) in a majority of age categories.

Related hypotheses (BMI)

$H_0$1 r: In the groups of B_1, B_{2-3} of visually impaired and sighted girls (boys) of our test sample between six and eleven years of age there are no differences in weight-height indexes in a majority of age categories.

$H_0$2 r: Visually impaired and sighted girls (boys) in our test sample between six and fifteen years of age do not differ in the probability distribution of weight-height indexes from a standard by Moravec (1990) in a majority of age categories.

We employed a similar method to determine related hypotheses in the application of motor tests to investigate the level of motor competences. Their definitions are specified in the results section for each test.

Test samples

In the context of monitoring motor competence, we analysed a sample of 252 children. The sample included 114 visually impaired children from the Czech Republic and Poland and 138 non-disabled children from common schools from the Czech Republic.

The population of visually impaired children from Poland was selected due to their geographic, social and cultural similarity. The development and condition of the Polish special education system is also very similar. The group of visually impaired children was divided into two categories of B_1 a B_{2-3} according to VI degree. Children and youth in the B_1 category represent an individual group because the degree of their visual impairment does not allow any visual work. This is also the reason why the final part of our research focuses exclusively on the group of completely blind children of B_1 category. For classification purposes we used the system of the International Blind Sports Association (http//www.IBSA.com).

Research methods applied

In the context of anthropometric indicators we measured body height and body weight and determined the BMI index. To assess the level of motor competence we used motor skill tests. As stated by Měkota and Blahuš (1983, 9) "…a significant means of studying human motor skills, i.e. quantification of various physical manifestations, preconditions and abilities". In determining motor competence, we searched available literature and found no comprehensive systematic survey by means of standardized motor skill tests that would assess physical abilities in visually impaired children and youth in the period of prepubescence and pubescence. After a deliberate test selection we mapped the area of physical abilities in visually impaired children and youth with an emphasis on a group of blind individual of B_1 category. Due to the fact that we verified the functionality of the tests also in blind children and youth of B_1 category, they also serve as a tool that can be used by teachers, coaches and other staff to verify motor competence in their pupils and trainees and compare their results with relevant standards.

We are aware of the fact that in this way we are unable to cover the whole extent of the issue of motor competence in visually impaired children and youth in the period of prepubescence and pubescence. In spite of that we believe that the results of our testing provided us with sufficient information on the state of motor competence of this group of children and youth.

For the purposes of this study we used the following motor skill tests, see Annex for full versions.

Used motor skill tests

A. Area of fitness abilities

Test of strength abilities

a) Motor skill test of dynamic explosive strength of lower extremities – two-footed standing jump
b) Motor skill test of dynamic local endurance of abdominal muscles – sit-up
c) Motor skill test of static local endurance of abdominal muscles – pull-up hold
d) Motor skill test of static strength – hand grip (dynamometry)

Test of general endurance

a) Harvard step test (modified)

B. Area of coordination abilities

Motor skilfulness test

a) Motor skilfulness test – exercise with a bar

Motor balance test

a) Motor balance test – Flamingo test
b) Motor balance test – one-legged standing hold on a beam

C. Area of movement capacity abilities

a) Sitting reach – deep forward sitting bend with legs together

Statistical methods

Statistical results processing of individual motor skill tests was performed by means of a parametric analysis of variance. However, this only indicates whether there are any statistically significant differences between the groups. Using the Scheffe's method we defined the differences between specific groups. A cross-check comparison was performed by a non-parametric Kruskal and Wallis analysis of variance. A t-test was used to perform a comparison with relevant standards. We are aware that the mentioned statistical methods could not have been applied in an optimum way regarding the low number of probands in individual categories. In these cases the positions of individual pupils were estimated according to overall developmental trends in the respective groups of visually impaired children and youth. The selected indicators (e.g. average values) were, using the triangulation standard applicable to the Czech children's population, compared with the values of the non –disabled population of visually impaired children monitored in this survey. For this reason, some of the values (e.g. average values) do not correspond with the statistical indicators in terms of the number of probands; therefore, some values in the tables are irrelevant (average) in cases, where the number of probands is too low (n = 1 etc.) In these cases the results were derived from developmental trends of the monitored indicators and overall developmental trend of the respective populations.

4.2 Survey results

4.2.1 Results of anthropometric indicators (body height, body weight, BMI)

In the survey we compared not only girls and boys of B_1 and B_{2-3} categories with sighted individuals (Table 7), who were the subject of our research, but also with a standard by Moravec (Moravec, 1990) (Table 8). As far as pubescence is concerned we focused on visually impaired individuals of B_1 category and on a comparison of height characteristics as specified by Moravec.

4.2.1.1 Body height

a) Statistical processing and graphical interpretation of height in the sample of girls

Table 7. Basic statistical data on height in the sample of girls

Age	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	2	107.000	16.97	2	125.750	3.89	3	129.500	7.78
7	3	126.667	2.89	5	130.600	6.41	24	125.542	4.75
8	4	124.376	3.64	9	133.667	5.99	26	128.462	5.12
9	8	126.875	10.33	4	134.500	7.72	9	135.222	5.67
10	2	130.000	9.90	0	0.00	0.00	3	139.667	10.07
11	4	147.125	4.97						
12	0.	0.00	0.00						
13	4	154.750	8.77						
14	2	165.500	3.54						
15	2	152.000	2.83						
16	1	152.000	0.00						
20	1	134.000	0.00						
Total	**33**			**20**			**65**		

Legend: B_1, B_{2-3} – visual impairment category
S – sighted population
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean
s – standard deviation

Table 8 shows data relating to the group of girls under research. B1 category does not include any data for twelve-year-old girls because there were no girls in this category. The same applies to B2–3 category of ten-year-old girls.

Table 8. Statistical characteristics of physical development in girls aged 7–16 years (Moravec, 1990 – adapted)

Age	Height (cm)		Weight (kg)		Weight-height index	
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
7	123.89	6.15	24.76	4.33	0.199	0.029
8	129.82	6.26	27.41	4.71	0.210	0.029
9	135.43	6.78	30.44	5.74	0.223	0.035
10	141.19	7.19	34.28	6.71	0.241	0.039
11	146.59	7.53	37.66	7.79	0.255	0.044
12	152.78	7.41	42.38	8.88	0.275	0.047
13	158.18	7.09	47.92	8.59	0.301	0.046
14	162.26	6.44	51.00	9.00	0.314	0.046
15	164.96	5.75	54.93	7.71	0.331	0.040
16	165.44	5.96	57.00	7.65	0.343	0.041

Legend: $\bar{x}$ – arithmetic mean
s – standard deviation

A comparison of individual groups was performed by a parametric analysis of variance, then we applied Scheffe‘s method to determine the difference between specific groups. A cross-check comparison was performed by a non-parametric Kruskal and Wallis analysis of variance. A comparison with a standard by Moravec (1990) (Table 8) was performed by means of a t-test.

The analysis of body height in girls was based on research question No. 1. We defined partial hypotheses **$H_0$1** and **$H_0$2** for each age category and visual group of visually impaired children and youth. In order to compare developmental trends we formulated related hypotheses **$H_0$1 r**, **$H_0$2 r**.

Partial hypotheses

$H_0$1: There are no differences in body height in six-year-old girls between group B_1 and sighted girls in our test sample.

Similarly, partial hypotheses were defined for other age categories and visual impairment groups (B_1 aged 7, 8, 9, … years, B_{2-3} aged 7, 8, 9, …. years).

Related hypothesis

$H_0$1 r: Between six and eleven years of age in the groups of B_1, B_{2-3} of visually impaired and sighted girls of our test sample there are no differences in body height in a majority of age categories.

Partial hypotheses

$H_0$2: Visually impaired and sighted girls in our test sample at the age of six years do not differ in the probability distribution of body height from a standard by Moravec (1990).

Similarly, partial hypotheses were defined for other age categories.

Related hypothesis

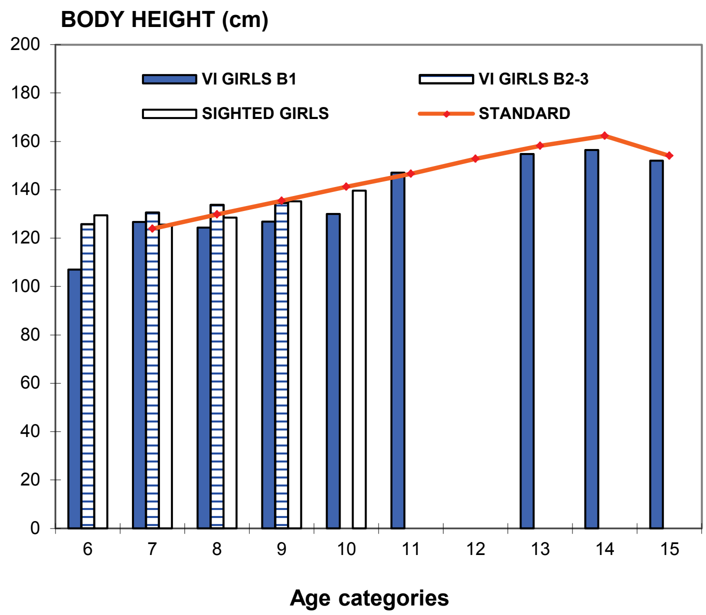
$H_0$2 r: Visually impaired and sighted girls in our test sample between six and fifteen years of age do not differ in the probability distribution of body height from a standard by Moravec (1990) in a majority of age categories (Table 8).

Based on a parametric analysis of variance and Scheffe's test at a level of significance of $\alpha = 0.05$ we conclude that in seven-, nine-, ten- and eleven-year-old girls of all groups and categories there are no differences in statistical distribution of body height and thus confirm **$H_0$1**. **$H_0$1** is rejected only in eight-year-old girls of B_{2-3} category. We can confirm the validity of **$H_0$1 r** in a majority of age categories. To verify this result we also used a non-parametric test by Kruskal and Wallis.

A comparison of girls by means of a t-test according to a standard by Moravec confirmed the validity of the partial hypothesis **$H_0$2 r** in a majority of age categories and groups

A graphical scheme of the comparison of individual groups of girls including references to the standard is shown in Figure 8.

Figure 8. Body height girls



b) Statistical processing and graphical interpretation of height in the sample of boys

In the analysis of body height in the sample of boys we applied the same assumptions as in girls. Basic statistical data are specified in Table 9.

Table 9. Basic statistical data on height in the sample of boys

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	1	127.00	0.00				1	116.00	0.00
7	5	122.00	6.48	7	124.34	5.89	23	125.26	3.79
8	6	126.00	8.60	7	133.21	7.47	27	128.22	6.12
9	1	138.00	0.00	3	138.50	12.28	15	137.73	8.11
10	10	140.56	9.19	3	145.00	10.26	4	140.75	0.96
11	6	137.91	7.32	1	148.00	0.00			
12	1	128.00	0.00						
13	1	143.00	0.00						
14	5	154.40	5.72						
15	5	151.40	10.69						
16	1	173.00	0.00						
Total	**42**			**20**			**70**		

Legend: B_1, B_{2-3} – visual impairment category
$\bar{x}$ – arithmetic mean
S – sighted population
s – standard deviation
N – number of pupils in the respective age category

Just as in the sample of girls we based the analysis on a standard by Moravec (Table 10).

Table 10. Statistical characteristics of physical development in boys aged 7–16 years (Moravec, 1990 – adapted)

Age	Height (cm)		Weight (kg)		Weight-height index	
	$\bar{x}$	s	$\bar{x}$	s	$\bar{x}$	s
7	124.73	6.47	24.96	4.03	0.199	0.026
8	130.51	6.13	28.24	5.23	0.215	0.032
9	136.03	6.27	31.01	5.63	0.227	0.034
10	140.98	6.84	34.43	6.67	0.243	0.039
11	146.35	7.13	38.35	7.53	0.260	0.042
12	151.36	8.00	41.90	8.30	0.275	0.045
13	158.19	8.75	47.12	9.65	0.296	0.048

14	164.56	11.68	53.06	11.25	0.319	0.051
15	172.67	8.05	61.11	9.67	0.352	0.045
16	176.10	7.34	65.46	8.69	0.371	0.041

Legend: $\bar{x}$ – arithmetic mean
s – standard deviation

As in the case of girls, we based our assumptions on research question No. 1 and defined partial hypotheses **$H_0$1**and **$H_0$2** for each age category and visual group of visually impaired boys. In order to compare developmental trends we defined related hypotheses **$H_0$1 r** and **$H_0$2 r**.

Partial hypotheses

$H_0$1: There are no differences in body height in six-year-old boys between group B_1 and sighted boys in our test sample.

Similarly, we defined partial hypotheses for other age categories and visual impairment groups.

Related hypothesis

$H_0$1 r: Between six and eleven years of age in the groups of B_1, $B_{2–3}$ of visually impaired and sighted boys of our test sample there are no differences in body height in a majority of age categories.

Partial hypotheses

$H_0$2: Visually impaired and sighted boys in our test sample at the age of six years do not differ in the probability distribution of body height from a standard by Moravec (1990) (Table 10).

Similarly, partial hypotheses were defined for other age categories.

Related hypothesis

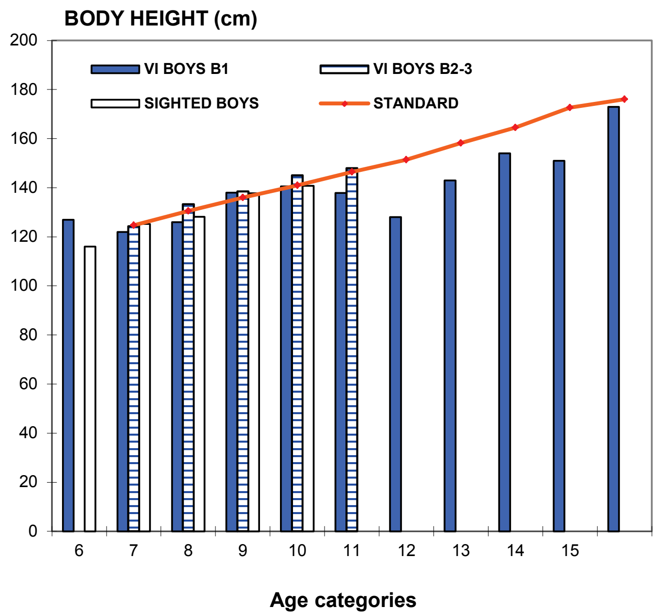
$H_0$2 r: Visually impaired and sighted boys in our test sample between six and fifteen years of age do not differ in the probability distribution of body height from a standard by Moravec (1990) in a majority of age categories (Table 10).

Based on a parametric analysis of variance and Scheffe's test at a level of significance of $\alpha = 0.05$ we conclude that between the groups of seven- to eleven-year-old boys there are no statistically significant differences in probability distribution of body height. To verify this result we also used a non-parametric test by Kruskal and Wallis. Also here we conclude that there are no differences in this age group of boys at a level of significance of $\alpha = 0.05$. We confirm the **$H_0$1 r** hypothesis in body height in six- to eleven-year-old boys.

A comparison of visually impaired boys by means of a t-test with a standard by Moravec confirmed the hypothesis in all cases, all age categories and groups of visual impairment. **$H_0$2 r**.

The whole situation is clearly shown in Figure 9.

Figure 9. Physical height boys



4.2.1.2 Body weight and weight-height index

a) Statistical processing and graphical interpretation of body weight and weight-height indexes in the sample of girls

Body weight was the second anthropometric indicator monitored in our survey. This indicator is a crucial morphological parameter used in the assessment of body movement dynamics (Riegerová & Ulbrichová, 1993). From an anatomic perspective, the human body consists of fat mass, muscles, bones, internal organs and other tissues. The proportion of active muscle mass and fat is crucial to movement dynamics. Therefore, our survey also included the weight-height index in order to obtain a complete overview of the height-weight ratio in visually impaired individuals (Table 11).

Table 11. Basic statistical data on weight in the sample of girls

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	2	19.00	5.66	2	26.00	1.41	2	25.00	4.24
7	3	24.00	3.00	5	27.20	3.96	24	24.96	4.92
8	4	24.75	2.22	9	28.56	4.18	26	26.50	4.59
9	8	26.38	7.60	4	29.50	6.56	9	30.44	5.88
10	2	30.50	0.71	0	0.00	0.00	3	31.33	3.79
11	4	44.00	11.43	0	0.00	0.00	0	0.00	0.00

12	0	0.00	0.00						
13	4	43.50	9.84						
14	2	42.00	7.07						
15	2	54.00	11.31						
16	1	72.00	0.00						
Group	**33**			**20**			**65**		

Legend: B_1, B_{2-3} – visual impairment category
S – sighted population
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean
s – standard deviation

The missing data are due to the fact that there were no girls of a specific type of visual impairment in the respective grades.

The analysis of body weight in girls was based on research question No. 1. We defined partial hypotheses **$H_0$1** and **$H_0$2** for each age category and visual group of visually impaired children and youth. In order to compare developmental trends we defined a related hypothesis **$H_0$1 r** and **$H_0$2 r**.

Partial hypotheses

$H_0$1: There are no differences in body weight in six-year-old girls between group B_1 and sighted girls in our test sample.

Similarly, we defined partial hypotheses for other age categories and visual impairment groups.

Related hypothesis

$H_0$1 r: Between six and eleven years of age in the groups of B_1, B_{2-3} of visually impaired and sighted girls of our test sample there are no differences in body weight in a majority of age categories.

Partial hypotheses

$H_0$2: Visually impaired girls of B_1 group and sighted girls in our test sample at the age of six years do not differ in the probability distribution of body weight from a standard by Moravec (1990).

Similarly, partial hypotheses were defined for other age categories.

Related hypothesis

$H_0$2 r: Visually impaired and sighted girls in our test sample between six and fifteen years of age do not differ in the probability distribution of body weight from a standard by Moravec (1990) in a majority of age categories (Table 8).

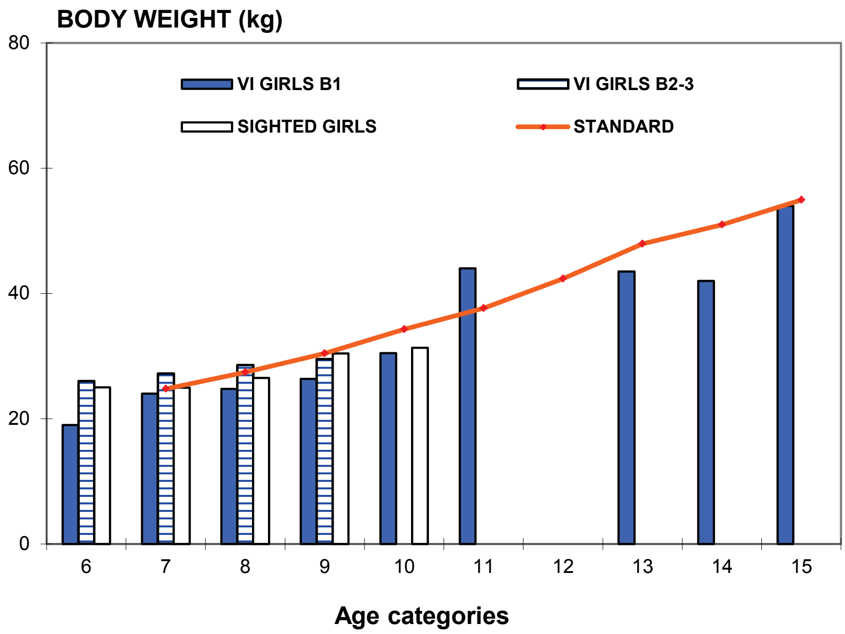
According to an analysis of variance we confirm partial hypothesis $\mathbf{H_01}$ for all age and visual categories. We confirm that none of the groups of tested girls significantly differed in body weight. The testing was performed at a level of significance of α = 0.05. Based on the above we can confirm the related hypothesis $\mathbf{H_01\ r}$.

A comparison of individual age categories and visual impairment groups with a standard by Moravec confirmed all partial hypotheses $\mathbf{H_02}$ based on an analysis of variance at a level of statistical significance of α = 0.05.

Therefore, we can also confirm related hypotheses $\mathbf{H_02\ r}$. None of the groups of tested girls between six and fifteen years of age significantly differs in body weight from a standard by Moravec. Body weight of both groups of visually impaired girls is comparable with common population as in the case of body height.

A graphical comparison is shown in Figure 10.

Figure 10. Body weight girls



To have a comprehensive overview, let us compare the indicators of the weight-height index in visually impaired girls of all categories and age groups with a standard by Moravec (1990).

Table 12 shows basic statistical data in the sample of girls for the determination of the weight-height index.

Table 12. Basic statistical data for the determination of the weight-height index in the sample of girls.

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	2	0.18	0.03	2	0.20	0.004	2	0.19	0.02
7	3	0.19	0.02	5	0.20	0.02	24	0.20	0.03

8	4	0.20	0.02	9	0.21	0.03	26	0.21	0.03
9	8	0.20	0.05	4	0.22	0.04	9	0.22	0.04
10	2	0.24	0.01	0	0.00	0.00	3	0.22	0.02
11	4	0.30	0.07	0	0.00	0.00	0	0.00	0.00
12	0	0.00	0.00						
13	4	0.28	0.05						
14	2	0.27	0.04						
15	2	0.36	0.08						
16	1	0.47	0.00						
Total	**33**			**20**			**65**		

Legend: B_1, B_{2-3} – visual impairment category
S – sighted population
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean
s – standard deviation

For comparison reasons we defined hypotheses **H_0 1**, **H_0 1 r**, **H_0 2** and **H_0 2 r.**

Partial hypotheses

$H_0$1: There are no differences in the weight-height index in six-year-old girls between group B_1 and sighted girls in our test sample.

Similarly, we defined partial hypotheses for other age categories and visual impairment groups.

Related hypothesis

$H_0$1 r: In the groups of B_1, B_{2-3} of visually impaired and sighted girls of our test sample between six and eleven years of age there are no differences in weight-height indexes in a majority of age categories.

Partial hypotheses

$H_0$2: Visually impaired and sighted girls in our test sample at the age of six years do not differ in the probability distribution of the weight-height index from a standard by Moravec (1990).

Similarly, partial hypotheses were defined for other age categories.

Related hypothesis

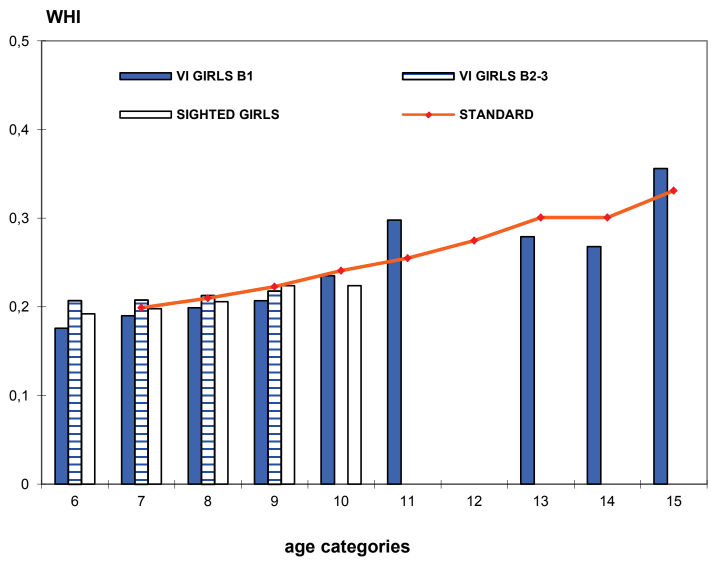
$H_0$2 r: Visually impaired and sighted girls in our test sample between six and fifteen years of age do not differ in the probability distribution of the weight-height index from a standard by Moravec (1990) in a majority of age categories (Table 8).

Based on a parametric and non-parametric analysis of variance and Scheffe's test we confirm all partial hypotheses **$H_0$1.** Thus we can conclude that there are no statistically significant differences between the groups of girls at a level of statistical significance of $\alpha = 0.05$. Based on the above we can also confirm the related hypothesis **$H_0$1 r**.

Under identical conditions as for **$H_0$1** we can confirm all partial hypotheses **$H_0$2** and also the related hypothesis **$H_0$2 r**. Similarly, no statistically significant differences were observed between visually impaired girls, sighted girls and a standard by Moravec (1990) compared by a t-test.

These facts are clearly shown in Figure 11.

Figure 11. Weight-height indexes



Based on statistically verified results we can state that the weight in both groups of visually impaired girls in the period of prepubescence and pubescence does not statistically significantly differ from common population of the same age and gender. Similarly, these girls are comparable in terms of weight-height indexes.

b) Statistical processing and graphical interpretation of body weight and weight-height indexes in the sample of boys.

In visually impaired boys we conducted a similar comparison of weight and weight-height indexes as in girls. Table 13 shows the basic statistical data.

Table 13. Basic statistical data for the determination of weight in the sample of boys.

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	1	24.00	0.00	0	0.00	0.00	1	20.00	0.00
7	5	21.60	2.07	6	26.00	4.34	23	24.26	2.73
8	6	26.00	9.01	7	30.29	5.28	27	26.62	4.23

9	1	29.00	0.00	3	45.33	13.57	15	31.80	6.34
10	10	38.30	6.57	3	43.67	17.47	4	33.50	1.00
11	6	37.50	9.40	1	41.00	0.00	0	0.00	0.00
12	1	21.00	0.00						
13	1	34.00	0.00						
14	5	40.70	5.74						
15	5	40.60	6.10						
16	1	52.00	0.00						
Group	**42**			**20**			**70**		

Legend: B_1, B_{2-3} – visual impairment category

S – sighted population

n – number of pupils in the respective age category

$\bar{x}$ – arithmetic mean

s – standard deviation

For weight comparison reasons we defined the following partial hypotheses: **H_0 1**, **H_0 1 r**, **H_0 2** and **H_0 2 r.**

Partial hypotheses

$H_0$1: There are no differences in body weight in six-year-old boys between group B_1 and sighted boys in our test sample.

Similarly, we defined partial hypotheses for other age categories and visual impairment groups.

Related hypothesis

$H_0$1 r: In the groups of B_1, B_{2-3} of visually impaired and sighted boys of our test sample between six and eleven years of age there are no differences in weight in a majority of age categories.

Partial hypotheses

$H_0$2: Visually impaired and sighted boys in our test sample at the age of six years do not differ in the probability distribution of weight from a standard by Moravec (1990).

Similarly, partial hypotheses were defined for other age categories.

Related hypothesis

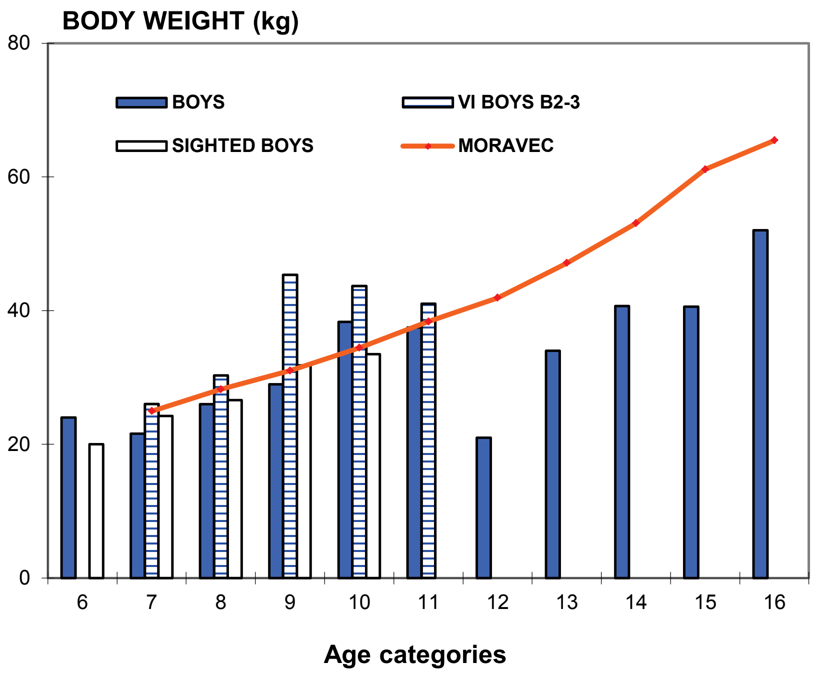
$H_0$2 r: Visually impaired and sighted girls in our test sample between six and fifteen years of age do not differ in the probability distribution of body weight from a standard by Moravec (1990) in a majority of age categories (Table 8).

After an assessment of the results of a parametric analysis of variance and Scheffe's test we confirm partial hypotheses **$H_0$1** in all age categories except nine-year-old visually impaired boys of category $B_{2\text{–}3}$. These nine-year-old boys have a higher weight compared with sighted boys. The same conclusions were also based on the results of a non-parametric analysis of variance. Both tests were performed at a level of significance of α = 0.05. According to the above we confirm **$H_0$1 r.**

Partial hypothesis **$H_0$2** is confirmed in 8, 9, 10, 11, 12 and 13-year-old children compared by means of a t-test between the samples of visually impaired boys, sighted boys and a standard by Moravec (1990). Hypothesis **$H_0$2** was not confirmed in seven-year-old visually impaired individuals of category B_1 and in fourteen- and fifteen-year-old boys of the same category B_1. In all cases boys have smaller weight values. The comparison was performed at a level of significance of α = 0.05. Based on the results we can confirm **$H_0$2 r** because in a majority of all age categories, boys' weight does not differ from a standard by Moravec.

The whole situation is shown in Figure 12.

Figure 12. Body weight boys



The weight-height index is again complemented with information about weight and height in visually impaired boys in various age and visual categories. Table 14 shows the basic statistical data concerning the sample of boys. Category $B_{2\text{–}3}$ of six-year olds included no boys.

Table 14. Basic statistical data for the determination of the weight-height index in the sample of boys

AGE	B_1			$B_{2\text{–}3}$			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	1	0.19	0.00	0	0.00	0.00	1	0.17	0.00
7	5	0.18	0.01	6	0.21	0.03	23	0.19	0.02

8	6	0.20	0.06	7	0.23	0.03	27	0.21	0.03
9	1	0.21	0.00	3	0.32	0.07	15	0.23	0.03
10	10	0.27	0.04	3	0.30	0.10	4	0.24	0.01
11	6	0.27	0.07	1	0.28	0.00	0	0.00	0.00
12	1	0.16	0.00						
13	1	0.24	0.00						
14	5	0.26	0.03						
15	5	0.27	0.04						
16	1	0.30	0.00						
Total	**42**			**20**			**70**		

Legend: B_1, B_{2-3} – visual impairment category
S – sighted population
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean
s – standard deviation

For weight-height indexes we formulated the following partial hypotheses: **H_0 1**, **H_0 1 r**, **H_0 2** and **$H_0$2 r.**

Partial hypotheses

$H_0$1: There are no differences in body weight-height indexes in six-year-old boys between group B_1 and sighted boys in our test sample.

Similarly, we defined partial hypotheses for other age categories and visual impairment groups.

Related hypothesis

$H_0$1 r: In the groups of B_1, B_{2-3} of visually impaired and sighted boys of our test sample between six and eleven years of age there are no differences in weight-height indexes in a majority of age categories.

Partial hypotheses

$H_0$2: Visually impaired boys of group B_1 and sighted boys in our test sample at the age of six years do not differ in the probability distribution of the weight-height index from a standard by Moravec (1990).

Similarly, partial hypotheses were defined for other groups and age categories.

Related hypothesis

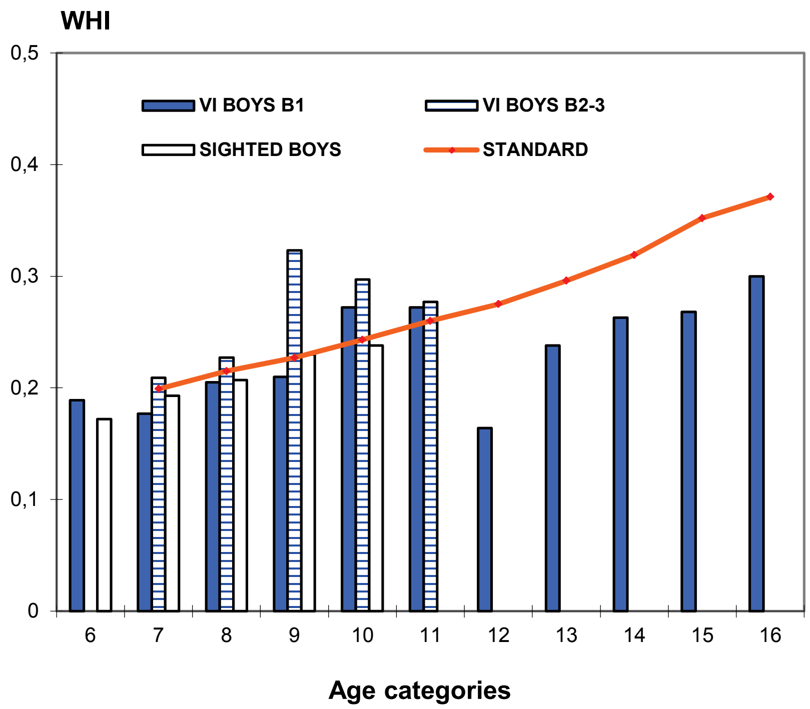
$H_0$2 r: Visually impaired and sighted boys in our test sample between six and fifteen years of age do not differ in the probability distribution of the weight-height index from a standard by Moravec (1990) in a majority of age categories (Table 10).

Based on a comparison of weight-height indexes we can confirm partial hypotheses **$H_0$1** in all age categories except seven- and nine-year-old boys. In seven-year-old boys, groups B_1 and B_{2-3} are statistically significantly different. Boys of group B_1 achieved the lowest average values. Boys in group B_{2-3} achieved higher average values. In nine-year-old boys, group B_{2-3} statistically significantly differs from sighted boys and group B_1. Boys of group B_{2-3} achieved higher average values. The comparison was again performed by means of a parametric as well as non-parametric analysis of variance at a level of statistical significance of α = 0.05. With respect to the above we confirm **$H_0$1r.**

A comparison with a standard by Moravec (1990) performed by means of a t-test confirms **$H_0$2** in all age categories in visually impaired boys of group B_{2-3} and sighted boys in our test sample. In group B_1 hypothesis **$H_0$2** was confirmed in the category of eight- to thirteen-year-old boys. **$H_0$2** was not confirmed in seven-, fourteen- and fifteen-year-old boys in this age group, they achieved lower average results. The testing was performed at a level of statistical significance of α = 0.05. Based on the results of partial hypotheses **$H_0$2** in individual age categories and visual impairment groups we confirm **$H_0$2 r**.

For clarity purposes, weight-height indexes are shown in Figure 13.

Figure 13. Weight-height indexes – boys



According to statistically verified results we conclude that weight in visually impaired boys in both categories of impairment do not considerably differ in general developmental trends. The same can be confirmed in weight-height indexes.

4.2.2 Results of motor skill tests

A) Test of fitness abilities

Test of strength abilities

4.2.2.1 Two-footed standing jump

a) Statistical and graphical interpretation of test results – two-footed standing jump in the sample of girls

Table 15 shows basic statistical characteristics in the sample of girls for two-footed standing jump.

Table 15. Basic statistical data in the sample of girls – two-footed standing jump.

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	2	66.50	0.70	2	58.50	82.73	2	159.50	28.99
7	3	63.67	36.53	5	88.80	52.91	24	122.04	26.81
8	4	64.50	17.23	10	88.70	62.16	26	127.73	23.96
9	8	72.25	47.05	4	96.50	65.32	10	132.30	15.20
10	2	81.50	0.71	0	0.00	0.00	3	140.00	6.24
11	4	89.25	24.34	0	0.00	0.00	0	0.00	0.00
12	0	0.00	0.00						
13	4	91.00	45.51						
14	2	113.00	18.38						
15	2	71.00	41.01						
16	1	100.00	0.00						
Total	33			21			66		

Legend: B_1, B_{2-3} – visual impairment category
$\bar{x}$ – arithmetic mean
S – sighted population
s – standard deviation
n – number of pupils in the respective age category

Result processing was performed in a similar way as statistical processing of basic anthropometric data. All samples were compared by means of a parametric as well as non-parametric analysis of variance. The differences between individual age categories and visual impairment groups were assessed using the Scheffe's test. For a mutual comparison with a standard by Moravec we used a t-test.

The analysis of two-footed standing jump in girls was based on research question No. 2. According to the above we formulated hypotheses **$H_0$1**, **$H_0$2** and **H_0 r.**

Partial hypotheses

$H_0$1: Visually impaired girls of group B_1 and sighted girls in our test sample at the age of six years do not differ in the level of dynamic explosive strength in the lower extremities in two-footed standing jump.

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in B_{2-3} aged 7, 8, 9, …. years).

$H_0$2: Otherwise visually equipped girls of both visual categories (B_1 and B_{2-3}) and girls in our test sample at the age of six years do not differ in the probability distribution of the level of dynamic explosive strength in the lower extremities in two-footed standing jump from a standard by Moravec (1990).

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in B_{2-3} aged 7, 8, 9, …. years).

Related hypothesis

$H_0$2 r: Visually impaired and sighted girls in our test sample between six and fifteen years of age do not differ in the level of dynamic explosive strength in the lower extremities in two-footed standing jump from a standard by Moravec (1990) in a majority of age categories (Table 16).

The girls' performance was compared in two tiers. First we conducted an analysis of performance in individual age categories and visual impairment groups by means of a parametric as well as non-parametric analysis of variance and Scheffe's test. After that we used a t-test to compare individual groups with a standard by Moravec (Table 8).

Table 16. Standard for girls – two-footed standing jump, sit-up and pull-up hold (Moravec, 1990 – modified)

Age	$\bar{x}$/s	Two-footed standing jump (cm)	Sit-up (number of repetitions)	Pull-up hold (sec.)
7	$\bar{x}$	122.81	22.17	9.87
	s	15.99	7.66	9.94
8	$\bar{x}$	135.20	25.63	11.94
	s	17.58	8.17	10.72
9	$\bar{x}$	139.57	27.18	11.55
	s	18.69	8.30	11.63
10	$\bar{x}$	151.70	31.28	15.12
	s	18.77	8.73	15.64
11	$\bar{x}$	161.55	33.40	13.38
	s	19.21	9.64	12.39

12	$\bar{x}$	167.31	34.03	12.92
	s	20.86	9.02	12.79
13	$\bar{x}$	174.56	34.81	12.76
	s	20.51	8.60	13.90
14	$\bar{x}$	175.56	34.80	15.82
	s	21.73	9.02	15.63
15	$\bar{x}$	178.49	35.75	13.41
	s	19.56	7.95	12.24
16	$\bar{x}$	180.05	37.07	13.43
	s	20.18	8.73	11.96

Legend: $\bar{x}$ – arithmetic mean

s – standard deviation

Based on an analysis of the results achieved by means of a parametric analysis of variance at a level of significance of $\alpha = 0.05$ and Scheffe's test in girls of group B_1, B_{2-3} and sighted population in our sample we conclude that there is no statistically significant difference in the category of six-year-old individuals. **$H_0$1** is confirmed. In seven-year-old girls, there is a statistically significant difference between group B_1 and sighted girls. In terms of average percentage, girls of group B_1 achieved only 51.63% of the performance of sighted girls in our sample. **$H_0$1** is rejected. In eight-year-old girls of groups B_1 and B_{2-3} there are statistically significant differences. In terms of percentage, girls of group B_1 achieved 50.7% of the performance of sighted girls in our sample; girls of group B_{2-3} achieved 69.3%. Therefore, **$H_0$1** is rejected in both visual impairment groups. In nine-year-old girls, group B_1 statistically significantly differs from sighted girls in our sample. Girls of group B_1 achieved average values lower by 54.5%. Again, **$H_0$1** is rejected. Similar results were observed in a non-parametric analysis of variance.

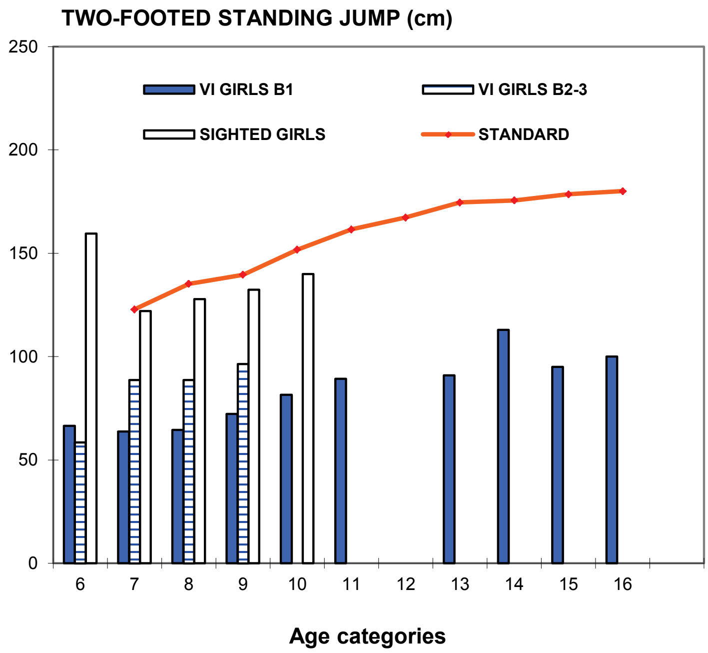
A comparison of groups B_1, B_{2-3} and sighted girls in our sample with a standard by Moravec (1990) was conducted by means of a t-test at a level of statistical significance of $\alpha = 0.05$. In seven-, fourteen- and fifteen-year-old girls of group B_1 no statistically significant difference was observed. **$H_0$2** is confirmed. In the other age categories (8, 9, 10, 11, 12, 13 years) of girls of group B_1 a statistically significant difference compared with the standard was proved, therefore **$H_0$2** is rejected. Girls in the mentioned age categories achieved lower average values. In group B_{2-3} a statistically significant difference was proved only in eight-year-old girls, therefore **$H_0$2** is rejected. Sighted girls in our sample were comparable with the standard in all age groups.

$H_0$2 is thus confirmed only in girls of group B_1 aged 7, 14 and 15 years. In group B_{2-3} **$H_0$2** is confirmed in all age categories except eight-year-old girls. In sighted girls **$H_0$2** is confirmed in all age categories.

With respect to these conclusions we confirm **$H_0$2 r** in sighted girls and girls of group B_{2-3} in a full extent. We further conclude that the developmental trends in a majority of age categories in this physical ability are comparable with general developmental trends. We observed a statistically significant difference in girls of B_1 from the standard in a majority of age categories, therefore $\mathbf{H_02}$ is rejected.

For clarity reasons we produced a graph demonstrating the performance in various groups and age categories (Figure 14).

Figure 14. Two-footed standing jump – girls



b) Statistical and graphical interpretation of test results – two-footed standing jump in the sample of boys

The analysis in boys was based on research question No. 2 as in girls. We formulated the following hypotheses: $\mathbf{H_01}$, $\mathbf{H_02}$ and $\mathbf{H_0}$ **r**.

Partial hypotheses

$\mathbf{H_01}$: Visually impaired boys of group B_1 and sighted boys in our test sample at the age of six years do not differ in the level of dynamic explosive strength in the lower extremities in two-footed standing jump.

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in $B_{2–3}$ aged 7, 8, 9, …. years).

$\mathbf{H_02}$: Visually impaired boys of both visual categories (B_1 and $B_{2–3}$) and boys in our test sample at the age of six years do not differ in the probability distribution of the level of dynamic explosive strength in the lower extremities in two-footed standing jump from a standard by Moravec (1990).

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, years, in $B_{2–3}$ aged 7, 8, 9, …. years).

Related hypothesis

$\mathbf{H_02}$ **r**: Visually impaired and sighted boys in our test sample between six and fifteen years of age do not differ in the level of dynamic explosive strength in the lower extremities in two-footed standing jump from a standard by Moravec (1990) in a majority of age categories (Table 17).

A standard by Moravec (1990) for the sample of boys in two-footed standing jump, sit-up and pull-up hold is specified in Table 17; basic statistical characteristics are shown in Table 18.

Table 17. A standard for boys – two-footed standing jump, sit-up and pull-up hold (Moravec, 1990 – modified)

Age	$\bar{x}$/s	Two-footed standing jump (cm)	Sit-up (number of repetitions)	Pull-up hold (sec.)
7	$\bar{x}$	130.09	21.99	13.06
	s	17.32	8.20	10.95
8	$\bar{x}$	139.20	26.71	17.25
	s	16.55	7.92	14.62
9	$\bar{x}$	147.20	29.03	19.65
	s	18.59	9.46	18.57
10	$\bar{x}$	157.13	32.42	17.62
	s	18.09	9.64	16.69
11	$\bar{x}$	164.23	33.57	
	s	19.68	9.07	
12	$\bar{x}$	175.12	37.56	
	s	21.02	8.98	
13	$\bar{x}$	184.19	39.54	
	s	21.85	9.94	
14	$\bar{x}$	196.22	39.57	
	s	24.44	9.14	
15	$\bar{x}$	211.92	43.11	
	s	21.22	8.27	
16	$\bar{x}$	218.93	45.36	
	s	21.58	8.76	

Legend: $\bar{x}$ – arithmetic mean
s – standard deviation
sec. – time in seconds

Based on an analysis of variance and Scheffe's test at a level of statistical significance of α = 0.05 in the sample of boys of group B_1, $B_{2–3}$ and sighted boys in our sample we conclude that there is a statistically significant difference in the category of seven-year-old boys in two-footed standing jump between boys of groups B_1 and $B_{2–3}$ and sighted boys in our sample. In terms of percentage, boys of group B1 achieved 46.15%, while boys of group B_{2-3} achieved 67.69% of the performance of sighted boys. Therefore **$H_0$1** is rejected in this age category in both visual impairment groups. The same conclusions were achieved by means of a non-parametric Kruskal and Wallis analysis of variance. There are statistically significant differences between eight-year-old sighted boys in our sample and boys of groups B_1 and B_{2-3}. In terms of percentage, boys of group B_1 achieved 31.21%, while boys of group B_{2-3} achieved 50.00% of average performance of sighted boys in our sample. **$H_0$1** is rejected in both cases. The category of nine-year olds included only one boy, therefore we could not perform any comparison.

In ten-year-old boys, statistically significant differences were observed only between group B_1 and sighted boys in our sample. The percentage of their average performance in comparison with sighted individuals is 56.16%. Therefore, **$H_0$1** is rejected.

Table 18. Basic statistical data in the sample of boys – two-footed standing jump.

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$ (cm)	s	Number (n)	$\bar{x}$ (cm)	s	Number (n)	$\bar{x}$ (cm)	s
6	1	105.00	0.00	0	0.00	0.00	1	147.00	0.00
7	4	78.00	17.66	6	88.83	45.74	23	130.00	17.40
8	6	44.33	27.70	4	71.50	83.04	29	142.62	14.97
9	1	67.00	0.00	2	108.00	8.49	15	143.67	17.96
10	8	79.75	35.50	3	126.67	14.19	4	142.25	15.33
11	6	73.33	23.32	1	141.00	0.00	0	0.00	0.00
12	1	85.00	0.00						
13	1	152.00	0.00						
14	5	121.00	15.75						
15	5	109.40	62.42						
16	1	140.00	0.00						
Total	**39**			**16**			**72**		

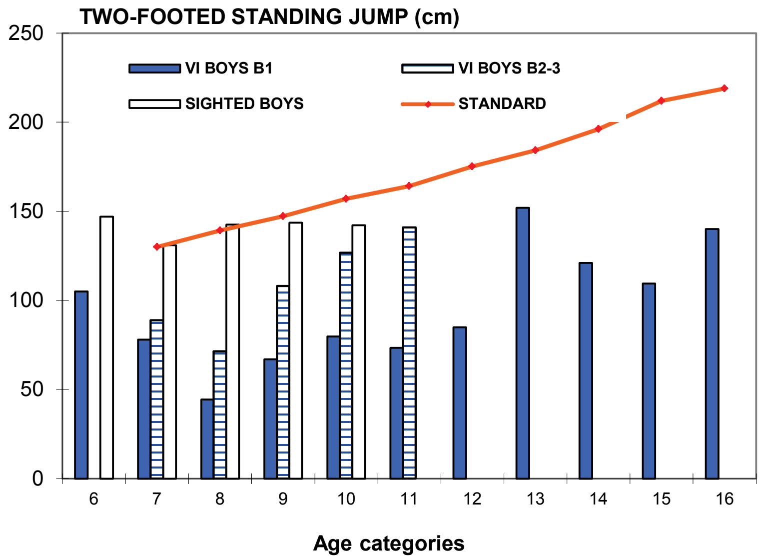
Legend: B_1, B_{2-3} – visual impairment category
S – sighted population
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean
s – standard deviation
cm – jump length in centimetres

A comparison with a standard by Moravec (1990) was performed by means of a t-test. In all age categories of boys of group B_1 a statistically significant difference compared with the standard was proved. All of them achieved lower average performance values. Therefore, **$H_0$2** is rejected in all age categories. Boys of group B_{2-3} differ from the standard only in the category of eight-year olds and achieved statistically significantly lower average performance values. Therefore, $\mathbf{H_0 2}$ is rejected in these cases. Sighted boys in our sample are comparable with the standard in all age groups. As a result, $\mathbf{H_0 2}$ can be confirmed in all age categories.

Based on the above mentioned results $\mathbf{H_0 2}$ **r** is confirmed in sighted boys in our sample as well as in visually impaired boys of group B_{2-3}. In a majority of age categories both groups are comparable with general developmental trends presented by Moravec in his standard. $\mathbf{H_0 2}$ is rejected in group B_1.

The following Figure shows a graphical interpretation of these facts.

Figure 15. Two-footed standing jump – boys



4.2.2.2 Sit-ups

a) Statistical and graphical interpretation of the results of the sit-up test in the sample of girls

The second motor skill test in the area of strength abilities is based on sit-ups. Basic statistical data of our sample of girls are shown in Table 19, standard by Moravec in Table 8.

Table 19. Basic statistical data of sit-up motor skill test in girls

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	2	18.00	2.82	2	22.00	5.65	2	30.00	4.24
7	2	21.00	4.24	5	27.20	8.43	24	28.96	5.33
8	4	13.00	12.14	10	22.10	11.92	26	33.77	10.86
9	8	20.25	8.06	4	29.50	9.33	10	30.10	5.11
10	2	22.50	0.70	0	0.00	0.00	3	29.00	4.58
11	4	18.25	3.77	0	0.00	0.00	0	0.00	0.00

12	0	0.00	0.00						
13	4	22.00	12.30						
14	2	23.50	3.53						
15	2	27.00	0.00						
16	1	20.00	0.00						
Total	**32**			**21**			**66**		

Legend: B1, B_{2-3} – visual impairment category
S – sighted population
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean
s – standard deviation

Statistical processing was performed using the same statistical processes as in previous tests.

We formulated the following hypotheses on the basis of research question No. 2: $\mathbf{H_0 1}$, $\mathbf{H_0 2}$ and **H0 r**.

Partial hypotheses

$\mathbf{H_0 1}$: There are no differences in the performance in the sit-up test in six-year-old girls between visually impaired girls of group B_1 and sighted girls in our test sample.

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in B_{2-3} aged 7, 8, 9, …. years).

$\mathbf{H_0 2}$: There are no differences in the performance in the sit-up test in six-year-old girls in both visual impairment groups (B_1 and B_{2-3}) and girls in our test sample compared with a standard by Moravec (1990).

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in B_{2-3} aged 7, 8, 9, …. years).

Related hypothesis

$\mathbf{H_0 2}$ **r**: The performance in the sit-up test in visually impaired girls and sighted girls in our sample does not differ from a standard by Moravec (1990) in a majority of age categories at the age of six to fifteen years.

Based on an analysis of variance at a level of significance of $\alpha = 0.05$ and Scheffe's test we conclude that in six-year-old girls there are no statistically significant differences between both groups of visually impaired girls and sighted girls in our test sample. These conclusions were also confirmed by a non-parametric Kruskal and Wallis test. Therefore, $\mathbf{H_0 1}$ is confirmed. In seven-year-old girls no statistically significant differences were observed, therefore $\mathbf{H_0 1}$ is confirmed. However, a statistically significant difference was observed in sit-up performance between eight-year-old girls of group B_1 and sighted girls in our sample. The same applies to visually impaired girls of group B_{2-3}. $\mathbf{H_0 1}$ is rejected in both visual impairment groups. However, this result is somewhat "distorted" by above-average performance values in the group of sighted girls in our sample. Their performance considerably exceeds the average value specified in a standard by Moravec (1990). In nine-year-old girls of group B_1 we observed a statistically significant difference only in comparison with sighted girls in our sample. These nine-year-old girls of group B_1 achieved a lower average performance value. Again, $\mathbf{H_01}$ is rejected.

To compare ten-year-old girls we used a t-test because group B_{2-3} did not include any girls. A comparison of girls of group B_1 and sighted girls in our sample did not reveal any statistically significant differences, therefore $\mathbf{H_01}$ confirmed.

A t-test at a level of statistical significance of $\alpha = 0.05$ was used for a gradual comparison of all age categories and visual impairment groups of girls in our sample with a standard by Moravec (1990).

In the category of seven-year-old visually impaired girls of group B_1 no statistically significant difference was observed. $\mathbf{H_02}$ is confirmed in this age category. A statistically significant difference was observed in eight-, nine-, ten- and eleven-year-old girls of group B_1. Girls in all of these age categories achieved lower performance values. Therefore, $\mathbf{H_02}$ is rejected in these cases. In the category of twelve-year olds there was no girl of group B_1. Thirteen- and fourteen-year-old girls in group B_1 were comparable with a standard. $\mathbf{H_02}$ is confirmed for these two age categories.

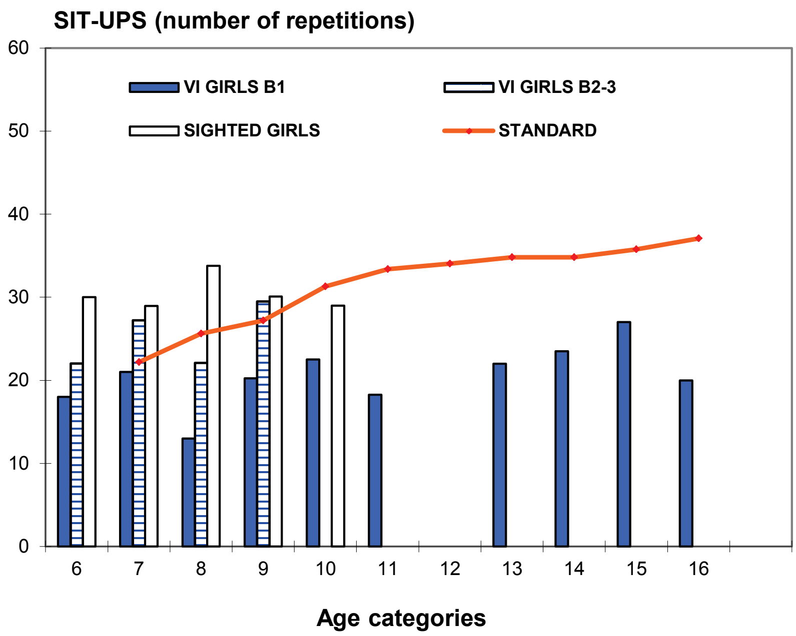
Visually impaired girls of group B_{2-3} of all age categories are comparable with a standard by Moravec, therefore $\mathbf{H_02}$ is confirmed.

In sighted girls in our sample we observed a statistically significant difference in seven- and eight-year-old girls. Compared with a standard, their performance was above-average. In the other age categories girls were comparable with a standard.

$\mathbf{H_02}$ **r** is confirmed in a full extent in sighted and visually impaired girls of group B_{2-3} in all age categories. In girls of group B_1 $\mathbf{H_02}$ **r** is rejected because the required number of prevailing age categories was not achieved.

Figure 16 shows graphical interpretation of sit-up test performance in the sample of girls.

Figure 16. Sit-ups in the sample of girls



b) Statistical and graphical interpretation of the results of the sit-up test in the sample of boys

In a similar way we processed the results in the sample of boys. Table 20 shows basic statistical data in the sample of boys. A standard by Moravec is shown in Table 10.

Table 20. Basic statistical data of the sit-up motor skill test in the sample of boys

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	1	16.00	0.00	0	0.00	0.00	1	22.00	0.00
7	5	11.40	11.39	5	16.20	8.35	23	28.61	8.61
8	6	13.00	10.83	5	26.80	5.40	29	35.79	8.68
9	1	23.00	0.00	2	16.50	0.71	15	28.53	5.69
10	8	12.75	10.03	3	18.67	3.79	4	44.00	11.52
11	6	17.83	8.93	1	17.00	0.00	0	0.00	0.00
12	1	16.00	0.00						
13	1	36.00	0.00						
14	5	31.80	9.27						
15	5	28.40	5.50						
16	1	42.00	0.00						
Total	**40**			**16**			**72**		

Legend: B_1, B_{2-3} – visual impairment category
S – sighted population

For the purposes of statistical processing we used the same statistical procedures as in the previous cases.

We formulated the following hypotheses on the basis of research question No. 2: $\mathbf{H_0 1}$, $\mathbf{H_0 2}$ and $\mathbf{H_0\ r}$ for the sit-up test in the sample of boys.

Partial hypotheses

$\mathbf{H_0 1}$: There are no differences in the performance in the sit-up test in six-year-old boys between visually impaired boys of group B_1 and sighted boys in our test sample.

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in B_{2-3} aged 7, 8, 9, …. years).

$\mathbf{H_0 2}$: There are no differences in the performance in the sit-up test in six-year-old boys in both visual impairment groups (B_1 and B_{2-3}) and boys in our test sample compared with a standard by Moravec (1990).

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in B_{2-3} aged 7, 8, 9, …. years).

Related hypothesis

$\mathbf{H_0 2}$ **r**: The performance in the sit-up test in visually impaired boys and sighted boys in our sample does not differ from a standard by Moravec (1990) in a majority of age categories at the age of six to fifteen years (Table 10).

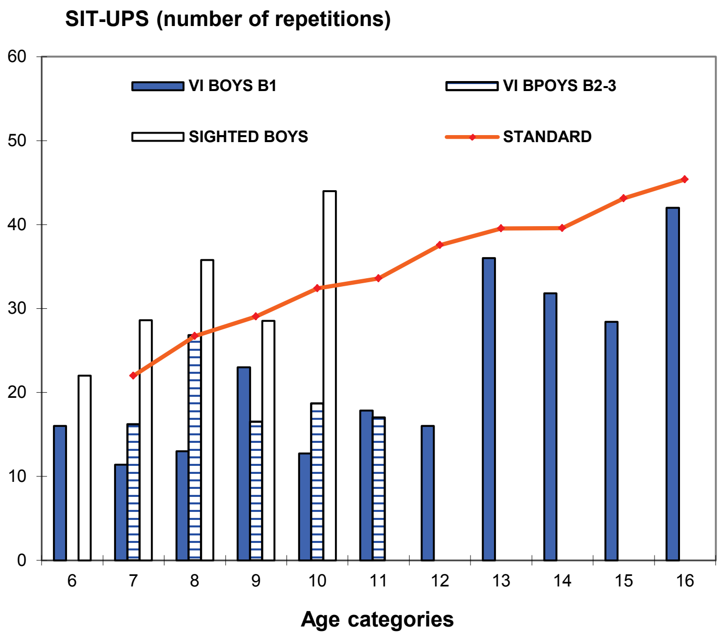
Based on an analysis of variance at a level of significance of α = 0.05 and Scheffe's test we conclude that in seven-year-old boys there are statistically significant differences between both groups B_1 and B_{2-3} and sighted boys in our sample. $\mathbf{H_0 1}$ is rejected in seven-year-old boys of both visual impairment groups. In eight-year-old boys, statistically significant differences were observed between boys of group B_1 and boys of group B_{2-3}, and also between boys of group B_1 and sighted boys in our sample. In eight-year olds $\mathbf{H_0 1}$ is confirmed in sighted population boys in our sample as well as visually impaired boys of group B_{2-3}, $\mathbf{H_0 1}$ is rejected for category B_1. For nine-year olds we again used a t-test because group B_1 included only one boy. There is a statistically significant difference between group B_{2-3} and sighted boys in our sample at a level of significance of α = 0.05. Sighted boys achieved higher average performance values. In ten-year-old boys, similar differences were again observed between boys of group B_1 and B_{2-3} and sighted boys in our sample. Therefore, in both visual impairment groups $\mathbf{H_0 1}$ is rejected because sighted boys in our sample achieved higher performance values. In this case and in the previous cases the results were also confirmed by a non-parametric Kruskal and Wallis analysis of variance.

For a comparison with a standard by Moravec (1990) we used a t-test at a level of statistical significance of α = 0.05. In seven-year-old boys of group B_1 no significant difference was observed, therefore $\mathbf{H_0 2}$ is confirmed. A statistically significant difference was observed between eight-year-old boys of group B_1 and standard values; therefore $\mathbf{H_0 2}$ is rejected in this case. In nine-, twelve- and thirteen-year-old boys, only a graphical comparison will be made because there was only one boy in each group. A statistically significant difference was observed between ten- and twelve-year-old boys of group B_1 and standard values; therefore $\mathbf{H_0 2}$ is rejected in this case. Performance values in both groups were below standard values. No statistically significant differences were observed among fourteen-year-old boys; therefore $\mathbf{H_0 2}$ is confirmed in this case. A statistically significant difference was observed between fifteen-year-old boys of group B_1 and standard values; therefore $\mathbf{H_0 2}$ is rejected in this case. All performance values of group B_1 in all age categories where $\mathbf{H_0 2}$ was rejected were below standard values according to Moravec. After that we compared boys in group B_{2-3}. No statistically significant differences were observed between seven- and eight-year-old boys from standard values; on the contrary, there was a statistically significant difference in the case of nine- and ten-year-old boys. In seven- and eight-year-old boys $\mathbf{H_0 2}$ is rejected; in nine- and ten-year-old boys $\mathbf{H_0 2}$ is confirmed, adding that the younger boys achieved below-average results. Finally we compared sighted boys in our sample with standard values. A statistically significant difference was observed in seven- and eight-year-old boys. Compared with standard values, their performance was above-average. In the remaining categories, i.e. nine- and ten-year-old boys, no statistically significant differences were observed, therefore $\mathbf{H_0 2}$ is confirmed.

The statistical results indicate that in sighted boys in our sample $\mathbf{H_02\ r}$ is confirmed in a majority of age categories. $\mathbf{H_02\ r}$ is rejected in groups B_1 and B_{2-3} in a prevailing number of age categories.

Graphical interpretation is shown in Figure 17.

Figure 17. Sit-ups in the sample of boys



4.2.2.3 Pull-up hold

a) Statistical and graphical interpretation of the results of the pull-up hold test, girls

Pull-up hold is a test, where visual control has only a limited role. We formulated the following hypotheses on the basis of research question No. 2: $\mathbf{H_01}$, $\mathbf{H_02}$ and **H0 r**.

Partial hypotheses

$\mathbf{H_01}$: There are no differences in the performance in the pull-up hold test in six-year-old girls between visually impaired girls of group B_1 and sighted girls in our test sample.

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in B_{2-3} aged 7, 8, 9, …. years).

$\mathbf{H_02}$: There are no differences in the performance in the pull-up hold test in six-year-old girls in both visual impairment groups (B_1 and B_{2-3}) and girls in our test sample compared with a standard by Moravec (1990).

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in B_{2-3} aged 7, 8, 9, …. years).

Related hypothesis

$\mathbf{H_02\ r}$: The performance in the pull-up hold test in visually impaired girls and sighted girls in our sample does not differ from a standard by Moravec in a majority of age categories at the age of six to fifteen years.

A standard by Moravec is shown in Table 8. The basic statistical characteristics of the sample of girls are specified in Table 21. The results of the pull-up hold test are given in seconds /sec./

Table 21. Basic statistical data, motor skill test – pull-up hold, girls

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$ /sec/	s	Number (n)	$\bar{x}$ /sec/	s	Number (n)	$\bar{x}$ /sec/	s
6	1	3.60	0.00	1	0.00	0.00	2	10.50	12.02
7	0	0.00	0.00	5	5.06	6.19	24	8.41	6.32
8	3	7.97	5.76	9	2.13	2.06	26	8.08	6.88
9	8	4.31	5.91	2	11.00	1.41	10	7.10	7.93
10	2	0.28	0.40	0	0.00	0.00	3	10.33	9.02
11	4	0.83	0.98	0	0.00	0.00	0	0.00	0.00
12	0	0.00	0.00						
13	4	3.20	3.45						
14	2	7.55	0.21						
15	2	2.15	3.04						
16	1	0.20	0.00						
Total	30			17			66		

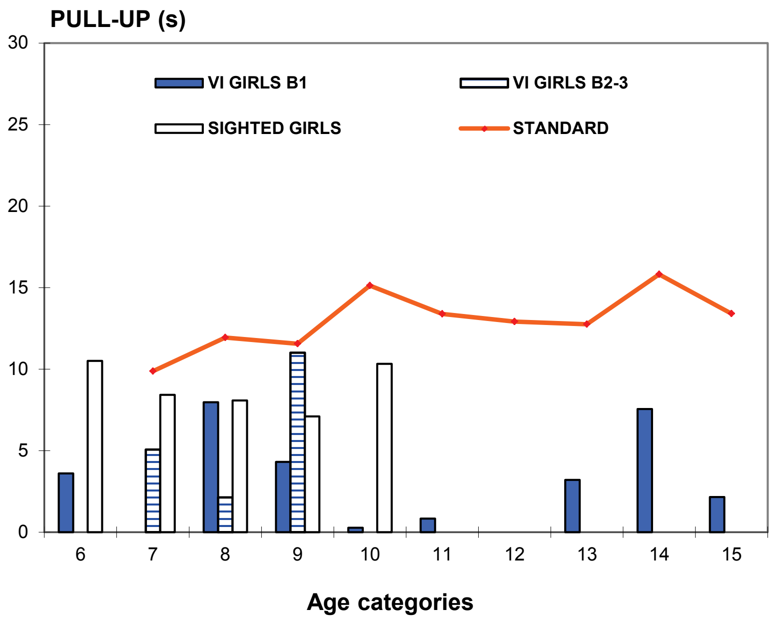
Legend: B_1, B_{2-3} – visual impairment category
S – sighted population
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean
s – standard deviation
sec. – time in seconds

An analysis of the results of this test in individual groups of visually impaired girls and girls in our sample between six and ten years of age revealed no statistically significant differences based on a non-parametric analysis of variance. Therefore, $\mathbf{H_01}$ is confirmed in all visual impairment groups and age categories. The comparison was performed at a level of statistical significance of $\alpha = 0.05$. At the same level of significance we compared our samples with a standard by Moravec (1990). Only eight- and fourteen-year-old girls in group B_1 were comparable with standard values. $\mathbf{H_02}$ is confirmed for both of these age categories. In the remaining age categories of group B_1 a statistically significant difference compared with the standard was proved. $\mathbf{H_02}$ is rejected for these age categories. Girls of group B_{2-3} were comparable with standard values by Moravec, only eight-year-old girls differed. Therefore, $\mathbf{H_02}$ is rejected in eight-year-old girls and $\mathbf{H_02}$ is confirmed in the other age categories. The same applied to a comparison of sighted girls with standard values. Also here, a statistically significant difference was observed only in eight-year-old girls. **$H_0$2** is rejected in eight-year-old girls and **$H_0$2** is confirmed in the other age categories.

Based on an analysis of the results we conclude that sighted girls in our sample and girls of group B_{2-3} meet the conditions of **$H_0$2 r** in a majority of age categories. **$H_0$2** is rejected in group B_1.

Graphical interpretation of these findings is shown in Figure 18.

Figure 18. Pull-up hold in the sample of girls



A comparison with standard values by Moravec (1990) did not confirm our assumption concerning the comparability of the performance of girls in our sample. In group B_{2-3} and in sighted girls in our sample the performance values were close to standard values and were not statistically significant. In girls of group B_1 however, **$H_0$2 r** is rejected. Moreover it should be noted that the performance in girls in several age categories was at the threshold of measurability. Some girls were unable to hold in the pull-up position.

b) Statistical and graphical interpretation of the results of the pull-up hold test, boys

We formulated the following hypotheses on the basis of research question No. 2: $H_0$1, $H_0$2 and H_0 r.

Partial hypotheses

$H_0$1: There are no differences in the performance in the pull-up hold test in six-year-old boys between visually impaired boys of group B_1 and sighted boys in our test sample.

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in B_{2-3} aged 7, 8, 9, …. years).

$H_0$2: There are no differences in the performance in the pull-up hold test in six-year-old boys in both visual impairment groups (B_1 and B_{2-3}) and boys in our test sample compared with a standard by Moravec (1990).

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in B_{2-3} aged 7, 8, 9, …. years).

Related hypothesis

$H_0$2 r: The performance in the pull-up hold test in visually impaired boys and sighted boys in our sample does not differ from a standard by Moravec in a majority of age categories at the age of six to eleven years.

A standard by Moravec is shown in Table 10. The basic statistical characteristics of the sample of boys are specified in Table 22. The performance of pull-up hold are given in seconds /sec./

Table 22. Basic statistical data, motor skill test – pull-up hold, boys

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$ /sec/	s	Number (n)	$\bar{x}$ /sec/	s	Number (n)	$\bar{x}$ /sec/	s
6	1	3.30	0.00	0	0.00	0.00	1	13.00	0.00
7	4	4.35	5.28	4	6.02	2.11	23	9.87	8.47
8	5	2.98	4.14	5	17.94	17.99	29	13.90	11.68
9	1	5.60	0.00	2	0.75	1.06	15	15.73	11.32
10	8	0.69	1.86	3	23.87	39.96	4	17.00	13.49
11	6	0.95	1.53	0	0.00	0.00	0	0.00	0.00
12	1	1.78	0.00						
13	1	12.70	0.00						
14	5	9.16	6.23						
15	5	4.39	3.38						
16	1	7.80	0.00						
Total	**38**			**15**			**72**		

Legend: B_1, B_{2-3} – visual impairment category

S – sighted population

n – number of pupils in the respective age category

$\bar{x}$ – arithmetic mean

s – standard deviation

A comparison with a standard by Moravec was possible only until eleven years of age. Older boys perform repeated pull-ups. The same applied to our pilot study conducted between 1994 and 1995. It turned out however that more than a half of visually impaired prepubescent individuals were unable to perform a single pull-up. Based on this finding, our further investigation of otherwise visually equipped boys focused on pull-up hold at the expense of the fact that from eleven year of age on there will be no comparison with standard values.

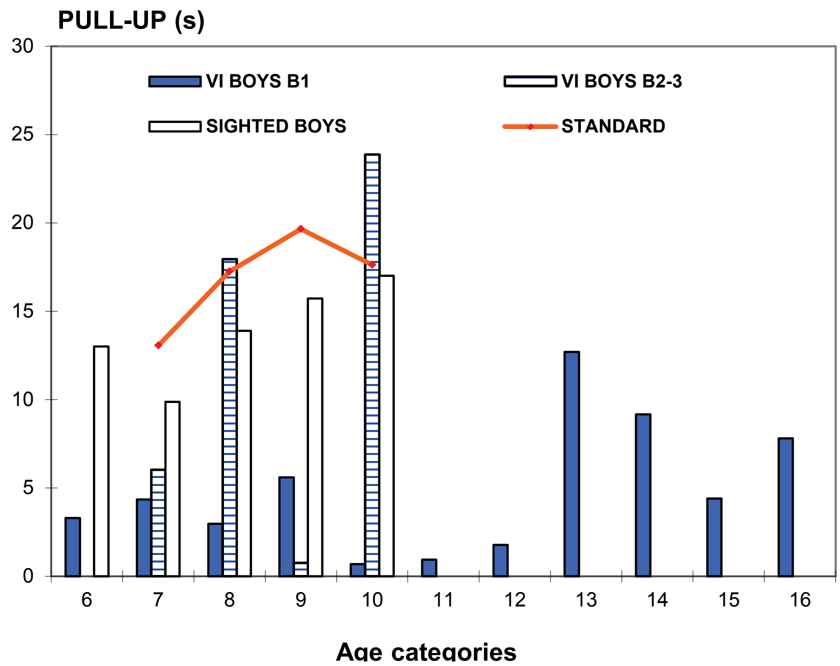
In processing the results of the pull-up hold test we first compared the categories of boys in groups B_1, B_{2-3} and sighted individuals. In the categories of seven- and eight-year-old boys no statistically significant difference was observed in a parametric analysis of variance. Therefore, $\mathbf{H_01}$ is confirmed. In nine-year-old boys we could only perform a comparison of boys in group B_{2-3} with sighted boys because group B_1 included just one boy. In ten-year-old boys, no statistically significant differences were indicated by a non-parametric test between group B_{2-3} and sighted individuals in our sample. Using a Kruskal and Wallis non-parametric test a statistically significant difference was observed both between boys of group B_1 and sighted boys, and boys in group B_{2-3} and sighted boys. While boys in group B_1 achieved below-average performance and therefore $\mathbf{H_01}$ is rejected, boys in group B_{2-3} achieved above-average performance.

The categories and groups of boys in our sample were gradually compared with standard values by Moravec (1990). A t-test in group B_1 revealed a statistically significant difference in all assessed age groups. $\mathbf{H_02}$ is rejected in all age categories. In group B_{2-3} a statistically significant difference was observed in seven- and nine-year-old boys. Similarly, $\mathbf{H_02}$ is rejected in this case. On the contrary, no statistically significant differences were observed in eight- and ten-year-old boys. No statistically significant differences were observed in any age group in sighted boys compared with standard values.

Based on an analysis of results $\mathbf{H_02}$ **r** is confirmed in sighted boys in our sample as well as in otherwise visually equipped boys of group B_{2-3}. $\mathbf{H_02}$ is rejected in group B_1.

Graphical interpretation of the results is shown in Figure 19.

Figure 19. Pull-up hold in the sample of boys



4.2.2.4 Dynamometry – hand grip

a) Statistical and graphical interpretation of the results of the right hand grip test, girls

The third motor skill test in the area of strength abilities is based on dynamometry – hand grip. In our survey we tested grip strength of both hands. We believe that of all tests dynamometry is the least influenced by the handicap of visually impaired children and youth. We applied the same statistical methods as in the previous cases. The results were compared with a survey by Kozlík (1968) (Table 23). The results by Kozlík (1968) cannot be regarded standard values as in the case of Moravec (1990) regarding the insufficient number of pupils. Despite this fact the results can be used for a more objective comparison of visually impaired children and youth during prepubescence.

The first aspect to assess was right hand grip in the sample of girls. No considerable differences were observed in the technique or effort of the girls compared with their sighted counterparts.

Table 23. Hand grip – dynamometry (Kozlík, 1968)

Right hand grip – girls /kp/					
Age	**7**	**8**	**9**	**10**	**11**
$\bar{x}$	7.68	9.57	12.55	15.08	16.58
s	3.95	5.39	3.39	4.15	3.78

Legend: $\bar{x}$ – arithmetic mean
s – standard deviation

Table 24 shows basic statistical data concerning right hand grip in the sample of girls.

Table 24. Basic statistical data, motor skill test – right hand grip, girls

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	2	4.00	4.24	2	11.00	0.00	2	17.50	4.95
7	3	8.33	1.53	5	12.20	2.59	24	12.97	2.78
8	4	12.50	1.73	10	13.50	3.21	26	13.69	2.84
9	8	12.38	4.11	4	13.75	7.14	10	15.40	2.83
10	2	12.30	3.26	0	0.00	0.00	3	13.67	2.08
11	4	18.45	3.44	0	0.00	0.00	0	0.00	0.00

12	0	0.00	0.00						
13	4	20.23	6.56						
14	2	22.15	6.58						
15	2	20.00	2.82						
16	1	28.10	0.00						
Total	**32**			**21**			**65**		

Legend: B_1, B_{2-3} – visual impairment category
$\bar{x}$ – arithmetic mean
S – sighted population
s – standard deviation
n – number of pupils in the respective age category
strength – in kp

Hand grip is a test, where visual control has no role. We formulated the following hypotheses on the basis of research question No. 2: **$H_0$1**, **$H_0$2**.

Partial hypotheses

H_0 1: There are no differences in the performance in the hand grip test in six-year-old girls between visually impaired girls of group B_1 and sighted girls in our test sample.

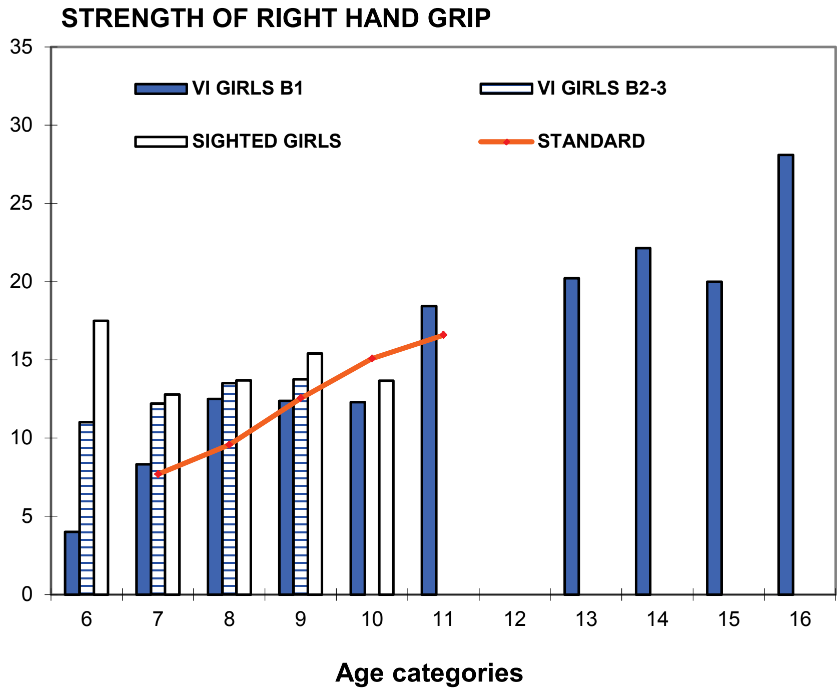
Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in B_{2-3} aged 7, 8, 9, …. years).

$H_0$2: There are no differences in the performance in the hand grip test in six-year-old girls in both visual impairment groups (B_1 and B_{2-3}) and girls in our test sample compared with a survey by standard by Kozlík.

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in B_{2-3} aged 7, 8, 9, …. years).

Based on a comparison of all visual impairment groups in our sample we conclude that there are no statistically significant differences in any of the groups between six and ten years of age. Therefore, H01 is confirmed. The only exception were seven-year-old girls of group B1, where we observed a statistically significant difference from sighted girls at a level of statistical significance of $\alpha = 0.05$. However, this difference is considerably influenced by above-average performance of sighted girls. In the text below we will focus on a comparison of individual visual impairment groups with a survey by Kozlík (1968), who tested girls until the age of eleven. The values observed in all age groups of girls of category B1 did not differ from a survey by Kozlík (1968). H02 is confirmed. The only statistically significant difference was observed in eight-year-old girls. Their performance was higher than average values observed by Kozlík. Similar above-average values were achieved by girls of category B2–3 at the age of seven and eight years. At the age of nine these girls were comparable with a survey by Kozlík. A similar situation as in the previous group was observed in sighted girls in our sample. Seven-, eight- and nine-year-old girls achieved above-average results; only in the group of ten-year olds no statistically significant difference was observed. The comparison was performed by means of a t-test at a level of statistical significance of α = 0.05. These facts are clearly shown in Figure 20.

Figure 20. Dynamometry – right hand grip, girls



Based on the facts above we can conclude that girls‘ performance in right hand grip is comparable in all groups and categories. The dynamics of strength development in right hand grip shows a regular increase in all groups and age categories. This trend is also apparent in girls of category B_1 at a later age.

b) Statistical and graphical interpretation of the results of the left hand grip test, girls

In a similar way we assessed left hand grip in the sample of girls. Table 25 shows performance values measured by Kozlík (1968).

Table 25. Hand grip – dynamometry (Kozlík, 1968)

Left hand grip – girls /kp/					
Age	**7**	**8**	**9**	**10**	**11**
$\bar{x}$	7.19	8.85	11.96	11.85	15.11
s	3.59	4.92	3.66	4.70	3.63

Legend: $\bar{x}$ – arithmetic mean
s – standard deviation

Basic statistical data of our sample of girls in hand grip are shown in Table 26.

Table 26. Basic statistical data, motor skill test – left hand grip, girls

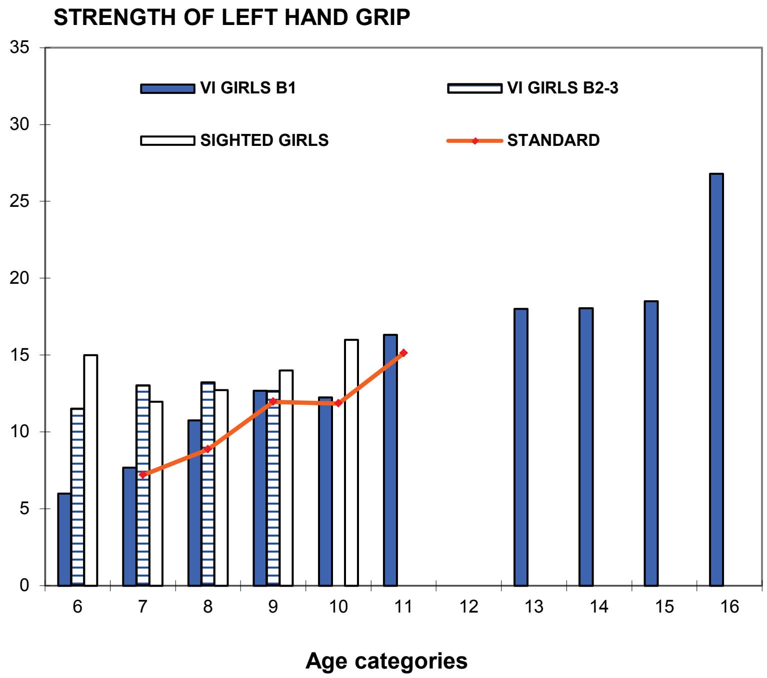
AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	2	6.00	2.82	2	11.50	0.70	2	15.00	7.07
7	3	7.67	1.15	5	13.00	2.44	24	11.96	2.88
8	4	10.75	2.63	10	13.20	3.55	26	12.73	3.00
9	8	12.68	5.21	4	12.63	5.50	10	14.00	3.12
10	2	12.25	1.76	0	0.00	0.00	3	16.00	1.73
11	4	16.33	5.41	0	0.00	0.00	0	0.00	0.00
12	0	0.00	0.00						
13	4	18.40	5.93						
14	2	18.05	3.18						
15	2	18.50	4.24						
16	1	26.80	0.00						
Total	**32**			**21**			**65**		

Legend: B_1, B_{2-3} – visual impairment category
S – sighted population
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean
s – standard deviation
strength – in kp

A comparison of various visual impairment groups and age categories in our survey using a parametric and non-parametric analysis of variance at a level of statistical significance of $\alpha = 0.05$ indicated the following results. There are no statistically significant differences between the groups of girls in our sample, except seven-year-old girls of group B_{2-3}. These girls differed in a statistically significant way from the group of sighted girls in our sample. However, the performance of sighted girls was above-average compared with the results of Kozlík's research. Therefore, H_01 is rejected in seven-year-old sighted girl.

A comparison of various visual categories by means of a t-test with the results of Kozlík's survey indicated the following conclusions. In group B1 no statistically significant differences were observed, therefore H02 is confirmed. In group B2–3 in seven- and eight-year-old girls no statistically significantly difference was observed. Girls in this age category achieved higher average performance values compared with Kozlík, therefore H02 is rejected. Nine-year-old girls are comparable with Kozlík's survey, therefore H02 is confirmed. Sighted girls at the age of seven and eight years achieved above-average results, therefore H02 is rejected in this age category. At the age of nine and ten years the performance was comparable with Kozlík's study, therefore H02 is confirmed. Figure 21 shows this comparison.

Figure 21. Dynamometry – left hand grip, girls



Similar to the dynamometry of the right hand, also in this case we observed an agreement in performance between various girls' categories in our survey and the research study by Kozlík (1968).

c) Statistical and graphical interpretation of the results of the right hand grip test, boys

In the sample of boys we used identical procedures as in the sample of girls. We formulated the following hypotheses on the basis of research question No. 2: **$H_0$1**, **$H_0$2**.

Partial hypotheses

$H_0$1: There are no differences in the performance in the hand grip test in six-year-old boys between visually impaired boys of group B_1 and sighted boys in our test sample.

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in $B_{2–3}$ aged 7, 8, 9, …. years).

$H_0$2: There are no differences in the performance in the hand grip test in six-year-old boys in both visual impairment groups (B_1 and $B_{2–3}$) and boys in our test sample compared with a survey by standard by Kozlík.

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in $B_{2–3}$ aged 7, 8, 9, …. years).

The results of Kozlík's survey (1968) are specified in Table 27.

Table 27. Hand grip – dynamometry – boys (Kozlík, 1968)

	Right hand grip – boys /kp/				
Age	7	8	9	10	11
$\bar{x}$	9.49	14.00	16.90	20.91	21.03
s	4.93	6.51	5.84	6.22	4.97

Legend: $\bar{x}$ – arithmetic mean
s – standard deviation

The basic statistical data of the sample of boys are specified in Table 28.

Table 28. Basic statistical data, motor skill test – right hand grip, boys

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	1	9.00	0.00	0	0.00	0.00	1	12.00	0.00
7	5	10.40	3.78	6	13.00	4.00	23	14.04	2.75
8	6	8.83	3.13	7	17.14	4.41	29	16.00	2.36
9	1	18.00	0.00	3	16.00	7.55	15	19.40	2.77
10	9	17.46	4.69	3	20.67	5.69	4	20.25	3.59
11	6	16.77	2.21	1	16.00	0.00	0	0.00	0.00
12	1	14.50	0.00						
13	1	26.60	0.00						
14	5	23.14	4.08						
15	5	22.85	5.56						
16	1	27.30	0.00						
Total	**41**			**20**			**72**		

Legend: B_1, B_{2-3} – visual impairment category
$\bar{x}$ – arithmetic mean
S – sighted population
s – standard deviation
n – number of pupils in the respective age category
strength – in kp

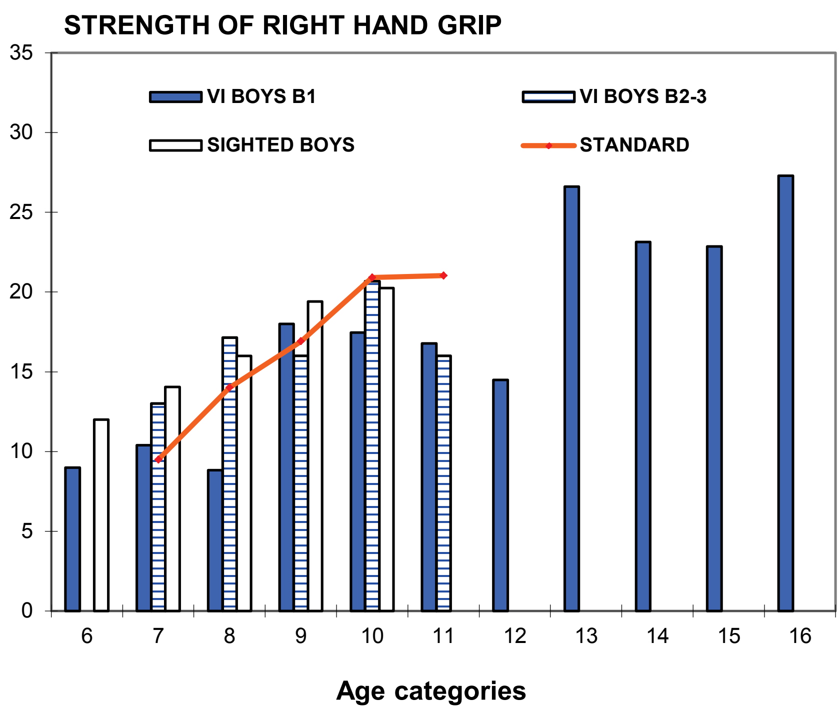
At first, a parametric analysis of variance was used to compare boys in our sample of all visual impairment groups and age categories up to the age of eleven. A pair comparison was made using a t-test. The comparison was performed at a level of statistical significance of α = 0.05. In seven-year-old visually impaired boys no statistically significant difference was observed between the groups. Therefore, $\mathbf{H_01}$ is confirmed. In eight-year-old boys of group B_1 a statistically significant difference was observed in comparison with group $B_{2\text{–}3}$ as well as sighted boys in our sample. Boys of group B_1 achieved the lowest performance, therefore in group B_1 $\mathbf{H_01}$ is rejected and confirmed in the remaining two groups. Nine-year olds were compared using a t-test. In boys of group $B_{2\text{-}3}$ a statistically significant difference was observed in comparison with sighted boys in our sample. They achieved lower performance values. In ten-year olds all categories are comparable. Therefore, $\mathbf{H_01}$ is confirmed.

A comparison of individual visual impairment groups with a survey by Kozlík (1968) revealed that boys of group B_1 of various age categories alternately agreed and differed in a statistically significant way. In seven-year olds no statistically significant difference was observed, in eight-year olds a statistically significant difference was observed, in ten-year olds both samples were comparable, between eleven-year-old boys of group B_1 and Kozlík's sample a statistically significant difference was observed.

In group $B_{2\text{–}3}$ the sample in all age categories was comparable with a survey by Kozlík (1968). Therefore, $\mathbf{H_02}$ is confirmed in this case.

A comparison of sighted individuals in our sample with a survey by Kozlík (1968) revealed that seven-, eight- and nine-year-old boys differed in a statistically significant way. In all three cases they achieved higher average values compared with boys from Kozlík's sample. Therefore, $\mathbf{H_02}$ is rejected in these cases. At the age of ten boys in both samples were comparable in the strength of right hand grip, therefore $\mathbf{H_02}$ is confirmed. Graphical interpretation of these findings is shown in Figure 22.

Figure 22. Dynamometry – right hand grip, boys



d) Statistical and graphical interpretation of the results of the left hand grip test, boys

We tested left hand grip in a similar way. As in the previous cases, the sample was compared with the sample investigated by Kozlík (1968). The basic statistical characteristics of Kozlík's sample are specified in Table 29.

Table 29. Hand grip – dynamometry – boys (Kozlík, 1968)

	Left hand grip – boys /kp/				
Age	7	8	9	10	11
$\bar{x}$	8.88	12.33	16.16	20.14	20.15
s	5.29	4.46	5.51	6.00	4.63

Legend: $\bar{x}$ – arithmetic mean
s – standard deviation

Basic statistical data of our sample of boys in left hand grip are shown in Table 30.

Table 30. Basic statistical data, motor skill test – left hand grip, boys

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	1	10.00	0.00	0	0.00	0.00	1	10.00	0.00
7	5	10.20	3.42	6	11.83	2.48	23	12.30	2.05
8	6	8.97	2.82	7	15.71	2.13	29	15.24	2.64
9	1	14.00	0.00	3	17.33	5.51	15	17.40	2.38
10	9	17.13	2.93	3	20.33	5.13	4	18.75	2.87
11	6	14.86	3.37	1	16.00	0.00	0	0.00	0.00
12	1	9.83	0.00						
13	1	30.10	0.00						
14	5	22.35	3.85						
15	5	21.99	4.81						
16	1	29.00	0.00						
Total	**41**			**20**			**72**		

Legend: B_1, B_{2-3} – visual impairment category
S – sighted population
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean
s – standard deviation
strength – in kp

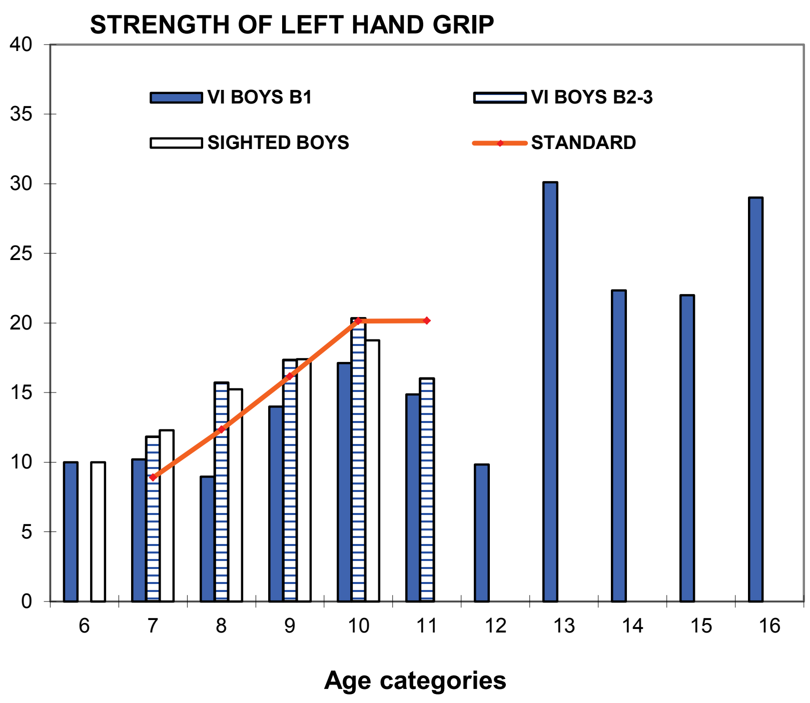
We processed the results of this test as in the previous cases. First we compared boys of groups B_1, $B_{2\text{-}3}$ and sighted boys in our sample. The results indicate that except eight-year-old boys of group B_1 all groups in our sample are comparable according to a parametric as well as non-parametric analysis of variance. Therefore, $\mathbf{H_01}$ is confirmed for all visual impairment groups and age categories. An exception is a group of boys of B_1, who achieved lower average performance values, therefore $\mathbf{H_01}$ is rejected in this case. The testing was performed at a level of statistical significance of $\alpha = 0.05$.

A comparison of boys of group B_1 with a survey by Kozlík (1968) confirmed an agreement only in the group of seven-year olds. In eight-, nine- and ten-year olds a statistically significant difference was observed at a level of statistical significance of $\alpha = 0.05$. In both age categories boys achieved lower average performance values. $\mathbf{H_02}$ is conformed in seven-year-old boys and rejected in nine- and ten-year-old boys.

In group B_{2-3} compared with Kozlík's survey a statistically significant difference was observed in seven- and eight-year-old boys. In both age categories these boys achieved higher average performance values than Kozlík's boys. Therefore, $\mathbf{H_02}$ is rejected. No statistically significant differences were observed in the categories of nine- and ten-year olds, therefore, $\mathbf{H_02}$ is confirmed.

A comparison of sighted boys in our sample with the sample investigated by Kozlík (1968) precisely copies the situation in the previous group. Seven- and eight-year-old boys do not differ from Kozlík's sample in a statistically significant way. Again, in both age categories boys achieved above-average results. Nine- and ten-year-old boys in both groups are comparable in the strength of left hand grip. Graphical interpretation of this test is shown in Figure 23.

Figure 23. Dynamometry – left hand grip, boys



Based on our findings we can conclude that the strength of right and left hand grip is fully comparable between boys of group B_{2-3} and sighted boys in our sample. Statistically significant differences were observed in a comparison with the results of Kozlík's survey. In all cases, the boys of our sample achieved higher average performance values. Statistically significant differences were observed in boys of group B_1. As documented above, the differences were observed in the strength of both hands. The level of strength in the left hand is significantly lower compared with other groups included in our survey. A lower level of strength was also observed in relation to Kozlík's sample.

4.2.2.5 Test of general endurance – Harvard step test

To have a comprehensive overview of the level of motor competence in otherwise visually equipped prepubescent and pubescent individuals, selected tests included a general endurance test were performed. The step test was selected during the course of the pilot study and carried out prior to our survey. The test met all criteria required for tests aimed at children and youth of group B_1. The use of sporttesters simplified the measurement and allowed precise heart rate assessment. For our purposes we selected a modified version of the step test designed for untrained individuals (Měkota, 1983). A lower degree of load was selected by decreasing the frequency of stepping to 24 cycles per minute. We used a smaller step (height 30 cm), which is normally used for testing women. Other step test principles were maintained. The only problem we encountered was the general standard to which the results of our sample were related. Therefore, in the sample of prepubescent individuals we compared otherwise visually equipped girls and boys with sighted population in our sample. In pubescent individuals we made a comparison with index values /I/ as stated by Riegerová (1993). These values are specified in Table 31. However, in agreement with Měkota (1983) we must add that these values are unsuitable for our tested population. Therefore, the development of a standard for step test will be the subject of a more extensive survey.

Table 31. Values of step test I index for fitness assessment

Very weak fitness	I – less than 55
Below-average fitness	I – 55–64
Average fitness	I – 65-79
High fitness	I – more than 90

Legend: /I/ – step test score

a) Statistical and graphical interpretation of the results of the Harvard step test in girls

The basic statistical data are specified in Table 32.

Table 32. Basic statistical data, Harvard step test, girls

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$ /I/	s	Number (n)	$\bar{x}$ /I/	s	Number (n)	$\bar{x}$ /I/	s
6	2	43.50	2.12	2	54.00	12.72	2	41.50	6.36
7	3	46.00	1.00	5	38.60	1.67	24	44.13	5.41
8	3	50.00	9.17	10	45.10	4.33	26	45.77	5.45
9	8	41.50	2.98	4	30.25	20.19	10	46.10	6.71
10	2	40.50	4.95	0	0.00	0.00	3	47.00	9.17
11	4	41.50	4.51	0	0.00	0.00	0	0.00	0.00
12	0	0.00	0.00						
13	4	45.25	3.50						
14	2	42.50	0.71						
15	2	42.00	4.24						
16	1	45.00	0.00						
Total	**32**			**21**			**66**		

Legend: B_1, B_{2-3} – visual impairment category
S – sighted population
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean
s – standard deviation
/I/ – step test index

Partial hypothesis

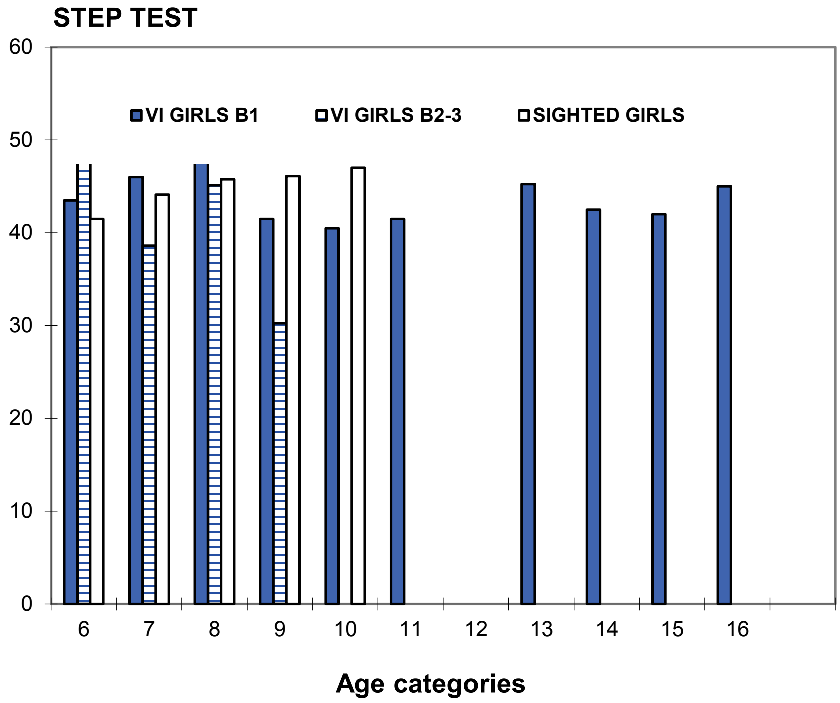
$H_0$1: There are no differences in the performance in the step test in six-year-old girls between visually impaired girls of group B_1 and sighted girls in our test sample.

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in B_{2-3} aged 7, 8, 9, …. years).

The assessment was performed by means of a parametric as well as non-parametric analysis of variance at a level of significance of $\alpha = 0.05$. In the category of six-year-old girls no statistically significant difference was observed. Therefore, **$H_0$1** is confirmed. This agreement was confirmed by a parametric analysis of variance and a non-parametric Kruskal and Wallis test. In seven-year-old girls a parametric analysis of variance did not reveal any statistically significant differences in any of the groups. On the contrary, a non-parametric Kruskal and Wallis analysis of variance confirmed a statistically significant difference. Girls of group B_{2-3} achieved lower performance compared with girls of the two remaining groups. Therefore, $\mathbf{H_01}$ is rejected in this case. Using a parametric and non-parametric analysis of variance, eight-year-old girls did not differ in any of the groups, therefore, $\mathbf{H_01}$ is confirmed. In nine-year-old girls a statistically significant difference was observed in group B_{2-3} compared with sighted girls. Girls of this group achieved lower performance values, therefore $\mathbf{H_01}$ is rejected Ten-year-old girls were compared using a t-test. The comparison of this age category of sighted girls and visual impaired girls of group B_{2-3} no statistically significant difference was observed. Therefore, $\mathbf{H_01}$ is confirmed in this case.

Graphical comparison (Figure 24).

Figure 24. Harvard step test, girls



According to the results that girls achieved in various age categories, the index level /I/ is comparable in almost the whole age range. This could mean that the level of general endurance does not increase or slightly increases with age. To verify this assumption it was necessary to develop a general standard of the step test index /I/ on a more extensive sample of sighted girls.

b) Statistical and graphical interpretation of the results of the Harvard step test in boys

The assessment was performed using the same statistical methods as in the sample of girls. Regarding the difficult comparability with the index values /I/ as stated by Riegerová (1993), who uses original values by L. Brouha (in Měkota & Blahuš 1983, 151), our comparison included only the groups of our sample. Table 33 shows the basic statistical data of the sample of boys.

Table 33. Basic statistical data, Harvard step test, boys

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$ /I/	s	Number (n)	$\bar{x}$ /I/	s	Number (n)	$\bar{x}$ /I/	s
6	1	47.00	0.00	0	0.00	0.00	1	46.00	0.00
7	5	43.80	4.44	5	43.20	6.18	23	44.30	4.86
8	5	33.00	19.30	5	44.20	7.66	29	46.45	3.55
9	1	46.00	0.00	2	46.50	10.60	15	45.73	8.82
10	8	43.37	3.74	3	42.33	4.16	4	47.75	1.71
11	6	42.00	4.09	1	42.00	0.00	0	0.00	0.00
12	1	47.00	0.00						
13	1	47.00	0.00						
14	5	48.00	3.54						
15	5	45.40	3.21						
16	1	52.00	0.00						
Total	**39**			**16**			**72**		

Legend: B_1, B_{2-3} – visual impairment category
$\bar{x}$ – arithmetic mean
S – sighted population
s – standard deviation
n – number of pupils in the respective age category
/I/ – step test index

Partial hypothesis

H_0 1: There are no differences in the performance in the step test in six-year-old boys between visually impaired boys of group B_1 and sighted boys in our test sample.

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in B_{2-3} aged 7, 8, 9, …. years).

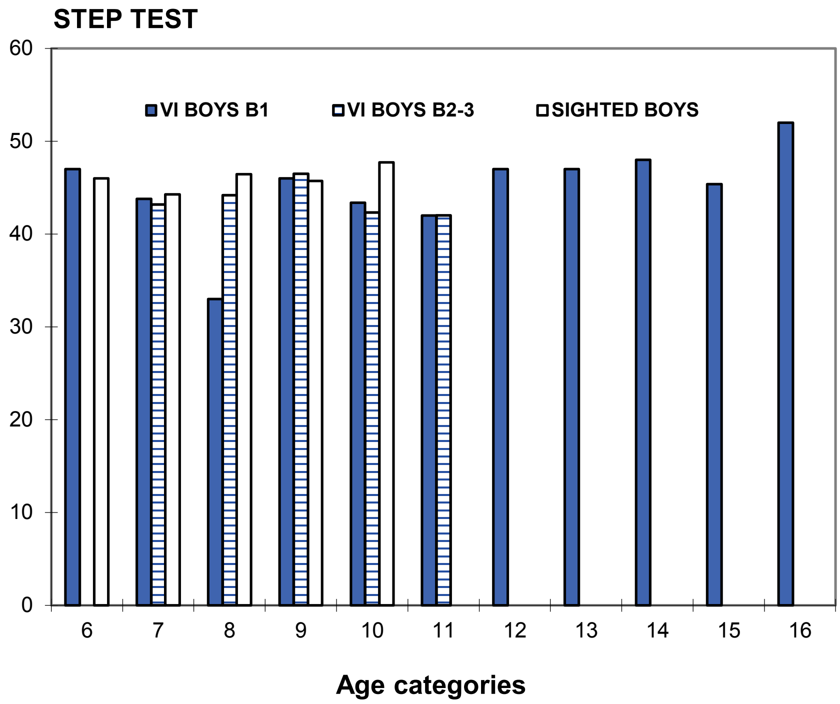
A comparison of various groups and categories of boys in our sample using a parametric and non-parametric analysis of variance at a level of statistical significance of $\alpha = 0.05$ indicated the following conclusions. Six-year-old boys of group B_1 are comparable with sighted boys of the same age. In this age category of group B_1 **$H_0$1** is confirmed. In the category of seven-year-old boys no statistically significant difference was observed using a parametric and non-parametric analysis of variance. Again, **$H_0$1** is confirmed. In eight-year-old boys, group B_1 differed from sighted boys in a statistically significant way. Therefore, **$H_0$1** is rejected in this group. A comparison of nine-year-olds was performed using a t-test between group B_{2-3} and sighted individuals. The results of the t-test at a level of significance of $\alpha = 0.05$ confirmed an agreement between both groups. In ten-year-old boys there was no statistically significant difference in any of the groups. Therefore **$H_0$1** is confirmed in both age categories for all groups.

Unfortunately, in an effort to increase the comparison objectiveness, we did not, as in the case of girls, find a standard that would be applicable for the purposes of comparison of our sample. In agreement with Měkota (1983) we state that the step test index /I/ as designed by L. Brouha is unsuitable for our population. Similarly, the standard published by Měkota and Blahuš (1983, 303) for university population is unsuitable. The results of a survey by Kozlík (1968) that included a step test in a population of a similar age compared with our sample were again unsuitable.

Regarding the fact that the step test is considered a reliable method for examining general endurance in visually impaired children and youth, a corresponding standard will have to be made during a follow-up survey.

A graphical comparison of step test indexes in boys of various age categories and visual impairment groups is shown in Figure 25.

Figure 25. Harvard step test, boys



As in the case of girls, the results indicate a degree of performance variability around index point forty. A comparison of index /I/ values between seven- and sixteen-year-old boys shows a difference of only five index points. As mentioned above, all available standards for step test assessment are inapplicable in our case. However, let us take a look at the distribution of their index points as stated by Měkota and Blahuš (1983). Their scale has 31 index points between 5th and 95th percentile. Our sample has, as mentioned above, only five points. We do not know whether the relatively small span of index points in our sample means stagnation in the growth of general endurance with increasing age or whether this is caused by different circumstances. These questions will have to be addressed by a more extensive study of sighted population, which will also develop a standard for objective assessment of general endurance in otherwise visually equipped children and youth during prepubescence and pubescence.

B. Coordination ability tests

From a structural perspective, coordination abilities are very complex. Their composition points to a high degree of mutual dependence and conditionality of individual partial abilities. The basic principle of coordination abilities includes movement control mechanisms and activity of the higher CNS. They are defined as generalized and relatively stabilized qualities of the process of movement control and regulation, which form the basis of diverse movement behaviour with rigorous coordination requirements (Kohoutek, Hendl, Véle, & Hirtz, 2005). Coordination cannot be understood the same way as other abilities. This is a totally different quality. In a certain way, coordination abilities are superordinate to other movement abilities and at the same time integrate these abilities. However, our intention is not to discuss terminology issues. This issue was discussed in detail e.g. by Bláha and Pyšný (2000). We just wanted to emphasise how complex the area of coordination abilities is. We are aware of the fact that a single motor skill test cannot cover the whole variety of the mentioned issue.

Motor skilfulness test

4.2.2.6 Exercise with a bar

In our survey the area of coordination abilities was represented by an exercise with a bar test. This exercise requires coordination of the whole body, coordination and spatial memory. This is one of the tests that requires minimum visual control after initial training. The whole set of exercises is repeated five times and overall duration in seconds /sec/ is recorded.

a) Statistical and graphical interpretation of the results of the motor skill test – exercise with a bar, girls

Statistical results processing was identical with the previous cases. The comparison was performed by means of a parametric as well as non-parametric analysis of variance at a level of significance of α = 0.05. The differences between individual groups were assessed using the Scheffe's test. For a comparison with a standard by Teplý (1986) we used percentage frequency on a six-point scale.

Table 34 shows basic statistical characteristics of the exercise with a bar test in the sample of girls.

Table 34. Basic statistical data of the exercise with a bar test in the sample of girls.

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	2	91.50	33.23	2	16.00	22.63	2	19.00	0.00
7	3	75.67	26.86	5	23.60	6.99	24	21.88	6.46
8	4	37.75	6.18	10	30.97	14.99	26	23.04	1.67
9	8	53.93	55.58	4	17.63	16.07	10	25.50	9.24
10	1	54.80	0.00	0	0.00	0.00	3	19.67	3.21

11	3	30.20	5.84	0	0.00	0.00	0	0.00	0.00
12	0	0.00	0.00						
13	4	43.38	31.64						
14	2	18.88	3.22						
15	2	37.17	1.65						
16	1	28.40	0.00						
Total	**31**			**21**			**66**		

Legend: B_1, $B_{2–3}$ – visual impairment category
S – sighted population
$\bar{x}$ – arithmetic mean in seconds /s/
n – number of pupils in the respective age category
s – standard deviation

Partial hypotheses

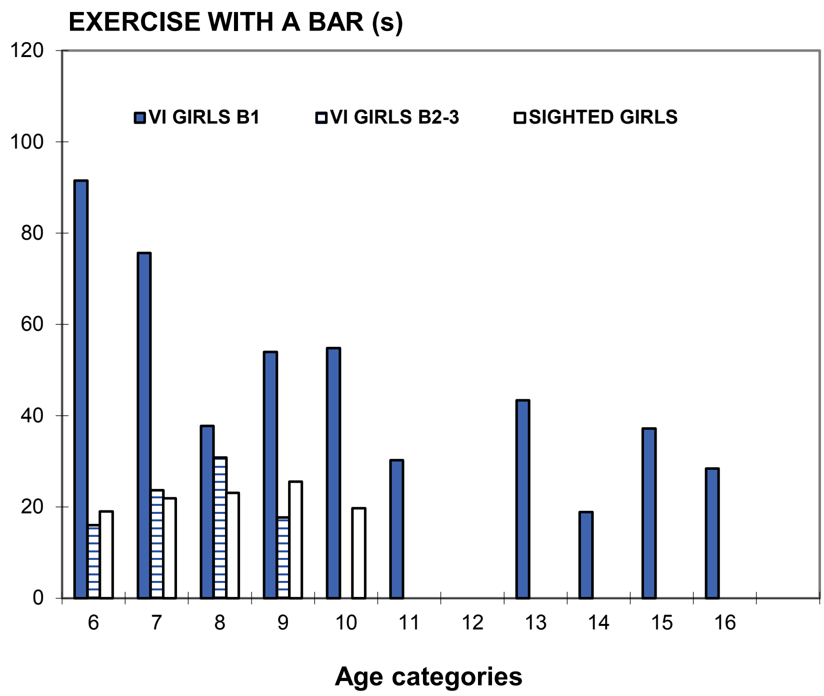
$H_0$1: There are no differences in the performance in the exercise with a bar test in six-year-old girls between visually impaired girls of group B_1 and sighted girls in our test sample.

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in $B_{2–3}$ aged 7, 8, 9, …. years).

Following a comparison of girls in groups B_1, $B_{2–3}$ and sighted girls in our sample we can state that there were no statistically significant differences in any of the groups of six-year-old girls. Therefore, **$H_0$1** is confirmed. In the category of seven-year-old boys, statistically significant differences were observed between girls of group B_1 and girls of group $B_{2–3}$, and also between girls of group B1 and sighted girls. Girls of group B_1 achieved worse results, therefore **$H_0$1** is rejected in this case. In eight- and nine-year-old girls no statistically significant differences were observed in any of the surveyed groups. In these age categories **$H_0$1** is confirmed in all groups. Ten-year old girls were compared using a t-test. Also here we can state that there are no statistically significant differences girls of group B_1 and sighted girls in our sample. In girls of group B_1 **$H_0$1** is rejected.

Graphical interpretation of these findings is shown in Figure 26.

Figure 26. Exercise with a bar – girls



Based on the performance achieved we can state that there are no statistically significant differences among girls of all groups. The only exception are girls of group B_1 at the age of seven and ten years. Table 35 shows a standard by Teplý (1986), which will be used to compare girls of all age categories and visual impairment groups in our sample.

Table 35. Standard for performance comparison in girls and boys – exercise with a bar (Teplý, 1986 – modified)

Performance	Girls and boys				
	7–8 years	9–10 years	11–12 years	13–14 years	15–16 years
Bad	45–41	42–38	40–36	37–29	33–27
Low	40–32	37–29	35–26	28–22	26–21
Average	31–27	28–24	25–20	21–18	20–15
Good	26–18	23–16	19–15	17–13	14–12
Very good	17 and less	15 and less	14 and less	12 and less	11 and less

Legend: The achieved performance is given in seconds /sec./

Table 36 shows a comparison of our sample of girls with a standard by Teplý (1986).

Table 36. Results of percentage frequency comparison in girls of our sample – exercise with a bar

Age	Cat.	1	2	3	4	5	6
7 years	B_1	0%	0%	0%	0%	3.1%	6.3%
	B_{2-3}	3.1%	6.3%	3.1%	3.1%	0%	0%
	NS	15.6%	43.8%	9.4%	3.1%	3.1%	0%
8 years	B_1	0%	0%	2.5%	2.5%	5.0%	0%
	B_{2-3}	2.5%	10.0%	5.0%	5.0%	0%	2.5%
	NS	17.5%	40.0%	2.5%	0%	0%	5.0%
9 years	B_1	0%	0%	9.1%	18.2%	0%	9.1%
	B_{2-3}	4.5%	9.1%	0%	0, %	4.5%	0%
	NS	0%	27.3%	0%	13.6%	4.5%	0%
10 years	B_1	0%	0%	0%	0%	0%	25.0%
	NS	0%	75.0%	0%	0%	0%	0%
11 years	B_1	0%	0%	33.3%	33.3%	33.3%	0%
13 years	B_1	0%	0%	0%	0%	0%	100%
14 years	B_1	0%	0%	100%	0%	0%	0%
15 years	B_1	0%	0%	0%	0%	0%	100%
16 years	B_1	0%	0%	0%	0%	0%	100%

Legend: 1 – very good performance
2 – good performance
3 – average performance
4 – low performance
5 – bad performance
6 – beyond norm
% – proportional frequency on a six-point scale "very good performance – beyond norm"

A previous comparison (Table 36) showed that sighted girls in our sample and girls of group B_{2-3} are, to a large extent, comparable with standard values by Teplý (1986). In group B_1 the performance of girls in this test was considerably weaker. Out of the nine monitored age groups, in five cases (6, 10, 13, 15, 16-year olds) the girls were primarily in the "below standard" zone. One group was in the bad performance zone (8-year olds), one in the low performance zone (11-year olds) and one in the average performance zone (13-year olds). These results indicate that the performance in the exercise with a bar test in girls of group B_1 is considerably lower compared with average sighted population. This fact also indicates a lower degree of skilfulness and coordination abilities.

b) Statistical and graphical interpretation of the results of the motor skill test – exercise with a bar, boys

As in the case of girls, the comparison of boys in our sample was performed by means of a parametric as well as non-parametric analysis of variance at a level of statistical significance of α = 0.05. The differences between individual groups were assessed using the Scheffe's test. For a comparison with a standard by Teplý (1986) we used percentage frequency on a six-point scale (Table 38). Table 37 shows basic statistical characteristics of the exercise with a bar test in the sample of boys.

Table 37. Basic statistical data of the exercise with a bar test in the sample of boys.

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	1	58.00	0.00	6	39.17	8.70	1	18.00	0.00
7	3	53.33	23.71	5	31.00	5.15	23	25.48	8.54
8	5	33.74	23.21	2	35.00	5.65	29	20.76	5.95
9	1	70.00	0.00	3	22.67	8.95	15	26.67	16.34
10	8	45.65	34.99	1	16.50	0.00	4	22.50	5.20
11	5	38.66	9.64	0	0.00	0.00	0	0.00	0.00
12	1	30.32	0.00						
13	1	16.00	0.00						
14	5	28.55	8.56						
15	5	43.70	11.93						
16	1	14.90	0.00						
Total	**36**			**17**			**72**		

Legend: B_1, B_{2-3} – visual impairment category
S – sighted population
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean in seconds /s/
s – standard deviation

Partial hypotheses

$H_0$1: There are no differences in the performance in the exercise with a bar test in six-year-old boys between visually impaired boys of group B_1 and sighted boys in our test sample.

Similarly, we defined partial hypotheses for the other groups and age categories (in B_1 aged 7, 8, 9, … years, in B_{2-3} aged 7, 8, 9, …. years).

Based on a comparison of our sample using a parametric and non-parametric analysis of variance we can state that there is a statistically significant difference between seven-year-old boys of groups B_1 and B_{2-3} from sighted boys in our sample (below-average results). $H_0 1$ is rejected in these groups. In the category of eight-year olds there are statistically significant differences between the performance of boys in group B_1 and sighted boys as well as boys in group B_{2-3} (below-average results). Similarly, in group B_1 $H_0 1$ is rejected. Nine-year-old boys were compared using a t-test, which indicated that there are no statistically significant differences between sighted boys and boys of group B_{2-3} in our sample. $H_0 1$ is rejected in nine-year olds in group B_1. The same applies to ten-year-old boys. The same results were achieved by means of a non-parametric Kruskal and Wallis analysis of variance.

Just as in girls, for the purposes of more objective assessment of the level of coordination abilities, we compared our sample of boys with a standard by Teplý (1986). The category of seven-year-old boys in group B_1 did not even reach the "low performance" level and was in all cases outside the mentioned standard. Boys of group B_{2-3} achieved below-average results in the "low performance" zone. Sighted boys of this age category as well as other age categories (8, 9, 10 years) achieved the most frequent "good performance" level in this test. In eight-year-old boys of group B_1 and B_{2-3} the most frequent performance was in the average zone. Nine-year-old boys in group B_1 are outside the standard. Boys of group B_{2-3} were most often in the "low" or "bad" performance zone. In the category of ten-year olds both groups of visually impaired children are most frequently in the "good performance" zone. The "low" performance level is the most frequent achievement of a half of eleven-year-old boys of group B_1. The other half of this group is outside the standard. Between eleven and sixteen years of age our comparison involved only boys of group B_1. The performance of twelve-year-old boys were "low", thirteen-year olds achieved "good" performance, fourteen-year olds "bad" and fifteen-year olds were outside the standard.

The overall results of the exercise with a bar test in boys indicate that the differences between individual age categories and groups of visually impaired individuals are not so distinct as in girls. The lowest performance was achieved by boys of group B_1. They were outside the standard at the age of seven, eleven and fifteen years. Differences were observed not only in their performance but overall movement abilities. Therefore, the quantity-based model will have to be complemented with a quality-based movement analysis. An analysis of harmoniousness, fluency, rhythmicity, accuracy and economy of movement will allow a deeper insight into motor competence of otherwise visually equipped boys and girls in prepubescence and pubescence.

Complete results of percentage comparison of performance frequency in the sample of boys are shown in Table 38.

Table 38. Results of percentage comparison of performance frequency in boys in our sample in the exercise with a bar test

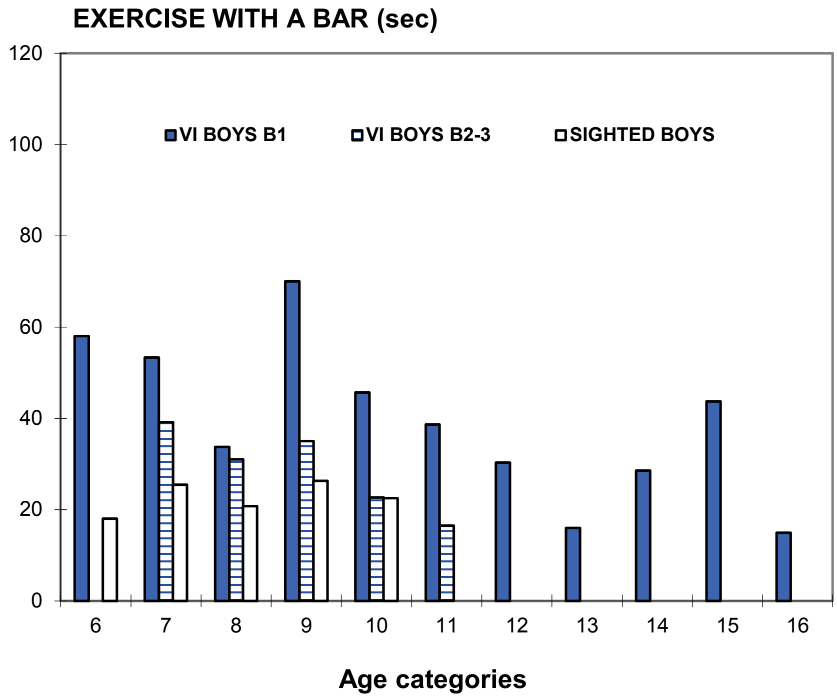
Age	Cat.	1	2	3	4	5	6
7 years	B_1	0%	0%	3.1%	0%	0%	6.3%
	B_{2-3}	0%	0%	3.1%	9.4%	3.1%	3.1%
	NS	3.1%	50%	3.1%	12.5%	0%	3.1%

8 years	B_1	2.6%	0%	5.1%	0%	2.6%	2.6%
	B_{2-3}	0%	2.6%	5.1%	5.1%	0%	0%
	NS	17.9%	46.2%	7.7%	0%	2.6%	0%
9 years	B_1	0%	0%	0%	0%	0%	5.6%
	B_{2-3}	0%	0%	0%	5.6%	5.6%	0%
	NS	0%	55.6%	11.1%	11.1%	0%	5.6%
10 years	B_1	0%	20.0%	0%	13.3%	6.7%	13.3%
	B_{2-3}	0%	13.3%	0%	6.7%	0%	0%
	NS	0%	13.3%	6.7%	6.7%	0%	0%
11 years	B_1	0%	0%	0%	33.3%	16.7%	33.3%
	B_{2-3}	0%	16.7%	0%	0%	0%	0%
12 years	B_1	0%	0%	0%	100%	0%	0%
13 years	B_1	0%	100%	0%	0%	0%	0%
14 years	B_1	0%	0%	0%	0%	100%	0%
15 years	B_1	0%	0%	0%	0%	0%	100%
16 years	B_1	0%	0%	100%	0%	0%	0%

Legend: 1 – very good performance
2 – good performance
3 – average performance
4 – low performance
5 – bad performance
6 – beyond norm
% – proportional frequency on a six-point scale very good performance – beyond norm

For better clarity the results of the exercise with a bar test in boys are also shown in Figure 27.

Figure 27. Exercise with a bar – boys



Motor balance tests

4.2.2.7 Flamingo test

In the motor balance test we used two tests. In the first stage of the research we tested balance abilities using a Flamingo test. This test is one of the items of the EUROFIT test battery (1988). Later it turned out that this test is hardly controllable for visually impaired individuals of group B_1, therefore we started to use a simplified version of single-footed standing for this group. The investigated factor in both of these tests was balance of the whole body.

a) Statistical and graphical interpretation of the results of the Flamingo test in girls

In statistical results processing we used the same procedures as in the previous tests. The comparison was performed by means of a parametric as well as non-parametric analysis of variance at a level of significance of $\alpha = 0.05$. The differences between individual groups were assessed using the Scheffe's test. Table 39 shows basic statistical characteristics of the balance abilities measured by the Flamingo test in the sample of girls.

Table 39. Basic statistical data of the Flamingo test in the sample of girls.

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	2	31.00	0.00	2	31.00		2	16.00	7.07
7	3	31.00	0.00	5	24.20	9.03	24	10.33	5.29
8	4	31.00	0.00	10	24.00	9.40	26	12.92	7.64
9	2	29.00	2.83	3	24.33	11.55	10	18.10	8.47
10	1	31.00	0.00	0	0.00	0.00	3	10.66	5.85
11	2	31.00	0.00	0	0.00	0.00	0	0.00	0.00
Total	**14**			**20**			**66**		

Legend: B_1, B_{2-3} – visual impairment category
S – sighted population
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean of the number of attempts
s – standard deviation

In the Flamingo test the subject stands single-footed on a beam (in a flamingo position) and tries to touch the ground with any part of the body as many times as possible during 60 seconds. If, during 30 seconds, 15 attempts are completed, the test finishes. It turned out throughout the course of the measurement in group B_1 that out of the total number of 33 girls only 14 were measurable. Even in these girls in many cases the error of manual measurement exceeded the achieved time. A slightly better situation was in the case of girls of group B_{2-3}. Just one girl did not meet the conditions for accepting the test performance but again, manual measurement showed considerable errors and did not ensure objectivity of the achieved results. In a follow-up study, time measurement must be ensured by different technical methods.

Based on the above we conclude that under the given conditions this test proved inaccurate for use in visually impaired individuals. During the measurement we found out that balance presents a considerable issue for visually impaired girls of both groups (B_1, B_{2-3}). Therefore, this issue has to be dealt with by a separate study.

b) Statistical and graphical interpretation of the results of the Flamingo test, boys

Statistical results processing was performed in a similar way as in the sample of girls. The comparison was performed by means of a parametric as well as non-parametric analysis of variance at a level of significance of $\alpha = 0.05$. The differences between individual groups were assessed using the Scheffe's test.

The results of this test confirmed a statistically significant difference only in eight-year-old boys but just as in the case of girls we have serious doubts about the validity and reliability of this test in testing visually impaired boys. The most questionable situation was in group B1. Compared with the same group of girls however, boys achieved statistically better results.

Table 40 shows basic statistical characteristics of the balance ability Flamingo test in the sample of boys.

Table 40. Basic statistical data of the sample of boys in the Flamingo test

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	1	31.00	0.00	0	0.00	0.00	1	10.00	0.00
7	5	18.60	16.98	6	25.83	12.66	23	15.87	5.87
8	5	24.80	13.86	7	19.29	11.07	29	13.48	5.57
9	1	31.00	0.00	3	18.66	16.44	15	14.93	7.69
10	6	25.83	12.66	3	23.33	13.29	4	12.00	6.05
11	1	31.00	0.00	1	31.00	0.00	0	0.00	0.00
Total	**19**			**20**			**72**		

Legend: B_1, B_{2-3} – visual impairment category
S – sighted population
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean of the number of attempts
s – standard deviation

4.2.1.8 One-legged standing hold on a beam

a) One-legged standing hold on a beam – girls

In girls of group B_1 between the ages of nine and sixteen years we used an easier alternative of beam standing. The tested person stands on a beam resting on the supporting leg. Once the other leg moves away from the beam the stopwatch is started. This testing was first performed in the left leg, then on the right leg. Tables 41 and 42 show the basic statistical data of the one-legged beam standing test in the sample of girls between nine and sixteen years of age (in seven- and eight-year-old girls we failed to perform the test at all).

Table 41. Basic statistical data, standing on the beam, left leg, girls

AGE	B_1		
	Number (n)	$\bar{x}$	s
9	6	0.65	0.53
10	1	1.06	0.00
11	2	1.35	0.14
13	4	1.17	0.69

14	2	2.58	1.57
15	2	2.59	2.11
16	1	0.82	0.00
Total	**19**		

Legend: B_1 – visual impairment category
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean in seconds /s/
s – standard deviation

Table 42. Basic statistical data, standing on the beam, right leg, girls

AGE	**B_1**		
	Number (n)	**$\bar{x}$**	**s**
9	6	0.73	0.67
10	1	1.03	0.00
11	2	1.30	0.22
13	4	1.43	0.85
14	2	2.55	0.97
15	2	2.43	0.69
16	1	1.20	0.00
Total	**19**		

Legend: B_1 – visual impairment category
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean in seconds /s/
s – standard deviation

Based on our experience gained in testing and after summarizing all results we came to the same conclusions as in the Flamingo test, i.e. even simplifying the conditions of the test did not bring the required level of validity and reliability of the test in visually impaired girls. The most suitable method of testing balance abilities in visually impaired girls appears one of the laboratory methods of testing balance abilities (compared Vařeka, 2001).

b) One-legged standing hold on a beam – boys

For the same reasons as in girls we modified the one-legged standing test in boys. Compared with girls, the achieved times and quality did not differ in a major way. Similarly, a significant difference was not observed between the lengths of standing on the right and left foot. For comparison reasons we provide basic statistical data on one-legged standing hold on a beam in the sample of boys (Tables 43 and 44). Based on these facts we can formulate similar conclusions as in the sample of girls. This means that for an objective assessment of balance abilities it is necessary to use either instrument-based time measurement or, even better, perform the assessment of balance abilities in laboratory conditions using a stabilometer. Another crucial aspect for correct performance of balancing exercise is the position of the whole body and its parts. From this perspective, the boys in our sample had serious deficiencies in the preconditions required for maintaining a correct balance standing position. For this reason this issue must be further dealt with.

Table 43. Basic statistical data in the sample of boys of group B1 in the left foot standing test.

AGE	B_1		
	Number (n)	$\bar{x}$	s
8	1	0.68	0.00
9	0	0.00	0.00
10	3	1.26	0.30
11	5	1.34	0.52
12	1	1.24	0.00
13	1	1.30	0.00
14	5	2.13	0.51
15	5	1.72	0.58
16	1	1.87	0.00
Total	22		

Legend: B_1 – visual impairment category
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean in seconds /s/
s – standard deviation

Table 44. Basic statistical data in the sample of boys of group B1 in the right foot standing test.

AGE	B_1		
	Number (n)	$\bar{x}$	s
8	1	0.85	0.00
9	0	0.00	0.00
10	3	1.45	0.78
11	5	1.51	0.30
12	1	1.35	0.00
13	1	1.79	0.00
14	5	1.92	0.59
15	5	1.59	1.14
16	1	2.01	0.00
Total	22		

Legend: B_1 – visual impairment category
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean in seconds /s/
s – standard deviation

C. Movement ability tests

Motor movement tests

Movement ability testing investigates the extent of movements in joints or joint systems. Movement ability is an ability to perform movements in an appropriate extent of full amplitude (Měkota & Blahuš, 1983). Movement ability has a strong effect on the whole area of skilfulness and is a required condition, not a sufficient condition (Čelikovský et al., 1979). There are two types of movement ability, i.e. active and passive. The measure of active movement ability is maximum amplitude reached by an active contraction of the corresponding muscles performed by a slow move enabling a hold in the maximum position. In case of a swing, the amplitude is higher but a hold is impossible. The highest extent of movement is reached if an external force acts. In this case the measured amplitude is an indicator of passive movement ability. In our study we focused on active movement ability tested in the slow move mode.

4.2.2.9 Deep forward sitting bend with legs together

a) Statistical and graphical interpretation of the results of the motor skill test – deep forward sitting bend with legs together, girls

Deep forward sitting bend with legs together is another test that does not require visual control. The achieved values are recorded in minus centimetres if zero is not reached, and in plus centimetres if the fingers reach beyond zero. Girls have better preconditions for higher performance because movement ability is one of the few motor skill tests where females exceed males. The comparison was performed only in the girls of our sample because we had no appropriate standard that could be used to relate our girls‘ performance. In twelve- to sixteen-year-old girls of group B_1 only average performance is specified without any comparison as there is no standard or control group in this age group.

Also in this test the assessment used a parametric and non-parametric analysis of variance. Differences between groups were determined using the Scheffe’s test.

Table 45 shows basic statistical data of the test of deep forward sitting bend with legs together in the sample of girls.

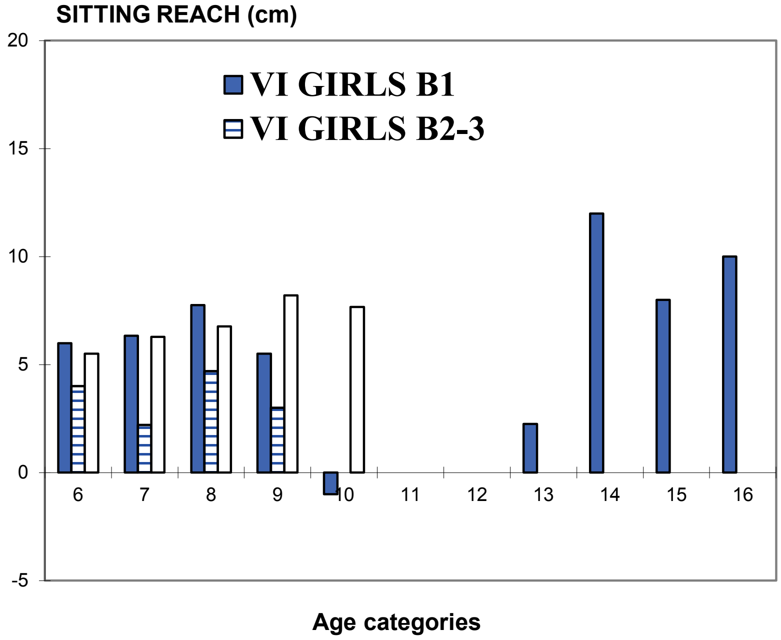
Table 45. Basic statistical data in the sample of girls – test of deep forward sitting bend with legs together.

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	2	6.00	9.90	2	4.00	7.07	2	5.50	2.12
7	3	6.33	9.29	5	2.20	9.73	24	6.29	5.17

8	4	7.75	4.79	10	4.70	7.04	26	6.76	5.63
9	8	5.50	7.44	4	3.00	4.24	10	8.20	4.07
10	2	-1.00	4.24	0	0.00	0.00	3	7.66	2.08
11	4	0.00	13.73	0	0.00	0.00	0	0.00	0.00
13	4	2.25	4.11						
14	2	12.00	1.41						
15	2	8.00	7.07						
16	1	10.00	0.00						
Total	**33**			**21**			**66**		

Legend: B_1, $B_{2\text{–}3}$ – visual impairment category
S – sighted population
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean in centimetres /cm/
s – standard deviation

Figure 28. Sitting reach with legs together – girls



Based on statistical results we can conclude that girls between six and ten years of age of all age categories and visual impairment groups do not differ in a statistically significant way in the reach test. In sighted girls between six and ten years of age the reach gradually increases. In the same category of girls of group $B_{2\text{–}3}$ the performance values are somewhat unbalanced. In group B_1 girls in all age categories except ten-year-old girls scored positive values, even at a later age between thirteen and sixteen years of age. Although there is no comparison with a standard, we can conclude that the level of movement ability in girls is rather good.

a) Statistical and graphical interpretation of the results of the motor skill test – deep forward sitting bend with legs together, boys

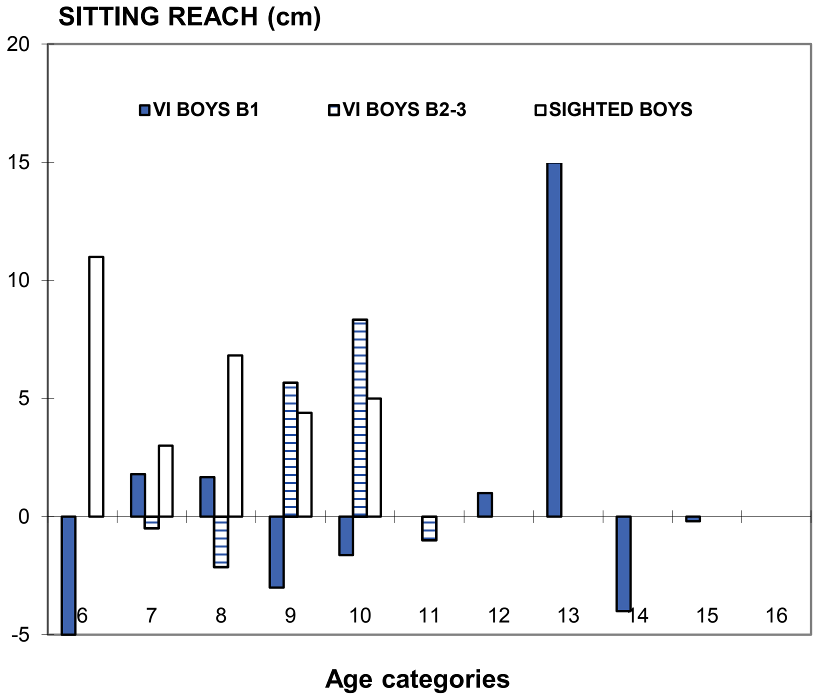
Statistical processing of results of the test of sitting reach with legs together in boys turned out to be very difficult. Their performance values are too variable and standard deviations are large, therefore in this test we only provide basic statistical results without definite interpretation. However, this issue needs to be addressed in a larger sample of sighted boys and a general standard developed in order to perform a more objective comparison of visually impaired boys of both visual groups.

Table 46. Basic statistical data in the sample of boys – test of deep forward sitting bend with legs together.

AGE	B_1			B_{2-3}			S		
	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s	Number (n)	$\bar{x}$	s
6	1	–5.00	0.00	0	0.00	0.00	1	11.00	0.00
7	5	1.80	3.96	6	–0.50	7.61	23	3.00	5.99
8	6	1.66	8.52	7	–2.14	7.42	29	6.83	5.32
9	1	–3.00	0.00	3	5.67	2.51	15	4.40	6.05
10	8	–1.62	10.00	3	8.33	1.53	4	5.00	6.05
11	6	0.00	7.45	1	–1.00	0.00	0	0.00	0.00
12	1	1.00	0.00						
13	1	15.00	0.00						
14	5	–4.00	4.84						
15	5	–0.20	14.65						
16	1	15.00	0.00						
Total	**40**			**20**			**72**		

Legend: B_1, B_{2-3} – visual impairment category
S – sighted population
n – number of pupils in the respective age category
$\bar{x}$ – arithmetic mean in centimetres /cm/
s – standard deviation

Figure 29. Sitting reach with legs together – boys



A comparison of boys‘ and girls‘ performance confirms that girls generally reach better results in movement ability skills. The statistical results of our samples of boys and girls are a proof of that. This is clearly shown in Figures 28 and 29.

5 /

Discussion and conclusions – assessment of anthropometric indicators and the level of motor competence

Zbyněk Janečka

5.1 Anthropometric survey

In the survey we tried to answer the following research question: Are there any differences in selected anthropometric indicators between the visually impaired population and sighted population in the period of prepubescence and pubescence?

Body height in girls and boys

Body height is an indicator that informs about the pace of growth. In visually impaired children a number of authors note a certain delay in their development (Andelson & Fraiberg, 1974; Cratty, 1971; Fraiberg, 1977; Říčan & Krejčířová, 1997). We investigated whether this fact applies to basic anthropometric characteristics during prepubescence and pubescence. The first monitored indicator was body weight. In our survey aimed at visually impaired girls this fact was not confirmed. Developmental tendencies in both visual impairment groups (B_1, $B_{2–3}$) copy developmental trends in sighted girls. The same conclusions were formulated in the case of visually impaired boys of both visual impairment groups. It can be stated that the development of body weight in visually impaired girls and boys between six and fifteen years of age is comparable with the development of sighted population of the same age.

Body weight and weight-height index in visually impaired girls and boys

Other monitored indicators were body weight and weight-height indexes. These indicators provide additional information about the overall constitution in visually impaired prepubescent and pubescent individuals.

Statistical results indicated a similarity of developmental curves also in body weight in girls. This means that girls of groups B_1 and $B_{2–3}$ are comparable with sighted girls in the basic weight indicators according to a standard by Moravec (1990). The same conclusions were formulated in the case of the weight-height index. Visually impaired girls of groups B_1 and $B_{2–3}$ are fully comparable with the generally accepted standard.

Weight in visually impaired boys of both visual impairment groups was assessed in a similar way as in girls. In the analysis we observed a higher degree of variability around the standard compared with visually impaired girls. In spite of this fact we could state that the general trends in weight development in six- to fifteen-year-old visually impaired boys are comparable with sighted population of the same age.

In the weight-height index the developmental tendencies in visually impaired boys are similar to the weight indicator. A detailed analysis of group B_1 did not confirm the null hypothesis in three age categories, but even here we could confirm the validity of general developmental trends.

Based on the results of the overall assessment of anthropometric indicators in visually impaired girls and boys we could conclude that their somatic development does not significantly differ from general developmental curves of non-disabled population.

This provides the answer to research question No. 1, i.e. that there are no significant differences in selected anthropometric indicators between visually impaired girls and boys of both visual impairment groups during prepubescence and pubescence.

5.2 Level of motor competence

In the survey we tried to answer the following research question: Are there any differences in the level of motor competences between visually impaired persons and sighted population in the period of prepubescence and pubescence?

Test of fitness abilities

In the area of fitness abilities we selected strength ability tests performed using the following test:

Two-footed standing jump

In the analysis of the performance in standing jump in girls, we assessed the visual impairment groups B_1 and B_{2-3} separately. Based on the statistical results of visually impaired girls of group B_{2-3} we can confirm comparability with a standard by Moravec (1990). In group B_1 the performance values are not comparable with the standard. Explosive strength of the lower extremities is thus at a low level. This was confirmed in girls of both age categories. Testing this ability also revealed an insufficient level of "two-footed jump". This was obvious especially in prepubescence girls. Therefore, we believe that insufficient performance in this test is not caused only by a low level of explosive strength in the lower extremities but also by badly performed physical activity model of the springing and flying stage of the jump.

Similar conclusions were confirmed in the sample of boys. In general developmental trends of explosive strength in the lower extremities, visually impaired boys of group B_{2-3} are comparable with sighted population. A low level of this ability was observed in B_1. Although the ability to "take off" was better in boys compared with girls, even here we observed significant problems with completing this activity.

Both in girls and boys of group B_1 of both age categories we can confirm a low level of dynamic explosive strength. The development of explosive strength in the lower extremities in boys and girls is thus one of the tasks of physical education in this group of children and youth.

Sit-ups

The performance of visually impaired girls of group $B_{2\text{-}3}$ was comparable with standard values by Moravec in all age groups. In prepubescence girls of group B_1 the performance values are also comparable with standard values. In this visual impairment group, pubescence girls deviate from standard values.

In the sit-up test, significantly worse results were achieved by visually impaired boys. They deviated from standard values both in group $B_{2\text{–}3}$ and in group B_1 in both age categories. This indicates a low level of strength and local endurance in abdominal muscles.

Regarding the fact that the development of abdominal muscle strength is not limited by visual control, strengthening of this muscle group is only a matter of regular training. A sound function of these muscles is then significant for correct body posture. And this is often an issue for visually impaired children and youth during prepubescence and pubescence.

Pull-up hold

Pull-up hold is another strength ability test. In girls of group $B_{2\text{-}3}$ no statistically significant difference was observed in comparison with standard values Moravec (1990). Girls of group B_1 differed from standard values by Moravec and achieved statistically significantly lower performance values. The performance of some girls in this group was on the limit of measurability. This indicates a very low level of strength in the upper extremities.

The performance of boys in group $B_{2\text{–}3}$ is comparable with the standard. In boys the standard by Moravec is designed only up to the age of ten years. Older boys perform repeated pull-ups on a bar. Therefore, we were unable to compare the performance in boys of group B_1 in the pull-up hold test with the standard in all age categories. Boys up to the age of ten years achieved below-average results and did not deviate from the standard by Moravec in a statistically significant way.

The measured results of boys in group B_1 between eleven and fifteen years of age indicated that their level did not reach average values in seven- to eight-year-old sighted boys. This could lead to an indirect conclusion that in this age category the performance in visually impaired boys is rather below-average.

Dynamometry – hand grip

Of all tests used in our survey dynamometry is the least affected by visual impairment. The performance values were compared among our samples and with the sample investigated by Kozlík (1968). These values were used for a more objective comparison of the achieved values even though the Kozlík‘s sample was not sufficiently large to be considered a general standard. Both right and left hand grip in the sample of girls in all age groups and visual impairment categories indicated no statistically significant differences compared among our samples or compared with the survey by Kozlík (1968).

In the sample of boys we can conclude that the strength of right and left hand grip is fully comparable between boys of group $B_{2\text{–}3}$ and sighted boys in our sample. Statistically significant differences were observed in a comparison with the results of Kozlík's survey. In all cases boys of our sample achieved higher average performance values. Statistically significant differences were observed in boys of group B_1. The differences were observed in the strength of both hands. The level of strength in the left hand is significantly lower compared with other groups included in our survey. A lower level of strength was also observed in relation to Kozlík's sample.

Test of general endurance

Harvard step test (modified)

According to the results that girls achieved in various age groups, the index level /I/ is comparable in almost the whole age range. This could mean that the level of general endurance does not increase with age or increases slightly. To confirm this assumption it would be necessary to develop a general standard for the step test index /I/ on a larger sample of sighted girls.

As in girls, the results in boys indicate a degree of performance variability around index point forty. A comparison of index /I/ values between seven- and sixteen-year-old boys shows a difference of only five index points. However, for a more objective and accurate assessment we do not have a general standard because all available standards for step test assessment are inapplicable in our case. However, let us take a look at the distribution of index points on a percentile scale as stated by Měkota and Blahuš (1983). Their scale has 31 index points between 5th and 95th percentile. Our sample has, as mentioned above, only five points. We do not know whether the relatively small span of index points in our sample means stagnation in the growth of general endurance with increasing age or whether this is caused by different circumstances. This issue can be resolved by a standard that would be developed according to a larger study of sighted children and youth during prepubescence and pubescence.

Test of coordination abilities

In the area of coordination abilities we selected motor skilfulness tests performed using the following test:

Exercise with a bar

The level of coordination abilities diagnosed using the exercise with a bar test in girls of group B_{2-3} is, to a large extent, comparable with standard values by Teplý (1986). Girls of group B_1 achieved significantly worse results in this test. We can conclude that they deviate from this standard in a statistically significant way. This indirectly points to a lower level of skilfulness abilities.

The overall results of the exercise with a bar test in boys indicate that the differences between various visual impairment groups are not as significant as in girls. The lowest performance was achieved by boys of group B_1. However, differences were observed not only in their performance but overall movement abilities during the test.

Motor balance test

Flamingo test

In the Flamingo test the subject stands single-footed on a beam (in a flamingo position) and tries to touch the ground with any part of the body as many times as possible during 60 seconds. If, during 30 seconds, 15 attempts are completed, the test finishes. It turned out throughout the course of the measurement in group B_1 that out of the total number of 33 girls only 14 were measurable but also in these cases the error in manual measurement was often higher than the achieved time. A slightly better situation was in the case of girls of group $B_{2–3}$. Just one girl did not meet the conditions for accepting the test performance but again, manual measurement showed considerable errors and did not ensure objectivity of the achieved results. In a follow-up study, time measurement must be ensured by different technical methods. Based on the above we conclude that under the given conditions this test proved inaccurate for use in visually impaired individuals.

Just as in the case of girls, we have serious doubts about the validity and reliability of this test in testing visually impaired boys. The most questionable situation was in group B_1. Compared with the same visual impairment group of girls, boys achieved better statistical results. Therefore, this issue has to be dealt with by a separate study.

One-legged standing hold on a beam

Based on our experience gained in this test we came to the same conclusions as in the Flamingo test, i.e. even simplifying the conditions of the test did not bring the required level of validity and reliability of the test in visually impaired girls. The most suitable method of testing balance abilities in visually impaired girls appears one of the laboratory methods of testing balance abilities (compared Vařeka, 2001).

For the same reasons as in girls we modified the one-legged standing test in boys. Compared with girls, the achieved times and quality did not differ in a major way. Similarly, a significant difference was not observed between the lengths of standing on the right and left foot. Based on these facts we can formulate similar conclusions as in the sample of girls. This means that for an objective assessment of balance abilities it is necessary to use either instrument-based time measurement or, even better, perform the assessment of balance abilities in laboratory conditions using a stabilometer.

Another crucial aspect of correct performance of balancing exercise is the position of the whole body and its parts. In terms of body posture, the girls and boys in our sample had serious deficiencies in the preconditions required for maintaining a correct balance standing position.

Although our assumption cannot be underpinned by verified statistical conclusions, during the measurement we found out that balance presents a considerable issue for visually impaired children of both visual impairment groups (B_1, $B_{2–3}$). Based on our experience we tend to incline to the general assumption that balance abilities in visually impaired individuals are at a very low level irrespective of gender (compare Cratty, 1971, 163–165).

Movement ability test

Sitting reach with legs together

Based on statistical results we can conclude that girls between six and ten years of age of all investigated age categories and visual impairment groups do not differ in a statistically significant way. In sighted girls between six and ten years of age the reach gradually increases. In the same category of girls of group B_{2-3} the performance values are somewhat unbalanced. In group B_1 girls in all age categories except ten-year-old girls scored positive values, even at a later age between thirteen and sixteen years of age. Although there is no comparison with a standard, we can conclude that the level of movement ability in girls is rather good.

Statistical processing of the results of the test of sitting reach with legs together in boys turned out to be very difficult. Their performance values are too variable and standard deviations are large, therefore definite interpretation is impossible. However, this issue needs to be addressed in a larger sample of sighted boys and a general standard developed in order to perform a more objective comparison of visually impaired boys of both visual groups.

A comparison of boys‘ and girls‘ performance confirms that girls generally reach better results in movement ability skills. The statistical results of the samples of boys and girls are a proof of that.

In searching the answer to research question No. 2, the analysis of all results indicates the following:

- in girls of group B_1 the level of motor competence during prepubescence and pubescence differs from sighted population in a statistically significant way,
- in boys of group B1 the level of motor competence during prepubescence and pubescence differs from sighted population in a statistically significant way,
- in girls of group B_{2-3} during prepubescence and pubescence the level of motor competence is statistically comparable with population of the same age,
- in boys of group B_{2-3} during prepubescence and pubescence the level of motor competence is, similarly to girls, statistically comparable with sighted population.

6 /

Sports socialization at home and in a facility

Zbyněk Janečka

In an effort to perform a comprehensive assessment of motor competence, we were also interested in the level of sports socialization. Sports socialization reflects not only the level of self-assessment of physical activity skills but also the degree of incorporating physical activity into life preferences of a visually impaired child. To perform this analysis, we adopted the following scales and questionnaires by Válková (1994), who used the work by Renson and Vanreusel (1990). For the conditions of visually impaired individuals modified by Janečka (1995).

Research samples

The application of research methods in analysing sports socialization was carried out in identical groups of children as the survey of anthropometric indicators and the level of motor skills.

Methods sports socialization analysis

To depict a complete picture of physical activity in visually impaired children and youth we also used a questionnaire that included scale, closed, semi-closed and open-ended items. We focused on subjective assessment of the volume of feasible physical activity, possibility of participation in physical activity in the family and in school and also the possibility of using equipment and aids (Annex 1). The questionnaire addressed the issue of transport to school and sociology-based questions addressing relationships with friends and classmates (Annex 1).

To assess the level of sports socialization Válková (1994) verified the following criteria within the "Child" project.

Volume of sports skills (Annex 1)
(Maximum 50 points in part one and maximum 10 points in part two)

Total score: maximum 50 + 10 = 60 points

VL	very low	21–25 points
L	low	26–32 points
LA	lower average	33–37 points
HA	higher average	38–44 points
H	high	45–53 points
V	Hvery high	54–60 points

6.1 Results of sports socialization analysis

The results were processed in the following tables. The values in all age categories are average values. Girls and boys were assessed separately in two groups B_1 and B_{2-3}.

Table 47. Sports skills – girls B1

Age	7	8	9	10	11	12	13	14	15	16
A Sports skills	39	40	46	45	43	44	43	43	46	44
Total score A	HA	HA	H	H	HA	HA	HA	HA	H	HA

Table 48. Sports skills – girls B2–3

Age	7	8	9	10	11	12	13	14	15	16
A Sports skills	36	38	42	46	43	44	43	46	46	42
Total score A	LA	HA	HA	H	H	HA	HA	H	H	HA

Table 49. Sports skills – boys B1

Age	7	8	9	10	11	12	13	14	15	16
A Sports skills	36	35	40	43	41	41	43	41	44	43
Total score A	LA	LA	HA	HA	HA	HA	HA	HA	HA	HA

Table 50. Sports skills – boys B2–3

Age	7	8	9	10	11	12	13	14	15	16
A Sports skills	37	32	38	45	42	43	42	44	44	40
Total score A	LA	L	HA	H	HA	HA	HA	HA	HA	HA

Sports socialization (Annex 1)
(Minimum 37 points, maximum 124 points)

Socializations at home and in a facility are scored separately. The results were again processed in the following tables. The values in all age categories are average values. Girls and boys were assessed separately in two groups B_1 and B_{2-3}.

Sports socialization scoring points:

VL	very low	below 48 points
L	low	48–60 points
LA	lower average	61–73 points
HA	higher average	74–86 points
H	high	87–99 points
VH	very high	above 99 points

Table 51. Sports socialization at home and in a facility – girls B1

B Sports socialization at home	28	31	30	36	41	40	37	32	39	31
C Sports socialization in school	23	26	32	29	33	33	30	30	28	26
Total B + C	51	57	62	65	74	73	67	62	67	57
Total score B + C	**L**	**L**	**LA**	**LA**	**HA**	**LA**	**LA**	**LA**	**LA**	**L**

Table 52. Sports socialization at home and in a facility – girls B2–3

B Sports socialization at home	30	35	36	40	37	40	35	34	33	34
C Sports socialization in school	28	31	30	34	32	31	30	26	25	26
Total B + C	58	66	66	74	69	71	65	60	58	60
Total score B + C	**L**	**LA**	**LA**	**HA**	**LA**	**LA**	**LA**	**L**	**L**	**L**

Table 53. Sports socialization at home and in a facility – boys B1

B Sports socialization at home	35	40	40	38	42	40	39	41	37	37
C Sports socialization in school	32	31	31	30	33	36	35	31	31	28
Total B + C	67	71	71	68	75	76	74	72	68	65
Total score B + C	**LA**	**LA**	**LA**	**LA**	**HA**	**HA**	**HA**	**LA**	**LA**	**LA**

Table 54. Sports socialization at home and in a facility – boys B2–3

B Sports socialization at home	31	36	36	39	42	40	38	41	41	36
C Sports socialization in school	33	36	36	34	31	30	35	34	30	30

Total B + C	64	72	72	73	73	70	73	75	71	66
Total score B + C	**LA**	**LA**	**LA**	**LA**	**LA**	**LA**	**LA**	**HA**	**LA**	**LA**

The overall score indicates that the groups of both girls and boys in all age categories are in the lower average zone. A comparison of the results of sports skills and sports socialization reveals that a higher score is achieved by the volume of sports skills. In girls of group B_1 the score was around higher average except seven-year-old girls. The same applies to girls of group B_{2-3}. Here, lower average was also scored by eight-year-old girls. In the other age categories the score was higher average. The results indicate that after nine of ten years of age the level of sports skills is relatively stable. After thirteen years of age in girls, the level of sports socialization begins to decline. Similar results were achieved by boys. Only the average score was higher compared with girls. The level of sports socialization culminates between ten and fourteen years of age. After that it begins to decline even in boys.

A similar issue was also addressed by Šafaříková (1999). She assessed the quality of movement activities and the relationship of visually impaired children to physical activity. On a scale of "often, sometimes, never, N/A", Šafaříková assessed the following areas:

1) Extracurricular leisure time in the boarding house
   The results indicate that a majority of visually impaired children sometimes engage in physical activity. However, they prefer playing a musical instrument. They also spend leisure time listening to music, using a computer of with friends.
2) Leisure time outside the boarding house (weekends, holidays, special days)
   Compared with the previous question, there was a considerable difference in the frequency of physical activity. A half of respondents answered that they did not participate in this kind of activity at all. They meet their friends much less.
3) Which activity do you like most in your leisure time?
   The most frequent answer was music and playing a musical instrument. Sport and learning scored at the same level.
4) Active participation in sports clubs
   Four fifths of girls and boys said that they were not active members of any sports club.
5) Order of subjects according to children's preferences
   Out of thirteen subjects offered in the questionnaire, physical education was ranked sixth.

For comparison reasons, below are some findings by Frömel, Novosad and Svozil (1999), who analysed the engagement of common population of children and youth in structured and non-structured physical activity in leisure time. The authors stated that the engagement of common population in structured forms of physical activity is insufficient both in terms of daily and weekly physical activity regime. The results by Frömel et al. (1999) correspond both with the survey by Šafaříková (1999) and our conclusions, i.e. that non-structured physical activity decreases with age. This applies both to girls and boys. The study by Frömel further indicates that the amount of physical activity in girls of all age categories is significantly lower compared with boys and that there is a general decrease in the number of hours of spontaneous physical activity. This fact is also confirmed in visually impaired youth by our findings. A significantly different group is represented by young people who engage in physical activities in sports clubs five to seven times a week. Such group does not exist in visually impaired children and youth but a few insignificant exceptions. Visually impaired youth rather belongs to the second group, which completely lacks leisure time physical activity. The passivity trends are of course intensified by various degrees of visual impairment. However, these are specifics that need to respected and accepted in working with visually impaired children and youth. Promotion of activity and movement should therefore be everyday endeavour of professionals involved in educating visually impaired children and youth.

6.2 Conclusions of sports socialization analysis

The engagement of visually impaired children and youth in structured forms of physical activity is insufficient both in terms of daily and weekly physical activity regime. Moreover, the frequency of structured activity decreases with age. This fact applies both to girls and boys. The amount of physical activity in girls of all visual impairment groups and age categories is lower compared with boys. A significantly different group compared with visually impaired individuals is represented by young people who engage in physical activities in sports clubs five to seven times a week. Such group does not exist in visually impaired individuals. Visually impaired youth rather belong to the second group, which completely lacks leisure time physical activity. The passivity trends are of course intensified by various degrees of visual impairment.

Based on these findings ensuing from previous conclusions we must state that the issue of controlled physical activity deserves more attention. Unfortunately, during prepubescence when children have a spontaneous need to engage in physical activity, there is an insufficient number of teachers in primary special schools with adequate erudition in physical education. Moreover, almost in all special schools physical activities are substituted with rehabilitation and physiotherapeutic procedures. We have a reason to believe that if we do not rouse interest and provide required motor skill preconditions and a need for physical activities during prepubescence, we will have serious difficulties addressing this issue during pubescence. Established stereotypes then present a barrier even to qualified PE teachers in the second stage of special schools.

7 /

Physical activity in visually impaired children and youth from the perspective of adulthood

Ladislav Bláha

In previous chapters we monitored the level of motor competence in children and youth. To better understand the needs in the area of physical activity we will now analyse physical activity in children and youth in terms of pursuing PA by adult visually impaired persons. Comprehensive knowledge of the whole situation will indicate how to work with children and youth during their school attendance so that movement and physical activity become a natural part of their lifestyle in adulthood.

Visually impaired persons represent a numerous group of individuals with decreased abilities to interact with their environment, which act as a serious determinant influencing their lifestyle with an effect on the assessment of quality of life (Bruce, Harrow, & Obolenskaya, 2007; Rimmerman & Morgenstern, 2003). This can be further aggravated by the negative effects of current lifestyle such as hypokinesis, bad nutrition, stress, excessive consumption of electronic media, etc. A decrease in the volume of undertaken physical activity (hereinafter referred to as PA) accompanies an increase sedentary lifestyle. There is also increased prevalence of other lifestyle diseases and risks (cardiovascular diseases, atherosclerosis, bad posture and muscle imbalances, locomotion stereotype disorders, bone thinning, diabetes, etc.) There is no reason to believe that visually impaired persons are not affected by this phenomenon. A number of research findings indicate that some negative trends lying especially in an imbalance between energy intake and expenditure are accelerated (Bláha, 2011). A limitation or loss of perception of visual information leads to increased dependence on kinestetic, acoustic and tactile perception and the relevant receptors. This unlikeness is also apparent through movement in order to establish balance with the environment and is the focus of numerous studies. The conclusions of these studies provide a comprehensive overview of the issues of physical activity in visually impaired persons and try to challenge the impossibility of using PA as a means of maintaining health and cultivation of lifestyle. This is a very topical issue indeed. Also because correlations were proved between the level of PA and health indicators (Abu-Omar & Rütten, 2008). The use of PA can lead to the required mental changes, changes in social behaviour, formation of physical activity skills and can support required knowledge (Abu-Omar, Rütten, & Robine, 2004; Baumann et al., 2009; Bauman, Sallis, Dzewaltowski, & Owen, 2002; Frömel et al., 2006; Graf et al., 2004; Guthold, Ono, Strong, Chatterji, & Morabia, 2008; Rütten et al., 2001; Rütten & Abu-Omar, 2004a, b; Sigmund et al., 2008a, b; Sigmundová, Sigmund, & Chmelík, 2009;Twisk, 2001). Unfortunately, our studies indicate (Bláha, 2011) that the existence of these correlations is not or cannot be used to a required degree in visually impaired persons and that the desirable changes in the area of PA in visually impaired persons is not addressed in a systematic way.

The complexity of the issue is also significant in relation to a decreased level of physical abilities (Hirtz et al., 2007; Hopkins, Gaeta, Thomas, & Hill, 1987; Lieberman & McHugh, 2001; Nakamura, 1997; Short & Winnick, 1988). A decreased level of balance abilities affects the overall level of mobility, prevalence of negative aspects characterizing social skills and an earlier onset of cardiorespiratory diseases and obesity (Leverenz, 2009). An assessment of balance abilities in visually impaired individuals performed by Zahálka et al. (2011) indicated a necessity to increase postural stability in a standing position and locomotion through physical education. At the same time, lower ability levels and delays in coping with specific skills were observed in visually impaired children (Blessing, McCrimmon, Stovall, & Williford, 1993; Janečka, 2003; Nielsenová, 1998). The conclusions of foreign research studies aimed at determining the level of physical abilities is also confirmed or commented on by Janečka (2001; 2003). The author used a test battery partially based on UNIFITTEST. He applied coordination ability tests, questionnaires (to assess the level of sports socialization) and others. In visually impaired children of group B_1 the lowest level of explosive strength abilities were observed in the lower extremities, in the sit-up test, pull-up hold test and in dynamometry. The findings inspired the author to apply intervention programmes in visually impaired children. Some indicators characterizing the level of selected abilities are apparently comparable with or better than common population. This is also seen in the assessment of reaction abilities (reaction to an audio stimulus) and in orientation tasks of a locomotion nature (Bláha, Valter, & Král, 1998; Bláha, Valter, Pyšný, & Macháček, 1999, 2001; Bláha & Pyšný, 2000). The usual lower level of physical abilities observed in visually impaired children is an apparent result of the differences in their psychomotor development compared with non-disabled children. Janečka, Štěrbová and Kudláček (2008) highlighted the issue of developing a different partial physical activity model instead of the correctly developed chain of muscle coordination, which presents a barrier to developing higher motor competence in children. Children are affected by delayed development of head control and abnormal manifestations of restlessness. Some rarities in visually impaired children are also observed by other authors. Bunc, Segeťová, Šafaříková and Horčic (1997a, b) point to the unexplained deviations of some vegetative functions, biological rhythm and changes in heart rate (HR) values in visually impaired children from usual values. The authors emphasise constant muscle tension in these children, which apparently causes higher HR values throughout the day. The authors also determine BMI values in visually impaired children, and for the purposes of cultivation of aerobic fitness in field conditions the authors developed standards that determine three zones of aerobic fitness and physical performance (Bunc, Šafaříková, & Segeťová, 1997). In adulthood the monitored indicators do not usually improve also because the time dedicated to PA is lower (Houwen, Hartman, & Visscher, 2009) and the question is whether and how interventions can be implemented to promote PA in visually impaired persons. The decisive factors seem to include a changed attitude to PA, PA acceptance and PA performance. Our studies (Bláha, 2011) indicate that visually impaired persons attribute their non-participation in PA to their impairment; on the other hand they are not willing to find ways to change this even if conditions are favourable (Bláha & Machačová, 2007; Bláha, Pálková, Ženíšková, & Machačová, 2009). Participation in physical activity programmes would be possible only after a comprehensive resolution of a number of issues in the area of education, physical activity preparation, supply of suitable activities and required motivation. The most frequent reasons for discouraging visually impaired individuals from participation in physical activity include fear from being injured, lack of will, disinterest, bad weather and overweight. Further reasons include lack of mental support by the environment, feelings of uselessness, resignation and laziness. However, the objective reasons are difficult conditions preventing free movement, which is a serious barrier to performance of various types of PA. Forced attention and demanding orientation in a space in visually impaired persons probably also leads to a need for passive rest. This could be corrected by cooperation with guides, and to a certain extent in the offer of adequate PA. Some minor papers and examples often present individual and group success in the delivery of PA as possible solutions. Of course, these cannot be considered universal but a combination of positive factors aimed at the needs of specific participants could bring positive results. This especially applies to applications aimed at younger age groups and potential visually impaired participants. In the first place this includes a series of qualification papers aimed at sports or education. The contribution of these papers can be significant if their conclusions are generalised or put to practice, or if background is provided for detailed and deeper surveys. Physical activity and methods of application are described e.g. by Bergl (2001), Dědičová (2003), Dufková (2005), Fialová (2006), Finková (2011), Hájek (2008), Hornová (1999), Charousek (2004), Kittlerová (2005), Linhartová (2008), Loulová (2009), Mátlová (2000), Novotná (2003), Obermanová (2004), Provazník (2008), Součková (2005), Stodůlka (2006), Štěpánek (2009), Štych (2007), Tomášková (2005), Valentová (2008) and others. Less frequent are conclusions based on the application of complex research techniques or combining several scientific fields (Dvořák, 2006; Dvořáková, 2001; Holubová, 2000; Kvapilová, 2004; Macháček, 2000; Mrňák, 1999; Říhová, 2001; Sobotková, 2004 and others). A common denominator of some qualification papers is the place of physical activity in the life of a visually impaired individual (Došková, 2009; Drahovzalová, 2009; Frková, 2006; Křivková, 2005; Pálková, 2006; Příhodová, 2007; Richterová, 2011). These and other papers provide valuable information from selected areas associated with the phenomenon of physical activity. Deeper knowledge forms a basis of conclusions of more complex studies. Through our research questions we defined the areas of individual sections of the research that have a common conclusion.

Research question No. 3

Is physical activity in visually impaired persons of the same volume as in the common population?

Research question No. 4

To what extent is usual locomotion performed by visually impaired persons?

8 /

Study I.
Assessment of the volume of reported physical activity and inactivity in visually impaired persons

Ladislav Bláha

The objective of the study aiming to answer research question No. 3 was to find out the extent to which the volume of daily PA is performed in comparison with passive rest and thus becomes a part of everyday life in visually impaired persons. We also wanted to use the observed indicators to highlight possible risks associated with a lack of PA in the lifestyle of visually impaired persons.

Principal hypothesis

Visually impaired persons reported lower indicator values characterizing performed physical activity compared with the common population.

Methods

This study was performed in the Usti Region. This is a varied region with diverse natural conditions and several towns with 30,000 to 80,000 inhabitants. Some towns retained their historical centres and the dominant type of built environment. Some towns were affected by mining activity and industrial development. On the outskirts of many towns the predominant housing type includes panel blocks of flats. However, there are also enclaves of detached houses. The development of the region has gone through a number of difficult and critical periods. This also influenced the current structures of the inhabitants and related phenomena (criminality, occurrence of troublesome localities, level of education and unemployment). In bigger towns various associations emerge and visually impaired individuals have a chance to meet (Ústí nad Labem, Lovosice, Litoměřice). The data for the study were retrieved from the clients of the Centre for visually impaired persons in Ústí nad Labem aged 18–69 years (Table 55). The respondents with various degrees of impairment (n = 152) consented to participation in the survey and submitted the required survey data, which provided detailed information about the sample (Table 56). The degree of impairment was classified according to IBSA (International Blind Sport Association). Independent on our research study, the selected data were then compared with the non-disabled population of the same region (n = 2,177).

Table 55. Samples of visually impaired men and women by impairment degree.

Respondents		Age		Height		Weight		BMI	
	n	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
MB_1	31	49.87	11.32	174.87	6.00	82.29	9.89	26.95	3.44
MB2	10	44.80	10.45	181.30	10.41	80.60	5.32	24.78	3.61
MB3–4	18	39.00	12.10	180.28	5.69	80.94	6.64	24.92	1.93
WB_1	40	52.53	12.01	163.85	8.28	81.05	15.2	30.30	5.93
WB2	19	50.47	8.94	163.37	6.16	71.00	12.2	26.52	3.83
WB3–4	34	42.44	13.08	163.77	6.18	68.77	13.3	25.61	4.49

Legend: MB1 etc. – Visually impaired men, classification B_1 etc.
WB1 etc. – Visually impaired women, classification B_1 etc.
Height (cm); weight (kg); BMI ($kg.m^{-2}$); *M* – mean; *SD* – standard deviation

Table 56. Characteristics of the sample of visually impaired men and women by age, BMI, education, smoking and participation in structures physical activity.

Respondents		Age		Height		Weight		BMI	
	n	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
R VI 25–44	58	33.55	5.58	170.83	9.32	73.91	13.49	25.25	3.89
R VI 45-69	94	55.88	6.52	168.05	10.09	79.32	12.69	28.23	4.96
R VI BMI ≤ 25.00	50	42.34	11.91	172.44	11.54	66.80	10.86	22.32	1.59
R VI BMI > 25.00	102	49.82	12.10	167.48	8.53	82.38	11.11	29.44	4.03
R VI elementary	53	50.53	11.15	169.98	8.67	79.23	12.68	27.46	4.41
R VI secondary	94	45.86	12.74	168.63	10.53	75.67	13.40	26.72	4.95
R VI university	5	42.00	17.07	169.00	10.20	86.20	11.10	30.41	5.10
R VI non-smoking	110	47.70	12.46	166.59	8.70	76.86	13.62	27.75	4.98
R VI smoking	42	46.48	12.73	175.71	9.75	78.31	12.21	25.37	3.79
R VI structured PA	28	40.39	12.49	169.57	9.71	73.96	14.92	25.68	4.77
R VI non-structured PA	**124**	**48.94**	**12.01**	**169.01**	**9.93**	**78.00**	**12.75**	**27.42**	**4.76**

Legend: R VI 25–44 (45–69) – visually impaired respondents aged 25–44 years, or (45–69) years
R VI BMI ≤ 25.00 (> 25.00) – visually impaired respondents with BMI value ≤ 25.00 (> 25.00)
R VI elementary (secondary; university) – visually impaired respondents with completed elementary (secondary; university) education
R VI non-smoking (smoking) – visually impaired respondents – non-smoking (smoking)
R VI structured PA (non-structured PA) – visually impaired respondents taking part in structured physical activity (not taking part in structured physical activity)
Height (cm); weight (kg); BMI ($kg.m^{-2}$); *Mdn* – median; *IQR* – interquartile range; *M* – mean; *SD* – standard deviation

Physical activity was assessed according to the IPAQ questionnaire (Epidemiology Unit, University of New South Wales, Sydney), internationally standardized (Craig et al., 2003) short administration version. The questionnaire was applied as a simple diagnostic technique to identify basic information about physical activity and inactivity. The data obtained allow a specification of their physical load and a comparison with the common population data. *International Physical Activity Questionnaire* – IPAQ-short (Annex 3) covers physical activity and inactivity in 15–69-year-old population performed during the last seven days and allows a comparison of PA of vigorous and moderate intensity, walking and sitting in the context of other personal, demographic and environmental data. This research tool is frequently applied and is the basis for numerous studies of international significance (Bauman et al., 2009; Guthold, Ono, Strong, Chatterji, & Morabia, 2008). Selected items relating to the assessment of PA of various intensity and walking are converted to METs and METs – min.week^{-1} (Ainsworth et al., 2000). The conversion to these energy expenditure units, which was also applied in our study, provides a comprehensive overview of individual loads and characteristics of the samples. Conversion coefficients also allow a comparison of selected population groups with respect to various PA structures. There is also an opportunity of categorization of individuals with low, medium or high activity. MET (metabolic equivalent) can be defined as energy expenditure during inactive sitting, when an adult consumes 3.5 ml of oxygen per one kg of body weight per one minute, which is approximately one kilo calorie per one kg of body weight per one hour (Frömel, Svozil, &Novosad, 1999).

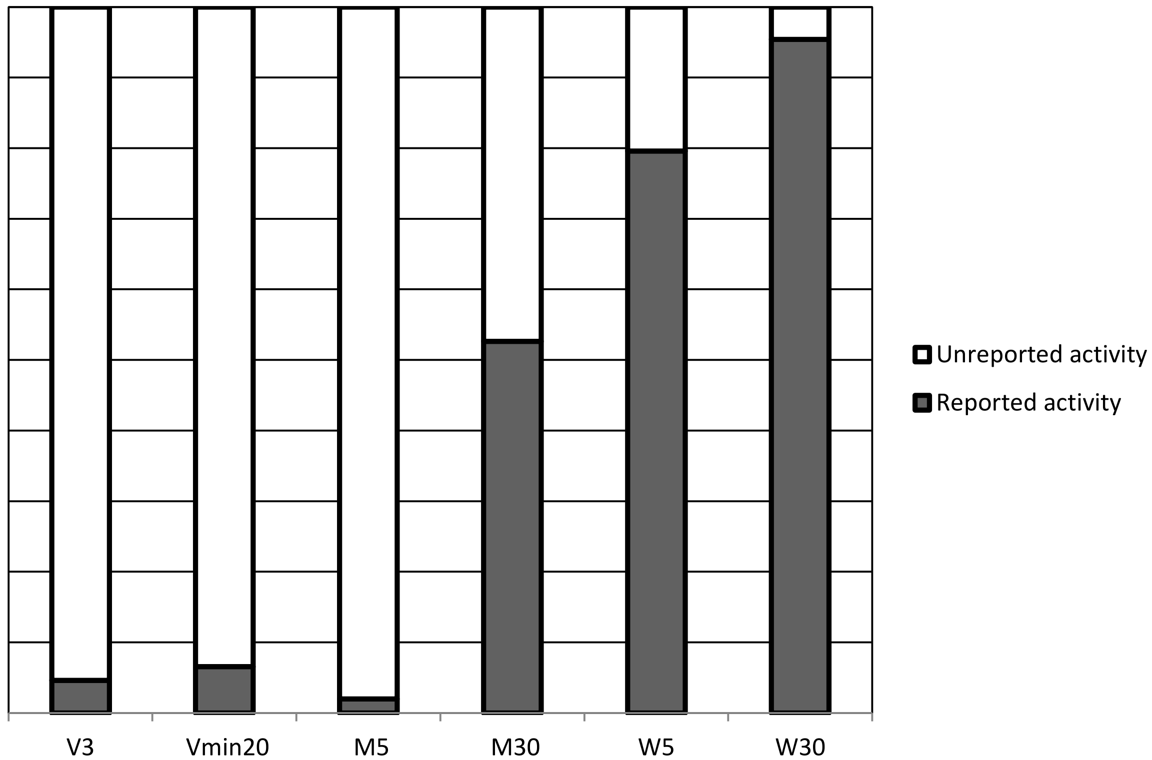
The items of the questionnaire were processed to determine the weekly amounts of vigorous physical activity (also referred to as VPA), moderate physical activity (also referred to as MPA), walking and total physical activity (also referred to as TPA). To obtain a continuous score we proceeded according to the *Manual for data processing and analysis of the International Physical Activity Questionnaire (IPAQ) – long and short version* (2005). The data were processed in the *STATISTICA 08* programme using relevant Mann-Whitney and Kruskall-Wallis tests. We focused particularly on the reported engagement in PA and related indicators (also in relation to the general population in the region), differences in these indicators according to degree of impairment, age, gender, presented organized participation in PA, reported smoking and BMI values. We also considered respecting health recommendation criteria in the context of reported inactivity.

8.1 Results

The results confirmed direct effects of impairment on performing PA in visually impaired persons. In our survey there was a majority of persons with completed secondary education (61.8%) and elementary education (34.9%). The survey included only few university graduates (3.3%). A majority of respondents had higher BMI values (BMI > 25.00), the sample included 27.6% of smokers. It should be added that over 71.7% of visually impaired respondents did not own a cottage, passenger vehicle or bicycle. This confirms difficulties using this property but also a lower social status of visually impaired individuals. A total of 78.3% had a dog. However, the data do not indicate whether this is a guide dog. Only a small proportion of visually impaired individuals are members of PA promoting clubs or associations (18.6%). It can be concluded that in comparison with the common population, visually impaired persons have a lower number of university graduates and members of various sports clubs and associations. There are also more persons with higher BMI values.

The dominant component of the reported one-week PA in visually impaired respondents is walking; the values are considered satisfactory. Engagement in vigorous PA is very low. A slight improvement was observed in the proportion of respondents reporting at least 30 of moderate physical activity in a week (53% of respondents) and repeated walking in a week (80%). Engagement in the reported walking for at least 30 minutes is at a high level (Figure 30). Low values were observed in vigorous physical activity, lower values were also observed in moderate physical activity and consequently overall physical activity (Table 57). This is also the cause of a lower amount of overall physical activity compared with the common population respondents (3,896 MET – min.week-1 in the common population as opposed to 2,967 MET – min.week-1 in visually impaired respondents). The differences are considered materially significant (d = 0.19).

Figure 30. Proportion of overall number of visually impaired respondents reporting participation in selected types of physical activity in a week.



Legend: V3 – vigorous physical activity on at least three days in a week
Vmin20 – at least 20 minutes of vigorous physical activity
M5 – moderate physical activity on at least five days in a week
M30 – at least 30 minutes of moderate physical activity
W5 – walking on at least five days in a week
W30 – at least 30 minutes of walking

Table 57. Indicators of performed physical activity in visually impaired respondents

Indicator	Visually impaired respondents (n = 152)			
	M	*SD*	*Mdn*	*IQR*
VPA/day (min.)	8	34	0	0
VPA (MET – min.week-1)	59	239	0	0
MPA/week (min.)	171	269	60	240
MPA/day (min.)	24	38	9	34
MPA (MET – min.week-1)	685	1,077	240	960
Walking/week (min.)	673	549	480	600
Walking/day (min.)	96	78	69	86
Walking (MET – min.week-1)	2,222	1,812	1,584	1,980
TPA (MET – min.week-1)	2,967	2,506	2,111	2,766

Legend: VPA/day – corrected average daily duration of vigorous physical activity in minute
VPA – values of performed vigorous physical activity per week in MET – min.week^{-1}
MPA/week – overall amount of moderate physical activity per week in minutes
MPA/day – average daily duration of moderate physical activity in minutes
MPA – values of performed moderate physical activity per week in MET – min.week^{-1}
Walking/week – overall amount of walking per week in minutes
Walking/day – average daily duration of walking in minutes
Walking – values of performed walking per week in MET – min.week^{-1}
TPAs – sum of performed physical activity per week in MET – min.week^{-1}
M – average; *SD* – standard deviation; Mdn – median; IQR – interquartile range

Table 58. Indicators of overall physical activity in common population respondents and visually impaired respondents

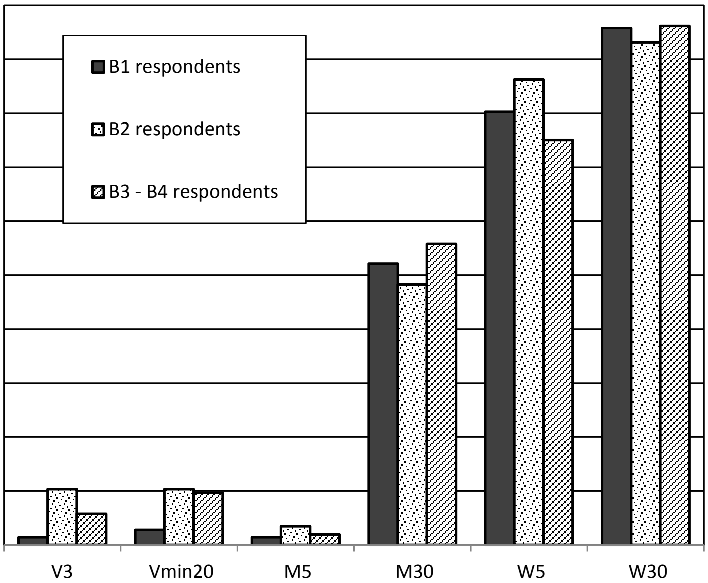
Indicator	Common population respondents (n=2,177)				Visually impaired respondents (n = 152)					
	M	*SD*	*Mdn*	*IQR*	*M*	*SD*	*Mdn*	*IQR*	*U*	*d*
TPA (MET – min. week^{-1})	3,896	2,716	3,426	3,972	2,967	2,506	2,111	2,766	4.489*	0.186

Legend: TPA – units in MET – min.week^{-1};
M – average; *SD* – standard deviation; Mdn – median; IQR – interquartile range;
U – value of Mann-Whitney test;
d – calculated value of material significance coefficient;
in tests marked with an * statistically significant values at a level of significance of $p < 0.05$ were observed.

The general low engagement of visually impaired respondents in vigorous PA is accented by virtual non-performance in persons with severe degrees of impairment (Figure 31).

Vigorous PA is performed in younger persons (Figure 32) and in organized PA (Figure 33), these conditions also result in higher engagement in moderate physical activity.

Figure 31. Differences in the proportion of overall number of respondents with various types of visual impairment reporting participation in selected types of physical activity in a week.



Legend: V3 – vigorous physical activity on at least three days in a week
Vmin20 – at least 20 minutes of vigorous physical activity on a day in a week
M5 – moderate physical activity on at least five days in a week
M30 – at least 30 minutes of moderate physical activity on a day in a week
W5 – walking on at least five days in a week
W30 – at least 30 minutes of walking on a day in a week
The same legend applies to Figures 32 and 33.

Figure 32. Differences in the proportion of overall number of visually impaired respondents of various ages reporting participation in selected types of physical activity in a week.

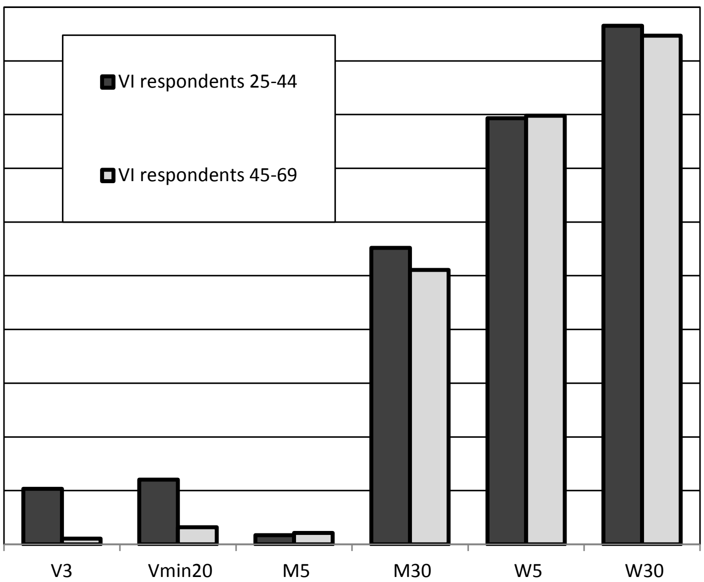
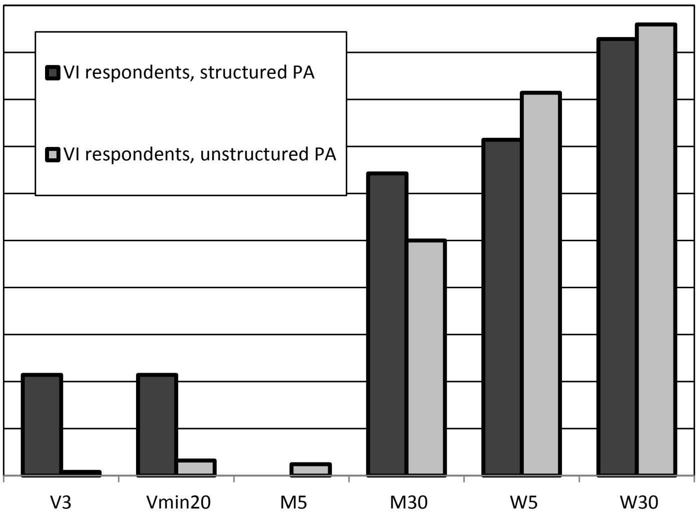


Figure 33. Differences in the proportion of overall number of organized and non-organized visually impaired respondents reporting participation in selected types of physical activity in a week.



A number of specifics must be taken into consideration in visually impaired individuals with respect to their engagement in organized forms of PA (Table 59). In respondents engaged in organized forms of PA (n = 28) we observed higher values of vigorous PA (192 MET – min.week^{-1}), where the differences were statistically and materially significant (d = 0.65) compared with other individuals. On the contrary however, compared with other visually impaired respondents (n = 124) they recorded lower walking values (1,748 MET – min. week^{-1}). These differences were statistically significant and were around small to medium effect of material significance (d = 0.34). The values of overall performed PA are in favour of visually impaired persons without engagement in organized PA (3,060 MET – min.week^{-1} as opposed 2,551 MET – min.week^{-1}), although the differences are not statistically significant and are around small effect of material significance (d = 0.2).

Table 59. Selected indicators of performed physical activity in visually impaired respondents according to reported engagement in organized physical activity.

Indicator	Participating in organized PA (n = 28)				Non-participating in organized PA (n = 124)					
	M	*SD*	*Mdn*	*IQR*	*M*	*SD*	*Mdn*	*IQR*	*U*	*d*
VPA	192	370	0	210	29	187	0	0	4.000*	0.649
MPA	611	782	480	840	702	1,135	80	960	0.782	0.127
Walking	1,748	1,858	1,287	1,188	2,329	1,791	1,980	1,980	2.097*	0.340
TPA	2,551	2,470	1,767	1,163	3,060	2,515	2,634	2,826	1.229	0.199

Legend: VPA, MPA, Walking, TPA – units in MET – min.week^{-1};
M – average; *SD* – standard deviation; Mdn – median; IQR – interquartile range;
U – value of Mann-Whitney test;
d – calculated value of material significance coefficient;
in tests marked with an * statistically significant values at a level of significance of $p < 0.05$ were observed.

Minor differences in selected PA indicators were also observed according to the reported smoking/non-smoking of visually impaired respondents (Table 60). However, there were no statistically significant differences between smokers (n = 42) and non-smokers (n = 110) in any of the PA indicators. Similarly, the material significance coefficients, except vigorous PA in favour of smokers (d = 0.23), are too low (e.g. in TPA the value is d = 0.03). A similar situation was observed in determining the differences between a sample of visually impaired respondents with BMI values ≤ 25 (n = 50) and a sample with BMI values > 25 (n = 102), where none of the indicators was statistically significant (Table 61). A slightly bigger difference was observed in a comparison of PA indicators in respondents aged 25–44 years (n = 58) and 45–69 years (Table 62). In case of vigorous PA a statistically significant difference was observed in favour of the younger sample; the material significance coefficient was on the limit of medium effect (d = 0,39). On the contrary, in the indicator of total PA respondents aged 25–44 years are slightly below the level of the older sample (2,844 MET – $min.week^{-1}$ as opposed to 3,042 MET – $min.week^{-1}$).

Table 60. Selected indicators of performed physical activity in visually impaired respondents according to reported smoking or non-smoking.

Indicator	Non-smokers (n = 110)				Smokers (n = 42)					
	M	*SD*	*Mdn*	*IQR*	*M*	*SD*	*Mdn*	*IQR*	*U*	*d*
VPA	39	183	0	0	111	342	0	0	1.408	0.228
MPA	687	1098	240	960	681	1,031	360	960	0.415	0.067
Walking	2,248	1,860	1,716	1,980	2,156	1,700	1,535	2,277	0.208	0.034
TPA	2,974	2,542	2,075	2,928	2,948	2,439	2,291	2,544	0.200	0.032

Legend: VPA, MPA, Walking, TPA – units in MET – $min.week^{-1}$
M – average; *SD* – standard deviation; Mdn – median; IQR – interquartile range;
U – value of Mann-Whitney test;
d – calculated value of material significance coefficient;
in tests marked with an * statistically significant values at a level of significance of $p < 0.05$ were observed.

Table 61. Selected indicators of performed physical activity in visually impaired respondents according to BMI values.

Indicator	Visually impaired respondents with BMI ≤ 25.00 (n = 50)				Visually impaired respondents with BMI > 25.00 (n = 102)					
	M	*SD*	*Mdn*	*IQR*	*M*	*SD*	*Mdn*	*IQR*	*U*	*d*
VPA	95	317	0	0	41	189	0	0	0.969	0.157
MPA	626	1,029	240	720	714	1,103	240	960	0.180	0.029
Walking	2,152	1,724	1,584	1,980	2,257	1,861	1,980	1,980	0.204	0.033
TPA	2,873	2,394	2,052	2,517	3,012	2,570	2,417	2,970	0.037	0.006

Legend: VPA, MPA, Walking, TPA – units in MET – min.week^{-1}
M – average; *SD* – standard deviation; Mdn – median; IQR – interquartile range;
U – value of Mann-Whitney test;
d – calculated value of material significance coefficient;
in tests marked with an * statistically significant values at a level of significance of $p < 0.05$ were observed.

Table 62. Selected indicators of performed physical activity in visually impaired respondents according to age.

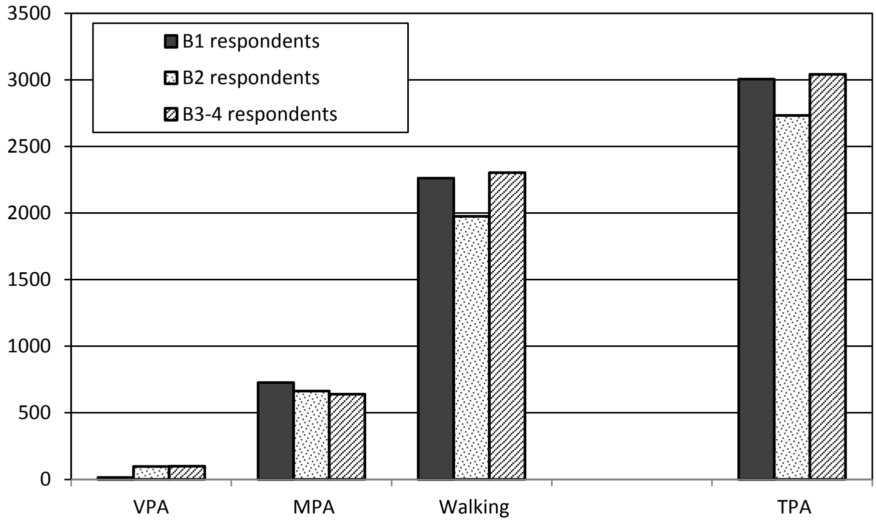
Indicator	Age 25–44 years (n = 58)				Age 45–69 years (n = 94)					
	M	*SD*	*Mdn*	*IQR*	*M*	*SD*	*Mdn*	*IQR*	*U*	*d*
VPA	93	264	0	0	38	221	0	0	2.373*	0.385
MPA	577	972	240	720	752	1,136	180	960	0.410	0.066
Walking	2,175	1,795	1,534	1,782	2,252	1,831	1,980	1,980	0.424	0.069
TPA	2,844	2,415	2,079	2,199	3,042	2,571	2,177	3,024	0.099	0.016

Legend: VPA, MPA, Walking, TPA – units in MET – min.week^{-1}
M – average; *SD* – standard deviation; Mdn – median; IQR – interquartile range;
U – value of Mann-Whitney test;
d – calculated value of material significance coefficient;
in tests marked with an * statistically significant values at a level of significance of $p < 0.05$ were observed.

A multiple comparison of levels of significance and PA indicators across visually impaired respondents according to various criteria did not reveal any statistically significant differences. Similarly, the application of the Kruskal-Wallis test to the samples according to education criteria did not indicate any statistically significant differences between the samples in in vigorous PA [H(2, 152) = 7.91; $p = 0.019$; $\eta^2 = 0.05$], moderate PA [H(2, 152) = 0.65; $p = 0.723$; $\eta^2 = 0.004$], walking [H(2, 152) = 5.49; $p = 0.064$; $\eta^2 = 0.036$] or total PA [H(2, 152) = 4.05; $p = 0.132$; $\eta^2 = 0.027$].

The differences between the samples of respondents with various degrees of visual impairment are minimum in the structure of performed PA according to the amount of MET minutes per week (Figure 34).

Figure 34. Comparison of the structure of performed physical activity in respondents with various degrees of visual impairment in MET minutes per week.



Legend: VPA – values of performed vigorous physical activity per week in MET – minutes per week (MET – min $week^{-1}$)
MPA – values of performed moderate physical activity per week (MET – min.$week^{-1}$)
Walking – values of performed walking per week (MET – min.$week^{-1}$)
TPA – sum of performed physical activity per week (MET – min.$week^{-1}$)

The Kruskal-Wallis test applied to PA indicators only in the samples with visual impairment (including separated categories of B_3 and B_4) did not indicate any statistically significant differences in vigorous PA [H(3, 152) = 5.04; p = 0.169; η^2 = 0.033], moderate PA [H(3, 152) = 0.55; p = 0.909; η^2 = 0.003], walking [H(3, 152) = 1.44; p = 0.696; η^2 = 0.009] or total PA [H(3, 152) = 0.71; p = 0.872; η^2 = 0.004]. Similar values will result from summing the visual impairment categories of B_3 and B_4 ($B_{3\text{-}4}$). Similarly, there are no statistically significant differences between PA indicators in various samples – vigorous PA [H(2, 152) = 4.01; p =0.135; η^2 = 0.027], moderate PA [H(2, 152) = 0.55; p = 0.761; η^2 = 0.004], walking [H(2, 152) = 1.02; p = 0.602; η^2 = 0.007] or total PA [H(3, 152) = 0.71; p = 0.703; η^2 = 0.005]. Again, no statistically significant differences were revealed between men and women with various degrees of impairment (B_1, B_2 and B_3–B_4) in vigorous PA [H(5, 152) = 7.19; p = 0.207; η^2 = 0.048], moderate PA [H(5, 152) = 1.16; p = 0.949; η^2 = 0.008], walking [H(5, 152) = 1.77; p = 0.880; η^2 = 0.012] and total PA indicators [H(5, 152) = 2.28; p = 0.809; η^2 = 0.015].

No statistically significant differences were observed in PA indicators between visually impaired men and women, also the relevant values of material significance are low (Table 63).

Table 63. Indicators of performed physical activity in visually impaired men and women

Indicator	Visually impaired men (n = 59)				Visually impaired women (n = 93)					
	M	*SD*	*Mdn*	*IQR*	*M*	*SD*	*Mdn*	*IQR*	*U*	*d*
VPA	84	291	0	0	43	199	0	0	1.086	0.176
MPA/sum (min.)	149	48	30	240	185	298	60	240		
MPA/day (min.)	21	31	4	34	26	43	9	34	0.237	0.038
MPA	598	864	120	960	741	1,193	240	960		
Walk-ing/sum (min.)	683	577	480	750	667	534	600	540		
Walking/ day (min.)	98	82	69	107	95	76	86	77	0.061	0.010
Walking	2,255	1,903	1,584	2,475	2,202	1,762	1,980	1,782		
TPA	2,936	2,381	2,205	2,715	2,986	2,595	2,034	2,832	0.214	0.035

Legend: VPA – values of performed vigorous physical activity per week in MET – minutes per week (in MET – min.week^{-1})
MPA/week – overall amount of moderate physical activity per week in minutes
MPA/day – average daily duration of moderate physical activity in minutes
MPA – values of performed moderate physical activity per week in MET-min•week-1
Walking/week – overall amount of walking per week in minutes
Walking/day – average daily duration of walking in minutes
Walking – values of performed walking per week in MET-min•week^{-1}
TPA – sum of performed physical activity per week in MET-min•week-1
M – average; *SD* – standard deviation; Mdn – median; IQR – interquartile range;
U – value of Mann-Whitney test;
d – calculated value of material significance coefficient;
in tests marked with an * statistically significant values at a level of significance of $p < 0.05$ were observed.

Visually impaired respondents do not report significant deviations in the amount of total PA (expressed in MET – min.week^{-1}) according to impairment degree. In terms of gender, the differences between men and women of the respective visual impairment classification are also very low.

8.2 Fulfilment of health-based criteria

Meeting health-based recommendation criteria in terms of amount and frequency of performed PA appears difficult for visually impaired individuals. This applies especially to participation in vigorous PA with triple 20 minute repetitions a week. In group B_1 the criteria are not achieved by 70 persons (98.6%); in B_2 by 26 persons (89.7%) and in B_{3-4} by 50 persons (96.2%) with visual impairment. In five-time repetition of moderate physical activity for a period of 30 minutes a week the non-achievement indicators are also high (between 96% and 98% of all visually impaired samples). In five-time repetition of walking for a period of 30 minutes a week the indicators are better. In the samples arranged by degree of impairment the criteria were achieved in group B_1 by 54 persons (68.9%), in B_2 by 23 persons (79.3%) and in B_{3-4} by 38 persons (73.1%) with visual impairment. The proportions of respondents meeting the health-based criteria indicate that visually impaired individuals who are able to meet more than one health-based criterion are exceptional (Table 64). Compared with the common population, meeting health-based criteria was lower in visually impaired individuals, which is primarily caused by non-performance of vigorous PA (Bláha, 2011). Visually impaired individuals exceed the common population only in the indicator of repeated walking in a week for at least 30 minutes.

Table 64. Proportion of respondents meeting health-based criteria

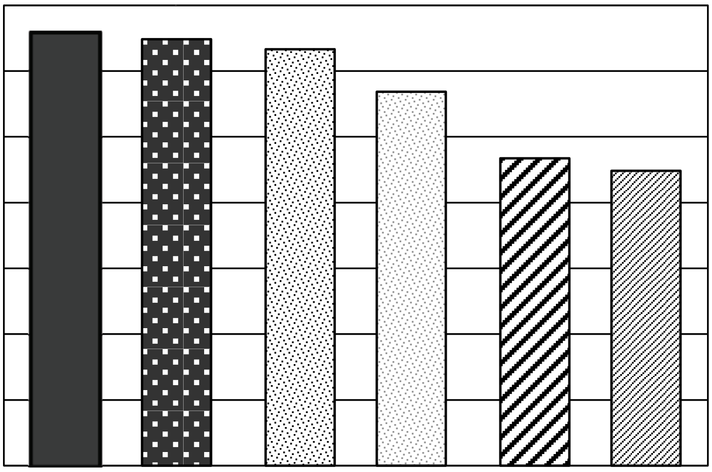
Indicator		Respondents			Total
		B_1	B_2	B_{3-4}	
Meets no criteria	**n**	17	5	13	35
	f	23.94 %	17.24 %	25.00 %	
Meets 1 criterion	**n**	52	21	37	110
	f	73.24 %	72.41 %	71.15 %	
Meets 2 criteria	**n**	2	3	2	7
	f	2.82 %	10.34 %	3.85 %	
Meets 3 criteria	**n**	0	0	0	0
	f	0 %	0 %	0 %	
Total	**N**	71	29	52	152

Legend: n – number
f – column frequency (proportion of N)
N – number for the whole column

Sitting – inactive behaviour

Visually impaired persons spend a considerable part of the day sitting or in passive rest. We observed significant differences in comparison with the common population (Bláha, 2011). Sitting time is the highest in the sample of respondents classified in group B1. With decreasing severity of impairment, inactivity time decreases as well. Visually impaired men reported longer sitting time compared with visually impaired women (Figure 35).

Figure 35. Sitting time in the samples of men and women with various degrees of visual impairment in a week



Legend: values in minutes per week ($min.week^{-1}$)

8.3 Discussion

The present data were statistically processed also with respect to various comparisons with the common population. In several cases the observed differences are described. A relatively significant finding is a lower amount of total reported physical activity compared with the common population, which confirms the principal hypothesis. These comparisons are specified in detail in other sources (Bláha, 2011). Specific types of impairment cause considerable inter-individual differences; the data relating to the samples of respondents with various degrees of visual impairment can be, given the specified number of survey participants (n = 152), susceptible to deviations as a result of extreme values reported by several participants. The values of material significance coefficients (especially of vigorous PA) indicate that several individuals are probably involved in sports activities. Basic demographic data on the respondents indicate interesting facts that extend or confirm the so far accepted understanding of some specifics concerning visually impaired persons. For a number of reasons, very few visually impaired individuals have so far achieved university degree; the number of secondary school graduates is also lower compared with the common population (in the common population secondary school graduates accounted for 73.50% and university graduates for 19.25% of respondents). Apparently, the system of education has not overcome the barriers caused by visual impairment. The causes of this would have to be presented separately. Worth mentioning is a lower proportion of individuals with BMI values ≤ 25.00. Apart from the age structure of the respondents, we believe this condition is a result of lifestyle, i.e. imbalance between energy intake and expenditure, and engagement in PA. As a general rule, visually impaired individuals do not possess passenger cars, bicycles, and have limited opportunities to use a cottage. It appears logical that this could be explained by the social status and economic possibilities of these individuals. In contrast, 90.49% of common population respondents reported they had at least one of these opportunities. The engagement of visually impaired individuals in organized PA is also very low.

The structure of PA performed throughout a week in visually impaired individuals indicates several serious facts. In the first place we should specify the PA promoting correlates and describe a physically active respondent with visual impairment. The results indicate that a more physically active individual with visual impairment (in terms of TPA) is a woman aged 45–69 years, non-smoking, not involved in organized PA, whose visual impairment is classified as B_3–B_4. We should mention however statistically insignificant differences in overall PA between samples B_1 and B_2. We deliberately gave preference to the respondents in group $B_{3\text{-}4}$ because of their considerably lower sitting time in a week (455 minutes) as opposed to group B_1 (653 minutes) and B_2 (591 minutes).

Visually impaired individuals sporadically perform vigorous PA. This incidence can be attributed to visually impaired individuals who are real athletes and have opportunities to pursue these activities, or the estimate of their load might have been unrealistic, or we are witnesses to exceptional performance. The values of VPA indicators in visually impaired respondents are low (59 MET – min.week^{-1}) and considerably decrease the values of final sums of PA (TPA). Better organization of visually impaired individuals would surely help improve these values (out of the total number of 152 persons only 28 accept engagement in this type of PA). It can be stated however that in case of visual impairment a number of individuals are not willing to or are unable to apply PA at this intensity level. As a result, the body is not subject to the required level of load with desirable health effects (see V3 × 20 min.) To a large extent, this also applies to moderate physical activity, although the situation here is much better compared with vigorous PA. In spite of this fact however, PA is not applied in a sufficient number of individuals or desirable extent (see visually impaired men – 598 MET – min.week^{-1}; visually impaired women – 741 MET – min.week^{-1}). Higher levels of moderate physical activity in women compared with men can be attributed to a wide range of activities required for maintaining the household or job-related activities. The frequency of moderate physical activity is also low. We believe that the main reason is again visual impairment, which prevents selected types of physical activity (also job-related) at a higher intensity maintaining the required quality level. An obvious exception could be a selected type of sport-oriented physical skill or walking provided its performance would be at a required intensity level respecting spatial orientation. The application of the IPAQ-short questionnaire in visually impaired persons raises some questions in relation to determining the level of VPA and MPA indicators. The absence of other (additional) research methods is to the detriment of accuracy of possible corrections in the reported values by the respondents. In this context, one issue is the assessment of load duration and individually perceived intensity but there are also other variables in visually impaired persons that could influence reporting of this activity (and inactivity). Similarly, the determination of the degree of load (and related stress and energy expenditure) deserves more precision as this load is not a result of PA performance itself but rather spatial orientation, i.e. overcoming barriers during locomotion and tackling physical activity tasks in the absence or limited perception of visual information. We believe that visually impaired persons tend to overestimate some facts on the intensity of load as a result of these crucial factors.

Visually impaired persons are very good at reporting walking activity. This type of locomotion is apparently the most frequent physical activity used for commuting to work, providing services and ensuring various needs. Walking is also used as a form of active transport between the place of residence and places from where other types of transport are used. This also substitutes the absence or inability to use own passenger vehicles. Walking activity data (2,222 MET – min.week^{-1}) in visually impaired persons represent a crucial component of total PA (TPA) and fully correspond with the general population both in terms of duration and derived load in MET – min.week^{-1}. To a large extent, walking is accepted by visually impaired respondents as a type of PA that could otherwise be performed at a higher intensity under usual circumstances. In our opinion the walking data are clearly a reflection of non-use of own means of transportation (cars, bicycles) and walking duration as a result of a specific way of locomotion. Walking thus raises a number of questions. The main issue is walking quality and intensity associated with walking. Unfortunately, the research method applied is not sensitive to this and we can only speculate that walking duration is, in terms of load, at the same level in both population groups. Our doubts are induced particularly by the following:

- Locomotion in visually impaired persons is usually slower as these individuals need to deal with spatial orientation issues – therefore a distance covered by the same or smaller number of steps is shorter (walking uncertainty results is a shorter step).
- Locomotion in visually impaired persons is negatively affected by spatial orientation. It is difficult to assess to what extent locomotion is individually associated with attention and mental load and thus energy expenditure.

Nonetheless, walking appears the only significant physical load in visually impaired persons. However, walking cannot make up for the loss associated with vigorous PA and moderate PA neither in terms of intensity nor amount. As a result, overall energy expenditure is relatively low (visually impaired men − 2,937 MET – min.week^{-1}; visually impaired women – 2,986 MET – min.week^{-1}) and is lower in comparison with common population respondents (Bláha, 2011).

It appears that lifestyle in visually impaired persons is primarily defined as “sedentary” because a considerable amount of time is spent sitting. It would be interesting to particularize the reasons but we believe that this is again caused by the need for rest after a number of activities that are demanding in terms of orientation, and habits that cannot always be considered appropriate. Visually impaired individuals are also affected by difficult employability; similarly, other activities (gardening, walks, etc.) are not easy, which can lead to neglect or refusal. Visually impaired women appear more active (visually impaired men − 596 min.týden^{-1}; visually impaired women − 559 min.week^{-1}). This again confirms our assumption that women spend more time taking care of the household, minor works etc., whereas visually impaired men tend to prefer passive rest. In visually impaired respondents it turns out that sitting time decreases with the degree of impairment. This is apparently due to increased possibilities to participate in a larger spectrum of leisure activities and probably also a lesser need to rest as a result of exertion and mental load associated with spatial orientation and transfer.

Research question No. 4

To what extent is usual locomotion performed by visually impaired persons?

9 /

Study II
Assessment of the volume of performed locomotion in visually impaired persons

Ladislav Bláha

The aim of the study focusing on research question No. 4 was to uncover the load structure of visually impaired individuals by means of monitoring basic locomotion activities and weekly application of pedometers and record sheets. The study aims to put into context the obtained data and daily recommended step counts in terms of health development or maintenance, employment of visually impaired individuals, etc.

Principal hypothesis

The research samples of visually impaired persons do not regularly achieve the level of generally recommended values of locomotion activities for healthy adults, i.e. 7,000 to 13,000 steps per day.

Methods

The basic framework of our research study was defined by a project at the Faculty of Physical Culture, Olomouc called *Research of seniors in the University of the third age – Change in physical activity behaviour using pedometers and the INDARES system*. In the conditions of the Usti and Karlovy Vary regions we especially used a project called *Delivery of selected physical activities in visually impaired citizens of Ústí nad Labem* (2006), which continued through an offer of physical activity programmes for visually impaired individuals in the region. Through this comprehensive monitoring we attempted to obtain data on the lifestyle of visually impaired individuals (2005−2009), complement these data with information relating to specific issues of their lives with impairment and use pedometers in selected persons to record the amount of walking for a predetermined period. In this way we aimed to put the values in context with acknowledged values characterizing the following physical (walking) behaviour (Tudor-Locke & Bassett, 2004):

- less than 5,000 steps per day – sedentary lifestyle,
- between 5,000 and 7,499 steps per day – little active,
- between 7,500 and 9,999 steps per day – partially active,
- more than 10,000 steps per day – active,
- more than 12,500 steps per day – highly active lifestyle.

We investigated the extent to which visually impaired individuals are involved in the following zones: healthy adult cover daily 7,000–13,000 steps (less in women compared with men), healthy older adults cover 6,000–8,500 steps and individuals with health-related limitations cover 3,500–5,500 steps (Tudor-Locke & Myers, 2001).

The application of pedometers in visually impaired persons was carried out for a period of one year (2008) and presented some problems. There were particularly issues with recording pedometer data, which had to be performed by other people than those carrying the pedometers. Wearing pedometers was in these cases limited to 8 days (two weekend days and 5−6 working days). Pedometer values were noted in record sheets.

For our research purposes we used the YAMAX Digiwalker SW-200 and YAMAX Digiwalker SW-700 pedometers (Annex 4), record sheet for recording performed physical activity and inactivity and comparison of individual values with recommended values. To investigate PA and other socio-demographic and environmental data we used the IPAQ-long questionnaire (Craig et al., 2003) − at the end of the survey (Annex 5) and the Neighborhood Environment Walkability Scale (NEWS-A) – at the beginning of the survey. A high degree of validity and reliability of the applied questionnaires was verified by numerous studies (Cerin, Saelens, Sallis, & Frank, 2006; Saelens, Sallis, Black, & Chen, 2003). The YAMAX Digiwalker SW-700 and SW-200 pedometers (Yamax Corporation, Tokyo, Japan) are small lightweight (20 g) electronic devices for measuring vertical oscillations. The data on total step counts and the derived calculated distance and energy expenditure (average step length and weight need to be pre-set) can be read from the display after the protective cover is opened. The YAMAX pedometers have an electric circuit, which is closed and opened by a sprung pendulum arm reflecting vertical oscillations during walking (Schneider, Crouter, & Basett, 2004; Sigmund et al., 2008c). Vertical oscillations exceeding the sensitivity threshold are recorded as steps (Tudor-Locke et al., 2002). The number of steps – more precisely the number of sufficiently strong vertical oscillations is the most precisely measured value; in the case of distance and energy expenditure the error rate increases, which must be taken into account in results interpretation.

9.1 Results

The pedometer-based survey involved a total of 35 persons with various degrees of visual impairment. In order to distinguish the participants according to their method of locomotion, the study presents the results of those individuals who stated they needed a guide in an unknown environment and under bad conditions. Another criterion was not exceeding the age limit of 65 years, which we considered the general retirement age. The data were correctly completed and the required criteria met by 13 men and 17 women (Table 65).

Table 65. Structure of the samples of visually impaired men and women in Usti and Karlovy Vary regions

Samples		Descriptions of visually impaired participants							
		age		degrees of impair-ment		employed		region	
	n	*M*	*SD*	B_1	B2	Yes	No	Usti	Karlovy Vary
M VI	13	46.00	11.93	9	4	6	7	7	6
W VI	17	41.76	10.91	7	10	8	9	11	6
Total	**30**			**13**	**14**	**14**	**16**	**18**	**12**

Legend: M VI – visually impaired men
W VI – visually impaired women
Usti – Usti region
Karlovy Vary – Karlovy Vary region
n – number; *M* – average; *SD* – standard deviation

The pedometer-based survey indicated that the amount of walking activity was not big in any of the samples of visually impaired individuals. Generally, men reported a higher number of steps. In both samples of visually impaired men and women we observed a decrease in the locomotion indicators during weekend days (Table 66).

Table 66. Daily amount of pedometer-reported steps in visually impaired men and women

Samples		Indicators of locomotion in visually impaired samples					
		Weekdays		Weekend days		Whole week	
	n	*M*	*SD*	*M*	*SD*	*M*	*SD*
M VI	13	4,918	2,658	4,457	3,293	4,796	2,314
W VI	17	4,820	2,371	3,853	3,094	4,505	1,809

Legend: M VI– visually impaired men
W VI – visually impaired women
n – number; *M* – mean; *SD* – standard deviation; values indicate performed steps per one day ($steps.day^{-1}$)

The values of performed steps in both samples are below 5,000 steps per one day. This confirms the hypothesis of a low level of walking performance in the samples. The probands in both samples reported considerable differences in performed locomotion. The application of the Mann-Whitney test (according to the medians of the samples $M\ VI_{Mdn} = 4{,}482\ steps.day^{-1}$ and $W\ VI_{Mdn} = 4{,}033\ steps.day^{-1}$) indicated no statistically significant differences between the samples of visually impaired men and women in the monitored parameters of daily steps in a week ($steps.day^{-1}$) (Mann-Whitney test U= 0.069; $p < 0.05$), the material significance coefficient is also low (d = 0.15). One of the monitored indicators in the visually impaired participants was a correlation between employment of the probands (number of working hours) and the reported amount of steps (Tabulka 67). In the sample of visually impaired men and women this correlation is confirmed on six out of seven days.

Table 67. Average daily amounts of steps in unemployed and employed persons with visual impairment

Days in a week	Indicators of locomotion in visually impaired samples							
	Unemployed (n = 16)			Employed (n = 14)				
	M	*SD*	*Mdn*	*M*	*SD*	*Mdn*	*U*	*d*
Whole week	3,584	1,737	3,275	5,828	1,626	5,569	2.451*	0.898
Monday	3,818	1,950	4,313	6,383	1,749	6,435	2.200*	0.803
Tuesday	3,379	1,840	3,033	5,556	2,749	5,274	2.162*	0.792
Wednesday	4,131	1,976	3,992	5,794	2,348	6,047	1.954	0.690
Thursday	3,804	2,524	3,518	6,132	2,997	6,097	2.332*	0.853
Friday	3,995	2,420	3,451.5	6,369	2,221	6,425	2.501*	0.912
Saturday	3,327	3,000	2,162.5	4,768	2,456	4,615	1.995*	0.732
Sunday	2,757	1,798	2,315	5,907	4,360	4,319	2.494*	0.910

Legend: *M* – average;
SD – standard deviation;
Md – median;
n– number;
U – value of Mann-Whitney test;
d – calculated value of material significance coefficient;
tests marked with an * are statistically significant at a level of $p < 0.05$; the values are given in performed steps per one day (steps˙day^{-1})

Visually impaired men in our sample meet the health recommendation indicator, i.e. recommended daily amount of walking activity mostly at the lower limit of the zone, seven individuals do not meet the recommended daily amount and are in the zone of persons with health limitations (Figure 36). In visually impaired women, meeting the health recommendation of average daily amount of walking activity is even worse in spite of the fact that the generally recommended amount of walking activity is lower (approximately 4,500–9,000 steps). In most visually impaired women we observed non-performance of the recommended criteria or performance at the lower limit of the recommended values (Figure 37).

Figure 36. Achievement of health recommendations – average daily amount of walking activity – visually impaired men

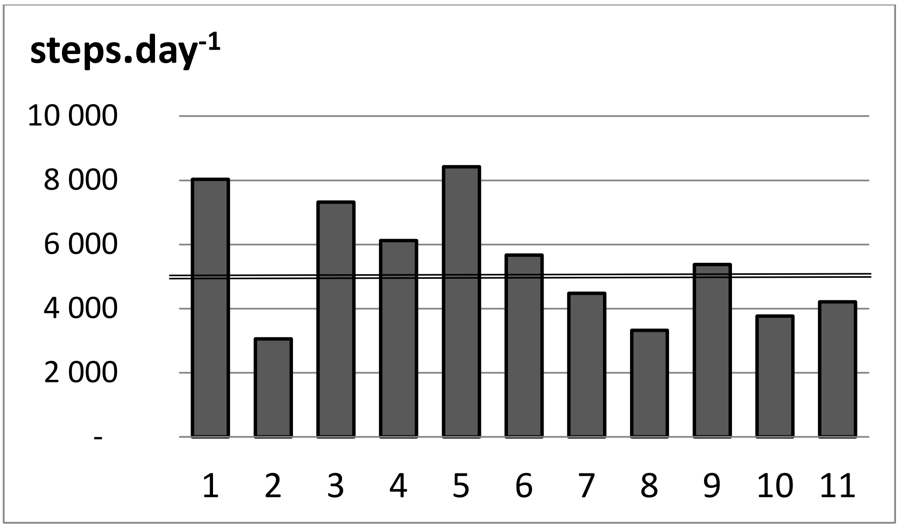
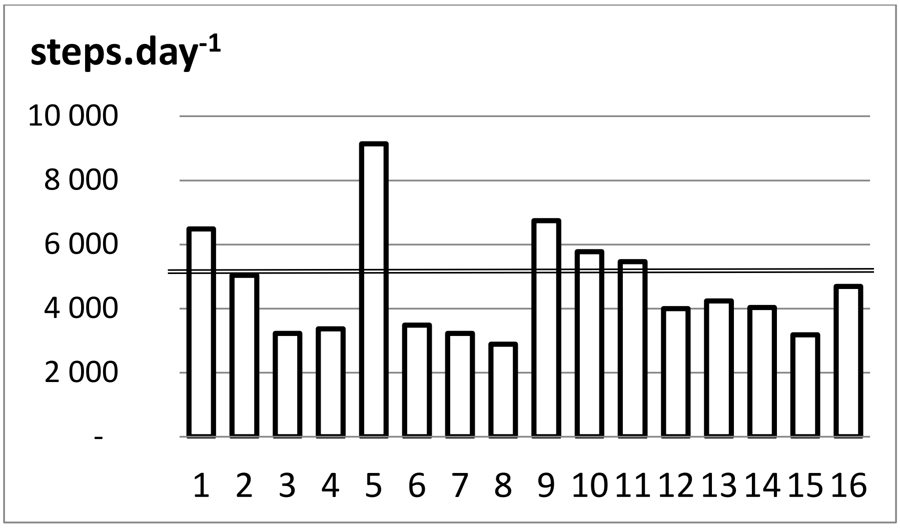


Figure 37. Achievement of health recommendations – average daily amount of walking activity – visually impaired women



At the same time, visually impaired men and women were assessed using the IPAQ-long questionnaire, the aim of which was to specify the spectrum of applied PA and especially to identify the correlations of applied diagnostic techniques. The indicators of total PA were low in the sample of visually impaired men (M = 2,020 MET – min.week^{-1}; SD = 1,487) as well as women (M = 1 627 MET – min.week^{-1}; SD = 1,913). The values of the correlation coefficients between the indicators of total PA and average daily values of performed steps (steps.day^{-1}) in both samples were low (r = 0.41).

9.2 Discussion

Some results indicate that for individuals with severe forms of visual impairment, their impairment is a limiting factor of walking activity. In reality however, visual impairment need not automatically classify them as individuals with a health limitation as their locomotion system is intact. Visual impairment influences not only the performance of PA but also considerably affects the performance of lifestyle-related "elementary" physical activity. It is obvious that these individuals will not achieve an adequate level of PA as a result of household work or transport to work. In terms of duration, walking is an activity applied at a relatively high level (Table 66) but its problem lies in the parameters. Walking tends to be slower, cautious and covering shorter distances. Also, walking is not complemented with additional locomotion activities. The causes can be fear of injury and desire of visually impaired individuals to avoid locomotion problems and sometimes stressful spatial orientation. As a result, PA is not performed, which is associated with low energy expenditure and overweight. Overweight is, particularly in persons with severe visual impairment, another reason for refusing participation in PA. This also leads to insufficient application of walking activity, which provably has a significant positive effect on the cardiorespiratory system and its sufficient amount can lead to a decrease in overweight in combination with other factors. The indicators of the level of walking activity are generally very low during weekdays (4,918 steps per day in visually impaired men and 4,820 steps per day in visually impaired women) and even lower on weekend days (4,457 steps per day in visually impaired men and 3,852 steps per day in visually impaired women). The same applies to average daily values in a week (Table 66). These values (according to Tudor-Locke & Bassett, 2004) signify a sedentary lifestyle. Attention should be paid to a comparison with expected values in individuals with health limitations (3,500 to 5,500 steps per day) because only one person suffered from combined impairment (man with number 13 on Figure 36) or another significant health limitation (Tudor-Locke & Myers, 2001), which in our opinion affected the walking ability. We should not omit the issue of movement on pavements, commuting to work, etc., which is frequently performed using a white stick and focusing on known points, type of pathway or environment, noise, sounds, etc. The low values in adult population of visually impaired individuals observed in the survey to a large extent confirmed our assumption, which was based on different research methods. Only four probands (three men and one woman) achieved values indicating a partially active lifestyle. It was also confirmed that visually impaired persons fall behind health-based recommendations of daily average amounts of walking activity. Both in men and women the individual average daily values fluctuate and in some cases (6 women out of 17) are in the zone of a sedentary lifestyle (according to Tudor-Locke & Bassett, 2004) at a level of 3,000 steps per day. In none of the monitored individuals did we observe a one-time participation in a social occasion, trip, etc. Their daily regime is obviously invariable and it appears that these persons tend to prefer rest and inactivity after they accomplish their work responsibilities and provide required needs. A positive aspect is the recorded higher daily amount of steps in employed or part-time employed individuals. The differences in the monitored indicators are statistically as well as materially significant. An active lifestyle in the form of direct participation in work-related activities and the reported amounts of walking activity can be considered a logical correlation. Work forces an individual to be active and in a way contributes to maintaining certain freshness and quality of life. It is thus necessary to increase motivation of visually impaired persons to perform various activities, participate in social occasions etc., to promote their activity through citizens' associations, sports clubs, educational institutions, etc.

The discussion needs to include a description of the specifics of our sample. The monitored visually impaired individuals were willing to take part in the survey. They suppressed their passivity, showed interest to participate, monitor and evaluate own PA even in the more demanding alternative of using a pedometer. Therefore, the presented values must be viewed with a degree of caution. The real state could be worse and the amount of really performed walking activity in other visually impaired individuals is probably lower.

It turned out that in the localities of our survey, visually impaired individuals did not feel walking was significant for the development of their health and cultivation of their fitness. The observed values point to a necessity to engage walking, particularly for the purposes of self-care. We consider this phenomenon important as it signifies the level of social contact of these persons, where the low values can reflect individually performed transfers instead of more vigorous walking with a guide, which is also less demanding in terms of spatial orientation. This deficit could be eliminated by partners or friends or non-profit organizations etc. Also, this could be improved through planning and cultivation of the walking environment by local authorities.

9.3 Conclusions of Bláha's studies aimed at the assessment of the volume of reported physical activity and inactivity and performed locomotion in visually impaired persons

- Visually impaired persons participate in vigorous PA in a small extent. If they do, their participation is only sporadic and usually in the form of organized PA.
- Visually impaired persons report participation in moderate physical activity at a very low level (685 MET – min.week^{-1}). Visually impaired women participate in moderate physical activity more than men. More moderate physical activity is also performed by visually impaired respondents aged 45–69 years with BMI values > 25.00. However, the differences are not statistically significant.
- Out of all monitored indicators, walking is the most frequently applied type of PA by visually impaired individuals. Considering walking-related values (2,222 MET – min.week^{-1}) visually impaired respondents are comparable with the common population. Impaired individuals who take part in organized PA use walking less compared with non-organized respondents (statistically significant difference of d = 0.34). In visually impaired respondents we observed higher (statistically insignificant) walking values in persons aged 45–69 years with BMI values > 25.00 and non-smokers.
- Insufficient engagement of visually impaired individuals in vigorous PA and moderate physical activity reflects in the total amount of all reported activities. In this indicator visually impaired persons are behind the common population. The TPA indicators in our visually impaired persons were 2,967 MET – min.week^{-1}. Better

values inside the sample of visually impaired respondents can be achieved by women, individuals aged 45–69 years and those with BMI values > 25.00.

- The health-based criteria concerning participation are not at a satisfactory level in visually impaired persons. A single criterion is met by 71–73% of visually impaired respondents. Two criteria are met by only a tiny group of visually impaired respondents. It is confirmed that visually impaired respondents are unable to meet especially the criteria of three times vigorous PA for 20 minutes in a week and five times moderate physical activity in a week.
- Visually impaired men and women spend a larger proportion of time sitting in all cases (irrespective of age structure). Particularly individuals with severe visual impairment prefer sitting rest; sitting is for them also a way of relaxing and entertainment. On the other hand, this also means that their lifestyle can suffer from excessive sedentary activity, which might have an adverse effect on their health.
- In terms of duration, walking is used by visually impaired individuals at a sufficient level. However, the real amount of performed steps is lower and this type of locomotion has different parameters than usual.
- In terms of walking use, visually impaired persons fall behind health-based recommendations of daily average amounts of walking activity.
- Both in men and women the individual average daily values fluctuate and in some cases are in the zone of a sedentary lifestyle at a level of 3,000 steps per day.
- It appears that full-time or part-time employed visually impaired individuals report higher values of daily step counts than other visually impaired individuals. The differences in the monitored indicators are statistically as well as materially significant.
- The results imply that walking in visually impaired persons was not performed at a sufficient level in the localities of our research.
- It turned out that pedometers and their use present suitable motivation for visually impaired persons to encourage their participation in locomotion activities.

10 /

Determinants of physical activity and lifestyle of Czech 11–15 years old students with visual impairments

Kudláček, Mikeška, Ješina

The Health Behavior in School-aged Children (HBSC) is cross-national study focused on young people's well-being, health behaviors and their social context. HBSC is done in collaboration with the WHO Regional Office for Europe and is conducted every four years in 45 countries and regions. The Czech Republic is part of international HBSC study since 1994 with regular data collection in four-year cycles. Until recently, the data collection did not include specific needs of children with disabilities and impairments (Brindová, Kmeť, & Ješina, 2013). In HBSC network, there have been tendencies to focus on specific needs of children with long-term illnesses (Rintala, et al., 2011). The only published results of HBSC study are with longitudinal data from Finland, where they included optional questions allowing them to identify children with long-term illnesses (Ng et al., 2016a; Ng et al., 2016b). However only children with mild impairments were able to respond to mainstream national HBSC study and therefore the need to further investigate lifestyle of children with moderate and severe impairments (e.g. blindness or deafness) was identified with HBSC network.

Inclusion of persons with visual impairments in leisure time physical activities can be very effective tool to prevent social exclusion (Janečka & Bláha, 2013). In working with children with visual impairments, we find significant impact of environmental and personal contextual factors (Bláha, 2011; Haegele, Zhu, Lee, & Lieberman, 2016; WHO, 2001). Riley, Rimmer, Wang & Schiller (2008) argue that participation in physical activities is essential part of lifestyle of persons with disabilities, which can also increase the quality of life and social participation (Kudláček, 2008). Psychosocial aspect of physical activities is especially important in sensitive time of child's development, which includes entry to elementary education and prepubescence (Janečka & Bláha, 2013).

Janečka and Bláha (2013) highlight following three specific needs of children with VI: (a) lack of experience with movement in strange environment; (b) actual limits of visual loss; and (c) learned movement stereotypes, which can hinder participation in changing environment. In Czech education, we can find significant differences between children with VI educated in special school and children included in mainstream schools. While students attending special schools often take part in organized physical activity in school PE and school based sport clubs, students attending general schools are many time excluded from physical education and all sport related extracurricular activities (Kudláček, 2008). Students with visual impairment can be very active, being good at sports as well as at school and we can find also successful examples of them doing sport studies at university level and serving as good examples to peers with and without disabilities (Reina & Alvaro-Ruiz, 2016).

So far these important determinants of quality of life are not well documented in the literature. On the other hand, there is possibility to influence the quality of life of persons with impairments by facilitating their involvement in physical activities, improvement of their physical literacy and health education (Ng et al., 2016a). International recommendation for physical activity of children and youth suggest 60 minutes of physical activity daily (Kalman, 2012). Unfortunately, these recommendations and most international renowned studies do not reflect specific needs of persons with visual impairments (Kalman, Hamřík, & Ješina, 2011). Therefore we need to pay extra attention to facilitate participation of persons with impairments in physical activity in general (Ng et al., 2016b), the improvement of quality of physical education (Block, 2007) as well as leisure time physical activities (Sherrill, 2006).

Understanding the real problems in lifestyle of children with VI can help us to make recommendations for strategic policies and transformation of educational, medical and social support systems. For this, we need valid and reliable evidence, which can help us to compare this population with non-disabled children. The purpose of this study was to analyze the determinants of physical activity and lifestyle of 11 to 15 years old children with visual impairment.

Methods

Survey was filled in years 2013-2015 by 53 participants, 34 boys (average age 13.4 yrs.) and 19 girls (average age 12.8 yrs.). Students were attending both special schools for students with visual impairments as well as general school setting from Olomouc, Brno, Opava, Liberec, Praha and Plzeň. Students filled in survey during their leisure time in special schools, at sport camps and during goalball competition, which took place in Olomouc in 2015. This purposive sampling implies potentially higher level of physical literacy and engagement in physical activity. Students filled survey in paper format individually with the help of trained independent assistant. Blind students used blind friendly version of survey.

Survey and data analysis

The whole study is realized within HBSC international study framework. Modifications to HBSC survey were done in coordination with colleagues from Faculty of Medicine P. J Šafárik University and colleagues within international disHBSC subgroup (Slovakia, Czech, Finland, France and Spain). Survey titled disHBSC is modified version of international HBSC survey, which is suitable for adolescents with impairment. Present study uses compulsory as well as optional items from HBSC package. Original HBSC study The international network is organized around an interlinked series of focus and topic groups related to the following areas: (a) Body image, (b) Bullying and fighting, (c) Eating behaviors, (d) Health complaints, (e) Injuries, (f) Life satisfaction, (g) Obesity, (h) Oral health, /I/ Physical activity and sedentary behavior, (j) Relationships: Family and Peers, (k) School environment, (l) Self-rated health, (m) Sexual behavior, (n) Socioeconomic environment, (o) Substance use: Alcohol, Tobacco and Cannabis, and (p) Weight reduction behavior. Questionnaire titled "disHBS" consists of 48 items and is thus considerably shorter from original HBSC study. The motivation for modification was the reduction of time needed for survey completion due to limited attention span of children with certain impairment, simplification due to limited cognition and communication skills and adding some impairment specific items. Final disHBSC survey is therefore modified but still comparable with main HBSC study.

Results

Presented results focus on topic of physical activity and screen time, and bullying. The most common place to do physical activities is school-based physical education (54.7 %). Second most commonplace to engage in physical activity is being active with friends outside of school (52.8 %). Only five children (9.4 %) did not attend physical education lessons due to medical reasons (Table 1).

Table 1 Location of physical activity

n = 53 (possibility to check more options)	n	%
Only in physical education at school	29	54.70
Outside school with friends	28	52.80
In sport club at school	20	37.70
Outside school with family	16	30.20
In sport club outside of school	11	20.80
Elsewhere	11	20.80
I do not attend PE at school due to health reasons	5	9.40

Girls were more active than boys. Seven out of 19 girls are physically active for 60 minutes seven days per week (table 2). The most frequent amount of physical activity among boys is five days per week.

Table 2 Regular physical activity (%)

	Boys (n = 34)		Girls (n = 19)	
	n	%	n	%
0	1	2.90	0	0.00
1	3	8.80	0	0.00
2	3	8.80	3	15.80
3	7	20.60	5	26.30
4	6	17.60	3	15.80
5	8	23.50	0	0.00
6	3	8.80	1	5.30
7 days	**3**	**8.80**	**7**	**36.80**

The most common reason for doing physical activity was to improve health (66%). Second most important reason (64.2%) was meeting with friends. Fifty seven percent of respondents mark reason to win as not important. Sixty percent of respondents mark meeting new friends as important reason to do physical activity. High cumulative scores of positive evaluation (important plus very important) are following: (a) To prove I can do it and (b) Maintain the weight. Highest cumulative score is in item to get In shape.

Table 3 Reasons for participation in physical activities (%)

Reasons for PA (N = 53)		Very important	Important	No important
Have Fun	n	17	29	7
	%	32.10	54.70	13.20
Be good at sports	n	17	20	16
	%	32.10	37.70	30.20
Win	n	8	15	30
	%	15.10	28.30	56.60
Meet new friends	n	17	32	4
	%	32.10	60.40	7.60
Improve health	n	35	16	2
	%	66.00	30.20	3.80
Be together with my friends	n	34	16	3
	%	64.20	30.20	5.70
Get in shape	n	24	28	1
	%	45.30	52.80	1.90
Look good	n	18	21	14
	%	34.00	39.60	26.40
Please my parents	n	26	20	7
	%	49.10	37.70	13.20
To be „cool“	n	9	20	24
	%	17.00	37.70	45.30
Maintain the weight	n	25	23	5
	%	47.20	43.40	9.40
Excitement	n	13	25	25
	%	24.50	47.20	28.30
To prove I can do it	n	23	25	5
	%	43.40	47.20	9.40

In preference of physical activity (Table 4) is the most common response ball games – 12 respondents participate in them at least twice per week. Swimming and adapted activities was done at least once per week by 15 respondent. Relatively high scores for non-participation are in following: gymnastics, aerobics, Zumba, (24 respondents), martial arts and self-defense (31 respondents), baseball, softball and cricket (28 respondents), dance (22 respondents) and climbing (25 respondents).

Table 4 Organized leisure time physical activities

Selected types of physical activity (n = 53)	No practice	Aprox. 1x–2x per year	Aprox. 2x–3x per month	Aprox. 1x per week	2x per week or more
Ball games	6	8	5	4	12
Athletics	5	9	8	6	7
Gymnastics, aerobics, Zumba	24	6	0	1	4
Swimming and adapted activities	4	6	6	15	4
Running, jogging	8	10	5	6	6
Martial arts and self-defense	31	3	0	1	0
Tennis, table tennis, badminton, showdown	9	11	4	8	3
Baseball, softball, cricket	28	3	1	2	1
Target sports (boccia, bowling, darts,...)	12	15	6	1	1
Dance (disco, techno, stand. and folk dances)	22	6	0	4	3
Skiing, downhill, cross-country	5	26	3	1	0
Skating, Ice Hockey, Inline skating	10	15	5	1	4
Cycling, spinning,	8	10	10	2	5
Indoor and outdoor climbing	25	6	0	4	0
Tourism	5	5	15	4	6
Canoeing, rafting, kayaking	19	15	1	0	0
Strengthening, bodybuilding, fitness	18	5	6	2	4

Screen time (Table 5) belongs to most common negative aspects of life style in children and adolescents. Screen time of children with visual impairments is not necessarily only negative as they use PC and smartphones for communication. Biggest group of boys (23.5%) watch television one hour per day. Most girls (36.8%) watch television 2 hours per day. Children with visual impairments spend very little time playing computer games. No time playing PC games was reported by 17.6% of boys and 31.6% of girls. More than 50% of boys and girls spend only one hour or less playing PC games. Time spend on internet, e-mail or doing homework was slightly higher 23.5% of boys spending 1 hour and 23.5% two hours per day. Most girls (31.6%) spend half an hour per day on PC. Children with visual impairment thus spend considerable time watching television of being in front of PC:

Table 5 Sreen time

Hours watching TV, DVD or video per day	Boys (n = 34)		Girls (n = 19)		Hours Playing PC games or playstation per day	Boys (n = 34)		Girls (n = 19)		Number of hours on PC (internet, e-mails, homework)	Boys (n = 34)		Girls (n = 19)	
	n	%	n	%		n	%	n	%		n	%	n	%
None	5	14.70	5	26.30	**None**	6	17.60	6	31.60	**None**	5	14.70	2	10.50
1/2 Hr. Hr	7	20.60	5	26.30	**1/2 Hr. Hr**	6	17.60	5	26.30	**1/2 Hr. Hr**	2	5.90	6	31.60
1 Hr.	8	23.50	1	5.30	**1 Hr.**	5	14.70	4	21.10	**1 Hr.**	8	23.50	2	10.50
2 Hrs.	6	17.60	7	36.80	**2 Hrs.**	5	14.70	3	15.80	**2 Hrs.**	8	23.50	3	15.80
3 Hrs.	4	11.80	0	0.00	**3 Hrs.**	2	5.90	0	0.00	**3 Hrs.**	3	8.80	3	15.80
4 Hrs.	2	5.90	0	0.00	**4 Hrs.**	4	11.80	0	0.00	**4 Hrs.**	2	5.90	2	10.50
5 Hrs.	1	2.90	0	0.00	**5 Hrs.**	2	5.90	1	5.30	**5 Hrs.**	1	2.90	0	0.00
6 Hrs.	0	0.00	1	5.30	**6 Hrs.**	1	2.90	0	0.00	**6 Hrs.**	3	8.80	1	5.30
7 Hrs. +	1	2.90	0	0.00	**7 Hrs. +**	3	8.80	0	0.00	**7 Hrs. +**	2	5.90	0	0.00

Approximately 68 % of boys and girls did not experience bullying in past few months. In frequency, 1-2x we find bullying among 14.7 % of boys and 10.5 % of girls. However approximately 18 % of boys an 20 % of girls experienced some bullying and about 9 % of boys and 10 % of girls experience regular bullying.

Table 7 The experience of bullying from others during past few months

Bullying from others	Boys (n = 34)		Girls (n = 19)	
	N	%	n	%
Never	23	67,6	13	68,4
1–2 times	5	14,7	2	10,5
2–3 times per month	1	2,9	2	10,5
Aprox. once per week	1	2,9	2	10,5
Few times per week	2	5,9	0	0

Discussion

Although our sample represents relatively active adolescents with visual impairments, it provides an interesting view of different determinants of their lifestyle In comparison with hypokinetic lifestyle of adolescents without disabilities, where screen time significantly influences leisure time behavior (Kalman & Vašíčková, 2013) students with visual impairment spend less time in front of computers. In boys with visual impairments 55.8 % spend more than 2 hours in from of PC, while in boys without impairments it is 76.87 % (Kalman et al,. 2011). We found similar comparison in girls where 47.1 % of girls with VI spend 2 hours or more in from of PC while in girls without impairments it is 63.37 %. Similar finding are in watching TV – 41.2 % vs. 65.4 % in boys and 42.1 % vs. 61.5 % in girls. Less time watching TV is understandable due to nature of visual impairment. On the other and we must emphasize that there was no item focusing on using smart phones and tablets, which seems to be preferable screen time activity of children with VI and we plan to add this item in future. Relatively positive finding of screen time activities do not transfer to more time spend in physical activities. Especially when we realize that, this is a group of sporting children with VI. Only 8.8 % of boys meet WHO recommendation of 60 minutes of PA per day. Ng et al. (2014) found 22.7 % of respondents meting WHO recommendation. However, we should emphasize that their respondents had less severe VI as they were able to respond to regular survey without adaptations for students with more severe VI. On the other hand, we found 36.8 % of girls meeting WHO recommendation vs. 9.1 % in HBSC study from Finland. Surprising findings for our active sample show that 9.4 % of respondents do not attend physical education at school and only 21 % of them attend sport activities outside of school. Almost 55% of students do physical activities only at school. This supports our assumption that if students are not included in physical education or school based sport activities, they will not take part in regular physical activity at all. Experiences from abroad (Perkins, Columna, Lieberman, & Bailey, 2013; Robinson & Lieberman, 2007) tell us that with appropriate support parents can be perfect facilitators of active lifestyle of children with VI. In contrary with nondisabled students (Kalman et al,. 2011). The main reason for doing physical activity in to stay in shape and meet new friends. Personal fitness and skill improvement, teamwork and friendship as motives for participation of children with VI were also found in Yao, Shapiro, & Liao (2016).

The most preferred physical activity is tourism, swimming with adapted activities and ball games which is similar to finding of Czech high school students of Kudláček and Frömel (2012

From our finding most alarming seems to be the experience with bullying where most students with VI had some experience with bullying and about 9 % of boys and 10 % of girls experience regular bullying (at least once per week). We did not find any such alarming finding in any European HBSC studies and common experience with bullying in Czech studies as approximately 6 % with the highest rates of bullying is in Ukraine and Poland with 17–18 % of 11 years old students (Madarasová, Dankulincová, Sigmundová, & Kalman, 2016).

Summary

The main purpose of the study was to explore selected determinants influencing participation in physical activity and healthy lifestyle of active students with visual impairments. As our sample represents sport active population, it is difficult to generalize these findings to whole population of students with VI. Furthermore we can expect that lifestyle of non-active students would be even worse. Especially among boys in our sample only 8.8 % meet WHO recommendation of daily amount of physical activity. More than fifty percent of our respondents do activity in only organized school setting (physical education and sports. This therefore implies that when students are included in general schools, but not included in general physical education, the amounts of physical activity would be much lower. It is important to realize specific aspects of screen time in population with visual impairments, where it computers, tablets or smart phones can serve as facilitators of social interaction. Eating habits of students with VI are comparable to their non-disabled peers, but there seem to be higher prevalence of bullying, especially among girls with VI. For further studies, we would recommend to find more representative sample and have substantial number of students from special schools and general schools so their results can be compared.

11 /

Developmental aspects in the evaluation of motor competences in visually impaired children and youth

Zbyněk Janečka

To understand the principles of ontogenesis, we need to know the stages and periods of human development. Based on this knowledge we will better understand any developmental deviations.

The presented periodization refers to ontogenetic development as described by Vaněk (1972), Příhoda (1977), Langmeier (1983). The selected periodization is primarily age-related because we worked with age-based developmental standards, the same applied to our system of education. In spite of this fact we are aware that age is not the only criterion for correct assessment of psychomotor development. Therefore, the age-related periodizations are complemented with developmental stages as presented by Krejčířová and Erikson.

Human age classification by Vaněk

Prenatal period – from conception to birth
Youth – from birth to twenty years of age. This period is further divided by Vaněk into two periods:

- **childhood** – from birth to eleven years of age,
- **junior age** – from eleven to twenty years of age.

The author further divides childhood and junior age into seven periods (*infant period, toddler period, puerile age, post-puerile age, pre-pubescence, pubescence, adolescence).*

In his periodization, Vaněk accentuates developmental differences in girls and boys. The toddler period ends at the age of three in girls but at the age of four in boys.

The puerile period is further divided into:

- **early childhood**, which lasts from five to nine in boys and to eight in girls,
- **late childhood**, which lasts to eleven in boys and to ten in girls,

The pre-pubescence period lasts from eleven to twelve in boys and from ten to eleven in girls.
The period of youth ends by:

- **pubescence**, which lasts from twelve to sixteen in boys and from eleven to fourteen in girls,

- **adolescence**, which lasts from sixteen to twenty in boys and from fourteen to eighteen in girls.

The adulthood period lasts from twenty to sixty and is divided into three periods:

- pre-acme – from twenty to thirty years of age,
- acme – from thirty to forty-five years of age,
- post-acme – from forty-five to sixty years of age.
-

The old age is classified by Vaněk into the following three periods:

- presenium – from sixty to seventy-five years of age,
- senium – from seventy-five to ninety years of age,
- silicernium – ninety years of age and more.

Human age classification by Langmeier

Langmeier (1983) chooses different criteria for the periodization of the human age.
Prenatal period – from conception to birth
Newborn and infant period lasts from birth to one year of age – ends with independent standing.
Toddler period lasts from one to three years of age – ends with the flying stage of running.
Preschool age and younger school age lasts from three to eleven years of age. The age of eleven years marks the beginning of **maturing**. This stage has two periods:

- pubescence – from eleven to fourteen years of age – end with sexual maturity,
- adolescence – begins between fourteen and sixteen and ends at the age of twenty years.

The adulthood period lasts from twenty to sixty-five. (After forty-five years of age women go through a period of climacteric). The period of adulthood is classified by Langmeier into three periods:

- yearly adulthood,
- middle adulthood,
- late adulthood.

The old age is the last period of human life and ends with death.

Human age classification by Příhoda

Příhoda's periodization of the human age is a detailed structure and has the following stages:
Antenatal period – from conception to birth.
First childhood – from birth to three years of age. This period is further divided into:

- Infant period – from birth to one year of age,
- Toddler period – from one to three years of age.

Second childhood – from three to eleven years of age. This period is further divided into:

- preschool age – from three to six years of age (beginning of permanent teeth),
- prepubescence – from six to eleven years of age.

Pubescence period – from eleven to fifteen years of age.
Hebetic period – from fifteen to thirty years of age. This period is further divided into:

- postpubescence period,
- mecitma.

Adultium – from thirty to forty-five years of age (life stabilization and climax).
Interevium – from forty-five to sixty years of age (beginning involution).
Senium – from sixty to X years of age. This period is divided into:

- old age,
- very old age,
- patriarchium.

Příhoda (1977) states that this classification is just for reference and indicates age gradients that humans go through from conception to death, and within this general concept deletes the developmental differences between men and women.

After this overview of human age classification let us now have a look at age groups that are the focus of our survey. It should be added however that this strict age classification cannot be the only criterion for the assessment of achieved developmental maturity state of a child. The age group addressed in our study must be also assessed for school maturity, which is associated with the period of prepubescence. Langmeier (1983) claims that every year our schools accept a group of children who are not ready for entering school. Special attention, as noted by Langmeier, J. Langmeier, M. and Krejčířová (1998), must be paid to children with disadvantages, e.g. visual defect, which impedes their entry into the school environment. Children with severe visual defects deserve even more individualized approach.

Developmental stages according to Krejčířová

Another factor crucial to addressing ontogenetic and psychomotor developmental aspects in otherwise visually equipped persons is the age when vision was lost or limited. Other effects are characterized by Krejčířová (Říčan, Krejčířová et al., 2006) as follows:

a) Infant age

During this period it is vital to develop a strong relationship with the mother (parents) although this relationship might include by certain separation anxiety around the 6th to 8th month. In visually impaired children this dependence on the mother (parents) might be longer than in sighted children and can cause a delay in other developmental tasks. A key role during this stage is played by motor skills. The infant age is also a period during which intensive psychomotor stimulation should take place. Naturally, joint physical activities of parents with their children are a suitable alternative. A time-tested method is infant swimming. This activity naturally follows the prenatal period, during which the child was in an aqueous environment, and at the same time encourages a natural contact between the parents and the child and strengthens their mutual confidence.

b) Toddler age

Krejčířová claims that the age between one and three years is described by increased physical activity. The development of all locomotion's in visually impaired toddlers is slower. Independent walking in a congenitally blind toddler usually starts between 18th and 24th month. Even more complicated is the situation in toddlers with multiple impairment. Physical sensory deprivation can result in inadequate behaviour of a toddler (anger, fits of rage, aggressiveness, stereotyped swaying movements…). Parents are required to show kind consistency, definition of clear and comprehensible rules and limits.

c) Preschool age

During preschool age a sighted child seeks for an own space to develop play and an initiative spirit. An otherwise visually equipped child, in spite of having learned basic locomotion and having partially caught up the delay from previous development, is increasingly limited by consistent control of parents and other adults. They, for "safety" reasons, do not provide the child with a sufficient space for self -realization. In this way, a child is more in the adults' world rather than his/her peers' world. As a result, such child perceives the adults' world more. At the same time, an otherwise visually equipped child starts to understand own unlikeness. With increasing age the child's effort to understand the surrounding world rises. Thinking, as noted by Krejčířová (Říčan, Krejčířová et al., 2006), is typically magic and in case of rich imagination a visual defect can lead to feeling of blame as a punishment for bad behaviour. All this can influence the child's social behaviour, which subsequently affects the whole development.

d) Younger school age

Krejčířová claims that during this period the child tries to achieve solid performance and competes in school and outside school. Continuous failure and ridicule can lead to lifelong feelings of inferiority, which also threatens children with sensory impairment. A very important role is played by positive contacts with peers. In case of isolation, natural social relationships are not developed. Children with severe visual impairment start to suffer from more significant differences also in social maturity, which has an effect on natural adoption of social roles and social skills, which are also a precondition for normal functioning of peer groups.

e) Pubescence and adolescence

This period is usually crucial in the lives of visually impaired young people. They go through a period which is generally difficult for maturing young people. They try to identify themselves and their positions in the surrounding world, search for ways to the members of the opposite sex, etc. At the same time they have to cope with their unlikeness. A very difficult position is taken by those who are under a protective effect of the family and the environment. A positive role might be a peer group, suitable hobby or sport in all forms. In young people with severe visual impairment, considerable differences in social maturity are observed. A well-managed period of pubescence has a strong impact on searching for and developing an own identity in adulthood, establishing good partner relationships, dealing with sexual issues, professional orientation and work and developing an own family background.

Developmental stages according to Erikson

a) Developmental stage of trust and hope

The first developmental task and topic is trust. Trusting hope is a lifelong basis of emotional relationships.

b) Developmental stage of autonomy

According to Erikson (in Říčan, Krejčířová et al., 2006) this stage corresponds with the toddler age. The central topic of this developmental stage is autonomy. The child learns to control his/her own body and mental processes. This leads to asserting own will also in social relationships. Toddler defiance and negativism is a typical feature of resistance against authority and will of others. In otherwise visually equipped children this stage persists much longer than in sighted children. This is probably caused by the discrepancy between the needs for self-realization and the limitation caused by visual deprivation.

b) Developmental stage of initiative

This stage falls in the preschool period. According to Erikson (Říčan, Krejčířová et al., 2006, 49) a child learns to penetrate the space of actions and conflicts boldly and with pleasure again for the whole life. A new higher method of self-regulation appears – ability to feel guilt, i.e. conscience. In congenitally blind children this is a period, during which their psychomotor development becomes equal with sighted children. This period is noted for difference in the quality and structure of basic locomotion patterns. There is a significant difference in the possibilities of addressing the issues of everyday life between sighted and blind children. In blind children this results in lesser flexibility of reactions to external stimuli. During this period, considerable dependence on parental support persists.

d) Developmental stage of diligence

This period roughly corresponds to the fifth grade of elementary school. This is a period, during which a child continuously and systematically learns to work and fulfil own curricular and extra-curricular duties. For people surrounding congenitally blind children this is an extremely difficult period. A habitual effort to protect an otherwise visually equipped child based on previous years when the child was a passive participant in many activities, is still obvious. It is important to leave the initiative and effort to complete the tasks to the child. This is often very time consuming and mentally demanding but it is the only way to lead a blind child to independence, adaptability and ability to cope with personal problems. A child has to learn to bear with failures. However, permanent failure can lead to feelings of inferiority. If these feelings prevail, the child becomes an outsider and loses a significant component of life perspective.

e) Developmental stage of personal and social identity

This is a relatively long developmental stage usually ending around the age of twenty years. This is a period of searching for an own place in a group of peers in terms of both competition and togetherness. In congenitally blind children there is still a conflict between family bonds and an effort to find an own social place. Delays in social maturing in comparison with sighted peers can lead to a loss of their position in a social group and can result in a relapse into family dependence. A part of searching for personal identity is gradual detachment from parental influences and adopting a unique perspective of own person and environment. For a congenitally blind child this is a complex period of searching for answers to questions like who am I, where do I belong, what do I believe in and how is my life going to develop. There is an apparent departure from children's self-conception and development of adults' self-conception, although of a not fully mature person. In visually impaired youth this period can extend over twenty years of age by a few years. However, nothing can stop a blind person to mature and become a harmonious personality. This requires intrinsic motivation and appropriate external help.

12 /

Psychomotor aspects in the assessment of the development of visually impaired children and youth at the age of 6–15 years

Zbyněk Janečka

In the previous chapter we dealt with classifying individual age groups into the whole developmental framework. Now we will have a closer look at specific age periods that are the focus of our study. The first period is prepubescence (6–11 years); the second period is pubescence (11–15 years).

The prepubescence period has two biological stages between 6 and 11 years of age. From 6 to 8 years of age and from 8 to 11 years of age. Both first years present a transition between the second childhood and prepubescent years (prae means pre, pubesco means maturing). The pubescence period, although it is subject to uneven development, also has two distinct stages. The first is preceded by a critical point, pubescence climax, occurring usually around 13 years of age. The two years from eleven to thirteen is identified as pre-pubescence, the other two years until fifteen as pubescence. Both stages, the first being stormier, the other being calmer, present a process of physical and mental maturing.

During prepubescence from six to eleven years of age, children's vocabulary increases due to education, in terms of both quantity and quality. Words representing thought outlines gradually develop into concepts with more precise content accuracy. During this stage of development of visually impaired children it is vital to harmonize the meaning of words with content accuracy to prevent their empty verbalization. Language is becoming a tool for thought relationships. From the beginning of school attendance, a significant role is played by educating children towards deliberate attention. According to Langmeier, J., Langmeier, M., & Krejčířová (1998), intellectual maturity starts to manifest in a child's thinking around 6 years of age, when significant progress takes place and the child starts to think in logical operations. A new judgement is derived from two known ones. However, this only applies to specific aspects. This is a stage of "specific operations".

To understand the principles of the development of speech and thinking in visually impaired children, their development must be considered in an ontogenetic context. This is, as in sighted children, subject to biopsychical laws of human development as described by Příhoda (1977).

The basis of the development of speech and thinking in visually impaired children is the development of understanding and their associations with objects. Psychomotor and verbal-motor development is longer than in sighted children and is dependent on the assistance of parents and the child's environment. A significant milestone in the development of thinking is overcoming the dependence on specific perceptions. Only after that a visually impaired child can start to overcome the visual impairment, although visual feedback is missing.

During this stage the development of thinking is delayed according to Čálek (1986) by one to two years. The development becomes even usually during preschool age depending on the degree of visual impairment.
The progress to more complex thinking operations is influenced particularly by achieving a certain degree of CSN maturity. According to Čálek „the principle of thinking is problem solving. It is encouraged when an individual faces a practical task, which cannot be accomplished by existing experience, skills, and the structure of thinking operations. Clearly, new associations must be integrated" (Čálek, 1986, 59). Based on research findings (Fraibergová, 1977), the same author states that … "congenital blindness "per se" does not constitute a sufficient cause of delayed intellectual development. Deficiencies in arranging groups of subjects in blind individuals are usually caused by a figurative handicap, not an operative or intellectual one" (Čálek, 1986, 69).

12.1 Child in prepubescence between 6 and 11 years of age

Physical development

According to Příhoda (1977, 248) "the growth curve is often limited merely to a child's height and weight. In reality however, a much more complex process of the uneven development law is involved. The skeleton (dentition) the neural, lymphatic and sexual systems all develop at various paces. Individual physical systems grow at different speeds and at the same time change their chemical composition". "The whole figure of a child depends on skeletal development. The skeleton is not fully developed between six and eleven years of age" (Příhoda, 1977, 249). The curvature of the spine is not yet permanent. At first the curvature of the thoracic spine stabilizes between eight and eleven years of age, then the curvature of the cervical and lumbar spine. In terms of mental condition the prepubescence period is marked by constant growth. The figure is still childish but slowly assumes the proportions of a mature human body, especially the lower extremities prolong. The bone tissue of a child contains a smaller amount of mineral resources compared with adults, which results in lower strength and hardness. However, there are more organic materials which make the bones very elastic. The muscles are still little developed. At the age of eight, according to Kuric (1963), of the total weight 27% is represented by muscles. At the age of eighteen the proportion is as much as 40%. Internal organs mature and assume their final structures. They are still smaller than in adulthood though. The brain is lighter on average by 150 g than in adulthood. According to the results of our survey, the development in otherwise visually equipped girls and boys is in full compliance with general developmental trends.

Perception development

During prepubescence the function of the analysers is rapidly developed. The sensory organs mature earlier than other body tissues, e.g. the eye reaches the final size in toddler age (Příhoda, 1977). During prepubescence a normal child sees individual objects, hears different tones, tastes and smells various matters. According to Příhoda (1977), this absolute perception further develops only little. Sensory and psychomotor stimulation in otherwise visually equipped persons of all visual impairment categories is necessary at this age despite the fact that the absolute perception no longer develops. In using and processing all available information from all senses, visually impaired children must be taught to perceive in a comprehensive manner. There is a significant contrast in the perception of eight-year-old children and adults in differentiated vision. The development of visual perception applies not only to sensory differentiation but also the stage of differentiation of viewed objects. The degree of abstraction within this development depends on the degree of maturity, level of education and influence of social effects. For visually impaired children this period is crucial in terms of perception and abstraction development. The bases of this process must be initiated much earlier in visually impaired children, already in the infant period. In visually impaired children who are blind from birth, this stage takes a little longer but under appropriate guidance a visually impaired child learn to perceive objects three-dimensionally. However, this complicates the return to two-dimensional understanding of relief pictures. This requires a degree of the above mentioned abstraction.

Motor development

In terms of physical activity the primary aspect in prepubescent individuals is the relationship between variability and motor development (Riegerová & Ulbrichová, 1993). Motor development also depends on the function of the nervous system and bone growth and ossification. The growth of muscles and bones in children of this age group is uneven. Therefore, their movements are not accurate and a little clumsy, particularly in the case of minor muscles (Příhoda, 1977). The development of motor performance during various stages of ontogenesis is marked by intra-individual variability (Štěpnička, 1974). From birth to the beginning of prepubescence the intra-individual variability is relatively small. Similarly, movement variability is small in the old age. From prepubescence to the middle age the variability is much more significant. This is probably related to a significant effect of external factors. During prepubescence, spontaneous physical activity is still at a high level. According to Kučera (1985), this is about 5.5 hours a day. This is the most favourable period for the development of motor skills and motor learning. Generally, this also applies to visually impaired children. A significant difference is that sighted children at this age are not so dependent on the stimuli coming from their parents during leisure physical activity. This independence later allows a significantly higher amount of spontaneous physical activity and natural stimulation in the development of physical abilities and skills compared with their visually impaired peers.

Intellectual development and thinking in visually impaired children

"Children in the second childhood, although attending nursery school, develop thinking by own processing of experience, as if from themselves" (Příhoda, 1977, 261). Before six years of age a child does not fully distinguish live, non-live, subjective and objective. Such child insufficiently differentiates in a space and even less in time and relates the surrounding events to himself/herself. Such child's perception is still considerably complex and diffused, so the child distinguishes between objects by assessing their overall structure or random features. According to Příhoda (1977), syncretic perception lasts until about eight years of age but changes in terms of deeper differentiation between objects and persons, between imaginary and real revival, between a wish and reality. Prior to the beginning of school attendance, as suggested by Langmeier (1983), it is vital to assess children's preconditions for a successful entry to school not only in terms of age (respecting their visual impairment), but also the following perspectives:

a) **biological maturing** – precondition for achieving a certain degree of maturity of the central nervous system and a prerequisite for effective learning,
b) **capabilities of a child for schoolwork** – apart from biological factors, this area is influenced by environmental effects and previous education, where social maturity in visually impaired children can be a much more significant criterion for the assessment of school maturity than achieving biological maturity, although practice shows that both of these criteria are mutually conditioning,
c) **readiness for schoolwork** – emphasis on emotional readiness and motivation for schoolwork.

Entering school starts a new stage of cognitive development as growth is now externally supported and modified by continuous teaching.

In this context, if we speak in the following text about various stages of the human age, we do not consider just biological maturity of the organism or achieving a certain age, but also cognitive, emotional and social maturity, which is a result of co-action of maturing CNS with stimulating environmental factors.

12.2 Youth in pubescence between 11 and 15 years of age

The period of pubescence is described by Říčan (1997) as a stage of searching for identity, which should lead to acquiring a relatively mature perspective of own personality and the environment, in which the individual lives, particularly the wider community, nation and the whole mankind but also moral orientation requiring abstract thinking – who am I, what am I like, where do I belong, what am I going to do with my life. Otherwise visually equipped pubescent individuals also deal with an issue why am I different from my peers.

Development of the physical, humoral and nervous systems

The eleventh year of age is a nodal point in the process of development because a child achieves the peak of some physiological and psychological qualities, and it is also the point of transition between the first and second stage of elementary school, or elementary school and first grade of grammar school. During the five years from six years of age boys grew by 26 cm and girls by 28 cm, i.e. boys' average height is 140.7 cm; girls' is by 7 mm more. Boys' average weight is 33.8 kg; girls' is around 34.9 kg. The body becomes longer and thinner. In an eleven-year-old child, the physiological procedures significantly influence the child's development. During further development after eleven years of age the appearance of a pubescent child's body is determined particularly by the growth of the skeleton and muscles. Therefore, body height and weight are rough indicators of maturing. The development of body height during this period is affected by the growth of the lower extremities and trunk because the height of the head does not significantly change any more. Pubescence represents a fluent developmental transition, which consists of an infinite number of minor changes, whose accumulation develops a new quality. The period of pubescence is also marked by the rule of uneven development. In general terms, during these four years Příhoda (1977) distinguishes two clear stages, the first of which precedes the critical point, i.e. pubescence climax, which usually occurs around the age of 13. During the first period of pubescence girls grow faster until the age of fourteen, when their growth starts to slow down. Their physical structure is more fragile at the end of this period with noticeable differences relating to the extremities, shoulder width and pelvis width. Bone ossification continues very quickly during pubescence and in girls finishes earlier than in boys. Body tissues mature, the number of teeth is up to its maximum. Only the third molars remain unteethed. The development of the nervous system is almost completed in the internal cell differentiation as well as in the growth of the finest dendrite fibres in myelination. According to Langmeier J., Langmeier M. and Krejčířová (1998), the CNS between the ages 6 and 11 years achieves the lower limit weight of an adult individual. The brain hemispheres are significantly gyrified. The fact that the nervous system is well matured and the neurons are capable of a synchronous activity is also confirmed by regular presence of the alpha rhythm of the EEG record (this regular rhythm of a medium speed is typical for an EEG record of an awake adult person in a resting condition with eyes closed). All organs achieve a full function, the incretion of the humoral system reaches its climax around the age of 10 to 15. These complex physiological procedures, which are a precondition for mental maturing, do not occur independently on the external environment but are mutually conditioned and balanced. They are in an environment with a small frequency of stimuli and faster in a more stimulating environment. Vágnerová (2000) emphasises a hierarchical arrangement of the system: cerebral cortex, hypothalamus, hypophysis, gonads and peripheries. Physical as well as mental performance is subject to this neurohumoral unity. Its regulation conditions the pace of sexual development.

Perception development and improvement of space-time orientation

Perception in a pubescent individual is very rich. All sensory impressions are processed in a better way. In visually impaired youth, sufficient compensatory mechanisms start to develop substituting visual perception (a very positive role is played by new electronic aids). Differentiation of various objects and figures as well as a detailed analysis of real or represented situations has a great influence on finer coping of a maturing individual with the environment. According to Příhoda (1977) however, at this level, this process does not take place suddenly but through own activity with trials and errors. In spite of that a pubescent individual is able to complete the analysis, i.e. classify; isolate parts from a whole. This pro-differentiating gives the structure a new nature. Therefore, during this period associations with objects are not only clearer but also more critical. A particularly significant role is played by an advanced analysis with abstraction abilities. Only during pubescence a sufficient level of analytical-synthetic processes take place that lead to clear perceptions not only of particulars but also whole situations. Only this higher level of perception allows understanding of deeper associations between objects and persons. According to Pavlov (1953), from a physiological point of view, this activity is a result of dampening the activity of other analysers and at the same time the difficult synthetic process because perception is always based on a combination of various nervous stimulations. Perception is a sensory activity, which can take place even at the lowest level of analysis. The dog in the Munk's experiment saw although its occipital lobes had been removed. In this case however, perception is impossible. On the contrary, a blind person without a visual analyser, can “see” as a result of perception (Příhoda, 1977).

Příhoda (1977) defines orientation as a location of an event in time and space. It is the most significant factor in a dialectic association between an animal and an environment. In a young child, orientation is defined by concurrent events in a narrow environment. This primitive method of orientation is called presentism and topism. Only during prepubescence location in time and space gradually extends. A prepubescent individual freely moves within a perimeter of a few kilometres around the place of residence, but such individual’s orientation still has features of complexity. For a visually impaired prepubescent individual this period should be a period of intensive learning of spatial orientation and independent movement. The structuring of space-time orientation comes during the next stage of development of personal experience and is supported by special courses in school. Orientation in a pubescent individual is advanced. A thirteen-year old is able to travel over long distances without a company. Orientation in time is still difficult. Time is not defined only by perception but also by the rhythm of imagined events. Both types of orientation are limited by own experience. During this period, visually impaired youth is still dependent on a company of an adult person. However, such individual should cope with simpler routes around the place of residence.

Intellectual development in visually impaired youth

A typical feature of all mental activities in a pubescent individual is the fact that the second signal system gradually takes the decisive role (Kuric, 1963). This moves all mental activities to a higher quality level. Learning through both signal systems contributes to the development of cognitive processes. At the beginning of this period, the ability of analysing real or represented situations develops. In human ontogenesis, thinking is developed from syncretic viewing to an analytical activity, from complex unity to partial differentiation. Until then we speak of a child’s global opinion. This globalization trend usually disappears during the second prepubescence stage. At the end of pubescence, on the contrary, a considerable degree of generalization is apparent, although it is not complete and is not always underpinned by substantial features. Let us now have a closer look at the word as the basic building block in the process of developing the second signal system in visually impaired individuals. Similarly to sighted pubescent individuals, general rules apply. Speech however, has a strong socializing and compensatory nature. Speech is used by a blind individual to maintain contact with the environment, speech decreases isolation and facilitates cognitive processes. Situations occur when a blind individual uses words correctly in various contexts but the knowledge is verbal and is not supported by correct images. L. S. Vygotskij, (in Příhoda, 1977, 262) stated the following: “In no other area has verbalism taken root as strongly as in education of the blind”.

According to Příhoda (1977), thinking in pubescent individuals reaches a new level, it is now characterized by abstraction of generalized concretes and in particularly talented pubescent individuals also by non-demonstrative abstraction, which allows a higher constructive ability generally called intelligence. During pubescence the association and abstraction stage takes place; individuals in this stage are already predisposed to the highest thinking activity. In compliance with a Piaget's theory this is "formally logic" thinking. A well developing maturing individual is thus able to think about what cannot be clearly imagined, is able to understand very abstract concepts such as "justice", "truth", "right", etc. If a problem is to be solved, a single solution is not enough but various alternatives are considered. Achieving the stage of formal operations can be recognized by the fact that a child is able to apply logical operations independent of the content of judgements. The decisive factor is the form of opinion (conclusion) based on two judgements irrespective of a specific image, as described by Příhoda (1977).

Thinking in visually impaired children and youth in the process of socialization

The key to understanding the thinking of visually impaired children of category B_1 is often found in observing how the non-function of the most significant analyser affects the sensory-motor area. During the first stages of a child's development, vision is substituted with "speech of the hand", which encourages movement and directs towards an object as described by Fraibergová (1977). A negative effect on the development of thinking can be delayed manipulation with objects, low stimulation of the development of elementary motor skills, etc. Moreover, in the initial stages there is a problem that acoustic and tactile perceptions exist separately. For example, a sound ball is not considered a single object by a child. Should a visually impaired child of category B_1 start to search for something, this must be imagined in a space (Čálek, 1984). An irreplaceable role for a visually impaired child in the development of an image is played by information provided by the closest environment, particularly parents. A child without visual impairment familiarizes with the environment naturally, whereas a visually impaired child should be verbally explained where a table is located, how many chairs there are, in what direction and how far the window is. Identically significant is stimulating motor skills through leading to active "investigation" of the environment by the child, describing discovered objects and things. In this way, children are led to an own active approach. Information and stimuli must be well thought-out with respect to the demanding nature and increased requirements for the child's mental performance and will.

In congenitally blind children, according to Čálek (1985), it is necessary to verify sufficient preconditions for the development of a fully-fledged personality. At the same time it must be acknowledged that their development has a distinctive progress and issues. For a visually impaired child the period of pubescence is more difficult. On the one hand such child is burdened with deficiencies in some competences, on the other hand a pubescent child starts to comprehend the implications of the limiting social pressure, which imposes different evaluation criteria compared with sighted individuals and does not allow similar choices (e.g. particular professions). During pubescence, visually impaired children go through changes such as revolt, negativism to subjectively unacceptable behaviour of the society (e.g. sympathy). A number of changes take place that increase uncertainty and challenge the idea that the world is safe and that a pubescent individual is positively accepted. The need for certainty is also related to the need for emotional acceptance (generally speaking the need for an accepted position in the world). The development is generally subject to a stimulus, a change. However, each change subjectively represents a loss of confidence in the so far existing condition, in which the individual has been knowledgeable in. During this period, a visually impaired pubescent individual is confronted with own limitation in a different way than before; self-knowledge leads to an unpleasant certainty that the impairment is of a permanent nature and that it must be accepted as a part of own identity (Vágnerová, 1995).

Psychomotor development of a pubescent with visual impairment

From a biological perspective, the period of pubescence is delimited by the first symptoms of sexual maturing on the one hand and achieving sexual maturity on the other hand. A definite description of psychomotor development is complicated. The so far smooth developmental line is disrupted. According to Měkota (1988), numerous individuals are affected by the following:

- deterioration of physical coordination,
- disruption of the dynamics and economy of movement,
- ambiguity in motor behaviour.

According to Měkota (1988), coordinated movements in prepubescence children are substituted with ungainly or ponderous movements in pubescent individuals. Some swing movements are performed with excessive muscle effort (convulsively), others without appropriate strength (flabbily). Movement of an adolescent is very unsettled. Sometimes there are redundant movements and an excessive range of movement, which has a negative effect on movement economy. A rapidly growing pubescent individual must learn again to control own body. Certain physical activity tasks are performed with enormous enthusiasm, other appear difficult. These changes do not take place only in the area of coordination abilities. Various fitness abilities are affected as well. In terms of motor learning this period is not very favourable for developing new physical activity skills. The development of visually impaired pubescent individuals depends on how motor skill development was influenced during the two basic sensitive periods. The first period is from birth to three years of age, the other between 6 and 9 years of age. If no appropriate physical activity interventions and psychomotor stimulations were performed and basic physical activity stereotypes (walking, running, etc.) were not fixed in a correct way, the problems in motor skill development in visually impaired youth are, as stated by Měkota, also affected by insufficient or inappropriate development in these two sensitive periods.

Vision plays a significant role in physical activity because most PE activities, physical recreation and sport require a precise visual analysis. Optical and motor coordination allows correct performance of intended movements according to their projection and together with a motor and kinesthetic analyser provide feedback informing whether the movement is performed as intended. Based on this feedback any movement corrections take place. A visually impaired child does not have this opportunity; therefore, other mechanisms must be involved informing about the course of movement. This results in the differences between sighted and visually impaired individuals in orientation, training, learning and performing movements. The decisive factor is the degree of remaining vision. Another significant aspect is the type of visual impairment. We need to consider not only the difficulties of an impaired individual in tasks requiring visual control but also the type of visual impairment because in a number of visual defects inappropriate physical activities could result in damage to or complete loss of vision. Therefore, before a visually impaired individual performs any physical activity, a physician – ophthalmologist must specify the precise specification of the defect and contraindicated activities. General principles for performing exercise must be individualized and dosed from case to case. We need to respect the visual impairment, consider other existing diseases or physical defects and other therapeutic methods.

13 /

Psychomotor development in visually impaired persons with respect to motor competence development

Zbyněk Janečka

Significance of vision for psychomotor development in a congenitally blind child

Movement is naturally associated with the existence of each living organism. Human motor skills ensure physical activities of everyday life and all related functions. From the very first moments after birth the child's development is associated with visual perception of everything that takes place around the child. Sound stimuli present a significant source of motivation for motor as well as cognitive development of a child. Vision helps develop a detailed image of the physical structure, body movements and the surrounding environment. The development of visually impaired persons is affected by a completely different way of perception of and learning about the surrounding environment. Visually impaired individuals create an image of the surrounding world based particularly on visual perceptions, which are of a lower quality level. Congenitally blind children learn about the surrounding environment only through tactile, auditory, vestibular and proprioceptive information. Therefore, the image projected by visually impaired persons of their own body and the surrounding environment differs in quality in comparison with the image of non-disabled population. As a result of their visual defect, visually impaired children are limited not only in the amount of visual information (according to the degree of visual impairment of complete vision loss) but also the quality (loss or constriction of the visual field, hazy or blurred vision). As a result of absent visual stimuli the perception of the surrounding world is incomplete, less accurate and different in quality (Keblová, 1998). Vision provides important feedback to the vestibular and proprioceptive system. In visually impaired children this significant feedback is missing. This is one of the reasons for delayed motor skill development in these children (Prechtl, Cioni, Einspieler, Bos, & Ferrari, 2001). Levtzion-Korach (Levtzion-Korach et al., 2000, 226) adds that "in order for a child to start exploring the surrounding world, first the presence of nearby objects and persons must be registered. This spatial awareness is performed especially through vision. Auditory stimuli do not present a sufficient substitute for the development of internal image of the surrounding world or a specific object. Before a child acquires this image, pure sounds do not present sufficient motivation for touching objects, grasping them, exploring and relocating". Bigelow (1992) claims that it is only the understanding of the presence of objects in an intimate environment through tactile recognition that facilitates the development of motor skills in a blind child. In visually impaired children not only visual functions are impaired but other sensory systems are affected that use visual stimuli for their functioning. In the following table Skalická according to Hyvärinen (Skalická, 2000, 30) shows the development of visual functions during the first year after birth.

Table 68. Development of visual functions during the first year of life (Skalická, 2000)

Age	Visual function
0–1 month	Looks at a light source, turns the head and eyes. Fixes a face for a short time. Fixes movement in the horizontal plane.
2 months	Eye contact with other persons. Interested in lip movement. Watches suspended hooks. Does not use the so far external (temporal) visual field. Watches vertical movement.
3–6 months	Watches hands. Stretches out hands to set suspended hooks in motion. Looks alternately at two toys. Watched a falling or rolling objects. Recognizes important objects at longer distances. Uses the visual field in the whole extent.
7–10 months	Tries to find minor objects and grasp them. Looks at pictures. Watches an adult drawing. Recognizes partially concealed objects.
11–12 months	Visually orientates in a domestic environment. Looks out of a window and recognizes known people.

If visual perception is not developed in a visually impaired child in the above described way, the child's somatognosy and stereognosy are seriously affected. **Somatognosy** is generally understood as an ability of correct identification of an own body. This is awareness of the body that defines the associations between the individual and the environment. Somatognosy is related to **stereognosy,** which is understood as an ability of spatial perception and contact with the outer environment (without vision) in relation to our body image. Body images in various individuals differ. An imperfection of this image points to insufficient compensatory possibilities in case of locomotion system disorders (Kolář, 2009). Stránecký (2009) states that individuals with stereognosy or somatognosy disorders are not able to fully realize (experience) their body posture in a space (e.g. head position in a space, feet touching the ground). As a result of visual deprivation, body posture and postural stability are affected in congenitally blind children. The upright body posture has three main components: **sensory** – proprioception, exteroception, vision and the vestibular system, **control** – brain, spinal cord, and **executive** – anatomically and functionally defined locomotion system. The author further adds that if children fail to create a sufficient image of their own body, any body posture corrections become difficult. According to Rokyta, Kršiak and Kozák (2006), body image stability can change due to cortical plasticity. Experimental findings and clinical observations brought evidence supporting the dynamic nature of the nervous system, which is characterized by a balance between rigidity and plasticity (Trojan & Pokorný, 1997). Langmeier, Kittnar, Marešová and Pokorný (2009) describe plasticity as a general feature of the nervous system, which allows adjustment of the structure and function of neuronal systems. Kolář et al. (2009) define neuroplasticity as an ability of the nervous system to change according to external or internal conditions – both physiological (e.g. load, idleness), and pathological (e.g. damage to the locomotion system), experience and repeated stimuli (e.g. learning). After birth our brain contains double the amount of nerve cells than in adulthood. As soon as a certain part of the brain achieves optimum tuning throughout its development (e.g. cortex for fine motor skills of the hand), redundant neurons die by a natural process – apoptosis. The opposite of apoptosis is sprouting, during which dendrites and especially dendritic spines sprout. Both opposite processes (apoptosis, sprouting) are of ley significance for the dynamic changes of the nervous system, i.e. for its neuroplasticity (Kolář et al., 2009). Immature nervous tissue is highly plastic. Dynamic changes in the nervous system take place from the very first days of an individual's development after conception. After birth, the evolution, adaptation and reparation plasticity gradually decrease. Evolution plasticity reaches its peak during the first months after birth (infants, toddlers). It rapidly decreases after 3 and 6 years of age; at 12 the level of evolution plasticity equals adult age (Kolář et al., 2009). However, the possibilities of these changes cannot be compared with the level of evolution plasticity during the first months after birth. Cohen et al. (1997) note that the cortical area in individuals blinded at an early age can process proprioceptive information. The proprioceptive system processes the so-called deep perception that provides information about body positions and movements. The proprioreceptors include muscle spindles, Golgi tendon organs, mechanoreceptors in articular capsules (react to changes in joint position changes) and skin receptors (react to skin movement) (Rokyta et al., 2008). Being aware of the position of various body parts in a space depends particularly on the afferentation of the above specified receptors. The excitations from these receptors are synthesized in the cerebral cortex and allow awareness of the body in a space (Ganong, 2005). Proprioceptive perception includes statesthesia (perception of mutual position of various body parts), kinesthesia (perception of movement of various body parts) and nociception (Rokyta et al., 2008). Proprioception disorders are associated with problems with own body perception, which manifests particularly in the area of motor planning (Kolář et al., 2009). Proprioception is also important for adequate postural control (Irrgang et al., 1994). An insufficient number of visual stimuli negatively affect the proprioceptive system and the development of cerebellum functions (Prechtl, Cioni, Einspieler, Bos, & Ferrari, 2001). All movements of our body are analysed by means of feedback mechanisms of the visual or proprioceptive system. Visually impaired persons can use vision-based feedback in a limited way or this control misses completely. Therefore, proprioception plays a very significant role in visually impaired individuals. As a result of insufficient feedback of the visual system, the motor development includes ineffective and uneconomical movements or physical activity skills. Visually impaired individuals are thus affected by inadequate proprioceptive development, which is the basis for the development of body image. In the second place, proprioceptive development of visually impaired individuals negatively affects muscle tension, balance, postural setting, laterality and spatial orientation. Inadequate development of the proprioceptive system is affected by the generally lower number of opportunities for visually impaired individuals to perform physical activity (Blach, Wiener, & Welsh, 1997). The results of a research study by Giagazoglou et al. (2009) indicate that proprioceptive information cannot fully compensate for the role of vision in feedback-based control of motor skills. Yoshimura, Matsugi, Esaki, Nakagaki and Hiraoka (2010) emphasise that the perception of an own body in a space using proprioception depends on other than visual experience (tactile, proprioceptive, vestibular) from early childhood. From the beginning, blind children have a very limited image of their own body, which is also different in terms of quality, compared with non-disabled children. In their imagination the trunk is long and very thin, and their hands are much bigger than they really are. Rokyta, Kršiak and Kozák (2006) claim that congenitally blind children are unable to draw their own body correctly or produce a sculpture of their body. The level of stereognosy and somatognosy is also associated with selective mobility and ability to relax, which are closely correlated with the image of an own body (Kolář & Křikavová, 2008). According to Blach, Wiener and Welsh (1997), visually impaired children often have problems with performing selective movements (e.g. supination – pronation movement in grasping and opening a door handle). Therefore, the authors consider significant to develop the ability to perform isolated movements necessary for effective and economic performance of everyday activities, e.g. learning the technique of the long white stick. According to Balunová, Heřmánková and Ludíková (2001), somatognosy and stereognosy are closely related to acquiring skills that are subject to solid knowledge of an own body and body position in a space. The authors claim that based on Wiener (1998) these activities include distance estimation, maintaining straight walking direction, angle estimation, perception of camber, learning the white stick technique. In the area of spatial orientation, higher demands are placed on preschool visually impaired children compared with non-disabled children.

14 /

Visual information and its deficiency in movement cultivation

Ladislav Bláha

The visual analyser provides information from the wide outer environment. As a result, it is possible to perceive complex as well as partial movement and successfully create an image thereof. "An absence or significant limitation of vision leads to serious modifications in acquiring physical activity skills because blindness or severe visual impairment presents changes in the quantity and quality of sensory-perception operations and thus the perception of the environment" (Bláha, 2001a, 27). The process of acquiring and cultivation of physical activity skills is thus impeded by a number of relevant barriers. Therefore, adequate provisions must be searched at multiple levels. This usually leads to increased dependence on kinestetic, acoustic and tactile perception and the relevant analysers. It is also necessary to make maximum use of ***compensatory mechanisms.*** In a practical context, the impairment largely limits the satisfaction ensuing from natural movement in blind children and children with severe visual impairment because their need for movement is no lesser than in other children, and presents a barrier to their development (Kemper, 1993). According to Nielsenová (1998, 29) in the first years after birth the most serious implications of this barrier "…can lead to children's passivity and forgetting movements unless they acquire a sensory association and later they perform deliberate movements that were originally unintentional and kinematic". These and other facts contribute to weak or incorrect posture, observable physical stereotypes such as rhythmical swaying and turning (Leverenz, 2009), weak use of individual abilities, limited range of acquired skills and generally a lower level of physical fitness. This is also related to abnormal mimic expressions and various forms of movements leading to a contact with the visual analyser (rubbing eyes), particularly in relation to emotions or a lower level of self-control, self-reflection or intelligence.

Psychomotor development is closely related to the time of origination or worsening of the impairment (particularly with respect to the use of the residual memory trace – see Daďová, Čichoň, Švarcová, & Potměšil, 2008, 35) and its level. The limit for practical use of ***visual imagination*** is between 5 and 7 years of age (Požár, 2007). The images acquired until then gradually vanish and lose their significance for spatial orientation. A child who realizes the visual impairment must necessarily reconcile to a loss of certain competences. However, this is a traumatic period. On the contrary, a congenital handicap presents a more serious burden in mental development. "A child with congenital blindness suffers from a lack of movement, spatial and material experience, which results in a considerable ***sensorimotor developmental deficit***" (Kemper, 1993, 99) influencing further ontogenetic development. Interaction with the environment is imbalanced or limited. A space is not fully accessible, which worsens the deficit of environmental images and possibilities of active influencing of this deficit. The result is a certain type of isolation, which can result in inadequate ("timid") reactions of a visually impaired child. An accompanying effect is fear from space and objects located within the space. With respect to the fact that they are undiscovered and difficult to justify in a rational way, they are perceived by a visually impaired individual as "potentially dangerous". This could lead to passivity and dependence, which must be avoided as it brings further barriers to the process of acquiring new skills. Visually impaired children are described by "physical poorness", fear from movement, underdeveloped orientation and mobility. In most blind children these phenomena result in a low level of fitness and coordination abilities (Scherer, 1983). The mentioned facts lead to an assumption of lower motor competence in visually impaired persons. Unfortunately, personality development of a visually impaired person cannot include everything that could normally support changes in "elementary or sport-related physical skills and also changes of behaviour and behaviour possibilities in the area of motor skills" (Hirtz et al., 2007). Learning simple skills is the basis of acquiring complex skills and relevant ***motor competences*** – i.e. the level of physical skills pertaining to an individual of a certain age, gender, physical constitution, medical condition, existing in a certain social environment, etc., expected from the individual by the surrounding environment (Hirtz et al., 2007; Samay & Lamon, 1996). This introduces the issue of the deviation from a "normally developing individual" and presents individual preconditions for movement learning. Movement learning (learning through sensorimotor activities) must be different in a number of ways from visually impaired persons, which could level off any deficits and use effective procedures of acquiring physical skills with respect to specific types of impairment. This is also associated with searching for various ways and methods of increasing motor competence in terms of capability (legitimacy) to perform movement and movement acts in an adequate way while accepting individual competences (Válková, 2010).

15 /

Posture and postural stability

Zbyněk Janečka, Kateřina Chrobáková

As mentioned above, a significant precondition for movement is appropriate muscle tone and activated posture. Posture presents a dynamic process of maintaining the position of the body and its parts before the movement is commenced and after it is completed (Dylevský, 2009). Posture is understood as active holding of body segments against external forces, of which the most significant one is gravitational force. Posture is ensured by means of internal forces, particularly muscle activity controlled by the CNS. Taking and maintaining a posture is a part of all motor programmes (e.g. walking and other ways of active locomotion) (Vařeka & Vařeková, 2009). Maintaining the initial position – posture – is performed in a dynamic way, although it may seem as a static phenomenon in comparison with subsequent phase movement. Postural motor skills maintain the set position of individual body segments by constant balancing of the set position, which ensures readiness for a transition between rest and movement and vice versa. This readiness protects the body against potential damage (Véle, 2006). Vision is one of the three basic pillars ensuring and controlling postural stability together with the vestibular and proprioceptive systems (Hofstrom, Fransson, Karlberg, Ledin, & Magnusson, 2002). According to Peterka (2002) the significance of the system varies depending on external conditions. In a standing position on a flat surface in a well-illuminated room a healthy individual relies on proprioception (70%), vision (10%) and information from the vestibular system (20%). In a standing position on an uneven surface the significance of visual and vestibular information increases, whereas the significance of proprioception decreases. According to Portfors-Yeomans and Riach (1995), the role of vision in the development of postural control is not entirely clear. Postural stability is understood as an ability to maintain upright body posture and react to changes of internal and external forces in order to prevent an unintentional or uncontrolled fall (Vařeka & Vařeková, 2009). The strategies for ensuring postural stability are divided into static (without changes in the support base) and dynamic (with changes in the support base). The static strategies use particularly the ankle and hip mechanisms, the dynamic strategies use the mechanisms of side step, grasping a nearby firm support and other ways of increasing the support base (Vařeka, 2002). The ankle strategy activates especially smaller muscle groups near the ankle joint. This mechanism is used for maintaining stability in an upright standing position in case of minor deviations of the centre of gravity. The hip strategy activates large muscle groups near the hip joint. This strategy us used in the centre of gravity is deviated in an extent where the ankle strategy would not be sufficient, i.e. in case of a faster or stronger deviation of the centre of gravity or standing on an uneven surface. The objective of the strategy is to return the centre of gravity back above the support base (Rose, 2003).

16 /

Mechanisms of ensuring postural stability in the visually impaired

Zbyněk Janečka

Flores (in Lephart & Fu, 2000, 42) states that persons with proprioception disorders (insufficient quality of proprioception) primarily use the hip strategy to ensure postural stability. As mentioned above, visually impaired persons suffer from inadequate development of proprioception, which can be understood as a proprioception disorder. Ray, Horvath, Croce, Mason and Wolf (2008) explored the ankle and hip postural stability strategies in 23 persons with severe visual impairment (average age 39.8 ± 14.38). The results of the study indicated problems of visually impaired persons with ensuring postural stability. The authors conclude that individuals with severe visual impairment are not able to fully compensate for the loss of visual control in ensuring postural stability. To a large extent, visually impaired persons used the hip strategy for ensuring postural stability. This fact can result in a larger number of falls on an uneven surface. Similarly, Horvath et al. (2007) suggest that controlling difficult postural situations (uneven surface, walking upstairs) in visually impaired individuals is associated with using the hip strategy for ensuring postural stability also in situations, where individuals without visual impairment would use the ankle strategy to restore stability. Similarly, Lee and Schmidt (2005) mention decreased postural stability in visually impaired persons compared with non disable individuals. To ensure postural stability in visually impaired individuals, higher demands are placed on the proprioceptive and vestibular system (Blasch, Welsh, & Wiener, 1997). The deficit of visual perceptions in visually impaired persons is compensated by higher sensitivity of these systems (Revaioli, Oie, Kiemel, Chiari, & Jeka, 2005). According to Friedrich et al. (2008) the most significant compensation in visually impaired persons is through the vestibular system. Greek authors (Giagazoglou et al., 2009) assessed muscle strength in the lower extremities and postural stability in 10 women with severe visual impairment in comparison with non-disable women (age = 33.5 ± 7.9). In all visually impaired women the authors observed decreased postural stability in the anteroposterior a mediolateral direction in comparison with non-disable women. On the contrary, muscle strength in the lower extremities in the tested groups did not differ in a significant way. The study also assessed oscillations in the Centre of pressure (referred to as COP) in a basic standing position, tandem standing position and single-foot standing position. In this respect, the results of the study correspond with the conclusions by Schmid, Nardone, Nunzio, Schmid and Schieppati (2007). In both studies, more significant COP oscillations were observed in visually impaired individuals as opposed to non-disable persons. Blasch, Welsh and Wiener (1997) describe postural changes that can be frequently observed in congenitally blind individuals, who are typically characterized by accented lumbar lordosis, pelvis anteversion, accented thoracic kyphosis (upper part of the trunk inclining in the anterior direction), scoliosis, significant flexion of the cervical spine or forward head position, arm protraction, flat foot, flection of the knee joints or knee hyperextension, foot eversion. If one of the mentioned postural changes appears in an individual, it is often followed by other changes. Scranton et al. (in Levtzion-Korach et al., 2000, 228) emphasise that blind children without an associated impairment are more frequently affected by foot deformation, scoliosis and increased ligament laxicity compared with non-disable children. This fact is attributed to postural changes that are typical for blind children.

17 /

Specifics of motor learning in congenitally blind children

Zbyněk Janečka

A significant part in working with a visually impaired child is understanding of the differences in motor learning in the conditions of visual deprivation. We will use a motor learning model to explain the specifics of learning in a sighted and blind child. Belej (1997) describes the target categories of motor learning as adaptation, maturing, learning and autoregulation. Physical activity is then a means, which is used in the process of adaptation to initiate interaction with the environment and learning. Belej considers physical activity the oldest activity in terms of phylogenesis and ontogenesis. Later, other activities of a cognitive nature ensue from physical activity. From a wider perspective, adaptation also includes maturing, learning and autoregulation. However, learning is a higher process in terms of quality. If we heeded only the adaptation stage in a congenitally blind child, the child's adaptation to the environment would be very limited. Vision provides as much as 90% information from the environment; vision drives and motivates activity. Total retardation would become fully obvious after completion of the natural maturing process. Learning is used to actively shift human development towards a deliberate process leading to autoregulation. Adaptation and autoregulation complement each other in the process of human development. "The development of physical skills is dominated by adaptation to load before motor learning. Motor learning is used to acquire physical skills that develop physical abilities. On the contrary, acquiring physical skills is dominated by motor learning over adaptation; physical abilities represent a precondition for acquiring physical skills" (Belej 1997, 14). The following table (Table 69) indicates that the process of learning is dominated by the trial and error method. This represents 50 to 60%. The proportion of algorithmic method of learning is 20 to 30%. In this way the area of intentional learning is ensured. Only about 10% of the human physical register is ensured by creative learning.

All of these aspects represent a necessary theoretical background for understanding, guiding and controlling psychomotor development of a congenitally blind child. Obviously, the level of motor competence in a blind individual cannot, for objective reasons, copy the level of motor competence in a sighted individual. In spite of this fact, the level of motor competence must be developed as much as possible. A house can only be built on solid foundations. Well activated posture with appropriate catenation of muscle groups is a solid base for the development of controlled motor skills. However, a necessary prerequisite for the development of motor skills is correct muscle tone (Kolář et al., 2009). This is understood as variable tension in the muscle depending on the CNS. Increased tension is called hypertonia, decreased overall tension is called hypotonia. Decreased tone is accompanied by hypermobility, which results in increased joint range and worse joint protection (Véle, 2006). A muscle tone disorder is understood by Kolář et al. (2009) as a posture and locomotion disorder. Muscle tension is closely associated with mental tension. Other forms of muscle tension disorders include trigger points, tender points, spasm, contraction, spasticity, rigidity, atony. Visually impaired persons are often affected by disorders of the locomotion system as a result of inadequate setting of muscle tension (Blasch, Welsh, & Wiener, 1997).

Table 69. Gradual acquisition of knowledge, skills and concepts by Belej (1997, 14)

	Kriteria						
	Cíl záměr	Aktivita subjektu	Procesy mechanizmy	Způsob učení	Typy učení	Styl učení	Výsledky učení
vývoj	Kognitivní	Produktivní uvědomělé	Senzoricko kognitivní	Tvořivý	Sociální	Tvorba programů Volba stylu	Aktivně získaná způsobilost k sociálnímu jednání a chování
					Problémové	Volba učiva Samostatné řešení Řízené řešení	Osvojení principů řešení
Kognitivní práh							
Ontogenetický	Záměrně cílené	Reproduktivní: Uvědomělé	Kognitivně senzomotorické	Algoritmický	Verbální Etapovité Programované Meotdické řady	S nabídkou Zpětnovazební Reciproční	Etapové, souběžné osvojení vědomostí, činností, pojmů individuálním tempem
					Instrumentální podmiňování Napodobování Diskriminačně diferenciační Explorační Skupinové	Praktický Příkazový	Osvojení vymezené činnosti, podle daného postupu vymezenými prostředky, podle předloženého vzoru
		Neuvědomělé	Senzomotorické	Pokus - omyl	Jednoduché podmiňování Vyhasínání Přivykání Vtlačování		Osvojování vyhasínání podmíněných reflexů vlivem působení prostředí

18 /

Types of sensorimotor skill learning in visually impaired persons

Ladislav Bláha

In acquiring a new type of movement, the dominant aspect is optical perception of information, which is also significant in persons with remaining vision. Optical perception of information is also the basis of ***imitation learning*,** which uses the possibility to create an image of movement exclusively through the visual analyser. The advantage is its usability in acquiring a wide range of skills through imitating an observed activity. Creating a correct image of a movement can be complemented by verbal comments. This leads to more accurate vocabulary, increased semantic system and supported abstract thinking. Improving and eventually dominant use of information represents a quality change in conveying information important for performing movement. ***Instruction learning*** is more demanding as the image of a physical skill is created according to verbal instructions (Rychtecký & Fialová, 1998). This type of learning is used in case the learning individual is provided with certain knowledge about a new skill and his/her conceptual system is able to cope with these instructions, i.e. correctly interpret them. Unfortunately, in this context we have to face one of the most challenging issues in acquiring new skills in visually impaired persons. With increasing severity of impairment and loss of optical information, more emphasis is put on the reception of kinesthetic, acoustic and tactile information. This also drops the need for simultaneous acquisition of movement; the beginning of motor learning cannot be based on imitating according to usual habits. The leading role in completely blind persons (or persons with retained light perception) is taken over by the tactile-kinesthetic analyser. The question that remains is the date of origination of the impairment and already acquired physical skills. If they are already acquired, they can be further developed thanks to created physical images and possible application of various types of learning using an appropriate conceptual system. The other pole is occupied by the reality of an individual with severe visual impairment who had not acquired elementary physical skills. These individuals lack the basis to develop further skills. Similarly, verbal description faces a limited image of movement and language competence. Therefore, perceiving the environment is dominated by touch. A disadvantage of perception by means of tactile analysers is a certain space limitation and a necessity of a direct contact with objects or the movement environment. It is impossible to perceive spaces or objects that are too big or too small or those that are too close or too distant. This already limited flow of information is processed slowly and in a fragmented way. Acquiring information about movement (moving objects) and its other qualities (associations with the environment, safety, possibility of damage to or change in quality after touching) bring further challenges (Požár, 2007). The tactile analysers can be supported by complementary verbal information by other persons. Especially children who are dependent on contact with the environment must be verbally supported. Persons with lower degrees of visual impairment perceive most information in a visual way. This has a positive effect on creating an image of movement and its performance in a space. Basic physical activity structures are developed faster also through synthetic and analytical or comprehensive procedures. Sometimes, however, visual information must be complemented. “Engagement of visual organs is usually very strenuous for this population, therefore, it is recommended to use appropriate aids and suitably illuminated spaces and adequate methodical and organizational forms” (Bláha, 2001a, 33). Although this part of visually impaired individuals can use a limited amount of optical information, a developmental delay is usually observed compared with the common population. This mainly results from the type and degree of visual impairment and also previous education.

The degree of impairment has a key role in selecting the most used type of sensorimotor learning – ***imitation learning***. An impossibility to use imitation learning in a usual way in a group of visually impaired individuals represents serious barriers to acquiring physical skills because the process of creating an image of space and movement is blocked and delayed in relatively critical periods of human motor development. Acquiring basic physical skills takes a longer time, has quality issues and is not properly linked according to their purpose. Moreover, they might not be learned in an extent to become the basic pillars for the development of more complex physical skills of a sports nature. The use of ***instruction learning*** faces an issue of communication between the trainee and the educator in understanding verbal information. A possible procedure is the application of the tactile and other analysers through a direct contact with the trainee – model who performs a specific activity.

The application of ***feedback learning*** also has some issues. Especially in the beginning feedback learning is underdeveloped and therefore distorted. For an individual with severe visual impairment a number of activities are largely based on the trial and error method, and are therefore random. The main bearer of feedback information about the success of a performed movement within e.g. education should be the teacher, parent, educator, who should reinforce the acquired skills and provide accurate data from the environment. Feedback information of visually impaired persons is complemented with detailed information and has a supportive function because the trial and error method can be individually demotivating. Unfortunately, feedback might not be sufficient in terms of information. The cause can again be the issue of (non)developed physical images, which does not constitute sufficient support for a review of a corrected physical skill, method of communication based on insufficient language competence of the learners, etc. Audiovisual means based on recorded movement should be used by the educator in a traditional way to analyse any errors by the trainee. A different method of work can be applied in case of persons who can use the visual analyser (even with corrective aids) as a dominant receptor of optical information. In both cases, appropriate use of feedback is necessary because timely correction of faulty movement can facilitate further physical activity and learning.

While ***problem learning*** appears more difficult to apply, a suitable method could be ***ideomotor learning***, which is based on exciting kinesthetic cells by a movement image (Rychtecký & Fialová, 1998). A prerequisite for its full application is a pre-developed ***movement reminiscence*** or in later blinded individuals a ***memory image*** (Scherer et al., 1983) as a ***visual reminiscence*** or ***movement model*** (Dobrý, 1997). Although this type of learning in the common population is not fully appreciated, the principle of intentional use of images can be and probably also is (Jansa, Dovalil et al., 2007) a natural and perhaps dominant type of learning in persons with severe visual impairment.

19 /

Procedures in movement learning in visually impaired persons

Ladislav Bláha

Incomplete or limited reception of visual information significantly influences the initial stages of motor learning. During these stages the principle of physical skills should be understood and first attempts undertaken (Jansa, Dovalil et al., 2007). However, movement programming is complicated. Under usual circumstances a movement image is developed through imitation or instruction learning. In persons with severe degrees of visual impairment, such image must be mediated by means of kinesthetic perception by guiding the learners' movement or in a tactile way on demonstrating persons. **It is essential to understand the task**. This must be facilitated by ***existing developed movement images***, it is necessary to ***capture the differences or identical features of newly acquired skills*** compared with previous ones and ***use verbal competences*** of the educator and the trainee for mutual understanding of the instructions. Verbal descriptions and instructions constantly make movement ***more accurate and encourage the development of movement images or recall memory traces*** – movement reminiscences. Moreover, ***the semantic system of verbal communication is getting more accurate***, which is necessary for instruction or feedback learning. In spite of the above, the visually perceived movement image cannot be replaced, especially in case of complex movements. Information perceived through kinesthetic, tactile and acoustic receptors is not sufficient for cognitive processes associated with a new physical activity task. This applies especially to preschool and younger school-aged children. Acquiring new physical skills in the common population is often based on comprehensive understanding of physical structure, which is differentiated into partial sections in order to improve the rough form. In children with severe visual impairment this procedure is rather exceptional; ***the most effective seems to be the analytical-synthetic procedure***. Effective use of ***comprehensive learning procedure*** is possible only after developing a movement image by transferring from known movements or if movement must be divided. It should be noted that the method of conveying information should correspond with the recipient's capacity. The teacher must decide whether and when a short clear piece of information should be given, or whether the descriptive method should be used, which is usually more extensive and complex.

Successful acquisition of an image of movement structure and first attempts are the most difficult stages of the process of acquiring new skills (Kemper, 1993; Scherer et al., 1983). This stage requires considerable patience, and transfer to the following stage should not be rushed. The role of the educator is crucial as possible errors must be revealed and corrected. Movement control is difficult and it is demanding for a visually impaired individual to select appropriate stimuli, which is complicated by interfering effects of the environment. This stage is considerably shortened in the following cases:

- the degree of visual impairment allows to build on visual information,
- memory images are recalled and appropriate communication between the trainee and the educator takes place,
- visually impaired individuals rely on acquired physical skills.

During the stage of particularizing the rough image and improved performance of activities (Jansa, Dovalil et al., 2007) it is recommended to use ***feedback reinforcement*** to repeat physical skills and make them more accurate. According to Scherer et al. (1983, 43) during this stage "a visually impaired person should, under appropriate conditions, perform movements without errors, these movements should be well-coordinated, harmonic and fluent". Generally, this stage is about movement cultivation. ***We build on verbal interventions, reinforce kinesthetic perception of a guided movement, and apply tactile corrections that allow more precise movement images.*** We demand that complex physical structures be realizable as physically friendly – performed in an effective way, independently, with certainty and under variable conditions (Jansa, Dovalil et al., 2007). ***Feedback reinforcement is used to remove uncoordinated, arrhythmic and inaccurate movements*** while maintaining stimulation to perform further attempts" (Bláha, 2001a, 32). ***Also, the association between physical performance and verbal particularization of reality is reinforced.***

Further improvement of physical skills is aimed at the performance aspect. Creativity comes to the forefront and a personal style is expressed in the style of physical skills. During this stage, the whole physical skill or its part might be automated (Dobrý, 1997), with an application of ideomotor training (Perič & Dovalil, 2010). The variability of physical skills and their creatively oriented application can be developed only in completely known environments (with no mobility issues) and under meeting further conditions (including already acquired skills) and intellectual preconditions. However, the quality of movement and quality of life in general is, by gaining another space, significantly enriched and at the same time released from the total amount of mental processes that until then had to be concentrated by visually impaired persons on correct performance of physical skills. After reaching the state of automated performance of physical skills, this free space e.g. in physical activity games can be dedicated to for example tactical solution of game situations, spatial orientation, etc.

20 /

Movement in a space as a result of optimum movement regulation, internal movement presentation and movement image

Ladislav Bláha

Active physical behaviour is preceded by ***internal movement presentation***.

Approaching physical presentation has no strict borders (Schnabel, Harre, & Borde, 1997). An optimum definition for movement learning can be ***generalized motor programmes*** (Měkota & Cuberek, 2007; Schmidt & Wrisberg, 2008), while in case of movement of visually impaired persons, ***movement images*** might be preferred (Bietz, 2001, 2002; Scherer et al., 1983). Developing an internal movement presentation is not easy. Its origination and quality is derived from a sufficient amount (mostly repeated) supply of information and methods of its assessment and storage. The problem of a visually impaired individual lies in insufficient supply of information (whether through central of peripheral vision; as a result the significance of proprioceptive kinesthetic perception increases). It is thus difficult to perceive own movement, which leads to "conscious presentation" and is also a prerequisite for further movement acquisition. (Schnabel, Harre, & Borde, 1997). ***The principles of movement learning are thus maintained. In visually impaired persons, emphasis is put on increased association between perceiving body positions and activities and perceiving other than optical information*** (usually acoustic or tactile). To develop a *movement image* various means of expressions are used, we should also not forget the specifics of communication with visually impaired persons.

For a part of visually impaired individuals, the first rough movement images are defined especially visually and spatially. For persons with a higher degree of congenital or very early visual impairment this is a very long process that leads through complex understanding of the space and own (active) role in the space. The skill of developing an image in a congenitally blind individual is similar to a sighted person. There is a special association with words that can, as opposed to abstract concepts, develop images (Cattaneo et al., 2008).

21 /

Development of movement images to be applied in physical skills

Ladislav Bláha

The content and function of illustrative images can considerably differ. They can be close to reality or completely off reality. Even congenitally blind individuals can have, as a result of various cognitive strategies, more verbal, semantic, haptic or purely spatial images (Cattaneo et al., 2008). They can also be images developed from various perspectives. Sometimes they might be such that in reality they could not correspond with the perception abilities of an individual (Bietz, 2002). As a result of an image, an individual can project himself/herself in the role of an acting object from various perspectives. What frequently happens is that as a result of images the acting subject "projects" own actions from an own perspective, which is accompanied by corresponding actions or events.

Images have their "functional role". Their development is based on relatively known or experienced situations, perceived objects, etc. Events experienced in the past are recalled and stored again. This "retrieval" becomes the basis of certain reflections and interpretations of experienced situations. In case an image is oriented at something new and unknown, i.e. future action, shaping of the image must include elements of expectation. They include conditions, effects, possibilities and requirements, etc. that are linked to anticipation and foreseeing of the future. They often show aspects relating to planning, development of concepts, etc. It turned out that also ***physical images*** that are based on well "stored" physical programmes ***can be altered in the process of assessing of acquired information and can become certain concepts of performed movements*** (Elliot, Khan et al., 2010). The most valuable fact is that these movement images ***are capable of presenting the expected movement outcome and are the basis for controlling the performed movements and their success***.

The movement image can show numerous peculiarities. This applies e.g. to the perspective of imaging, degree of specificity or abstractness and function that they might take. Another question is whether the image covers separate sections or a comprehensive physical skill. Movement images can also affect the associations between the acting subject and task accomplishment and thus describe the expected change in in spatial structures after the movement is completed (Vanlierde & Wanet-Defalque, 2004). The image of movement thus permeates the image of conduct. The variability of images also increases because their recollection can be based on physical experience, reminiscence, and physical activity programme (Elliot, Khan et al., 2010). Images can also be related to artificial recollection of "sensual pleasure", when an individual "is carried away by movement fantasies". The functional significance disappears, it has no contact with practical conduct and is transferred to the area of a "pleasant experience" (Bietz, 2002). If the development of an image is in agreement with real conduct of a subject, it becomes more associated with the purpose it was "recalled for". Emphasis is put on the peculiarities of the performed movements, we can trace elements of realizing sufficient control over movement, possible effects are anticipated, which allows the acting subject to prepare for a consequent movement activity. During the phase of perception before the movement is performed, other relevant stimuli help assess and interpret the subsequent results of movement.

A link between movement images and initiating physical activity need not automatically result in a successfully performed skill. Problems are caused especially by skills perceived as a unity (comprehensive physical skills). These skills might not seem difficult at first sight (turn in downhill skiing, upstart on bars, shot put, etc.) A problem that emerges is that an individual performing a movement is able to imagine the movement well but is unable to estimate the rate of decisive factors for successful performance of the respective skill (involvement of respective muscle groups, transfer of the centre of gravity, moment of head movement, etc.) The image is simply incomplete because the individual lacks significant information – knowledge of the real structure of movement. Only after acquiring the skill the image is completed with as appropriate degree of accuracy and complexity. This is a serious issue in acquiring physical skills in visually impaired persons because a loss of visual perception possibilities is significant for developing these complex images.

In the process of learning physical skills the respective images also anticipate the new – expected condition. They bridge or mediate the original and the new situation after the movement is performed. The process of planning and guiding a new physical skill is a considerably difficult process. Bietz (2002) classifies the following processes:

- *cognitive-based* (certain concepts are developed – solution plans, used during the first stages of motor learning), and
- *physical-adaptation* (their task is to make movement more accurate).

The development of a movement image is a matter of complex mental processes, which begin with perception of stimuli from the environment (Cattaneo et al., 2008). The core of developing images lies in complex structures of long-term semantic memory. These structures must be open to back recollection of ***representation schemes***. At the same time they must be capable of a certain type of reworking and must allow comparative and transformation processes, which are used for generating further images. The way images originate in visually impaired individuals differs from a sighted individual as a result of coding of objects and events. The reality is perceived by visual impaired individuals in a distorted way, is marked in a different way and at the same time enriched using other images (Cattaneo et al., 2008). The question is, to what extent and in which cases a missing visual perception can be replaced with or compensated for by haptic or auditive processes and when such compensation is not sufficient. A significant aspect for recalling images are lines, edges, angles and their mutual associations. A loss in the perception of visual information is changed or completed by instructions as an analogous means for recalling images.

For the development of motor skills, ***verbal communication*** is of paramount significance. For visually impaired persons it is the primary bearer of information. Verbal instructions are used to describe physical activity, task assignment, definition of space, assessment of success, motivation, etc. They inform kinesthetic receptors about correct performance of movement and help create a ***movement reminiscence*** (Scherer et al., 1983) or ***movement image*** applicable in new situations as a basis of transfer or cultivation of other skills. In the process of movement learning, visually impaired persons show deficiencies in creating images, which can be characterized as losses or gaps in image complexity. These losses intensify if a new physical skill is presented by verbal instructions using terms that are difficult to imagine for a visually impaired individual ("bird hop", "arabesque", "cat back", etc.), which can be easily imagined by a sighted individual. Another view of language functions is adequacy of used verbal instructions. Each communication participant attributes various meanings to various instructions. Although various objects are introduced in a tactile way, errors and deficiencies ensuing from information acquired in this way are further cumulated and cause deficiencies in the development of images. ***In contact with visually impaired persons there is an increasing effort to apply verbal instructions but also to apply adequate verbal expressions.*** This includes means based on good experience of a learning individual, which are underpinned by experienced actions, movement, etc. In this case the movement image induced by verbal means can be close to real accomplishment of a movement assignment.

Images and speech represent various representative forms of perception and conduct. As a result of speech and concepts that a language uses to mark objects, phenomena and their qualities, illustrative images, including construction processes can also be generated. Through language instructions it is possible to *activate organization features of movement operations*. The performance of a physical skill is reflected in the semantic system of representations – images. The use of speech and describing movement through language encounters limited language possibilities. The problem is that movement cannot be described in full extent and richness. Language and speech are the bearers of indispensable but limited information. This is because they must be coded through symbols, concepts and associations, and then decoded. The price for this process is a loss of a spectrum of information, which further increases as a result of various levels of language competence of communication participants. It should be stated however that "language representation" (instruction) combined with movement ***enrich the conditions for performing movement because they well complement the specifics of movement, and emphasise key points and parameters of movement. A significant role is played by initiation and encouragement, which do not directly activate the movement but create the conditions for its construction***.

It is generally acknowledged that the images of visually impaired persons considerably differ from images of the common population. The reason is different perception of oneself and the environment. The fact that usual communication between impaired and non-disabled persons works well is a result of identical or similar supply of information at a semantic level. Despite this fact there are exceptions where a lack of physical experience disables links between various aspects. Visually impaired persons miss an adequate semantic correlate at a level of motor experience (Bietz, 2002); the use of some terms is identified as verbalism.

The development of movement images is closely dependent on physical experience and is underpinned by knowledge associated with movement application. This fact negatively affects the socializing and individual developmental conditions of persons with severe visual impairment. A limited access to acquiring physical experience and difficult participation in secondary or mediated sports events in the role of observers (spectators) leads to gaps in the tank of movement images, a number of these representations are fragmentary and are not adequately associated. In case of orally conveyed information or instructions, movement learning in persons with severe visual impairment faces the challenge of accurate expression, correct identification, clear terminology, etc. Another issue is caused by gaps in creating images, which can be caused by expressions and terms related to movement. Therefore, a certain spectrum of physical activities is impossible or difficult to achieve by persons with severe visual impairment.

22 /

Human physical activity as a process of interaction with the environment

Ladislav Bláha

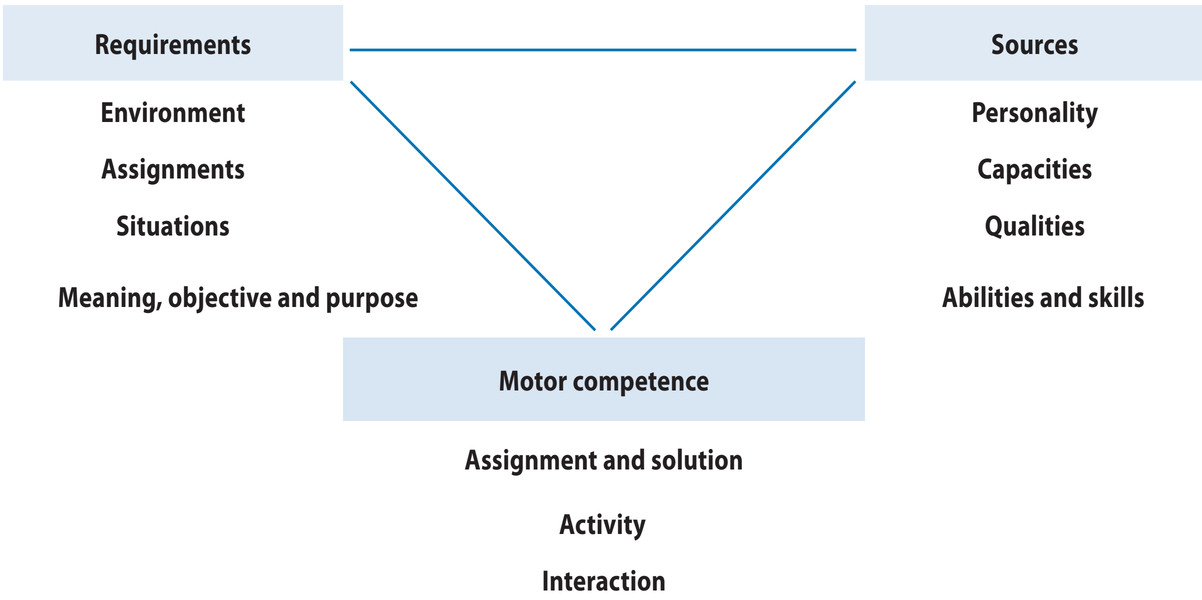
People change the environment to suit their needs; however, each individual is influenced by the environment. Human movement is closely associated with the surrounding environment. This mutual relationship can be considered interaction. During interaction ***an individual becomes actively involved in the environment*** ("executive side" of movement) but at the same time an individual ***as an acting and active subject is forced to learn about and respect the environment*** ("perception side" of movement). In this way, the environment is presented to each of us in the form of images developed through perceiving and appropriate processing of stimuli. This process of mutual influencing takes various forms depending on what abilities and skills this individual uses in the interaction with the environment. Each human individual is "equipped" in a different way. The question is whether an individual with a completely different set of equipment enters the interaction differently and what the interaction is like. Does the unlikeness caused by visual impairment influence the uniqueness of conduct of such individual?

A person with active conduct sets tasks. Accomplishment of a task is only possible through a change in the relationship with the environment and requires own energy. In order to accomplish a task, an individual has to imagine not only the target condition but also the way of using own energy to accomplish the task. This "design plan" includes the process of task accomplishment and the target condition, which makes it a guideline for performing active movement and a measure of controlling its successful accomplishment. ***Movement is essential for the human existence as it becomes a means of communication in the interaction with the environment.*** In the human – environment dialectical unity, movement is the basis of establishing harmony with the environment (Bietz, 2002). In relation to the environment, an individual's tasks are as follows:

- ***to maintain a certain condition as a reaction to the environment***, or
- ***to induce a change***.

A human is active as a result of a desire to ensure own needs. To satisfy these needs it is necessary to acquire new knowledge and skills. Achieving a state of individual readiness and a capability to use skills and abilities to deal with external and internal reality is identified as "competence". Gaining these skills and abilities "…becomes one of the crucial needs of humans" (Hirtz et al., 2007, 18). The so-called "competence model" is associated with abilities and skills of a human at a respective ontogenetic development level. At the same time this model is in contrast with "deficit models", developed as a result of decreased abilities of an individual to induce interaction with the environment in a usual way. Deficit models are associated with the old age or health impairment and maintaining quality of life (Bláha et al., 2009a; Hirtz et al., 2007). The competence model is also associated with Hirtz's (2007, 21) terms of motor competence and their sources, which are associated with the requirements for the human organism (Figure 38) and human motor development.

Figure 38. Association between requirements, sources and competences (Hirtz, 2007, 22)



Human movement is abundant in a number of qualities, each physical skill has specific features, its complexity has a direct effect on its practicability. Not surprisingly, performing a movement is structured into certain operations that are used to achieve the required effects. The basic principle is the anticipation mechanism, which puts individual segments of conduct into context. This mechanism is used to achieve the "design plan" of movement. Anticipated effects, which are expected with respect to the given conditions generate further ones – those that are required to achieve desirable effects. Anticipated effects also determine the way a situation is perceived. If movement is performed as expected, the perception cycle is very economical for the organism.

Lack of relevant information for ensuring interaction with the environment

Each of us enters the processes of interaction with the environment with different preconditions. These form the basic potential to influence the environment and cope with its variable conditions. The level of this potential is based primarily on genetically predisposed traits of a human with "…mental (intellectual), cognitive and physical (motor) abilities" (Měkota & Novosad, 2005, 11). These limit the performance possibilities of each individual and are decisive for having various "competences". A visually impaired individual is confronted with the requirements of the environment in a different way compared with the common population. This is most evident when performing physical skills, which are deliberately performed to change the environment or as a reaction to the environment. Skills of a "sports nature" are a typical example of deliberate adaptation of the environment to the needs and possibilities of the participants of these adapted (to the needs) physical activity programmes. Similarly, the way of reacting of visually impaired athletes is associated with a limitation or absence of some senses, i.e. possibility to receive certain information about the external environment. This process involves a specific method of organizing own active interventions and coping with the external environment. The common denominator of these models is searching for ways to substitute losses and to compensate for the deficit of information normally ensured by the visual analyser.

Interaction of the acting subject with the external environment is a complex and continuous process. This process takes place alternately not only in the form of seemingly well observable movements but also takes place covertly. The reason is that inside the acting subject there is a number of assessing, planning and other operations take place (Bietz, 2002; Kemper, 1995). In an active subject, the deficit in the reception of visual information leads to searching for ways of using the "remaining possibilities". They are not scarce, however, there are serious issues ensuing from the relationship between an individual and the environment.

1. ***A crucial issue in the context of a visually impaired individual and the environment is spatial orientation and space-related control of physical activity.*** This definition includes two areas. The first is the issue of orientation, i.e. relation and interaction of cognitive presentation of the environment. The second is perception control of an individual with respect to the environment. This means that ***the acting subject needs information, an image of a movement space, and an image of own active conduct in this environment*** (Scherer, 1991). The required and necessary information is acquired only as a result of independent movement in a space. The movement space must be perceived as a space perceivable by senses. A movement in a space is largely dependent on perceived and imagined, or firstly imagined and then perceived spatial associations. Regarding the fact that the use of senses in visually impaired person has earlier limits, their movement in a space has certain limitations (narrower). Unfortunately, these persons have only a part of relevant information; feedback is received through control mechanism but with a delay. As mentioned by Bietz: "The components of spatial images, i.e. cognitive presentations come to the forefront" (2002, 33), which means that a visually impaired individual needs to plan own activities and virtual movements (transfer with respect to an imagined space, which is gradually "discovered"). On the contrary, a sighted individual can determine movement plans directly in the perceived space.
2. ***A human as an active individual performs physical activity through a movement image.*** This is another significant aspect contributing to the quality of interaction with the environment. Together with the first aspect they are in a constantly variable relationship and at the same time in a dialectical unity. Within a certain arrangement, i.e. organization of the performed movement their functions might be defined as ***"perception-exploratory"*** and ***"operative-executive"*** (Bietz, 2002). The question thus is whether the more significant aspect is a spatial analysis or an image and performance of movement. The operative movement function is performed through activities in compliance with a relevant physical activity programme (Schmidt & Wrisberg, 2008) – action scheme (Bietz,

2002), which is the core of movement. If adequate physical activity programmes are unavailable, the movement or its anticipated image is doomed to failure. Difficulties arise especially in case of an image of unknown movements while learning new skills. This is exactly when the difficulties of visually impaired persons become more evident because they are multiplied as a result of images. The lack of perception forces them to construct not only spatial associations but also operative aspects of the observed course of movement and its effects. As a result, we face two associated problems – spatial image and movement image. For a blind learner, developing an image of an unknown movement is a real challenge, which should be addressed by special education. A considerable role in this process is obviously played by a different way of processing external information or instructions.

23 /

Movement regulation and development of movement images

Ladislav Bláha

Movement regulation is understood primarily as "organizing coaction of conscious and unconscious cognitive sensorimotor processes in the preparation, performance, control, correction and assessment of movement" (Schnabel, Harre, &Borde, 1997, 66). Without movement regulation it is impossible to succeed in performing physical activity tasks and activities associated with transferring in a space. Movement regulation in influenced by motivation, emotions, is a reflection of intellectual preconditions but particularly is a synthesis of ***the influence of perception and motor skills***. Their relationship is "…defined by movement coordination or the so-called sensorimotor coordination" (Schnabel, Harre, & Borde, 1997, 67). Movement regulation is defined as "…time- and space-arranged coaction of movement under the control of analysers that guide movement in compliance with the sequence of superordinate programmes of conduct" (Schnabel, Harre, & Borde, 1997, 67). In our conditions these processes are associated with a part of a complex of coordination abilities that "…have various operations of reception, processing and storing of information. These are perception, cognitive and mnemic operations" (Měkota & Novosad, 2005, 57) with a significant impact on movement quality in the form of movement regulation. ***Movement regulation is characterized as a comprehensive system of reception, processing and storing of information and their releasing at various levels.*** During its course, the supply and assessment of information opens an opportunity for ***internal movement presentation (images)***, which can be used during "…movement programming, comparative processes and movement corrections" (Schnabel, Harre, & Borde, 1997, 69).

Apart from ***movement presentation*** (images) some professionals (especially neuropsychologists) use the term ***mental imagery***, which are used to understand critical functions of human cognition and are often regarded as a "perceived" experience of an object without direct involvement of the object (Cattaneo et al., 2008). A mental image is described according to the method of perception; in case of acoustic, haptic, kinesthetic etc. perception an acoustic, haptic or kinesthetic image is developed; in case of visual perception this mechanism usually culminates in the form of ***visual images***. Apparently, congenitally blind individuals are not able to directly generate these images but they can develop mental images – in a similar way to sighted individuals. This is probably facilitated by a close association between perception and imagery and the fact that:

1. Areas of the brain responsible for perceiving visual information are not directly responsible for visual mental images in sighted individuals.
2. Areas of the brain responsible for perceiving visual information could also be activated by non-visual perception.

3. The process of visual information is complemented with other sensory methods.

Mental images are thus the final product of a series of construction processes using various types of information that are "copied" also according to the way of perception (Cattaneo et al., 2008).

For our purposes it is more convenient to use the term internal movement presentation, which "…is used to identify internal models, physical activity programmes, movement images and schemes movement-oriented images". In this context, Schnabel et al. (1997, 69) suggest that it "cannot be limited to the subject but also to the conditions of the environment especially with respect to the expected outcomes of activities". Contrary to Schmidt's ***physical activity programmes*** (1991, 2008) Schnabel's capacity of ***motor – movement presentation (movement presentation)*** is more extensive. The area of internal movement presentation in a space can be identified by models, physical activity programmes, images, and the so-called ***memory representation action schemes***. Bietz (2002, 28) uses these to describe "…generalized abstract representations of movement classes". They are defined by structures that are further modified by specific performance variability. In specific situations, they investigate and control movement performance, which must be adapted to situation requirements by setting appropriate parameters. Bietz (2002, 28) considers them "central functional units of physical conduct". The category of movement presentations also includes behaviour models specified according to the type of the environment, terrain, spatial structures, mapping and tank of environmental maps, acquired proportions of trajectories, descriptions of paths, specification of distances, terrain angular proportions, etc. The quality and quantity aspects of movement presentations significantly influences the quality of anticipation processes adopted for the purposes of movement organization.

Conscious perception of own movement is a prerequisite for developing an internal ***"conscious presentation"*** of movement (Schnabel, Harre, & Borde, 1997, 105). A significant role is played by ***proprioceptive kinesthetic perception***. "The development of a conscious presentation is supported by e.g. means of expression, which involves a consciously accepted proportion of internal presentations in an action, supported by verbalized perception and associated with unconsciousness or indirectly verbalized movement perception" (Schnabel, Harre, & Borde, 1997, 105). However, it is sometimes difficult to capture the spectrum of important information by usual means of expression. The already difficult situation presents another challenge to visually impaired persons. Under usual circumstances, the first rough movement images are defined especially visually and spatially. The problem is that unclear structures of developing a conscious presentation in visually impaired persons are complicated by movement and its specification by means of expression. For a fully developed movement image, the significant criteria are kinesthetic and relevant dynamic components as well as ideomotor reactions – i.e. subconscious motor innervation.

Movement presentation or movement image in a space is one of the most significant aspects in the life of visually impaired persons. The problem of their development has not been satisfactorily resolved (Cattaneo et al., 2008).

24 /

Implications of specific interaction with the environment for physical activity in visually impaired individuals

Ladislav Bláha

The specifics of interaction with the environment in visually impaired individuals are a direct result of sensory limitations, i.e. missing information. The consequences of these specifics can be observed in physical activity and in its development and in the process of acquiring physical skills. Another side effect is a decreased level of general knowledge relating to physical skills or even to the course of physical activity, for example of a game type.

The deficit is obvious in missing physical experience in relation to applying physical skills that should play a crucial role in the development of movement images. The generally lower quality and quantity of physical activity programmes – action schemes is a secondary consequence of visual impairment and influences developmental and socialization conditions of visually impaired persons. The "tank" of these programmes is directly dependent on experience with movement situations and learned movements. This includes experience with general elementary and more difficult movements in terms of coordination and also the range of experience with applying specific physical skills. These include e.g. experience with activities of a sports type. This very specific area of cognition can be only achieved through participation in these processes and in accomplishing various tasks leading to a determined objective, e.g. in a match. A participant in these processes acquires a considerable amount of knowledge reflexively. Perceived effects of variable situations have a significant influence on increasing experience, which is the basis of recalling required images in future situations. The significance of physical experience fluctuates depending on how it is stored in terms of volume, multilaterality and differentiation. It is also used for the reconstruction of known physical conduct or as a basis for the application of new movements. The repertoire of presented physical experience in visually impaired individuals is usually lower. Similarly, the representation structures related to the movement usually show a lower degree of differentiation, multilaterality and volume. In many cases they are incomplete or fragmentary in relation to elementary movements and the simplest skills (Bietz, 2002).

Similarly, the area of knowledge of movement has gaps. This is partially related to a deficit in physical experience, which can be at a certain level abstracted and put into context with the knowledge of the external world. On the other hand, the amount of physical experience can be of significance only after it is put into context with required knowledge. Certain limitations result from the fact that the amount of knowledge can be mediated only directly, where unintentional mediation of knowledge does not work and is a by-product of subconsciously perceived visual information. As a result, visually impaired persons do not have an opportunity to use this unintentional information, which under usual circumstances (especially in movement learning) complements movement images and helps construct a movement act. We should also mention the purely "spectator" role, which in usual passive participants develops a sufficient image even of complicated physical skills such as player skills used in various gaming situations with respect to e.g. player formation. Images of this type of sports actions will always be very fragmentary and differentiated. An absence of relevant physical experience does not allow passively experienced sports actions to be adequately interpreted and semantically expressed. Any discussions about "event on the playing field" or "sports events" are "empty" in terms of content as well as associated concepts because the reality is more distant for visually impaired individuals and is not supported by own experience or respective images.

25 /

Consequences of absence of visual stimuli in the development of a child's motor skills

Ladislav Bláha

To a large extent, the possibilities of using physical skills in visually impaired persons are indicated by previous and existing functional ability of the visual analyser and the date of origination of the impairment, or the pace of aggravation. The most serious problem is apparently the condition of complete congenital blindness. According to Keblová (1996, 7), a blind individual is any person with "…impaired visual perception, which prevents usual graphical performance and considerably hampers independent movement and spatial orientation". During the first months after birth, blind children are characterized by delayed development as a result of missing visual information compared with sighted children. Janečka, Štěrbová and Kudláček (2008, 24) emphasise a danger of "pathological images of correct function" in developing a different partial movement model than the correctly developed chain of muscle coordination. The following effects gradually take place:

- Development of other movement models limits higher motor competences.
- Individuals are affected by delayed development of head control and abnormal manifestations of restlessness.
- There are deficiencies in the links between vision and the proprioceptive and vestibular systems.
- Head orientation is affected by delayed coordination (Prechtl, Cioni, Einspieler, Bos, & Ferrari, 2001).
- The process of acquiring experience is limited, which is reflected in the cognitive, social, emotional, psychomotor and psychosomatic areas; this also affects performing physical activities, i.e. acquiring physical skills.
- "Lack or absence of visual stimuli is the cause of sensory deprivation" (Ludíková, 2003, 186). As stated by Vágnerová, Hadj-Mousová and Štech (2004, 154), "…impaired children are affected by narrower quantity and quality of stimuli, and limited active cognition, which results in fixation to a certain small part of the world allowing at least some cognition".
- There are signs of fear and a low degree of variability of physical acts.
- Worsened somatopedic indicators (the dominant one is kyphotic posture), incidence of muscle imbalances and decreased performance of some organs.
- Decreased indicator values relating to the level of numerous physical abilities.
- Possible incidence of characteristic physical stereotypes, i.e. so-called psychomotor peculiarities (e.g. rhythmic, swaying and turning movements, unusual mimic expressions or rubbing of the eyes and ears).

- Possible deviations from usual values of some vegetative functions, biological rhythm, muscle tone or changed heart rate values (Bunc, Segeťová, Šafaříková, & Horčic, 1997a, 1997b).

In spite of all limitations, according to Keblová (2001, 22), a visually impaired child should "…acquire skills at the same age as healthy children, e.g. learn to walk, speak, eat independently, on average between one and two years of age". However, controlling the movement space requires the application of special orientation techniques. It is obvious that the absence of information about the space and movement brings a number of negative consequences. Blindness or severe visual impairment significantly affects psychomotor skills, expression, perception and thinking, motivation. However, their effect depends on both internal and external variables such as personality structure, intelligence, social environment, material conditions, etc. From this perspective, performance of PA can appear as one of the variables intervening in the system, which might complement physical education including training of orientation and mobility. This variable has a potential for removing isolation and provides opportunities for communication with the environment. In this context, we are convinced about the significance of the cultivating environment in the application of various physical activity programmes.

Children with moderate visual impairment have better preconditions for at least partial use of visual experience and images; however, these must be further developed and reinforced. Spatial orientation and physical experience in a space are limited because the course of movement is often not seen or seen in a rough way. Sometimes a loss of visual control of key places can occur; as a result the performance of physical activity (especially in a larger space) can be often incorrect. Various issues can also occur in controlling the activities of a different subject or assessing nearby moving objects. It is vital to consider limited possibilities of time-space estimation and analysis. Incorrect reactions can lead to uncertainty, frustration and fear. Similarly, in children with moderate visual impairment we can observe motor immaturity, low level of skilfulness and incapability to perform a number of physical skills. The causes lie in missing physical experience and inadequate care by parents. We believe that well-performed physical activity can contribute to resolving this problem.

We should also mention the possibility of progressing visual impairment. In case of a progressive disease it is important to use all limited possibilities in advance to ensure the cultivation of required skills in order to facilitate the transfer of such impaired individual to more difficult conditions.

26 /

Ways of engaging visually impaired persons in physical activity

Zbyněk Janečka

From the perspective of a regular PE teacher who has no experience with integrating visually impaired pupils, the idea of engaging a blind pupil in physical education is very difficult. Engagement of such pupil is not easy and requires a number of didactic, organizational and personal measures. In the text below we will mention several examples of activities that are readily available to blind individuals. First we will mention a list of activities for visually impaired athletes. The next part includes examples of games suitable for visually impaired pupils that can be used in integrated PE lessons. These games adapted to visually impaired individuals are so specific that they will be dealt with in a separate chapter.

The Czech Blind Sportsmen Association offers a wide range of activities that can be used by visually impaired sportsmen in the Association's clubs. The content of a number of these sports and activities are close to activities usually incorporated in individual educational plans for visually impaired pupils.

Sports organized by the Czech Blind Sportsmen Association in the Czech Republic

- Alpine skiing
- Athletics
- Ten pin bowling
- Nordic skiing
- Cycling
- Futsal
- Goalball
- Judo
- Nine pin bowling
- Swimming
- Showdown
- Powerlifting
- Tandem cycling
- Chess
- Acoustic shooting

Other sports:

- Hiking
- Archery

For completeness, below are specified sports organized by the IBSA (International Blind Sports Federation)

- Alpine skiing
- Athletics
- Archery
- Futsal
- Goalball
- Judo
- Nine pin bowling
- Nordic skiing
- Powerlifting
- Showdown
- Shooting
- Swimming
- Tandem cycling
- Ten pin bowling
- Torball

Other sports:

- Baseball
- Chess
- Cricket
- Equestrian sport
- Golf
- Sailing
- Rowing
- Water skiing

Paralympic sports for the visually impaired:

- Winter sports
- Summer sports

Summer paralympic sports for the visually impaired

- Paralympic Athletics
- Paralympic tandem cycling – road
- Paralympic tandem cycling – track
- Football 5 a side
- Goalball

- Pralympic equestrian
- Paralympic judo
- Paralympic rowing
- Paralympic swimming

Winter paralympic sports for the visually impaired

- Alpine skiing
- Biathlon
- Cross country skiing

27 /

Inclusion of Students with Visual Impairments in General Physical Education

Martin Kudláček

Physical education should be one of the most important subjects within the school curriculum for students with visual impairments (Lieberman & McHugh, 2001). as it greatly enhances their independence and healthy development. In most European countries, teachers are not able to decide, if they will have a student with a disability in their class, but they can decide to which extent they will include this student (Lienert et al., 2001; O'Brien, Kudláček & Howe, 2009). If a students are unable to participate safely or successfully in general physical education, then they should receive support by Adapted Physical Education consultants. Adapted Physical Education represents appropriate physical education adapting, modifying, and changing physical activity so it is an appropriate for students with visual impairments. While growing number of Czech students with visual impairments are included in general schools it appears that many of them are not given opportunity to participate in physical education as according to Czech legislation students can be excused from their participation in PE (Bláha, Janečka, & Herink, 2010). According to Martin Block (1994) we should be considering continuum of placements (or supports) and not simply inclusive physical education, special setting or non-participation. According to the model of Continuum of placements, there is possibility to include students with special educational needs (SEN) without any adaptations or support. The next stage of support represents adaptations in curriculum followed by support by trained peer tutors. This form of support is not as common in European countries, but presents viable alternative to support by trained teacher assistants. The current problem in the support for inclusion in physical education is the lack of competency of both general PE teachers and teacher assistants (TAs). In most countries there is no specific training developing PE related competencies. In such cases TAs actually create barrier to successful inclusion.

Continuum of placements (Block, 1994)

1. **Full inclusion with no adaptations or support**
2. **Full inclusion with curriculum adaptations**
    1. multilevel curriculum-presenting the same content but at different levels
    2. curriculum overlapping-presenting alternative curriculum goals within the same activity
3. **Full inclusion with trained peer tutors**
    1. traditional/unidirectional peer tutoring

   2. reciprocal/bidirectional peer tutoring: both students with special needs and their typically developing peers take turns tutoring each other based on the task at hand
   3. cross-aged peer tutoring: older students with or without special needs tutor younger students with special needs
   4. class-wide peer tutoring: teams are formed and given specific sheets to practice; tutoring occurs reciprocally;
4. **Full inclusion with teacher assistants**
   1. full time: assistant accompanies child full time throughout the day
   2. flexible schedule: assistant accompanies child only when necessary
5. **Part- Time Segregated Placement Options**
   1. Split placement without support
   2. Split placement with support
6. **Community-Based Options**
   1. Part time: child‘s time is divided between community- and school-based activities
   2. Full time: curriculum is implemented through community-based activities
7. **Full-Time Segregated Placement Options Within a Regular School District**
   1. Small group (reverse integration: typically developing peers attend classes with peers with disabilities and assist as needed or specialist-directed: specialist directs activity of group)
   2. One-to-one (reverse integration: typically developing peer attends class with peer with disability or specialist-directed: specialist directs activity of student)
8. **Segregated Placement Options** (Day school for specific disabilities; Residential school for specific disabilities; Home schooling; Hospital setting)

For blind students part time segregated placement option can be good alternative. For example, when class is playing basketball or volleyball it can be appropriate if blind student spends time with peer tutor(s) and/or teacher assistant in parallel activity in separate classroom/ gym. The appropriate activity can be individual strength or fitness activities, learning and practicing adapted sports such as goalball or showdown. In cases when school cannot provide appropriate support to inclusion in students with visual impairment and students would be excluded from physical education there seem to be viable option to arrange physical education in cooperation with local organizations and sport clubs.

PAPTECA model

When planning inclusive physical education it is not sufficient only to think about needs for different adaptations for actual teaching, but it is important to consider whole process of service delivery in PE. According to Sherrill (1998) it is advisable to follow step by step procedure represented by **PAPTECA** model. In PAPTECA model each letter represents key stage in inclusive physical education:

(a) **P – Planning:** In the first stage of inclusive PE, we need to consider issues related to conditions of school, where services will be delivered. Important issues to be evaluating are PE curriculum, equipment (including special adapted equipment), accessibility and competency of teacher assistants, available spaces or number of students in PE classes.

(b) **A – Assessment:** It is an essential part of inclusive physical education as we need to determine the individual needs of visually impaired student in relation to physical education. Therefore in every country there should be set procedure to evaluate students in order to prepare individual education plans for PE.

(c) **P – Prescription:** In this stage Individual Education Plans for PE (IEPs) are prepared. In the process we should be setting appropriate goals, adaptations and support methods. In order to set appropriate goals we need to understand individual needs (results of assessment), interests of student with visual impairment, schools PE curriculum and other relevant information. In line with appropriate goal setting we should make sure that our GOALS are measurable and achievable (generally respecting SMART strategy in goals setting).

(d) **T – Teaching:** Teaching is crucial part of inclusive physical education as in this stage actual learning is taking place. We should emphasize that inclusion "at all cost" is not appropriate as we suggested in the above chapter on the concept of continuum of placements. We should emphasize that appropriate learning is the results of appropriate planning, assessment and prescription. We will talk about different approaches to ADAPTATION later in the text.

(e) **E – Evaluation:** Following similar tests and procedures used in the assessment, we should evaluate the individual progress of student at the end of each academic year. We can use the results of evaluation tests for setting IEPs for next year.

(f) **C – Counseling and coordination of resources:** The last two points of PAPTECA model stand outside of actual service delivery, but are essential for good service delivery. We propose that in every school district (region), there is a system to support PE teachers, who need to be teaching visually impaired students and do not feel confident to do so.

(g) **A – Advocacy:** In many countries students with special education needs are excluded from general physical education as teachers do not feel competent and there are not appropriate support mechanisms. Therefore we need to advocate for the existence of support systems as well as meaningful participation in PE.

Adaptations

As discusses above adaptation is key concept in adapted physical education. There are many approaches to differentiating and classifying adaptations. For the purpose of this chapter we choose Australian (Australian Sport Commission, 2012) model titled as **"TREE model".**

(a) **T – Teaching style:** Teaching style refers to the way the sport or activity is delivered to the participants. Strategies which can be used are appropriate arrangement of group, using visual aids or compensation of visual stimuli by auditory. We can use peer tutoring or engage teacher assistants. We can guide movement of students with VI and keep instructions short and clear.

(b) **R – Rules:** Rules can be simplified or changed depending on skill levels of students. Strategies could include allowing different point scoring actions, reducing competitive elements, reducing number of players, introducing peer tutors as guides or use adapted sports specially designed for persons with VI such as blind football or showdown.

(c) **E – Equipment:** For students with visual impairment we can use highly contrasting equipment which can also have slower trajectories. The most commonly used adapted equipment are sounded balls or other sounded equipment.

(d) **E – Environments:** Strategies for teaching students with VI include reducing playing area, using boards to allow more flow of games. We can also use special markings (e.g. tactile lines) to help students for better and safer orientation in space. We can also use alternative spaces in cases that main gym activity is unsuitable or unsafe (e.g. playing showdown, when class engages in game of volleyball).

While making adaptations we need to make sure that all students can be involved and challenged. We should not make adaptations which would lower the quality of physical education for students without disabilities nor should they feel that their classmate with visual impairment is burden in their PE. On the other hand we can use handicap as challenge for all classmates. We can introduce activities, which make them aware of special needs and possibilities of blind or visually impaired athletes. Such activities can include goalball, showdown, football with sound ball and blindfolds. At the same time we need to make sure that adapted activities are not dominating our physical education. At the same time we should always maintain the integrity of the game. This means we should not modify a game so much that it no longer resembles the game you were playing at the outset. Good example can be trying to modify volleyball by taking "volley" out of the game.

Another effective support in inclusive physical education can be the use of peer tutoring. Peer tutoring represents systematic use of peers as supports in PE. Peer tutors are recruited from interested students, which receive training in order to be able serve as "student teacher assistants". In this way VI student can receive very effective support while still interacting with peers (Klavina, 2008).

In conclusion we can state that students with all types and levels of visual impairment can and should be included in physical education. This requires appropriate support by qualified APE consultants, use of adapted equipment, qualified teacher assistants and possibly peer tutors. Still it is important to highlight that it is acceptable and sometimes desirable to deliver PE in parallel or separate format to make sure that all students are challenged in PE and student with visual impairment is receiving services according to well prepared IEP.

28 /

Selected aspects of physical activity games in visually impaired persons

Ladislav Bláha

Physical activity games for visually impaired participants represent a specific area of physical education and sport. The unique nature of these games is determined by typical features that make them available to persons with limited or missing visual spatial control. Regarding this fact the application of these games requires some modifications, safety measures, fair approach with respect to the degree of impairment, etc. Visually impaired persons are thus allowed to pursue specially designed games adapted to their impairment. Deciding on taking part in such games and individual game selection are subject to a number of relevant factors. In terms of a visually impaired individual, game selection depends on the degree and type of impairment, sociocultural background, actual degree of motor competence and acquired motor skills, mental specifics and last but not least financial possibilities. A crucial role is also played by the conditions offered by the environment (requirements for space, equipment and aids, requirements for controlling and refereeing, necessity of sighted individuals, availability to a blind individual, promotion by various organizations and institutions, etc.) A frequent issue is the requirement for a higher number of visually impaired individuals because some games are only possible with a larger number of participants. Ensuring all of these circumstances is not simple but is possible.

In the application of physical activity games it is appropriate to consider the specifics of the education reality, i.e.:

- *modification of physical activity games in terms of field dimensions, weight and size of the playing equipment (balls) etc. according to the degree of acquired physical skills of the participants respecting the degree of their psychosocial development,*
- *use of safety equipment and application of game practices to prevent injury, heavy blows etc. leading to increased fear from performing these activities.*

In detail, the following should be respected:

- *medical recommendations,,*
- *optimum size of the playing field,*
- *easy orientation in the environment (playing field, game participants, playing objects),*
- *different preconditions of visually impaired players in acquiring physical skills,*
- *difficulties ensuing from the image of "movement", i.e. understanding the motor-movement task,*

- *modification of playing equipment to suit the visually impaired population, accepting the specifics of using special equipment and aids,*
- *application of specific methods and styles in acquiring new physical skills.*

Visually impaired persons as well as their umbrella organizations show a various degree of interest in physical activity games. Increased support is given to sports games promoted by the IPC (International Paralympic Committee), i.e. goalball and football. The IBSA (International Blind Sport Association) supports goalball, torball, bowling, football and showdown. National associations (ČSZPS in the Czech Republic) might support other sports of physical activity games as a result of increased performance, traditions, etc. (beep-baseball, chess, showdown, roalball, basketball).

Knowledge and skills of controlling these games and preparing the participants for a match are the most significant issues hampering their wider use. **These issues occur in multiple tiers:**

a) issues of including a participant in a physical activity game (Bláha, 2002),
b) issues of acquiring and cultivation of specific gaming skills required to accomplish game tasks by the participant.

In the application of games it is appropriate to **understand the objectives and application possibilities**. The following questions emerge:

1. *What is expected from games for visually impaired individuals (social, health, performance aspects etc.)?*
2. *What are the real possibilities of the participants so that the games are applicable?*
3. *What games should be applied and how should their rules be adapted to involve the respective target groups?*

The answer to the third question is a complex one as it includes the issue of determining principal game tasks and acquiring necessary game skills by the participants. We aimed to define the typology of physical games and competitions according to a system devised by Tomajko and Dobrý (1999, 11) and later by Süss (2006, 15). The reasons for this definition are the following:

1. Determination of the areas of physical activity games that can be pursued by visually impaired individuals.
2. Highlighting the aspects that are sufficient for the application of these games.
3. Stressing the existence of a positive transfer, which can be used to enrich the spectrum of usable physical activity games in visually impaired persons.
4. Issues of institutional roles (e.g. ČSZPS) in recruiting children and youth for „game activities".

The range of games is extensive. To pursue simple games it is necessary to acquire a few basic skills. After that it is possible to approach more demanding games or different alternatives of the same games that require a higher amount of game tasks and a corresponding number of game skills. The limits of some visually impaired individuals can be shifted very far depending on the type of game or competition. Their popularity resulted in their inclusion among paralympic game (goalball, football) and increased institutional cooperation (Válková, 2008).

Table 70. Selected physical activity games, game tasks and most frequently applied physical skills

Types of games	Category – principle	Term, identification	Gaming tasks	Physical – gaming skills
I	Football	Football Indoor football Futsal	F: Moving the ball to the designated area using especially the lower extremities D: Preventing forwards from accomplishing their tasks	▪ Ball interception ▪ Ball handling ▪ Ball passing and shooting ▪ Perception of signals in order to ensure orientation in the field and identify players and the playing object. ▪ • Ball stealing and catching
I	Hockey	Circle ball Adapted floorball Hockey with an acoustic frisbee	F: Moving the playing object to the designated area using sticks D: Preventing forwards from accomplishing their tasks in an allowed way	▪ Ball interception ▪ Ball handling ▪ Ball passing and shooting ▪ Perception of signals in order to ensure orientation in the field and identify players and the playing object. ▪ Ball stealing and catching
I	Rolling	Goalball Toarball Bowls	F Move the ball to the opponent's goal in an allowed way D: Prevent the ball from moving to the defended area using the extremities and the trunk.	▪ Ball shooting (throwing) ▪ Passing the ball ▪ Perception of signals in order to ensure orientation in the field and identify players and the playing object. ▪ Taking a suitable position to catch the ball ▪ Safe ball interception
I	Basket	Basketball	F: Move the ball to the opponent's basket in an allowed way D: Identify the opponent and prevent the opponent from moving the ball to the basket	▪ Orientation in the designated area ▪ Identification of defending players ▪ Ability of a fast transfer

B	Bat	Beepbaseball Diamondball Brennball Rounders, etc.	D: Identification of a hit object and its interception Dt: Movement with a ball to the target box F: Introduction of a playing object into the game F: Transfer of a player to a target base or a different physical activity task	▪ Throwing (hitting) the ball ▪ Transfer (various forms of navigation) ▪ Perception of signals required for orientation during a match ▪ Analysis of signals and reaction to them ▪ Stopping and catching the rolling ball
N	Net catch	Combiball Zone volleyball	F: Throwing the ball over the net and hitting a free area of the opponent's field. D: Identification of a flying and falling acoustic ball and intercepting the ball	▪ Ball throwing ▪ Perception of signals in order to ensure orientation in the field and identify players and the playing object. ▪ Catching and interception of the ball
N	Racket – tennis	Showdown Rollping	F: using a racket (flat bat) to hit the acoustic ball so that the opponent is unable to intercept the ball or that the ball hits the designated area D: Catch the identified ball before it passes the designated area	▪ Identification of the ball in the designated area of the playing field ▪ Hitting a ball with a racket (bat)
N	Hitting targets	Bowling Nine pin bowling	F: hitting the target with the ball	▪ Target identification (orientation) ▪ Precise aiming and releasing of the ball

Legend: I – invasion games
N – net games
B – bat games
F – forward
D – defender
Dt – defender task
(Bláha, 2003c, 174)

It is expected that in current practice and also in integrated PE, activities for the visually impaired will be adapted and mixed with activities for sighted individuals. This is a much discussed issue in the context of education and leisure time activities (Bláha, 2010c; Bláha, Janečka, & Herink, 2010). Existing guidelines (Bláha, 2010b; De Pauw & Gavron, 1995; Ješina & Kudláček, 2009; Kudláček, Ješina, & Janečka, 2009; Kudláček, Ješina, & Štěrbová, 2008; Másilko, 2009) can be accepted as a stimulus for discovering new ways to enrich education and improve the cooperative environment in the classroom, and also as means of socializing of adults during a game. Emphasis is put on various areas of participant cooperation, range of acquired skills, player orientation, safety, and use of the potential of game performance or activities to improve their quality. It is necessary to respect a wide range of preconditions, i.e. spatial and material provisions, skill level, number of participants, chances of inclusion, etc. (Bláha, 2003b, 2006; Bláha & Pyšný, 2000; Bolach, 2001; Davis, 2002; Filipová, Keblová, Pecka, Tupý, & Vaněk, 1995; Friedrich, Hildebrandt, Knauff, & Kruf, 1986; Friedrich & Schwier, 1987; Herwig, 2001; Lieberman & Cowart, 1996; Másilko, 2009; Ratajczak, 2001; Rutkowski, 2001; Schucan-Kaiser, 1997; Sinning, 2001; Vachulová & Vachule, 1987; Winnick et al., 2005; Wurzel, 1987, 2001). If a visually impaired individual is included in a team of non-disables individuals, the issue is the significance of such individual's roles compared with non-disable participants. Adjustment of rules in favour of one or another part of a team can result in refusal to participate because one part of the team sees that their abilities are not sufficiently used or, on the contrary, are prioritized. These arguments are serious and are based particularly around visually impaired participants. Just as any other player, a visually impaired player should:

- feel positive game-based experience,
- feel that he/she contributed or should have contributed to the results of the game,
- feel own significance of a participant – player in a game,
- feel that a certain level of game skills is required, which can be further cultivated under appropriate conditions,
- feel that the result of the game was also the result of cooperation of all participants involved,
- feel that the game has its rules that prevent the risk of injury following a collision, fall, hit with the playing object, etc.

(Wurzel, 2004).

29 /

Description of selected games and brief playing instructions

Ladislav Bláha

29.1 Bat games for the visually impaired

Bat games are described as games during which „...the teams are divided by hitting the playing object with a bat" (Tomajko & Dobrý, 1999, 15). The limiting factor in a match is the number of players who are given out. During a defined interval (time, points, or another) the competing teams try to score a higher number of points. The principle of the game is that the playing object is introduced (ball is thrown or hit with a bat) followed by a certain physical activity task (running bases), which might be associated with another task. The defending team takes measures to stop these tasks or eliminate players who perform them. Bat games present some issues that can be easily eliminated by means of thorough preparation. For a smooth game it is necessary to ensure an optimum space and equipment, qualified mediated knowledge and skills, rules adapted to the participants, the participants should be required to use skills that correspond to their capabilities. In relation to visually impaired participants it is desirable to be prepared to react by introducing various corrections because the level of the game can quickly develop. The application of bat games requires considerable changes in spatial arrangement, used material and applied rules that govern the course of the game and allow visually impaired participants to apply physical activity that corresponds to their spatial perception maintaining the desired safety level. The game is based on developing images of physical activity tasks required from individual players. The basic preconditions of successful performance of bat games include the following:

- ability to throw (hit) the ball (if possible with a bell or electronic acoustic device),
- ability to transfer (various navigation devices are used at various levels),
- ability to perceive signals required for orientation during a game and course of a game,
- ability to analyse signals in an appropriate way and react to them,
- ability to stop and catch the rolling ball.

Once the principles of the game are understood, these skills are most important during the first stage. For the ***batter and then runner*** (running batter) this means:

1. „Introduce the ball (throwing, hitting) and
2. move to the target base as quickly as possible!"

For the ***defender – fielder*** the tasks can be formulated in the following order:

1. „Move to an area where you think the playing object is moving to!“
2. „Move to the trajectory of the rolling ball and pick it from the ground as quickly as possible!“ The following might be added as well:
3. „Bring (move) a picked ball to the target box (case, basket, base, etc.)!“

Based on these tasks it is possible to develop simple training exercise that can be, using an appropriate transformation, adapted competition activities. It is advisable to proceed from simple training exercise (later competition activities) and simple bat games and gradually add more complex rules. These measures help equalize the demanding nature of the game from both mental and physical perspectives, maintain a sufficient level of attractiveness and complexity for those who have a sufficient command of the physical activity task and are inclined to overcome more difficult barriers.

In spite of some difficulties, bat games can become a desirable complement to physical education lessons and leisure time activities of children, youth and adults. Controlling the games and setting their difficulty as a whole and their partial activities requires an experienced individual.

How to define space and the playing area

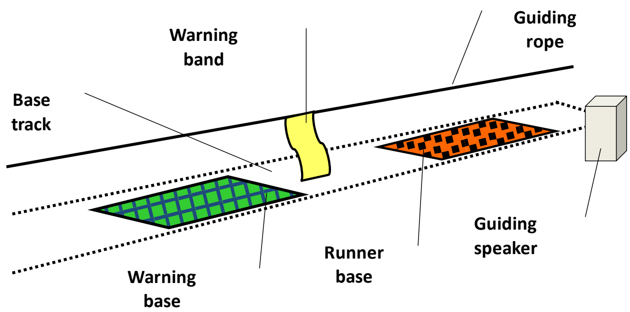
The basic criterion for the selection of the playing area is safety. All barriers must be removed (branches, structures and equipment not related to the game, stones, etc.), a flat surface must be chosen (no turfs, protrusions, holes) and a safe finish area must be provided (area with a different surface). In order to ensure correct perception of acoustic stimuli, the playing area should not be subject to excessive load.

The rules should minimize collisions between runners and fielders or between fielders. Effective measures include division of the attacking and defending sides – see „brennbal“ (Bláha, 2002, 2003a, Friedrich & Schwier, 1987), careful delimitation of lanes – see „diamond ball“ (Liebermann & Cowart, 1996), sectors or control by a sighted player or teacher – see „beep-baseball“.

Movement of players between bases and reaching bases

This physical skill includes a number of issues associated with the absence of visual control. Should a runner perform well, he/she needs to be sure of safe movement and finish. With respect to the degree of spatial orientation during locomotion, various “guiding methods” of a batter or runner might be applied. The basic simplest method of navigating is a guide, who controls virtually all activities of the runner. However, this leads to a certain degree of passivity of the visually impaired player and it is not suitable for more advanced game forms. Another possibility is the use of auxiliary orientation aids or equipment. For example in “diamond ball” and other disciplines the bases are connected by means of guiding ropes or bands. Players with moderate visual impairment should use wide smooth bands of bright colours, which can be actually seen. There is a danger of a collision with fielders when reaching bases. A possible solution is ignoring the rule of reaching the same base by the runner and the fielder or substituting with another rule (e.g. the runner reaches the base, the fielder has a different target). Player guiding can also be ensured by suitable adjustment of base connections – base lanes with a different surface material. This can be ensured by carpet or rubber strips, guiding lanes, etc. A considerable degree of independence and thus a large space for decision making is provided by acoustic signalling equipment. However, these require a single investment and they must be operated by a qualified person carefully watching the game. This signalling equipment must be safely attached, the same applies to cabling (beep-baseball). Acoustic navigation equipment uses speakers and signals the position of two bases. In a game, the signalling system is operated e.g. by the teacher. The speaker is located in a suitable place near the selected base and is turned on immediately after the ball is hit. The player tries to reach the bases with the speaker on. A critical moment could be reaching the base, which increases the perception threshold if performed in an intensive manner and under pressure. A possible solution is maintaining standard base distances, which would lead to reasonable estimation of their span. Running from base to base can be influenced by deviation above an acceptable limit and worse estimation of covered distance. Therefore, in case of guiding bands or ropes it might be advisable to place a warning band in a predetermined distance before the base, which would inform about reaching the target in a tactile way. In case of more difficult games and players achieving greater speeds a system of "warning bases" made of a different material can be used (Figure 39). However, this requires players with a sufficient level of spatial orientation. A combination of all these "orientation and signalling systems" increases confidence and safety, although this measure can be perceived by experienced players as underestimating their abilities. Target bases should be easy to distinguish from the surrounding ground; however, they should not be too raised to ensure safety of players. Persons with moderate visual impairment should use bright colours.

Figure 39. Arrangement of target base for runners



Hitting the ball

To acquire this skill by visually impaired players, generally the same methodological principles should be used as for non-disable individuals. The cultivation of this skill ends with hitting the ball, which is carried out after a well-performed pitch by a team-mate or teacher. The absence of visual control causes limitations in this case because hitting the ball pitched by the opponent (i.e. intentionally difficult to hit) is impossible without visual control or difficult technical adjustments. With a few exceptions hitting the ball in bat games is performed using a tripod. First attempts can be performed with adapted equipment using own pitch and a smaller bat. This is especially beneficial in the case of brennball (Kolář, 2001). However, a tripod appears safer and more beneficial for the following reasons:

1. The batter can fully concentrate on controlling the bat.
2. If a tripod is used, an incorrectly acquired skill appears less dangerous for the batter.
3. The position of the batter using a tripod allows better prediction of the direction of the hit ball and provides more space for corrections.
4. The use of a tripod also provides more space for the selection of equipment.

Worth mentioning is **beep-baseball,** in which the ball is pitched by a sighted team-mate. A prerequisite for successful introduction of the ball to the game are precise pitches of stable parameters into an agreed area and standard hitting attempts by a visually impaired player. However, a required condition is optimum timing of the sequence of activities of both players. This is facilitated by permitted verbal signalization of the pitcher. The first signal intended for all participants is an oncoming pitch. The second permitted signal is intended for the batter and is a *"starting call"*, which triggers complex processes of applying a relatively difficult physical skill in time.

A simple or reasonably difficult introduction of the playing object into the game should be facilitated by choosing appropriate equipment. A suitable piece of equipment is a large acoustic and usually soft ball. At first, hitting is performed using a single-handed bat, later a bat with a wide barrel.

Player movement – field defenders

Field players try to get hold of the pitched ball and accomplish other tasks. The most serious danger is a collision of defenders or a fall or injury during ball interception. The following helps eliminate the danger:

a) Assistance by a sighted person who gives signals to assigned and well-positioned players to intercept the ball, or stops other players using agreed instructions. Such sighted team-mate is also defined by beep-baseball rules.
b) Another possibility is to use acoustic warning devices or division of the playing field into sectors.

29.2 Examples of adapted bat games

29.2.1 Adapted rounders for the visually impaired

Rounders is a simple game. To understand the principles of the game a single (target) base is sufficient. Multiple bases can also be used.

From the starting (hitting) base with a tripod a guiding flexible rope (rubber rope) is stretched to guide the running batter. This rope (band) is positioned along the base lane over the first, second or third target base. In the positions of bases the rope might be provided with warning bands to inform the running batter about base positions. For safety reasons the whole playing field might be divided into sectors according to the number of players using flexible ropes (Figure 40), in case of experienced players it is possible to encourage fielders to intercept the ball using acoustic instructions by a sighted individual (Figure 41). Beginners introduce the ball into the game by e.g. throwing, which substitutes the more difficult hitting. If a bat is to be used to hit the ball, use a tripod. The tripod shall be positioned to the starting (hitting) base. Assisted by the teacher, the player with a bat will get familiarized with the tripod and the bat by touch (size, height of hitting, position of the guiding rope, required hitting position to direct the ball to the playing field, etc.) The teacher guides the player, holds the ball on the tripod, positions the player's hand on the device and informs the player about the required physical task and ensures the players understands the task. The teacher steps away from the player (from the hitting side – risk of injury) and gives an instruction to start the hitting procedure. If a hit is successful, the player puts the bat in the ground and moves as quickly as possible (under tactile control using the guiding rope) on the base lane towards the target base. According to the development of the game a sighted team-mate in the role of an „advisor" (coach) gives instructions required for a safe transfer of the player while maintaining an opportunity to score a point (in case of a single base) or a maximum number of points (in case of multiple bases). While the batter (running batter at this point) moves along the bases, fielders intercept the ball and try to put this player out. The difficulty of putting out can be adapted. In the basic alternative it is sufficient to "pick the ball from the ground", in advanced alternatives, also to cultivate spatial orientation skills, it is recommended to carry the ball to one of designated baskets or cases etc. Just as in the case of attackers – batters, this team can use an advisor for the purposes of safe guiding. Instructions must be given in an appropriate time and must not cause distraction or be counter-productive. Instructions can only be given once the ball stops or if a fielder is lost. To ensure a smooth and safe game, a chief referee must be present, who has the right to stop the players using an agreed acoustic signal and prevent possible (unlikely thought) collisions.

Figure 40. Field plan for rounders with delimited fielder sectors

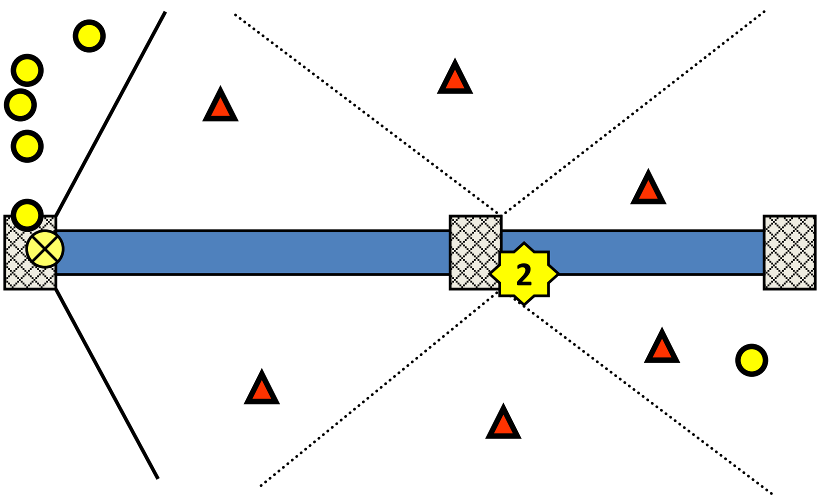
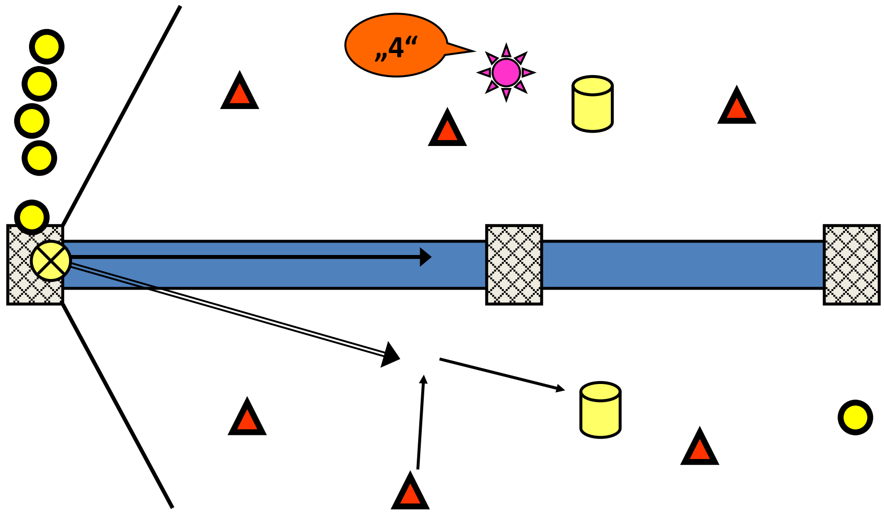


Figure 41. Field plan for rounders with collection boxes for fielder



29.2.2 Brennball

Adapted brennbal allows better delimitation of the movement of fielders and attackers. Appropriate setting of the game contributes to the development of the cardiovascular system of the participants and is suitable for further adjustments. The principle of brennball lies in separate activities of fielders (defenders) and batters (attackers) during a period of time. The length of the time period depends on the number of participants and the level of their skills, which is the most significant aspect of the course of the game. Each team has an identical period of “time on the bat”, i.e. attack and in the field, i.e. defence (e.g. 10 minutes). In the simple form brennball is a similar game to the previously described rounders. The teams take the positions as shown in Figure 42. After introducing the ball to the game (throwing or hitting to a designated area) the batter – runner – runs along the bases that protect the runner. The objective of the runner is to reach the finish; the runner’s progress can be stopped by quick interception of the ball by the fielders and passing the ball to the “brenner”. By entering the “brenner’s circle” and giving an agreed signal (e.g. arm raised above the head and holding the ball) the game finishes. After that the runners are allowed to reach the following base. If the fielders are unable to intercept or find the ball, the runners can run all the way home. For a run with one or more stops 1 point is awarded, for a continuous run 6 points are awarded. Balls from the brenner (sighted player giving instructions) are returned to the batting area, which is taken by another batter according to a specified sequence. In this case, obviously, the fielders have another task – carefully analyse the sequence of instructions given by the brenner and throw the ball in the brenner’s direction to finish the game as soon as possible. Other alternatives include the use of a collection basket for balls in the field, where intercepted balls are placed. The game finishes upon the referee’s instruction after the ball is placed in the basket. The basic task of the brenner is thus not required; the role of the “advisor” or instruction giver is taken by e.g. a designated player or the teacher. There can be more players on one base; the players can get ahead and change order. The game can also include more participants with various degree of impairment. During the specified period of time, the attackers take turns in the specified order, try to reach bases and quickly introduce the ball to the game because in this way they score maximum points. The controlling and managing task of the teacher is significant as he/she gives the instruction to introduce the ball into the game only after both opposing teams have completed their activities (achieving bases or transporting the intercepted ball to the basket or to the brenner). An alternative of scoring points by the attackers can be adjustment of the playing field so that the runner moves to the centre of the batter's field, where the basket is located (Figure 43). From there, the player runs from base to base and takes a point in the form of a ball or a different object and takes it to the finish (a total of three points). In this way, a running batter or runner solves a more spatially demanding task. If the player runs home without interruption, three more points are awarded as a bonus. Guiding is ensured by means of a rubber rope, which can also be used to mark out the sectors for the fielders.

Figure 42. Brennball field plan – alternative with a brenner

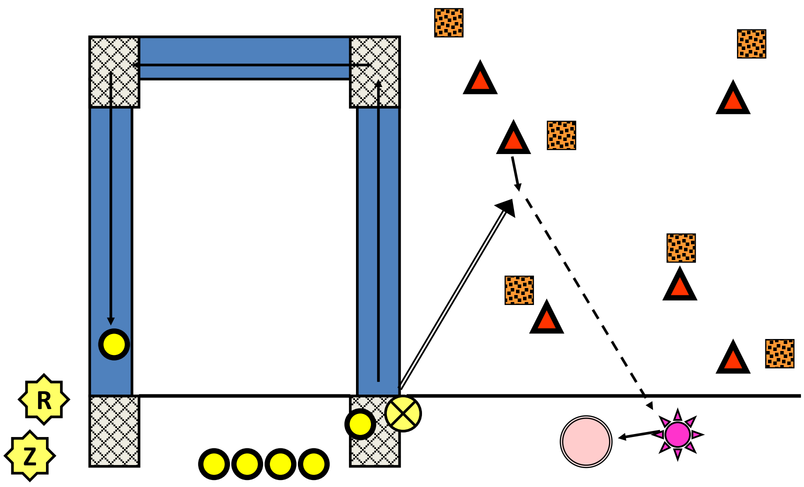
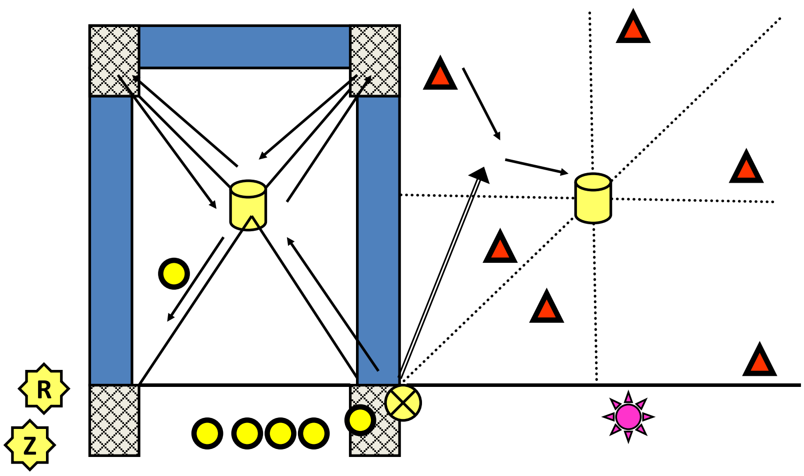


Figure 43. Brennball field plan – alternative with a ball box for runners and fielders



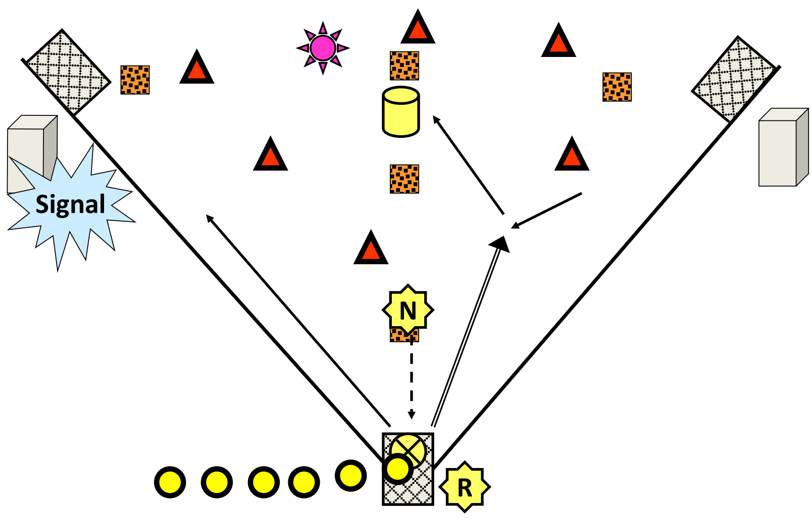
For each match a match record needs to be provided (Annex 6) with the following information for both teams: order of players on the bat (a), one point awarded for interrupted runs along the bases (b), six points awarded for an uninterrupted "home" run (c), two points awarded for catching a flying or bouncing ball (d), one point awarded for catching a rolling or still ball (e), one point awarded to the batters if the fielders are lost and need an instruction (f), one point awarded to the fielders if the runner is lost (g), four points awarded to the batters for crossing the base line by the brenner (h), five points awarded to the defenders for not observing the order of players on the bat /I/, six points awarded to the defenders for a missing batter (j) – if all players are on the bases (hitting to be performed according to the order, the respective player is called from the base).

For the purposes of better control of players on the playing field, each team should have at least one sighted participant (role of the brenner and coordinator of player activities); refereeing should be performed by the teacher, who controls the game, watches time, informs the record keeper about scored points and gives the players instructions to introduce the ball to the game. In the middle of the match the attacking team is awarded points for activities b, c, f, h, while the defending team is awarded points for activities d, e, g, i, j. The result of the match is given by total points after both halves.

29.2.3 Beepbaseball

Beepbaseball is a bat game using acoustic guiding devices. The principle of the game lies in introducing the ball into the game by hitting the ball pitched by a sighted player (in the "sports" form of the game) and running as quickly as possible to one of the two bases provided with a speaker (Figure 44). The speaker is activated when the ball is hit by a neutral observer. Points are scored for timely achievement of the target base. A critical moment is collecting – intercepting the ball by a fielder. This game can also be adjusted using a "collecting basket", to which picked balls are collected. However, this adjustment is not used by advanced players. The presence of sighted players is required for coordinating "intercepting – collecting" the ball (players are instructed) and especially for pitching the ball before hitting (using signals). This activity must be well acquired and the activities of the pitcher and batter must be coordinated. In usual conditions the ball can be hit from a tripod or thrown in.

Figure 44. Beepbaseball field plan

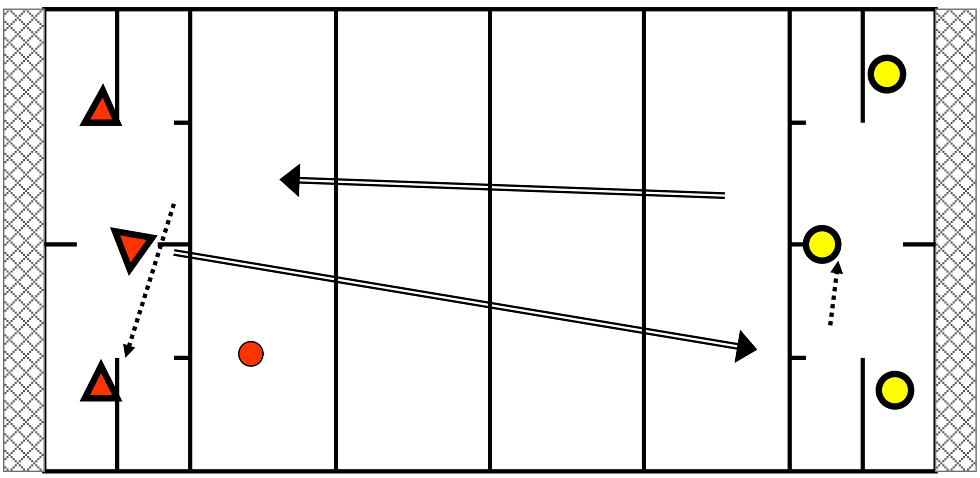


29.3 Goalball

The contemporary type of goalball is a result of long-term formation and reshaping of a physical activity game designed for the purposes of rehabilitation of visually impaired World War II veterans. The game was established in 1946 by Hanz Lorenzen from Austria and Sepp Reindle from Germany. The principle of the game allowed various parallel alternatives varying by region (various forms of "bowls", "rollball", "torball"). After the rules were detailed, goalball was internationally acknowledged and accepted among paralympic sports. Contemporary goalball played at tournaments is a modern, physically demanding collective sports game. A characteristic feature of the game is playing a bell ball over a playing field provided with plastic strips for better player orientation. The task of a trio of players moving in front of their goal is to transport the ball in an allowed way to the opponent's goal and score more goals. The playing field (dimensions 18 × 9m) is divided into six three-meter zones (from the centre line to the end lines – neutral, attacking and defensive zones) defining the players' movement range and way of throwing, i.e. allowed ball trajectory (Figure 45). The ball is shot towards the opponent's goal and must touch at least once the own defensive or attacking zone and at least once any neutral zone. Once the ball is touched by any of the defenders, it must be played to the opponent's half within ten seconds. This period can be used for passing or preparing a shot (one player maximum 2 consecutive shots). Players with eye patches use especially their hearing analysers to identify the direction of the flying ball and use their trunk or extremities to intercept or block the ball and prevent the opposing team from scoring. The goal is located at the end line and its height (1.30m) is another aspect helping players with orientation. Serious violation of rules results in a penalty shot, which can be characterized, according to the type of violation, as shooting the ball at one of the players of the violating team.

Non-transparent eye patches are worn throughout the whole match (2 × 12 minutes net time) and are used to balance any differences in the degree of visual impairment. Any adjustments to the eye patches during the match, breaks and game interruptions must be approved by the referee. The rules of international goalball competitions are approved by the IBSA. For detailed rules see:
http://www.goalball.cz/files/pravidla_2010-2013.pdf, http://goalball.info/about.php

Figure 45. Goalball field plan



Goalball requires team performance; however, individual tasks in fulfilling defensive and attacking roles are crucial (Bláha, 1995, 1996). The opponent is not tackled on a contact basis, the players need to cope with a difficult environment and accomplish a number of tasks associated particularly with the following:

- correct spatial orientation (positions in the defensive zone),
- correct orientation and position with respect to other team mates and opponents,
- assumption of a correct position of the trunk, extremities and head for catching the ball,
- adequate reaction to acoustic and tactile stimuli received through kinesthetic perception,
- sufficiently vigorous and precise ball shooting.

Goalball can be characterized by a small number of applied physical skills, not too difficult physical structures and demanding combinations. The proportion of creative skills seems small. Our survey (Bláha, Valter, & Bechyně, 1998) shows that for specific populations goalball is suitable to increase cardiorespiratory fitness; during this game physical demands vary. From a psychological perspective goalball is characterized by controlled aggressiveness not directly oriented at the opponent, creative tactical thinking and decision making under time pressure in case of adjustment of the rules. The game requires anticipation, the players are motivated not only in terms of their game performance but also team responsibility. Individual attacking activities in goalball are activities that provide conditions for an attacking attempt at the end of which the ball is played in order to score a goal. A significant part of the game is "shooting", which is also one of the most complex physical skills. Shooting in the game is either standing or running, single-handed or double-handed, bottom or side shooting, usually facing the opponent or sideways after a turnaround. The most frequent type of shooting is a technique resembling throwing a ball in bowling. The speed of shooting is quite high, usually between 50 and 60 km/h (Bláha & Sűss, 2001, 2004); therefore, appropriate catching techniques must be used. Regarding the fact that most shots slightly bounce or copy the surface, the most advantageous technique appears a change from the defensive position to a lying position on the side with the upper extremities upwards (the head slightly backwards) and straightened lower extremities. The chances of blocking the ball increase by raising the upper and lower extremity on the upper side of the body and splaying the fingers of the hand.

Goalball is a game for "tough guys". It should be noted that goalball causes numerous shocks, falls, hits, rotational movements etc. that some visually impaired individuals should avoid. Before the game begins it should be checked whether there are any such visually impaired individuals.

29.4 Football for the visually impaired

Football for the visually impaired originated in Spain and soon spread to Brazil and Argentina, who have the most successful teams. Brazil won the first World Championship in 1998, and also in 2000 and 2010. Argentina succeed in 2002 and 2006. In 2004 football was presented at the Paralympic Games.

The rules of this form of football are based on the rules of futsal. Teams consisting of 4 blind (B_1) fielders provided with eye patches and one sighted goalkeeper aim to defeat their opponent by scoring more goals. The playing field for this form of football is enclosed with 1.2m high boards. The dimensions of the playing field are 38–44 m to 18–22 m (the best option is 40 x 20 m). The size of the goal, which is located in the middle of the goal line, is 3 × 2 m. In front of the goal there is a goal area of 5.16 × 2 m. The goal area is located inside the penalty area having the shape of a semi-ellipse whose most distant point is 6m from the base line (and the goal). There is one penalty spot at a distance of six metres and another one eight metres from the centre of the goal. The field is divided into three zones: defensive, neutral and attacking. This zoning is used by the navigators. The game uses an acoustic ball of 60–62 cm in circumference and weight of 510–540 g. The acoustic feature allows the ball to be localized. Playing time is 2 × 25 minutes. The sighted goalkeeper is also the navigator in the defensive zone. In the neutral zone the players are navigated by the coach, in the attacking zone by a navigator behind the opponent's goal. During the game the players are obliged to clearly use the words "**voy**" or "**go"** or another similar word if a player is looking for a ball or is trying to take it away from the opponent. Moving across the playing field must be performed in an upright position with the head up. Violating the rules results in a direct free kick, or penalty kick if a rule is violated inside the penalty area. Breaking the rules is accumulated, after four violations a direct free kick is executed. This form of football is very close to the very popular futsal. The futsal rules can be applied:
http://www.teiresias.muni.cz/download/futsal/IBSA_Futsal_pravidla_hry_2009-2013.pdf

30 /

Engagement of visually impaired and non-disabled persons in games

Ladislav Bláha

The participation of visually impaired individuals in physical activity games played by sighted participants can sometimes be difficult. The application of usual games requires good perception of the environment, players of both teams and the playing object. Various game situations must be resolved quickly, under normal conditions, a sufficient amount of information for player decision making is ensured only by the perception of visual objects. The question is how to prepare an activity that provides visually impaired participants with a supply and evaluation of information and that is sufficiently attractive for blind as well as sighted players. There is a number of circumstances that must be taken into account when preparing a joint programme for both groups:

- Physical activity games usually have a high degree of physical activity in dynamically changing conditions.
- Active participation of visually impaired players is significantly limited by visual control of their movement in a space with respect to team-mates and opponents. In the context of manipulation with the playing object this limiting factor affects the coordination and control of the arm, hand and leg movement (Thiele, 1998).
- Sighted players usually have better tactical experience from previous participation in numerous games and have an opportunity to transfer their experience from other games.
- With a few exceptions, manipulation with the playing object is a worse controlled activity in blind players, which is a common aftermath of their "specific way" of motor learning.
- A number of physical activity games are of an invasive type, i.e. contact between players occurs, which might present an issue with respect to the risk of collision (Sinning, 2001).
- To include a visually impaired individual into a game it is absolutely necessary to consider possible risks of deterioration of the individual's impairment with respect to the spectrum of activities that are to be performed throughout the game.

However, physical activity games are so popular and have a great potential to influence a visually impaired individual in a positive way that it would be a shame not to use them. The attractive aspect is the "result", i.e. possibility to acquire competing experience (resolve competitive relationships) with a degree of cooperative behaviour, i.e. cooperation with team-mates. In such case the visually impaired individual can finally become a valuable and appreciated co-creator of the game. It is not easy to find a way of engaging sighted and visually impaired players in a similar useful way. A possible way is adjustment of existing games, training games or minor physical activity games. A training game can use and develop the potential of a game it is based on. In case of suitable adjustment the rules do not suppress the original idea of the game nor the players themselves, for whom the game has similar attributes as the original game. A certain group of games for visually impaired children were successfully applied by the Germans Bettina Wurzel (1987, 1991) and Silke Sinning (2001). In compliance with some of their thoughts, should a visually impaired player complete a game with a positive perspective of the physical activity, the player should:

- feel positive game-based experience,
- feel that he/she contributed or should have contributed to the results of the game,
- feel own significance of a participant – player in a game,
- feel that a certain level of game skills is required, which can be further cultivated under appropriate conditions,
- feel that the results of the game was also the result of cooperation of all participants involved,
- feel that the game has its rules that prevent the danger of injury following a collision, fall, hit with a playing object, etc.

According to Wurzel (1987, 42), the idea of a game should be that "…a decisive part of a team game performance consisting of sighted and blind individuals should reflect the cooperation between a sighted and blind player". In a practical context this means that decisive moments of point scoring (goals, baskets) should involve the final pass or at least any pass from a blind player. Similar to previously mentioned game activities, fighting for the ball must be sufficiently attractive for sighted players. Also, point scoring must respect the skills of a blind player and involve cooperation between the blind and other players. One of these principles is applied in a game called kreistorball.

30.1 Kreistorball

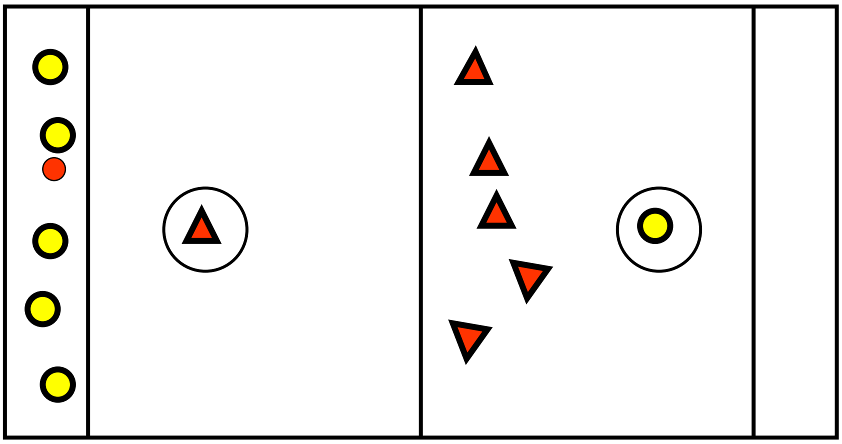
Compared with other games for the visually impaired, kreistorball has the following advantages:

- The course of the game is very quick, which makes it sufficiently attractive for sighted participants.
- This game is very safe as each blind individual has an assigned space for free movement, which prevents dangerous or limiting collisions with other players. From this area, the required game activities are performed.
- Before a point is scored, the blind individual must get hold of the ball. The player's skills are often decisive for the team's success.
- The game allows various combinations of players. It can be played with all sighted participants but also with one or two blind players. In this respect, the game appears suitable for integrated physical education.

Rules

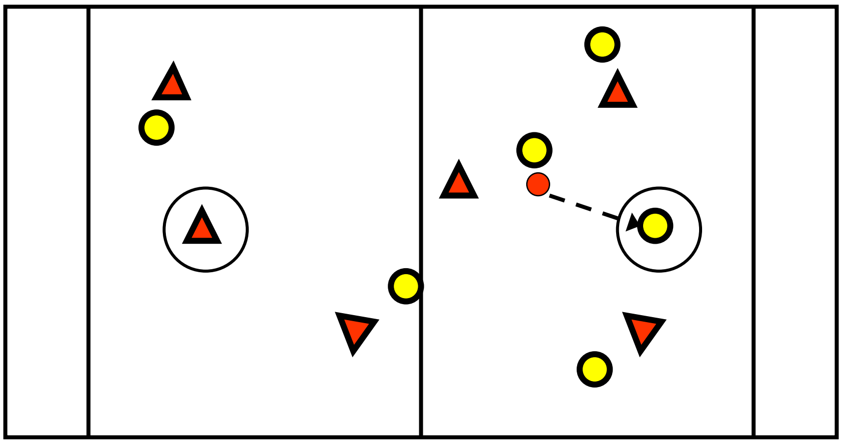
Kreistorball is a collective physical activity game of an invasive type. The aim of the game is to score more points than the opposing team. Points are awarded for a successful and pre-arranged pass from a blind player (player with artificial blindness), who moves in the end zone. The playing field of a rectangular shape has two end zones along the whole base line with a maximum width 1.00m (Figure 46). Visually impaired players move in two circles of approximate radius of 1.5–2m located on both sides in 1/6 of the length of the playing field. This is their exclusive area that cannot be entered by anyone else, visually impaired players must feel safe and have space for own ball manipulation. Each team usually further includes 4–5 sighted players, who move on a playing field with dimensions according to the dominant game skill applied (e.g. basketball dribbling – basketball court, the same applies to floorball, korfball, tchoukball). The teacher's role is to set the rules for player movement on the playing field and ball passing (e.g. korfball or handball rules can be applied) and also the way of ball interception in the end zone.

Figure 46. Kreistorball playing field and basic player positions before the ball is introduced



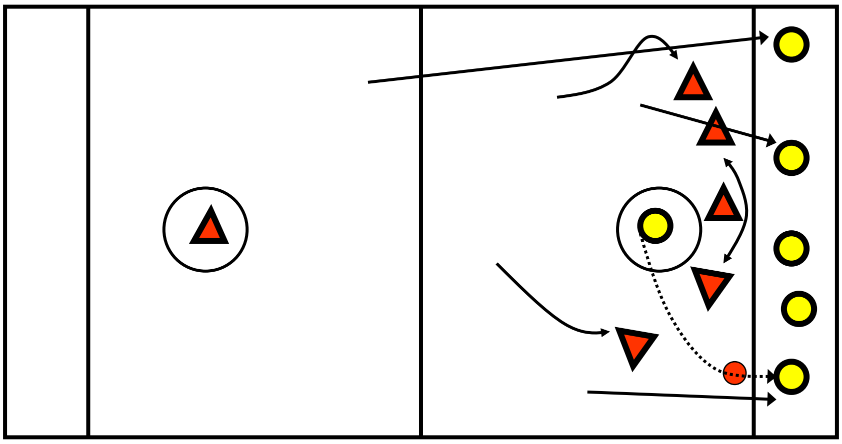
The game starts by playing the ball from the own end zone. If e.g. korfball rules are applied, the players are allowed to pass and catch ball in a way inherent to korfball. In this case for example, players cannot dribble the ball when they move. By making passes, the players try to reach a position from which they could pass (roll) the ball to a blind teammate into the designated circle on the opposite side of the playing field (Figure 47). The defenders move within the playing field and try to prevent the attackers from passing, or to seize the ball. The attackers are attacked by means of direct contact, they cannot touch a held ball, the ball can only be intercepted from the air. If they succeed, they become attackers.

Figure 47. Course of the game – passes in order to transport the ball to a blind team-mate



Once the attackers manage to transport the ball to the designated circle to their blind team-mate (player with artificial blindness), they immediately run into the end zone and use acoustic signals to signify their readiness for intercepting the ball from their passer. The passer identifies these signals and tries to pass so that the ball is not caught by the opponents, who are positioned in front of the end zone and try to catch the ball to prevent the opposing team from scoring (Figure 48). A point is scored when a player in the end zone catches the ball or does something that was previously agreed as a sign of a scored point (e.g. volleyball reception followed by catching).

Figure 48. Point scoring – passing the ball to a player in the end zone



The following should be respected:

- The ball cannot be taken away from a visually impaired player in his territory.
- A ball that is out is played by the team who did not cause the ball to go out.
- A visually impaired player must stay in the designated circle and must not be disturbed by confusing signals from the opposing team (also beyond fair play).
- In case of violating the rules, the ball is given to the opposing team, who play from the spot where the rules were broken.

31 /

Practical application of theoretical knowledge in integrated physical education of visually impaired students

Zbyněk Janečka

31.1 Communication with visually impaired individuals

Not all visually impaired individuals are identical. Sighted people tend to have various ideas and prejudices about the blind. Many people think that all blind individuals have better hearing and touch and that all of them are musical geniuses. It is true that reading the Braille is not simple for a sighted person. However, through regular training a sighted person can read the Braille just as a blind individual. The fact that blind individuals help themselves with hearing is natural. It is because hearing is the only distance sense that a blind individual can use. However, hearing of a blind individual is identical with an non-disabled person. A blind individual is only able to better pick from a number of surrounding noises and sounds. My blind friend says that she is totally tone-deaf. She cannot even hum a simple children's song. This is a proof that not all blind persons have to be musical. The musically talented ones had to learn for many years to become true masters of their instrument just as their sighted counterparts. Only reading from notes presents a considerable problem. Another myth is that the blind are fully dependent on the support of sighted people, that they cannot go to work, cook, do sports, travel, have a family and simply do usual everyday things. The truth is that there are differences among the blind. There are active and publicly known individuals with a lot of hobbies and interests and passive individuals who like to sit at home, do not try to find work, and do not have friends. However, this is a personal choice of each individual. Therefore, not all blind persons can be measured by the same yardstick. In many aspects, the blind are the same as other sighted persons. They just use special aids and means in their life that a sighted person does not need. These include white sticks, guide dogs, special computer programmes for enlarging font size, voice interfaces or a special tactile device called the Brazilian line. How can we help the blind in the best possible way? The answer is respecting their unlikeness and approaching them as even.

Many sighted individuals feel offended if a blind person refuses their help. The blind person is grateful for such help but sometimes it might be regarded as something inappropriate. They might feel as small incompetent children who require assistance all the time. Therefore, do not attempt to do things for the blind. Give them time and opportunity to do things themselves. This is much more significant for them. It is more difficult and time consuming but the blind are given a chance for an independent and full life.

Are there any taboo topics in communication with a blind person?

If we do not have an opportunity to meet blind individuals and speak to them, we might feel it is inappropriate to speak about blindness, visual defects, etc. Our long-lasting experience shows that there are no taboo words or topics in contact with blind individuals. A number of our blind friends have a great sense of humour and are able to make fun of their defect, for example two blind individuals might pass something and say "look at it". It is much more natural to use common expressions than to get entangled in apologies and stammer after using a seemingly inappropriate word. As mentioned above, the blind themselves normally use those words. Expressions such as "I can see", or "I have read" have a different form in the world of the blind but have the same meaning. They are used to acquire information about subjects, people, things etc. in a "tactile, hearing" and other ways. The result is a perception of an object that is identical in both cases.

Everyday situations in communication and considerate behaviour towards the blind

Not all everyday-life stereotypes can be applied in communication with a blind individual. Naturally, a gentle nod or a greeting hand gesture has no effect. A blind person needs to hear you. Therefore, we need to use an appropriate greeting. It is also appropriate to pronounce your name so that the blind person knows who he/she is talking to. Most blind people have a good memory for voices but you can spare them difficult remembering, particularly if you do not meet a specific blind person on a daily basis. Similarly, guessing games such as "who am I" might not be of great interest for the blind. You can also add the blind person's name to assure him that the greeting was dedicated to him/her. If you meet a blind person and want to shake hands, you need to describe what your intention is. Nice to meet you, can we shake hands? The blind person will naturally reach out his/her hand that you will shake. An absence of this verbal comment often leads to bad synchronizing and both parties might be slightly embarrassed as a result. Even such detail might cause a communication problem between you and a blind person. If you need to pass something to a blind person, address him/her with a name and touch him/her to indicate who you are talking to.

It might have happened to you that you were talking to somebody and suddenly he disappeared, while you were still talking. To a blind person it happens quite often, especially in a noisy environment that you departure is unnoticed. And this is very uncomfortable once the blind person realizes you have gone. By notifying that you are going to leave for a while you might prevent very embarrassing situations for both of you. Similarly, it might not be comfortable for a blind person when you think you need to talk all the time so that he/she knows you are still there. Even if well meant, this idle talk might not be comfortable.

What often happens is that a guide accompanying a blind person is considered an interpreter between the blind person and the surrounding world. Sometimes, officials first address the guide and neglect that the negotiated matter concerns the blind person. In a restaurant you might hear: "Sir, will he also have something to eat or drink?" No, blind people are not dangerous. You can talk to them without an interpreter. On the contrary, if you do not wish to humiliate a blind person by treating him as legally incapable, talk to him/her directly.

It might be difficult for a blind person to choose. Whether it be meal in a restaurant or goods is a shop. Here, a blind person will appreciate your help. Try to capture all possible eventualities. If possible, pass all goods to the blind person so that he/she can feel them and have an idea of the materials, sizes, shapes, etc. But be cautious not to impose your idea or taste on the blind person. Try to act as a detached observer. A blind person must decide on his/her own, although it might be difficult at times. You should also be close to the blind person at the moment of paying. Although a blind person usually knows what he/she pays with, your assistance will be appreciated in case of doubt. Also, ask the shop assistant to give the blind person enough time to put money away. Similar to sighted individuals, the blind do not like the stress caused by an avid shop assistant who turns to another customer in the line while you are still putting away your money and goods.

A lot of information is conveyed to a blind person through black print. These are various official documents, statements of account, and personal letters of a various nature. Despite all technical devices, sometimes blind persons need to have these documents read by a sighted individual. If this happens, look at the envelope, read the sender's address and ask the blind person if you are the one to read the document. This particularly applies to financial matters. Therefore, never open an envelope without the blind person's explicit consent. Always read the whole content of the document. Never make a synopsis after your quick read-through. In case of personal letters, first read the author's name, then start reading the content. Never comment on the content unless you have been asked to do so. In this case your role is just to substitute for the blind person's eyes. If you read newspapers or magazines, pick an article that is of interest to the blind person, not to you. You can read such article any time.

A delicate issue is using an unknown toilet. If a blind person needs to go to the toilet, it is easier with a known guide. Such guide knows what needs to be described: position of the bowl, toilet paper, hanger, if a coat needs to be removed. It is also important to check if the toilet is clean. This will be appreciated by both men and women. Also inform the blind person about the location of the sink, soap and towel or a different device for drying hands. With an unknown guide, the blind person should be able to ask for this information. A visit to an unknown toilet is not popular with blind people. This is confirmed by the fact that away from home blind people dramatically limit the intake of fluids to avoid going to the toilet often.

31.2 The blind walking with a guide

Blind people often walk with guides. Below are some practical principles. It is impractical, sometimes dangerous or ridiculous, if we push a blind person like moving a wardrobe or if we move backwards in front of him and pull him/her by the hands. A guide should walk half a step ahead. The blind person holds the guide just above the elbow. Holding with the right or left hand depends on the situation. The guide's walking speed depends on the feelings of the blind person. If the guide feels stiffness or convulsiveness in the movements of the blind person, he needs to slow down because the blind person might not feel safe and comfortable. It is also important to synchronize steps. The guide comments on everything important, such as abrupt changes in direction, kerbs, stairs, pedestrian crossing, etc. In case of a narrow passage the guide should instruct the blind person to hide behind, the guide should move his elbow to the back and peripherally check the blind person's position.

Even walking through a door must be trained. When approaching the door, the guide should lead the blind person to the side where the door is hinged. The guide is at the door handle side. The guide should notify the blind person about entering the door, and should position the blind person's hand on the door handle. Using the free hand, the blind person moves along the guide's arm grasps the door handle and opens the door, the guide enters the door first, the blind person enters second and closes the door.

In case of vertical height changes it is sufficient to inform the blind person about a kerb up or down and to slow down a little to step on or off the kerb. The same applies to staircases. The guide needs to specify however if the staircase is up or down. General information about a "staircase" might cause a collision, if the blind person imagines a staircase leading up while the actual is leading down. We all know the feeling when we expect a step which is in fact not there. On a staircase leading down this could have much more serious consequences than on a staircase leading up. Do not waste your time counting the steps. It is sufficient to comment on the first one and last one, but always well in advance. If the blind person wishes to use the railing on a staircase, describe its position or lead the blind person's hand to the railing. The same applies to escalators. The guide should notify in advance. When entering the escalators the guide should slow down and describe the position of the moving handrail. The blind person finds it, lets it glide in the hand, then grasps it firmly and enters the escalators with the guide. The change in the sloping of the handrail at the end of the escalators informs the blind person about approaching the end, where a timely instruction of the guide allows safe and fluent getting off.

31.3 The blind walking alone

At home a blind person can adjust the environment as required. Out in the street however, a number of unpredictable things can be surprising. There are many ways of dealing with these situations. The easiest way is to walk with a sighted guide. If the guide is permanent and trained to walk with the blind person, it is easy. More difficult situations for a blind person come when he/she is out alone with a white stick and has to ask an unknown untrained guide somewhere out in the street. For such blind person it is then easier to explain to the guide where he/she needs to go, how to link arms and which way of guiding is most comfortable. A significant aspect for a blind person is to reject guiding in a tactful way once the situation is manageable. Many nice and active sighted individuals are willing to accompany a blind person home, even if they were originally going the opposite direction.

If a blind person walks alone with a white stick it might happen even on a known trained route that he/she has to ask for directions if conditions abruptly change. Advice such as "look at the yellow house at the corner" is useless for a blind person. Such person cannot see the end of the street, let alone a yellow house. However, it is not easy to determine what an ideal description for a blind person should look like. Generally speaking, a natural guiding line is made by the walls of house blocks. A handy aspect could be the estimation of distance or time to a target. A sighted individual should understand what a blind person is able to recognize using a white stick, which is the person's 'extended arm'. Information about objects located out of the reach of the white stick is rather confusing for a blind person because these are objects that the stick "cannot see".

Very often, walking of a blind person is associated with a guide dog. Guide dogs are specially trained to help the blind. Guide dogs are provided with a special harness that allows easy control of the dog. If blind persons are with their dogs, they do not like anybody to distract the dogs, whether by giving a titbit or calling their names. A guide dog is on duty and must concentrate on its work as any other person to provide the master as much information as possible to guide him/her safely around all barriers. A blind person with a guide dog does not usually need any help. If so, the person will ask for help. In trying to help a blind person with a guide dog, it is not recommended to take hold of the dog's harness and try to drag both of them to the required place. It is confusing for both the dog and the person. In most cases it is sufficient to walk in front of them; the dog will follow this "guide" at the master's command. A guide dog should be permitted to all places including hospitals and medical facilities. Unfortunately, a blind person's guide dog is not always welcomed in shops, restaurants and other places.

31.4 Help provided to the blind

"Hello, can I help you?" is the most natural way of starting a conversation with a blind person in the street. It is unpleasant for a blind person when a sighted individual comes, thinking that the blind person needs help, and takes the blind person's hand without a prior notice and drags the person where he thinks the person is heading. This might cause a slight shock for the blind person, moreover, the case may be that he/she did not need any help but was just standing and waiting for some friends. Therefore, if we decide to offer help, we need to establish contact first, as mentioned above, and ask whether any need is required and what such help should be like. A blind person must be able to explain to the guide the basic guiding principles, how he is going to hold the guide, and how to give warning of high kerbs, steps or other barriers, which represent a problem for a blind person if he/she is not aware of them.

Very often, blind persons need assistance when using public transport. Everything is even more complicated today by using buttons to open the door of a tram, underground or bus. Getting on is an insurmountable problem for a blind person. Giving a signal to the driver using a walkie-talkie could help but this device is frequently out of operation or the driver has it turned off. A similar problem is to identify the number of an approaching tram or bus. How can we help the blind in the best possible way? Sometimes, it is sufficient to say the following, even if you were not asked: "Number nine is coming". Now the blind person knows whether it is the right bus or tram. And if you continue to wait at the bus stop for your connection, the blind person might tell you which number he/she is waiting for. At the moment of getting on it sometimes happens that there are too many willing guides. One pulls the blind person by the hand, another one pushes from the back, another one offers support from the side. These helpers rather carry the blind person to the bus or tram rather than letting him/her get on. All the person needs is a simple piece of advice. It is sufficient to describe or place the blind person's hand on the door handle and thus provide a fixed point, which does not solve everything but provides reliable orientation. A blind person is able to walk independently and knows how to use public transport. It is advisable to inform a blind person about a free seat and offer the seat. Excessive endeavour of several assistants who, with good intentions, push and turn the blind person and give perfect advice, might not lead to a desirable result. It is much easier to lead the blind person to a free seat and place his/her hand on the rest of the seat. The blind person will soon know where he/she is and what he/she needs to do. The same applies to sitting at a table. In such case, it is advisable to place the blind person's hand on the edge of the table for better orientation and assessment of the distance between the chair and the table. In case of an armchair with side rests the blind person's hand should be placed on the back rest and a warning should be given about the side rests.

If travelling by passenger car, guide the blind person to an open door where he/she is supposed to sit, place his/her hand on the door frame and the other hand on the car roof. Again, this gives clear orientation points. The blind person will manage the rest unassisted. It must be clear however who is going to close the door.

In all these situations help yourself with descriptions. It is important to understand that information such as "there is a free seat, you have a glass on the table" and pointing in these directions is not very practical for blind people. You should rather say: "There is a chair half a metre in front of you, there is a plate on the table in front of you not far from the edge of the table and about ten centimetres to the right of the plate there is a glass with a drink." By tapping these objects you help the blind person locate them using sound.

What happens very often is that a blind person needs help with looking for his/her belongings in a changing room after social, sports or other occasions. There might be a problem after asking "What does your coat (luggage) look like?" because blind people (especially men) do not know exactly what their clothing looks like and what colour it is. I have a story that happened years ago. After a swimming course for the blind we, still in our swimming suits, helped the blind get dressed. When they left I could not find my shirt. I looked everywhere and asked everybody but in vain. I said something about dishonesty and left. The whole mystery was resolved by the grandmother of one of the clients, who found the shirt in the laundry basket. After a while they found out that I was missing a shirt. They returned the shirt neatly washed and ironed. In many of our meetings we laughed at this story.

How to prevent situations like these? Leave a blind person to put personal belongings to a place he/she easily recognizes. If we put their things away, they will not be able to find them

31.5 System and order

Most sighted people, except neat freaks, do not fuss about system and order in things. If they throw away a thing they look and easily find it. Blind people have a problem with this looking. If they are to care for themselves, their household must be in order and each thing must have its place. It might be difficult with things used commonly as this system also needs to be respected by sighted members of the family. The order of locating things should be decided by the blind person because for him/her, searching for things is the most difficult. Rules about doors, drawers, chairs and other things must be thoroughly observed. Doors must be completely closed or opened. A semi-opened door might cause a painful experience. Wardrobes and drawers must always be closed. Chairs must be consistently positioned right at the table. Never leave any objects on the floor and in places where the blind person moves.

And one more important thing. When you arrange a meeting with a blind person, always be punctual. Arrive earlier so that it is you who waits. Do not let blind people waiting. Even a few minutes might be ages for them and in this way unnecessary fear and anxiety are caused.

31.6 The Visual impairment

So far we have spoken about blind people. It is clear why. They are in the most difficult situation. However, blind individuals have a number of similar problems. Moreover, from a statistical viewpoint, there are many more blind people than completely blind people. Many blind individuals also use a white stick, although they have limited vision. Most principles specified for the blind also apply to the completely blind. However, there are many completely blind individuals who underestimate their visual impairment and reject the white stick for various reasons. Then it is difficult to offer any help because it is very difficult to distinguish that a blind person needs help. This becomes apparent only in case of an accident. And that is obviously late. Behaviour of a blind person can be influenced by a number of circumstances. Under certain illumination, conditions and contrast a blind person might ask for help. At times they will manage themselves. It is not because somebody would like to make fun. Perhaps today's conditions allow better sight than yesterday and the same situation can be managed unassisted.

References

Abu-Omar, K., & Rütten, A. (2008). Relation of leisure time, occupational, domestic, and commuting physical activity to health indicators in Europe. Preventive Medicine, 47(3), 319-323.

Abu-Omar, K., Rütten, A., & Robine, J., M. (2004). Self-rated health and physical activity in the European Union. Sozial- und Präventivmedizin*, 49*, 235-242.

Adelson, E., & Fraiberg, S. (1974). Gross motor development in infants blind from birth. *Child development, 45,* 114-116.

Ainsworth, B. E., Haskell, W. L., Whitt, M. C., Irwin, M. L., Swartz, A. N., Strath, S. S., O´Brien, W. L., Bassett, D. R., Schmitz, K. H., Emplaincourt, P. O., Jacobs, D. R., & Leon, A. S. (2000). Compendium of physical activities: An update of activity codes and MET intensities. *Medicine and Science in Sports and Exercise, 33*(9), 498-516.

Akseliuk, M. (1996). *Power therapy*. Seattle, WA: Hogrefe & Huber

Autrata, R. & Vančurová, J. (2002). *Nauka o zraku*. Brno: IDVPZ.

[Online] https://www.ausport.gov.au/disability

Australian Sport Commission (2012). *Adapting and modifying for people with disability*.

Bauman, A. E., Sallis, J. F., Dzewaltowski, D. A., & Owen, N. (2002). Toward a better understanding of the influences on physical activity. *American Journal of Preventive Medicine, 23*(2), 5-14.

Bauman, A. E., Bull, F., Chey, T., Craig, C. L., Ainsworth, B. E., Sallis, J. F., Bowles, H. R., Hagstromer, M., Sjostrom, M., Pratt, M., Mitáš, J., & Frömel, K. (2009). The International prevalence study on physical activity: Results from 20 countries. *International Journal of Behavioral Nutrition and Physical Activity*. Retrieved from http://www.ijbnpa.org/ content/6/1/21

Bečičková, S. (1994). *Mapování pohybových schopností zrakově postižených žáků mladšího školního věku*. Diplomová práce, Univerzita Palackého, Fakulta tělesné kultury, Olomouc.

Belej, M. (1984). *Základy teórie motorického učenia*. Košice: Univerzita P. J. Šafárika.

Belej, M. (1992). Motorické učenie a ontogenetický vývin. *Acta Universitatis Palackianae Olomucensis. Gymnica, 22,* 285-287.

Belej, M. (1994). *Motorické učenie*. Bratislava: PVT.

Bergl, K. (2001). *Pohybové a sportovní aktivity vhodné pro zrakově postižené.* Diplomová práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Bietz, J. (2001). Wenn Blinde uns die Augen öffnen. *Sportunterricht*, *50*(6), 172-176.

Bietz, J. (2002). *Bewegungsvorstellung und Blindheit*. Schorndorf: Karl Hofmann Verlag.

Bláha, L. (1995). Goalball – hra pro zrakově postižené. In L. Čepička (Ed.), *Sborník konference „Hra v životě člověka"* (pp. 97-102). Plzeň: Západočeská univerzita, Pedagogická fakulta.

Bláha, L. (1996). Goalball – hra jen pro zrakově handicapované? *Tělesná výchova a sport mládeže, 62*(3)*,* 33-37.

Bláha, L. Valter, L., Pyšný, L., & Macháček, P. (1999). Měření jednoduché reakční doby na zvukový podnět u zrakově handicapovaných dětí hrajících goalball (komparativní studie). In F. Zahálka (Ed.), *Pohybové aktivity jako součást životního stylu pro příští tisíciletí. Mezinárodní studentská vědecká konference* (pp. 14-17). Praha: Univerzita Karlova, Fakulta tělesné výchovy a sportu.

Bláha, L. & Valter, L. (2000). Sledování některých efektů provozování goalballu u žáků škol pro zrakově postižené. In L. Čepička (Ed.), *Games in the programs of physical education and sport training processes. Proceedings of papers from 4th International scientific conference. Plzeň 25. – 27. 11. 1999* (pp. 138-141). Plzeň: Západočeská univerzita, Pedagogická fakulta.

Bláha, L. Valter, L., Pyšný, L., & Macháček, P. (2001). Ověřování testu diagnostikujícího rychlost reakce na zvukový podnět a jeho aplikace u zrakově postižených dětí. In L. Pyšný & L. Bláha (Eds.), *Pohyb a výchova – sborník referátů z vědeckého semináře s mezinárodní účastí* (pp. 6-11). Ústí nad Labem: Univerzita J. E. Purkyně, Pedagogická fakulta.

Bláha, L., Valter, L., & Bechyně, Z. (1998). Sledování některých ukazatelů vztahujících se k zatížení zrakově handicapovaných hráčů v goalballu. In B. Komeštík (Ed.), *Optimální působení tělesné zátěže: Sborník příspěvků I. ročníku vědecké konference – Hradec Králové, 10. – 11. 9. 1997* (pp. 50-54). Hradec Králové: Vysoká škola pedagogická.

Bláha, L., Valter, L., & Král, T. (1998). Stanovení jednoduché reakční doby na zvukový podnět u zrakově handicapovaných dětí hrajících goalball. In M. Janura (Ed.), *Celostátní studentská vědecká konference s mezinárodní účastí v oboru kinantropologie: Sborník referátů* (pp. 13-15). Olomouc: Univerzita Palackého, Fakulta tělesné kultury.

Bláha, L., & Pyšný L. (2000). *Provozování pohybových aktivit zrakově handicapovanou populací.* Ústí nad Labem: Universita J. E. Purkyně.

Bláha, L. (2001). *Vybrané efekty působení goalballu u zrakově postižených dětí.* Disertační

práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Bláha, L., & Süss, V. (2001). Sledování vybraných parametrů střelby u hráčů goalballu. In P. Tilinger, A. Rychtecký, & T. Perič (Eds.), *Sborník příspěvků národní konference. Sport v České republice na přelomu století* (pp. 368-371). Praha: Univerzita Karlova, Fakulta tělesné výchovy a sportu.

Bláha, L. (2002). Limity využití pálkovacích her u zrakově postižených. *Tělesná výchova a sport mládeže, 68*(8)*,* 41-44.

Bláha, L. (2003a). Příklady pálkovacích her pro zrakově postižené. *Tělesná výchova a sport*

mládeže, 69(2)*,* 12-19.

Bláha, L. (2003b). Vybrané aspekty provozování pohybových her u zrakově postižených. In L. Čepička (Ed.), *Games in the programs of physical education and sport trainig processes* (pp. 171-175). Plzeň: Západočeská univerzita, Pedagogická fakulta.

Bláha, L., & Süss, V. (2004). Sledování vybraných charakteristik střelby u hráčů goalballu. In J. Šimonek (Ed.), *Sborník mezinárodní konference Tělesná výchova a šport na univerzitách po vstupe do EÚ. Nitra 23. 9. 2004* (pp. 38-44) Nitra: Univerzita Konštantína Filozofa, Pedagogická fakulta.

Bláha, L. (2006). Možnosti začlenění zrakově postiženého jedince do provozování pohybových her. In L. Čepička (Ed.), *Proceeding of papers on games in the programs of physical education and sport training processes* (pp. 238-243). Plzeň: Západočeská univerzita, Pedagogická fakulta.

Bláha, L., & Machačová, V. (2007). Locomotor possibilities for visually handicapped inhabitans in region of Ústí nad Labem. *Acta Universitatis Palackianae Olomucensis. Gymnica, 37*(2)*,* 27.

Bláha, L., Pálková H., Ženíšková, A., & Machačová, V. (2009). Issues of the visually handicapped citizens´ attitude to physical activities. *Acta Universitatis Matthiae Belii. Physical Education and Sport, 1*(1)*,* 26-38.

Bláha, L. Balkó, Š, Drahovzalová, L., Bartůňková, M., Kloudová, L., & Ženíšková, A. (2009a). Chůze zrakově postižených spoluobčanů jako sledovaný prvek zdravého uplatňování pohybových aktivit. In M. Blahutková (Ed.), *Sport a kvalita života 2009. Sborník příspěvků mezinárodní konference konané 5. – 6. 11. 2009 v Brně* (10 p.) Brno: Masarykova univerzita, Fakulta sportovních studií.

Bláha, L., Janečka, Z., & Herink, R. (2010). Vybrané problémové okruhy integrace dětí se zrakovým postižením do školní tělesné výchovy. *Aplikované pohybové aktivity v teorii a praxi, 1*(2), 40-47.

Bláha, L. (2010a). Application of chosen outdoor physical activities of the visually handicapped people. *Journal of outdoor activities, 4*(1), 5-23.

Bláha, L. (2010b). Námět k začlenění jedince se zrakovým nebo jiným zdravotním postižením do pohybových her. *Tělesná výchova a sport mládeže*, *76*(2), 20-25.

Bláha, L. (2010c). Principy a náměty pro aplikaci vybraných pohybových her s účastníky se zrakovým nebo jiným zdravotním postižením. *Aplikované pohybové aktivity v teorii a praxi, 1*(1), 17-20.

Bláha, L. (2010d). *Pohybové aktivity a zrakové postižení.* Banská Bystrica: Univerzita Mateja Bela v Banskej Bystrici, Pedagogická fakulta.

Bláha, L. (2011). *Vybrané studie k uplatňování pohybových aktivit u osob se zrakovým postižením.* Ústí nad Labem: Univerzita J. E. Purkyně.

Blessing, D. L., McCrimmon, D., Stovall, J., & Williford, H. N. (1993).The effects of regular exercise programs for visually impaired and sighted children.*Journal of Visual Impairment & Blindness, 87*, 50-52.

Bláha, L. (2011). *Vybrané studie k uplatňování pohybových aktivit u osob se zrakovým postižením*. [Selected studies about implementation of physical activities of persons with visual impairments]. Ústí nad Labem: Univerzita J. E. Purkyně v Ústí nad Labem.

Block, M. (1994*). A teacher's guide to including students with disabilities in regular physical education.* Baltimore, MD: Paul H. Brookes.

Block, M. (2007). *A teacher's guide to including students with disabilities in general physical education (4th ed.).* Maryland: Paul H. Brooks Publishing Co.

Bolach, E., & Bolach, B. (2001). Zaklady gry w pilke noźna dla osob niewidomych (futsol). In S. Kowalik & M. Górny (Eds.), *Dziecko niepelnosprawne – aktywność ruchowa – dzia-lalność szkoly* (pp. 194-198). Poznaň: Akademia wychowania fizycznego.

Bruce, I., Harrow, J., & Obolenskaya, P. (2007). Blind and partially sighted people´s perceptions of their inclusion by family and friends. *British Journal of Visual Impairment, 25*(1), 68-85.

Bunc, V., Segeťová, J., Šafaříková, L., & Hrčic, J. (1997a). Hodnocení celodenního pohybového režimu u zrakově handicapovaných dětí. In P. Tilinger & T. Perič (Eds.), *Tělesná výchova a sport na přelomu století* (pp. 286-289). Praha: Univerzita Karlova.

Bunc, V., Segeťová, J., Šafaříková, L., & Horčic, J. (1997b). The assessment of whole day physical activity in visually handicapped children. *Acta Universitatis Carolinae Kinanthropologica, 33*(2), 61-65.

Bunc, V., Šafaříková, L., & Segeťová, J. (1997). A simple assessment of aerobic fitness in visually handicapped children. *Acta Universitatis Carolinae Kinanthropologica, 33*(1), 69-74.

Blash, B. et al. (1997). *Foundation of orientation and mobility*. New York: AFB Press.

Brindová, D., Kmeť, M., & Ješina, O. (2013). Sociálne determinanty zdravia školákov so zdravotným postihnutím. [Social determinants of health among pupils with disabilities]. *Studia sportiva*, 7(*3*), 67–75.

Cattaneo, Z., Vecchi, T., Cornoldi, C., Mammarella, I., Bonino, D., Ricciardi, E., & Pietrini, P. (2008). Imagery and spatial processes in blindness and visual impairment. *Neuroscience and Biobehavioral Reviews, 32,* 1346-1360.

Cerin, E., Saelens, B. E., Sallis, J. F., & Frank, L. D. (2006). Neighborhood environment walkability scale: Validity and development of a short form. *Medicine and Science in Sports and Exercise*, *38*(9),1682-1691.

Craig, C. L., Marshall, A. L., Sjöström, M., Bauman, A. E., Booth, M. L., Ainsworth, B. E., Pratt, M., Ekelund, U., Yngve, A., Sallis, J. F., & Oja, P. (2003). International physical activity questionnaire: 12 – country reliability and validity. *Medicine and Science in Sports and Exercise, 35*(8), 1381-1395.

Cratty, B. J. (1971).*Movement and spatial awareness in blind children and youth*. Springfield, IL: Charles C. Thomas Publisher.

Čálek, O. (1984). *Raný vývoj dítěte nevidomého od narození*. Praha: Univerzita Karlova.

Čálek, O. (1985). *Výchova dospívající mládeže k samostatnosti.* Praha: Ústřední výbor invalidů.

Čálek, O. (1986). *Vývoj osobnosti zrakově těžce postižených*. Praha: Státní pedagogické nakladatelství.

Čelikovský, S. et al. (1979). *Antropomotorika pro studující tělesnou výchovu.* Praha: Státní pedagogické nakladatelství.

Čížková, V. & Pisařovicová, J. (1954). Klinická endokrinologie dětského věku. In V. Příhoda, *Ontogeneze lidské psychiky.* Praha: Státní pedagogické nakladatelství.

Daďová, K., Čichoň, R., Švarcová, J., & Potměšil, J. (2008). *Klasifikace pro výkonnostní sport zdravotně postižených.* Praha: Univerzita Karlova.

Davis, R. W. (2002). *Inclusion through sports.* Champaign, IL: Human Kinetics.

De Pauw, K. P., & Gavron, S. J. (1995). *Disability and sport.* Champaign, IL: Human Kinetics.

Dědičová, K. (2003). *Pálkovací hry pro zrakově postižené.* Diplomová práce, Univerzita J. E. Purkyně, Pedagogická fakulta, Ústí nad Labem.

Dobrý, L. (1997). Stadia pohybového učení v praxi I. kognitivní stadium. *Tělesná výchova a sport mládeže, 63*(6), 2-4.

Došková, J. (2009). *Sledování pohybových aktivit vybraných zrakově handicapovaných žáků.* Diplomová práce, Univerzita J. E. Purkyně, Pedagogická fakulta, Ústí nad Labem.

Drahovzalová, L. (2009). *Monitorování pohybových aktivit a inaktivit zrakově postižených jedinců v Ústeckém kraji.* Diplomová práce, Univerzita J. E. Purkyně, Pedagogická fakulta, Ústí nad Labem.

Dufková, J. (2005). *Sporty v přírodě zrakově postižených.* Bakalářská práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Dvořák, T. (2006). *Posturální a kineziologické aspekty běhu na lyžích nevidomých.* Bakalářská práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Dvořáková, T. (2001). *Komunikace trasera a zrakově postiženého sportovce při běhu na lyžích.* Diplomová práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Dovalil, J. et al. (1982). *Malá encyklopedie sportovního tréninku.* Praha: Olympia.

Dziedzic, J. (1969). *Usprawnianie fizyczne niewidomych na turnusach rehabilitacyjno-leczniczych.* Poznań: Wyžsza Szkoła Wychowania Fizycznego.

Edelsberger, L. (Ed.), *Defektologický slovník.* Jinočany: Nakladatelství H & H.

EUROFIT-European Test of physical fitness. Rome: CouncilofEurope, Committee for Developmentof Sport.

Elliot, D., & Khan, M. (Eds.). (2010). *Vision and goal-directed movement.* Champaign, IL: Human Kinetics.

Evropská charta sportu pro všechny: zdravotně postižené osoby. (1996). Praha: Ministerstvo školství, mládeže a tělovýchovy.

Fialová, M. (2006). *Běh na lyžích nevidomých.* Bakalářská práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Filipová, G., Keblová, A., Pecka, D., Tupý, J., & Vaněk, P. (1995). *Učební osnovy základní školy pro nevidomé. Tělesná výchova II. stupeň.* Praha: Ministerstvo školství, mládeže a tělovýchovy.

Finková, I. (2011). *Základní didaktické problémy plavecké výuky osob se zrakovým postižením (součástí je legislativa k plavecké výuce na speciálních školách pro zrakově postižené).* Bakalářská práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Fafl, B. (1970). *Jak vidí vaše dítě?* Praha: Avicenum.

Flenerová, H. (1985). *Kapitoly z tyflopedie.* Praha: Univerzita Karlova.

Fraiberg, S. et al. (1977). *Theinsights for the blind:* comparative studies of blind and sighted infants. New York: Basic book inc. publisher.

Friedrich, G., & Schwier, J. (1987). Sportspiele für Blinde und Sehbehinderte.*Motorik – Zeitschrift für Motopedagogik und Mototherapie, 10*(3), 101-110.

Friedrich, G., Hildebrandt, U., Knauff, J., & Kruf, A. (1986). Spiele für sehgeschädigte Schüler. Bericht von einem Marburger Projekt. *Motorik – Zeitschrift für Motopädagogik und Mototherapie, 9*(1), 20-34.

Frková, K. (2006). *Uplatňování pohybových aktivit u zrakově handicapované populace Severočeského regionu.* Diplomová práce, Univerzita J. E. Purkyně, Pedagogická fakulta, Ústí nad Labem.

Frömel, K., Novosad, J., & Svozil, Z. (1999). *Pohybová aktivita a sportovní zájmy mládeže.* Olomouc: Univerzita Palackého.

Frömel, K., Bauman, A., Bláha, L., Feltlová, D., Fojtík, I., Hájek, J., Horák, S., Klobouk, T., Kudláček, V., Ludva, P., Lukavská, M., Mitáš, J., Neuls, F., Nykodým, J., Pelclová, J., Ryba, J., Řepka, E., Sigmund, E., Sigmundová, D., Suchomel, A., & Šebrle, Z.(2006). Intenzita a objem pohybové aktivity 15-69leté populace České republiky. Česká kinantropologie, 10(1), 13-27.

Graf, C., Koch, B., Kretschmann-Kandel, E., Falkowski, G., Christ, H., Coburger, S., Lehmacher, W., Bjarnason-Wehrens, B., Platen, P., Tokarski, W., Predel, H. G., & Dordel, S. (2004). Correlation between BMI, leisure habits and motor abilities in childhood (CHILT-Project). *International Journal of Obesity*, *28*, 22-26.

Guthold, R., Ono, T., Strong, K., Chatterji, S., & Morabia, A. (2008). Worldwide variability in physical inactivity. *American Journal of Preventive Medicine,34*(6), 486-494.

Haegele, J. A., Zhu, X., Lee, J. & Lieberman, L. J. (2016). Physical activity for adults with visual impairments: Impact of socio-demographic factors. European Journal of Adapted Physical Activity, 9(1), 3-14.

Hájek, Z. (2008). *Možnosti volnočasových aktivit zrakově postižené mládeže.* Závěrečná práce, Univerzita Karlova, Pedagogická fakulta, Praha.

Hebbelinck, R., Shephard, R. J., Vermeer, A., & Davis, W. E. (1995). *Physical and motor development in mental retardation*. Basel: Karger.

Hendl, J. (1999). Úvod do kvalitativního výzkumu. Praha: Karolinum.

Herwig, H. (2001). Tischtennis mit Sehbehinderten. *Sportunterricht*, *Lehrhilfen für den Sportunterricht, 50*(1), 6-10.

Hirtz, P. et al. (2007). *Phänomene der motorischen Entwicklung des Menschen*. Schorndorf: Hofmann Verlag.

Hodaň, B. (1992). Úvod do teorie tělesné kultury. Olomouc: Univerzita Palackého.

Herwig, H. (2001). Tischtennis mit Sehbehinderten. *Sportunterricht*, *Lehrhilfen für den Sportunterricht, 50*(1), 6-10.

Hirtz, P. et al. (2007). *Phänomene der motorischen Entwicklung des Menschen*. Schorndorf: Hofmann Verlag.

Holubová, E. (2000). *Zvláštnosti adaptace ve vodním prostředí dětí zrakově postižených.* Bakalářská práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Hopkins, W. G., Gaeta, H., Thomas, A. C., & Hill, P. McN. (1987).Physical fitness of blind and sighted children.*European Journal of Applied Physiology, 56*, 69-73.

Hornová, M. (1999). *Kuželkářský sport zrakově postižených.* Bakalářská práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Houwen, S. Hartman, E. & Visscher, C. (2009). Physical activity and motor skills in children with and without visual imairments. *Medicine and Science in Sports and Exercise, 41*(1), 103-109.

Hošek, V., & Rychtecký, A. (1975). *Motorické učení*. Praha: Státní pedagogické nakladatelství.

Hutzler, Y., & Sherrill, C. (1999). Disability, physical activity, psychological well being and empowerment: A life span perspective. In R. Lidor & M. Bar-Eli (Eds.), *Sport psychology: Linking theory and practice* (pp. 281–300). Morgantown, WV: Fitness Information Technology.

Charousek, Z. (2004). *Vybrané aspekty provozování kuželek a bowlingu u zrakově postižených jedinců.* Diplomová práce, Univerzita J. E. Purkyně, Pedagogická fakulta, Ústí nad Labem.

Choutka, M., Brklová, D., & Votík, J. (1999). *Motorické učení v tělovýchovné a sportovní praxi*. Plzeň: Západočeská univerzita.

Chytráčková, J., & Čelikovský, S. (1988). Svalová činnost převážně obratnostního charakteru. In M. Máček & J. Vávra (Eds.), *Fyziologie a patofyziologie tělesné zátěže* (pp. 55-56). Praha: Avicenum.

International Blind Sport Federation. (2010). *IBSA medical classification.* Retrieved from http://www.ibsa.es/docinteres/HTM/MedicalClassification.htm

Janečka, Z. & Górny, M. (1998). Methodical comments on a ski training of the blind. In H. Válková & R. Vute (Eds.), *Adapted physical activities in central Europe* (pp. 119-121). Olomouc: Palacký University.

Janečka, Z. (1998). Prostorová orientace hrou. In R. Vachule (Ed.), *Sport a rekreační aktivity zdravotně postižených dětí* (pp. 179-184). Praha: Asociace rodičů a přátel zdravotně postižených dětí v České republice.

Janečka, Z. (1998). Plavání nevidomých. In R.Vachule (Ed.), *Sport a rekreační aktivity zdravotně postižených dětí* (pp. 184-198). Praha: Asociace rodičů a přátel zdravotně postižených dětí v České republice.

Janečka, Z. (1999). Charakteristika psychických procesů, somatických a motorických ukazatelů zrakově postižených. In H. Válková & Z. Hanelová (Eds.), *Pohyb a zdraví: sborník z 2. mezinárodní konference* (pp. 249-252). Olomouc: Univerzita Palackého.

Janečka, Z. (1999). Motor competence of 7–10-year old children with visual disabilities. *Acta Universitatis Palacianae Olomucensis. Gymnica, 29(2),* 47-53.

Janečka, Z. (1999). Wady wzroku – wskazania i pzreciwskazania w wychowaniu fizycznym. In *Sport dla osób niepełnosprawnych osoby niepełnosprawne dla sportu.* Poznań:Akademia wychowania fizycznego.

Janečka, Z. (2000). The concept of motor competence investigation in visual disabled children aged 7-10. In R, Pišot (Ed.), *Otrok v gibaniu – A child in motion* (pp. 5002-508). Ljubljana: Pedagoška fakulteta Ljubljana.

Janečka, Z. (2001). Zrakové vady a pohybové aktivity. In H. Válková & Z. Hanelová (Eds.), *Pohyb a zdraví:sborník z 2. mezinárodní konference* (pp. 211-213). Olomouc: Univerzita Palackého.

Janečka, Z. (2001). The motor competence of visually disabled cildren in basic shool. In M. Dinold, G. Gerber, & T. Reinelt (Eds.), *13th international symposium / 5th european conferenceon adapted physical aktivity* (pp. 142-148). Wien: Manz Verlag Schulbuch.

Janečka, Z. (2002). Motorická kompetence zrakově postižených dětí v prepubescenci a pubescenci. In J. Jesenský (Ed.), *Edukace a rehabilitace zrakově postižených na prahu nového milénia* (pp. 111-113). Hradec Králové: Gaudeamus.

Janečka, Z. (2003). Ontogeneze jinak zrakově disponovaných dětí do tří let. In *Zdravotně postižení – programy pro 21* (pp. 124-127). Hradec Králové: Gaudeamus.

Janečka, Z., Kudláček, M., & Válková, H. (2003). Sport socialization with visual impairment in prebubescent and pubescent age. *Acta Universitatis Palackianae Olomucensis. Gymnica, 33(2)*, 7-10.

Janečka, Z. (2003). Motorická kompetence zrakově postižených prepubescentů a pubescentů. In L. Dobrý & O. Souček (Eds.), *Pedagogická kinantropologie 2003.*

Janečka, Z., Štěrbová, D., & Kudláček. M. (2008). Psychomotorický vývoj a vývoj motorických kompetencí kongenitálně nevidomého dítěte do 36 měsíců věku. *Tělesná kultura, 31*(1), 20-29.

Janečka, Z., & Bláha, L. (2013). *Motorické kompetence osob se zrakovým postižením*. [Motoric competence of persos with visual impairments]. Olomouc: UP v Olomouci.

Jansa, P., Dovalil, J. et al. (2007). *Sportovní příprava*. Praha: Q-art.

Jansa, P., Kocourek, J., Votruba, J., & Dašková, B. (2005). *Sport a pohybové aktivity v životě české populace.* Praha: Univerzita Karlova, Fakulta tělesné výchovy a sportu.

Jeřábek, J. (1985). *Ophtalmologie pro pedagogy* [Učební texty]. Praha: Státní pedagogické nakladatelství.

Jesenský, J. (2002). Vývoj, stav a strategie rozvoje v referenčním poli typologie. In J. Jesenský et al. (Eds.), *Edukace a rehabilitace zrakově postižených na prahu nového milénia* (pp. 14-34). Hradec Králové: Gaudeamus.

Jesenský, J. (2002). *Základy komprehenzivní tyflopedie I. Přehled systému komprehenzivní tyflopedie*. Hradec Králové: Gaudeamus.

Jesenský, J. (2003). *Základy komprehenzivní tyflopedie II. Kategorie komprehenzivní tyflopedie.* Hradec Králové: Gaudeamus.

Ješina, O., & Kudláček, M. (2009). Aplikované pohybové aktivity v integrované školní tělesné výchově I. *Tělesná výchova a sport mládeže, 75*(2), 15-19.

Kábele, F. (1976). *Tělesná výchova mládeže vyžadující zvláštní péči.* Praha: Státní pedagogické nakladatelství.

Kalman, M. (2012). Národní pohybové doporučení. [National Recommendation about Physical Activity] Retrieved from http://dataplan.info/img_upload/f96fc5d7def29509aeffc6784e61f65b/kalman_prezentace_olomouc.pdf

Kalman, M., Sigmund, E., Sigmundová, D., Hamřík, Z., Beneš, L., Csémy, L. (2011). *Národní zpráva o zdraví a životním stylu dětí a školáků.* [National Report on Health and Lifestyle of Children and Students]. Olomouc: Univerzita Palackého v Olomouci.

Kalman, M., Hamřík, Z., & Ješina, O. (2011). Podpora pohybových aktivit v kontextu APA. In: O. Ješina, Z. Hamřík, et al. *Podpora aplikovaných pohybových aktivit v kontextu volného času* (pp. 11-13) [Support of adapted physical activities in leisure time]. Olomouc: UP v Olomouci.

Keblová, A. (1996). *Integrované vzdělávání dětí se zrakovým postižením.* Praha: Septima.

Keblová, A. (2001). *Zrakově postižené dítě.* Praha: Septima.

Kemper, R. (1993). *Sensorik und Motorik. Experimentelle Untersuchungen zur akustischen Raumorientierung und Gesamtkörperkoordination mit Blinden und blindübend Sehenden.* Köln: Sport und Buch Strauss.

Kemper, R. (1995). Relationship between acoustic spatial orientation and body coordination in blind persons. In B. Svoboda & A. Rychtecky (Eds.), *Physical activity for life: East and west, south and north* (pp. 453-457). Aachen: Meyer & Meyer Verlag.

Kittlerová, Š. (2005). *Aplikace koloběhu pro zrakově postižené.* Diplomová práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Klavina, A.(2008). Using peer-mediated instructions for students with severe and multiple disabilities in physical education: A multiple case study. *European Journal of Adapted Physical Activity, 1(2),* 7–19.

Kohoutek, M., Hendl, J., Véle, F., & Hirtz, P. (2005).*Koordinanční schopnosti dětí. Výsledky čtyřletého longitudinálního sledování dětí ve věku 8 – 11 let.* Praha: Univerzita Karlova, Fakulta tělesné výchovy a sportu.

Kowalik, S. & Janečka, Z. (1998). Użytecność koncepcji jakości życia dla procesu rehabilitacji osób niepełnosprawnych. In S. Kowalik (Ed.), *Rozwiązywanie problemów życiowych mieszkańców domow opieki społecznej* (pp. 9-29). Kościan: AGA.

Kolín, J. (1989*). Oční lékařství.* Praha: Univerzita Karlova.

Kozlík, J., Šabat, K, & Kittler, J. (1968). *Studium vývoje tělesné zdatnosti dětí ve věku 6–11 let.* Praha: Státní pedagogické nakladatelství.

Krabec, D. (1987). *Testová baterie Eurofit ověřovací studie vybraných testů u české školní mládeže.* Diplomová práce, Univerzita Palackého, Fakulta tělesné kultury, Olomouc.

Králíček, P.: Úvod do speciální neurofyziologie. Praha: Univerzita Karlova v Praze. Karolinum.

Kraus, H. et al. (1997). *Kompendium očního lékařství.* Praha: Grada.

Koluchová, J. (1989). *Přehled patopsychologie dítěte II.* Olomouc: Univerzita Palackého.

Kuric, J. et al. (1963). *Vývojová psychologie.* Praha: Státní pedagogické nakladatelství.

Křivková, Z. (2005). *Význam pohybu pro formování osobnosti nevidomých.* Bakalářská práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Kudláček, M., Ješina, O., & Janečka, Z. (2009). Paralympijské vzdělávací programy. *Tělesná kultura, 32*(1), 44-55.

Kudláček, M., Ješina, O., & Štěrbová, D. (2008). Integrace žáka s tělesným postižením v kontextu školní tělesné výchovy. *Speciální pedagogika, 18*(3), 232-239.

Kudláček, M. (2008). *Inclusion of children with physical disabilities in physical education, recreation and sport*. Olomouc: UP v Olomouci.

Kudláček, M., & Frömel, K. (2012). *Sportovní preference a pohybová aktivita studentek a student středních škol*. [Sport Preferences and Physical Activity of High School Students]. Olomouc: UP v Olomouci.

Kvapilová, Z. (2004). *Senzomotorické dispozice zrakově postižených plavců*. Diplomová práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Květoňová-Švecová, L. (2000). *Oftalmopedie*. Brno: Paido.

Langmeier, J., & Matějček Z. (1963). *Psychická deprivace v dětství*. Praha: Státní pedagogické nakladatelství.

Langmeier, J. (1983). *Vývojová psychologie pro dětské lékaře*. Praha: Avicenum.

Langmeier, J., Langmeier, M., & Krejčířová, D. (1998). *Vývojová psychologie s úvodem do vývojové neurofyziologie*. Praha: H & H.

Leverenz, L. J. (2009). Visual impairment. In J. L. Durstine, G. E. Moore, P. L. Painter, & S. O. Roberts (Eds.), *ACSM´s exercise management for persons with chronic diseases and disabilities* (pp. 392-395). Champaing, IL: Human Kinetics.

Lieberman, L. J. (2005). Visual impairments. In J. P. Winnick (Ed.), *Adapted physical education and sport* (pp. 205-234). Champaing, IL: Human Kinetics.

Lieberman, L. J., & Cowart, J. F. (1996). *Games for people with sensory impairments: strategies for including individuals of all ages*. Champaign, IL: Human Kinetics.

Lieberman, L. J., & McHugh, E. (2001). Health-related fitness of children who are visually impaired. *Journal of Visual Impairment & Blindness, 91*, 272-287.

Linhartová, D. (2008). *Využívání nabídky adrenalinových sportů zrakově postiženými*. Bakalářská práce, Univerzita Palackého, Pedagogická fakulta, Olomouc.

Libra, J. (1985). *Speciální motorická docilita a učení*. Praha: Univerzita Karlova.

Lienert C., Sherrill, C., & Myers, B. (2001). Physical educators' concerns about integrating children with disabilities: A cross-cultural comparison. *Adapted Physical Activity Quarterly, 18* (1), 1-17.

Lievegoed, B. C. J. (1992). *Vývojové fáze dítěte*. Praha: Baltazar.

Litvak, A. G. (1979). *Nástin psychologie nevidomých a slabozrakých*. Praha: Státní pedagogické nakladatelství.

Loulová, M. (2009). *Veslování zrakově postižených*. Diplomová práce, Univerzita J. E. Purkyně, Pedagogická fakulta, Ústí nad Labem.

Ludíková, L. et al. (1988). *Tyflopedie I*. Olomouc: Univerzita Palackého.

Ludíková, L. et al. (1989). *Tyflopedie II*. Olomouc: Univerzita Palackého.

Ludíková, L. (2001). Dítě se zrakovým postižením. In O. Müller et al. (Eds.), *Dítě se speciálními vzdělávacími potebami v běžné škole* (pp. 123-144). Olomouc: Univerzita Palackého.

Ludíková, L. (2003). Integrace žáků se zrakovým postižením. In M. Valenta et al. (Eds.), *Přehled speciální pedagogicky a školská integrace* (pp. 179-206). Olomouc: Univerzita Palackého.

Ludíková, L. (2005). Speciální pedagogika osob s postižením zraku. In M. Renotiérová, L. Ludíková et al. (Eds.), *Speciální pedagogika* (pp. 191-207). Olomouc: Univerzita Palackého, Pedagogická fakulta.

Ludíková, L. (1990). *Předškolní výchova zrakově postižených dětí*. Olomouc: Univerzita Palackého.

Madarasová-Gecková, A., Dankulincová, Z., Sigmundová, D., & Kalman, M. (2016). Mezinárodní zpráva o zdraví a životním stylu dětí a školáků. [International Report on Health and Lifestyle of Children and Students]. Olomouc: Univerzita Palackého v Olomouci.

Macháček, P. (1992). *Mapování pohybových schopností nevidomých žáků 1. tříd ZŠ*. Diplomová práce, Univerzita Palackého, Pedagogická fakulta, Olomouc.

Marek, K. (2012). *Sledování vybraných lokomočních aktivit proměnlivými metodami osob se zrakovým postižením*. Diplomová práce, Pedagogická fakulta Univerzity J. E. Purkyně, Ústí nad Labem.

Másilko, L. (2009). Futsal pro nevidomé v České republice. In M. Blahutková (Ed.), *Sport a kvalita života* (pp. 77). Brno: Masarykova univerzita, Fakulta sportovních studií.

Mátlová, L. (2000). *Metodika a didaktika kuželkářského sportu zrakově postižených*. Diplomová práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Měkota, K., & Cuberek, R. (2007). *Pohybové dovednosti, činnosti, výkony*. Olomouc: Univerzita Palackého, Fakulta tělesné kultury.

Měkota, K., & Novosad, J. (2005). *Motorické schopnosti*. Olomouc: Univerzita Palackého, Fakulta tělesné kultury.

Mrňák, M. (1999). *Sledování zatížení hráčů goalballu během utkání*. Diplomová práce, Univerzita J. E. Purkyně, Pedagogická fakulta, Ústí nad Labem.

Nakamura, T. (1997). Quantitative analysis of gait in the visually impaired. *Disability and Rehabilitation*, *19,* 194-197.

Mazal, F. (1990). Hodnoty srdeční frekvence v pohybových hrách žáků 3. a 4. ročníků základní školy. *Acta Universitatis Palackianae Olomucensis. Gymnica, 20,* 105–116.

Měkota, K. & Blahuš, P. (1983). *Kapitoly z antropomotoriky I*. Olomouc: Univerzita Palackého.

Měkota, K., Kovář, R., & Štepnička, J. (1988). *Antropomotorika II*. Praha: Státní pedagogické nakladatelství.

Moravec, R. (1990). *Telesný a funkčný rozvoj a pohybová výkonnosť 7-18ročnej mládeže v ČSFR*. Bratislava: Ministerstvo školstva, mládeže a športu SR.

Moravcová, D. (2004). *Zraková terapie pacientů s nízkým vizem*. Praha: Triton.

Mysliveček, J. (2003). *Základy neurověd*. Praha: Triton.

Ng, K., Rintala, P., Tynjälä, J., Vilberg, J., & Kannas, L. (2014). Physical Activity Patterns of Adolescents with Long Term Illnesses or Disabilities in Finnish General Education. *Journal of Physical Activity & Health*. *7*(1), 58-72.

Ng, K., Rintala, P., Tynjälä, J., Valimaa, R., Vilberg, J., Kokko, S., & Kannas, L. (2016a). Physical Activity Trends of Finnish Adolescents with Long-Term Illnesses or Disabilities from 2002-2014. *Journal of Physical Activity & Health*. *13*(8), 816-821.

Ng, K., Rintala, P., Välimaa, R., Tynjälä, J., Villberg, J, Kokko, S., Kannas, L. (2016b). Daily physical activity in Finnish adolescents with long term illnesses or disabilities: psychosocial associations with participation in sports club. Epidemiology, Biostatistics and Public Health, *13*(3), e11699-1-e11699-10.

Nielsenová, L. (1998). *Učení zrakově postižených dětí v raném věku*. Praha: ISV nakladatelství.

Novotná, E. (2003). *Plavecká výuka nevidomého dítěte se zaměřením na plavecké dovednosti a plavecký způsob znak*. Diplomová práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Obermanová, A. (2004). Školní tělesná výchova zrakově postižených. Diplomová práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

O'Brien, D., Kudláček, M., & Howe, P. D. (2009). A contemporary review of English language literature on inclusion of students with disabilities in physical education: A European perspective. *European Journal of Adapted Physical Activity, 2(1),* 46–61.

Pálková, H. (2006). *Uplatňování pohybových aktivit u zrakově handicapované populace Ústeckého kraje*. Diplomová práce, Univerzita J. E. Purkyně, Pedagogická fakulta, Ústí nad Labem.

Pávek, F. (1970). *Ukazatele tělesné výkonnosti 7-19leté mládeže ČSSR*. Praha: VÚP.

Pavlov, I. P. (1953). *Sebrané spisy III.* Praha: SZN.

Perkins, K., Columna, L., Lieberman, L.J., & Bailey, J. (2013). Parents perceptions of physical aktivity for their children with visual impairments. *Journal of Visual IMpairment and blindness. 107(2)*,131-142.

Petrovskij, A. V. et al. (1977). *Vývojová a pedagogická psychologie*. Praha: Státní pedagogické nakladatelství.

Požár, L. (2007). *Základy psychológie ludí s postihnutím*. Trnava: Vydavatelstvo Typi Universitatis Tyrnaviensis.

Prechtl, H. F., Cioni, G., Einspieler, Ch., Bos, A. F., & Ferrari, F. (2001). Role of vision on early motor development: lessons from the blind. *Developmental Medicine & Child Neurology*, *43*(3), 198-201.

Provazník, M. (2008). *Tandem snowboarding zrakově postižených.* Diplomová práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Příhodová, K. (2007). *Význam sportu pro jedince se zrakovým postižením a jeho vliv na kvalitu života.* Diplomová práce. Univerzita Karlova, Pedagogická fakulta, Praha.

Poráčová, V. (1996). *Komparace některých motorických a somatických ukazatelů u zrakově postižených dětí mladšího školního věku a vidících.* Diplomová práce, Univerzita Palackého, Fakulta tělesné kultury, Olomouc.

Požár, L. (2002). Některé terminologické problémy. In J. Jesenský (Ed.), *Edukace a rehabilitace zrakově postižených na prahu nového milenia* (pp. 67-71). Hradec Králové: Gaudeamus.

Příhoda, V. (1977). *Ontogeneze lidské psychiky*. Praha: Státní pedagogické nakladatelství.

Rašev, E. (1994). Proprioreceptivní postulární terapie. *Rehabilitácia, 28*, 8-10.

Ratajczak, J. (2001). Nowe formy aktywności ruchowej w Ośrodku dla dzieci niewidomych w Owińskach. In S. Kowalik & M. Górny (Eds.), *Dziecko niepelnosprawne – aktywność ruchowa – dzialalność szkoly* (pp. 199-202). Poznaň: Akademia wychowania fizycznego.

Reina, R. & Alvaro-Ruiz, J. (2016). Full inclusion of a student with visual impairment over the full Physical activity and sport sciences degree: A case study. European Journal of Adapted Physical Activity, 9(1), 40-52.

Richterová, N. (2011). *Sportovní a pohybové aktivity zrakově postižených a jejich přínos pro integraci této skupiny.* Bakalářská práce, Masarykova univerzita, Fakulta sportovních studií, Brno.

Riley, B. B., Rimmer, J. H., Wang, E., & Schiller, W. J. (2008). A conceptual framework for improving the accessibility of fitness and recreation facilities for people with disabilities. Journal of Physical Activity and Health, 5(1), 158-168.

Rimmerman, A., & Morgenstern, H. (2003). Quality of life of visually impaired adults who are employed in extendedemployment programs in Israel. *Journal of Visual Impairment & Blindness, 97*(9), 551-561.

Rintala, P., Välimaa, R., Tynjälä, J., Boyce, W., King, M., Villberg, J., & Knnas, L. (2011). Physical Activity of Children with and without Long-Term Illness or Disability. *Journal of Physical Activity and Health*, *8*(8), 1066-1073.

Robinson, B. & Lieberman, L.J. (2007). Influence of a Parent Resource Manual on Physical Activity Levels of Children with Visual Impairments. *Rehabilitation Education for Blindness and Visual Impairment*, 39(3). 129-140.

Rutkowski, D. (2001). Aktywność ruchova niewidomych i slabowidzacych w trakcie obozóv harcerskich. In S. Kowalik & Górny, M. (Eds.), *Dziecko niepelnosprawne – aktywność ruchowa – dzialalność szkoly* (pp. 182-193). Poznaň: Akademia wychowania fizycznego.

Rütten, A., Abel, T., Kannas, L., von Lengerke, T., Lüschen, G., Rodríguez Diaz, J. A., Vinck, J., & van der Zee, J. (2001). Self reported physical activity, public health, and perceived environment: Results from a comparative Euroepan study. *Journal of Epidemiology and Community Health, 55,* 139-146.

Rütten, A. & Abu-Omar, K. (2004a). Perceptions of environmental opportunities for physical activity in the European Union. Sozial- und Präventivmedizin*,49,* 310-317.

Rütten, A., & Abu-Omar, K. (2004b). Prevalence of physical activity in the European Union. Sozial- und Präventivmedizin,*49,* 281-289.

Rychtecký, A., & Fialová, L. (1998). *Didaktika školní tělesné výchovy*. Praha: Karolinum.

Říhová, M. (2001). *Goalballem k lepší orientaci.* Diplomová práce, Univerzita J. E. Purkyně, Pedagogická fakulta, Ústí nad Labem.

Renson, R. & Vanreusel, B. (1990). *Growth and fitnes of flemisch girls*. Champaign, IL: Human Kinetics.

Riegerová, J. & Ulbrichová, M. (1993). *Aplikace fyzické antropologie v tělovýchově a sportu.* Olomouc: Univerzita Palackého.

Řehák, S. et al. (1989*).* Oční lékařství. Praha: Avicenum.

Říčan, P., Krejčířová, D. et al. (1997). *Dětská klinická psychologie.* Praha: Avicenum.

Sherill, C. (1998). *Adapted physical aktivity, recreation and sport*. Madison: Crossdisciplinary and lifespan (5th ed.).

Sherrill, C. (2004). *Adapted physical activity, recreation and sport: Crossdisciplinary and lifespan* (6th ed.). Boston, MA: WCB/McGraw-Hill.

Saelens, B. E., Sallis, J. F., Black, B., & Chen, D. (2003). Neighborhood-based differences in physical activity: An environmental scale evaluation. *American Journal of Public Health, 93,* 1552-1558.

Samaey, Ch., & Lamon, A. (1996). Motorische Entwicklung und motorische Kompetenz. *Motorik, 19*(4), 173-177.

Scherer, F. et al. (1983). *Sport mit blinden und sehbehinderten Kindern und Jugendlichen. Reihe Motorik. Band 4. 1.* Schorndorf: Verlag Karl Hofmann.

Scherer, H. G. (1991). Zum Problem der Bewegungsvorstellung blinder Menschen beim motorischen Lernen. In R. Daugs (Ed.), *Sportmotorisches Lernen und Techniktraining* (pp. 182-185). Schorndorf: Verlag Karl Hofmann.

Schmidt, R. A., & Wrisberg, G. A. (2008). *Motor learning and performance. A situation-ba-sed learning approach*. Champaign, IL: Human Kinetics.

Schnabel, G., Harre, D., & Borde, A. (1997). *Trainingswissenschaft: Leistung – Training – Wettkampf.* Berlin: Sportverlag.

Schneider, P. L., Crouter, S. E., & Bassett, D. R. (2004). Pedometer measures of free-living physical activity: Comparison of 13 models. *Medicine and Science in Sports and Exercise*, *36*(2), 331-335.

Schucan-Kaiser, R. (1997). *1010 Spiel- und Übungsformen für Behinderte (und Nichtbe-hinderte).* Schorndorf: Verlag Hofmann.

Shephard, R. J. (1990). *Fitness in special populations*. Champaing, IL: Human Kinetics.

Sherrill, C. (1998). *Adapted physical activity, recreation, and sport: Crossdisciplinary and lifespan*(5th ed.). Boston: McGraw-Hill.

Short, F. X., & Winnick, J. P. (1988). Adolescent physical fitness: A comparative study. *Journal of Visual Impairment & Blindness, 82,* 237-239.

Sigmund, E., Mitáš, J., Vašíčková, J., Sigmundová, D., Chmelík, F., Frömel, K., Horák, S., Nykodým, J., Šebrle, Z., Řepka, E., Feltlová, D., Suchomel, A., Mičan, O., Fojtík, I., Klobouk, T., Lukavská, M., & Bláha, L. (2008a). Biosociální proměnné pohybové aktivity dospělých obyvatel vybraných metropolí České republiky. Česká kinantropologie, 12(4), 9-20.

Sigmund, E., Sigmundová, D., Zacpal, J., Mitáš, J., Chmelík, F., Vašíčková, J., & Frömel, K. et al. (2008b). Koreláty pohybové aktivity randomizovaného souboru 15-65leté populace České republiky s využitím formální konceptuální analýzy. In P. Ludva (Ed.), *Pedagogická kinantropologie* (pp. 5-14). Ostrava: Ostravská univerzita, Pedaogická fakulta.

Sigmund, E., Zacpal, J., Mitáš, J., Sigmundová, D., Frömel, K., Horák, S., Nykodým, J., Šebrle, Z., Řepka, E., Feltlová, D., Suchomel, A., Mičan, O., Fojtík, I., Klobouk, T., Lukavská, M., & Bláha, L. (2008c). Aplikace Formální konceptuální analýzy při hodnocení výsledků z dotazníku o prostředí

(ANEWS) a změřeného počtu kroků u randomizovaného souboru 15-65letých obyvatel metropolí České republiky. *Studia Sportiva,2*(2), 13-22.

Sigmundová, D., Sigmund, E., & Chmelík, F. (2009). Vztah mezi prostředím a počtem kroků obyvatel českých metropolí. *Tělesná kultura*, *32*(2), 112-126.

Sinning, S. (2001). Sportspiele mit Sehbehinderten und Blinden – Anregung auch für Sehende. *Sportunterricht – Lehrhilfen*, *50,* 1-5.

Sjednocená organizace nevidomých a slabozrakých ČR. (2010). *Klasifikace zrakového postižení podle WHO.* Praha: Author. Retrieved from http://www.sons.cz/ klasifikace.php

Sobotková, L. (2004). *Specifické změny držení těla a funkční změny v pohybovém systému těžce zrakově postižených dětí (kazuistická studie).* Diplomová práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Součková, G. (2005). *Výcvik lezení nevidomých dětí na umělé horolezecké stěně.* Bakalářská práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Stodůlka, D. (2006). Úloha komunikace mezi trasérem a atletem se zrakovým postižením. Diplomová práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Süss, V. (2006). *Význam indikátorů herního výkonu pro řízení tréninkového procesu*. Praha: Karolinum.

Schmidt, R. A. (1991). *Motor learning and performance. From principles to practice*. Champaign, IL: Human Kinetics.

Smýkal, O. (1986). *Výchova nevidomého dítěte předškolního věku*. Praha: ÚVS svazu invalidů v ČSR.

Stejskal, P. & Hejnová, J. (1994). Vyšetření výkonnosti kardiovaskulárního systému pomocí CHR-testu. *Med. Sport. Boh. Slov., 3,* 41–49.

Srdečný, V. (1977). *Tělesná výchova zdravotně oslabených*. Praha: Státní pedagogické nakladatelství.

Syka, J., Voldřich, L., & Vrabec, F., (1981). *Fyziologie a patofyziologie sluchu*. Praha: Avicenum.

Sovák, M. (1980). *Nárys speciální pedagogiky*. Praha: Státní pedagogické nakladatelství.

Štěpánek, M. (2009). *Rychlostní plavání zrakově postižených se zaměřením na výkonnost v klasifikační třídě S12 a S13 muži.* Diplomová práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, PrahaŠtěpnička, J. (1974). Typologie motoriky. In S. Čelikovský et al. (Eds), *Antropomotorika*. Praha: Státní pedagogické nakladatelství.

Šafaříková, L. (1999). *Pohybové aktivity jako součást procesu výchovy a kultivace těžce zrakově postižených jedinců.* Disertační práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Škvára, F. (1977). *Tělesná výchova zdravotně oslabených*. Praha: Státní pedagogické nakladatelství.

Štanceľ, J. (1966). *Telesná výchova hluchoslepých a slepých žiakov*. Bratislava: Státní pedagogické nakladatelství.

Štych, O. (2007). *Vybrané aspekty provozování tandemové cyklistiky u zrakově postižených jedinců.* Diplomová práce, Univerzita J. E. Purkyně, Pedagogická fakulta, Ústí nad Labem.

Štreblová, M. (2002). *Poznáváme svět se zrakovým postižením. Úvod do tyflopedie*. Ústí nad Labem: Univerzita J. E. Purkyně.

Teplý, Z. (1986). *Kondiční testy 12 × 12*. Praha: ČÚV ČSTV.

Thiele, M. (1998). *Schülerinnen und Schüler mit Blindheit im Sportunterricht der allegemeinbildenden Schule*. Schleswig: SfS-AG Bewegung, Sport & Tanz. Retrieved from http://auge-on-line.de/ Beschwerden/Sehbehinderung/haupteil_seh behinderung.html

Tomajko, D., Dobrý, L. (1999). Pojmoslovné a terminologické vádemékum. Pohybová hra. *Tělesná výchova a sport mládeže, 65*(8), 11-15.

Tomášková, I. (2005). *Sportovní plavání v kategorii B1 – nevidomí.* Diplomová práce, Univerzita Karlova, Fakulta tělesné výchovy a sportu, Praha.

Tudor-Locke, C., Ainsworth, B. E., Thompson, R. W., & Matthews, C. E. (2002). Comparison of pedometer and accelerometer measures of free-living physical activity. *Medicine and Science in Sports and Exercise*, *34*(12), 2045-2051.

Tudor-Locke, C., & Bassett, D. R. et al. (2004). A preliminary study of one year of pedometer self-monitoring. *Annals of Behavior Medicine, 28,* 158-162.

Tudor-Locke, C., & Myers, A. M. (2001). Methodological considerations for researchers and practitioners using pedometers to measure physical (ambulatory) activity. *Research Quarterly for Exercise and Sport, 72*(1), 1-12.

Twisk, J. W. R. (2001). Physical activity guidelines for children and adolsecents: A critical review. *Sports Medicine,31*(8), 617-627.

Trojan, S. (1999). *Lékařská fyziologie.* Praha: Grada.

Uherík, A. (1978). *Psychofyziologické vlastnosti človeka*. Bratislava.

Ústav zdravotnických informací a statistiky České republiky. (2008). Mezinárodní statistická klasifikace nemocí a přidružených zdravotních problémů (MKN-10, I. díl – Tabelární část, 2. aktualizovaná verze).Retrieved from http://www.uzis.cz/ publikace/mezinarodni-statisticka-klasifikace-nemoci-pridruzenych-zdravotnich-problemu-mkn-10-dil-ta

Vágnerová, M. (1995).*Oftalmopsychologie dětského věku*. Praha: Univerzita Karlova-Karolinum.

Vágnerová, M. (2000). *Vývojová psychologie. Dětství, dospělost, stáří*. Praha: Portál.

Vágnerová, M., Hadj-Moussová, & Štech, S. (2000). *Psychologie handicapu*. Praha: Univerzita Karlova – Karolinum.

Válková, H., Vařeková, R., Hýža, M., Janečka, Z., Kostihová, H., Šterbová, D., & Veselý, J. (1994). *Komparace některých ukazatelů somatického, sociálního a psychomotorického vývoje postižených dětí 9-11 letých*. Nepublikovaná výzkumná zpráva z řešení projektu „Dítě“ Ministerstva školství, mládeže a tělovýchovy České republiky.

Válková, H., Janečka, Z. et al. (1998). The assessment of motor competence variables of disabled children (Methodological approach). In H. Válková & R. Vute (Eds.), *Adapted physical activities in central Europe* (pp. 151-159). Olomouc: Palacký University.

Válková, H., Janečka, Z. et al. (1998). Comparison of some motor competence variables versus variables of socialization among the groups of children with special needs. In H. Válková & R. Vute (Eds.), *Adapted physical activities in central Europe* (pp 160-171). Olomouc: Palacký University.

Vachulová, J., & Vachule, R. (1987). *Hry pro těžce zrakově postižené děti*. Praha: ÚV SI.

Valentová, L. (2008). *Metodika výuky tělesné výchovy u zrakově postižených na 1. stupni základních škol.* Diplomová práce, Univerzita Palackého, Pedagogická fakulta, Olomouc.

Válková, H. (2008). Fotbal v humanitárních aktivitách. In L. Charvát (Ed.), *Hry 2008. Výzkum a aplikace* (pp. 23-26). Plzeň: Západočeská univerzita, Pedagogická fakulta.

Válková, H. (2010). Kudy na to? O motorické kompetenci a principech adaptací v APA. *Aplikované pohybové aktivity v teorii a praxi, 1*(2), 31-39.

Vanlierde, A., & Wanet-Defalque, M. (2004). Abilities and strategie sof blind and sighted subjects in visuo-spatial imagery. *Acta Psychologica,116,* 205-222.

Vaněk, J. (1972). *K biologickým a psychologickým zřetelům výchovy*. Praha: Státní pedagogické nakladatelství.

Vařeka, I. (1999). Ontogeneze lidské motoriky jako schopnost řídit polohu těžiště. *Rehabilitace a fyzikální lékařství, 6(3),* 84-85.

Vařeka, I. (2001). *Posturální stabilita vidících a nevidomých. Vliv zrakové kontroly, typu velikosti opěrné báze.* Příspěvek na pracovním semináři „Přístrojové hodnocení posturální stability“, Olomouc.

Vašek, Š. et al. (1994). Špeciálna Pedagogika – terminologický a výkladový slovník. Bratislava: Slovenské pedagogické nakladateľsvo.

Vermeer, A. (1990). *Motor development adapted physical activity and mental retardation*. Amsterodam: Karger.

Véle, F. (1997). *Kineziologie pro klinickou praxi*. Praha: Avicenum.

Vítková, M. (1993). *Speciální pedagogika v raném a předškolním věku se zřetelem na rozvoj výtvarných aktivit*. Brno: Oddělení speciální pedagogiky CDVV MU.

Vítková, M. Řehůřek, J. Květoňová-Švecová, L., & Madler, I. (1999). *Možnosti reedukace zraku při kombinovaném postižení*. Brno: Paido.

WHO (2001). International classification of functioning, disability, and health : ICF. Geneva World Health Organization,

Wiener, P. (1986) *Prostorová orientace a samostatný pohyb zrakově postižených*. Praha: Avicenum.

Wiener, P. (1998) *Prostorová orientace zrakově postižených*. Praha: Ministerstvo školství, mládeže a tělovýchovy.

Winnick, J. P. et al. (1990). *Adapted physical education and sport*. Champaign, IL: Human Kinetics.

Winnick, J. P. & Short, F. (1985). *Physical fitnes testing of the disabled*. Champaign, IL: Human Kinetics.

Wiener, P. (1986). *Výchova prostorové orientace a samostatného pohybu zrakově postižených*. Praha: Avicenum.

Winnick, J. P. (1985). The performance of visually impaired youngsters in physical education activities: implications for mainstreaming. *Adapted Physical Activity Quarterly, 2,* 292-299.

Winnick, J. P. (Ed.). (2005). *Adapted physical education and sport*. Champaign, IL: Human Kinetics.

Wurzel, B. (1987). Kreistorball Ein Vorschlag für gemeinsame Spiel von Blinden und Sehenden. *Motorik, 10*(1), 41-46.

Wurzel, B. (1991). *Sportunterricht mit Nichtbehinderten und Behinderten: untersucht am Beispiel von Sehenden und Blinden*. Schorndorf: Verlag Karl Hofmann.

Wurzel, B. (2001). Gemeinsamer Unterricht von Nichtbehinderten und Behinderten – auch im Sport? *Praxis der Psychomotorik, 26*, 258-262.

Wurzel, B. (2004). *Kreistorball*. Metodické materiály. České Budějovice: Pedagogické centrum.

White, R. W. (1959). The koncept of competence. *Psychological Reviev*, *66*, 297-333.

Yabe, K., Kusano, K., & Nahaka, H. (1994). *Adapted physical activity*. Tokio: Springer Verlag.

Yao, W., Shapiro, D. R., & Liao, C. (2016). Parents motivation for participation in physical aktivity for children with impairments. European Journal of Adapted Physical Activity, 9(1), 15-26.

Zahálka, F., Malý, T., Richterová, M., Gryc, T., Hanuš, M., Malá, L., &Pavlů, D. (2011). Posturální stabilita dětí se zrakovým postižením. Česká kinantropologie, 15(3), 180-191.

Ženíšková, A. (2009). *Sledování pohybových aktivit a inaktivit zrakově postižených na Karlovarsku*. Diplomová práce, Univerzita J. E. Purkyně, Pedagogická fakulta, Ústí nad Labem.

Visual impairment classification. Retrieved from: http://www.sport-nevidomych.cz/index.php?dir=klasifikace&page=klasifikace_v_CR

Rules of specific physical activity games and related information

Rules – futsal for the blind. Retrieved from: http://www.teiresias.muni.cz/download/futsal/IBSA_Futsal_pravidla_hry_2009-2013.pdf

Goalball rules. Retrieved from:

http://www.goalball.cz/files/pravidla_2010-2013.pdf

http://goalball.info/about.php

Annexes A

Zbyněk Janečka

Sports socialization

The scales and questionnaires are completed directly with children on an individual basis if possible, children are also assisted by teachers, educators or parents. The other side can be used for other comments and reactions concerning the monitored child.

Skills scale

"What I can do and what I know" scale **Name and surname**

can do	has tried	has seen, heard about, knows about	has not encountered, does not know	points
(5)	(3)	(1)	(0)	

1st part maximum 50 points:

Running
Jumping
Throwing
Catching
Skiing
Swimming
Skating
Cycling
Sailing
Hiking
What else

2nd part maximum 10 points (1 point for each piece of knowledge of or experience with a sport)

Soccer
Combiball
Basketball
Goalball
Showdown
etc.

Scoring: 5:3:1:0 in the first part, maximum 50 points
Plus 1 point for each piece of knowledge or experience with the respective type of sport, maximum 10 points

Sports skills scoring points:
- 1st part maximum 50 points
- 2nd part maximum 10 points

TOTAL SCORE: MAXIMUM 50 + 10 = 60 POINTS

		1st part maximum		2nd part maximum
VL	very low	20–24 points	+	10 points
L	low	25–30 points	+	10 points
LA	lower average	31–35 points	+	10 points
HA	higher average	36–40 points	+	10 points
H	high	41–45 points	+	10 points
VH	very high	46–50 points	+	10 points

Sports socialization scale

The scales are completed directly with children on an individual basis if possible, children are also assisted by teachers, educators or parents. The questionnaire has identical questions for the following alternatives: at home (+) and in a facility (x). The other side can be used for other comments and reactions concerning the monitored child.

"Where I play and do sports" scale

Name and surname

+ – when I am at home
x – when I am at school

never – seldom	sometimes	often	points
(1)	(2)	(3)	

Terrace, balcony
Garden, yard
Street, housing estate
Playground
Forest, meadow
Swimming pool
Club, interest group
At friends' place

Scoring: 1:2:3
Minimum 8, maximum 24 points for each area (+), (x)

"What I play and do sports with" scale

Name, ... No.

+ – when I am at home
x – when I am at school

The scales are completed directly with children on an individual basis if possible, children are also assisted by teachers, educators or parents. The questionnaire has identical questions for the following alternatives: at home (+) and in a facility (x). The other side can be used for other comments and reactions concerning the monitored child.

never – seldom	sometimes	often	points
(1)	(2)	(3)	

Bicycle
Ball
Skipping rope
Skates
Roller skates
Skateboard
Swinging – climbing kit
Wall bars
Sledge, sled
Skis
Racket (badminton, tennis, table tennis, showdown)
Children's pool
Musical instrument
Pet
other sports equipment

Scoring: 1:2:3
Minimum 14, maximum 28 points for each area (+), (x)

"How do I get to school" questionnaire

The questionnaires are completed directly with children on an individual basis if possible, children are also assisted by teachers, educators or parents. The questionnaire has identical questions for the following alternatives: at home (+) and in a facility (x). The other side can be used for other comments and reactions concerning the monitored child. Circle how do you get to school most often.

1) driven by car (approximate time)	(0)	points
2) by tram, bus, etc. (approximate time)	(1)	point
3) on foot	(3)	points
4) by bicycle	(4)	points

Scoring 1–4 points

"Where do I have friends" questionnaire

(This applies to membership in children's clubs, groups or sports clubs)

.

Circle the best option

1) I have never been a member of a club or group	(0)	points
2) part-time member of a children's organization	(2)	points
3) part-time member of a sports club (group)	(3)	points
4) full-time member of a children's organization	(5)	points
5) full-time member of a sports club	(5)	points
6) full-time member of several children's organizations	(6)	points
7) full-time member of several sports clubs	(7)	points
8) full-time member of children's organizations and sports clubs	(8)	points

Scoring from 1–8 points

"At a summer camp" questionnaire

(This applies to traditional summer camps and sports camps)

Circle the best option

1) I have never been to either	(0)	points
2) I have been to a summer camp	(1)	point
3) I have been to a sports camp	(3)	points
4) I have been to a summer camp and sports camp	(4)	points

Scoring 1–4 points

Total score

47 minimum	– 120 maximum
below 48	– very low
48–60	– low
61–73	– lower average
74-86	– higher average
87–99	– high
above 99	– very high

Annexes B

Ladislav Bláha

List of Annexes

Annex 2
International statistical classification of diseases and related health problems

(ICD-10, Volume I – Tabular list, 2nd revision)

Tab 1 Visual disturbances and blindness (H53–H54)

Category of visual impairment	Visual acuity difference	
	Less than	**Equal or better than**
Moderate or no visual / impairment 0		6/18 3/10 (0.3) 20/70
Medium visual / impairment 1	6/18 3/10 (0.3) 20/70	6/60 1/10 (0.01) 20/200
Severe visual / impairment 2	6/60 1/10 (0.01) 20/200	3/60 1/20 (0.05) 20/400
Blindness 3	3/60 1/20 (0.05) 20/400	1/60* 1/50 (0.02) 5/300 (20/1 200)
Blindness 4	1/60* 1/50 (0.02) 5/300 (20/1 200)	Light perception
Blindness 5	No light perception	
9	Not identified or specified	

*Or counting fingers at a distance of 1 meter

Note: The term visual impairment under H54 corresponds to category 0 for moderate or no visual impairment, category 1 for medium visual impairment, category 2 for severe visual impairment, category 3, 4 and 5 for blindness and category 9 for unspecified visual impairment. The term weak sight (partial sight) from the previous revision was replaced with categories 1 and 2 in order to prevent confusion with conditions requiring care for the blind.

Source: Institute of Health Information and Statistics of the Czech Republic.

Annex 3
IPAQ-short questionnaire

Centrum kinantropologického výzkumu (www.cfkr.eu) Fakulta tělesné kultury, Univerzita Palackého v Olomouci

MEZINÁRODNÍ DOTAZNÍK K POHYBOVÉ AKTIVITĚ

Zajímáme se o pohybovou aktivitu, kterou vykonáváte jako součást Vašeho každodenního života. V otázkách se Vás budeme ptát na čas, který jste strávili pohybovou aktivitou **v posledních 7 dnech**. Prosíme Vás o zodpovězení všech otázek, i když se nepovažujete za pohybově aktivního člověka. Zamyslete se prosím nad aktivitami, které provádíte v zaměstnání, jako součást domácích prací, na zahradě, při přemísťování se z místa na místo a ve vašem volném čase při rekreaci, cvičení či sportu.

Zamyslete se nad **intenzivní pohybovou aktivitou** (tělesně náročná), kterou jste prováděl/a **v posledních 7 dnech**. **Intenzivní pohybová aktivita** se vyznačuje těžkou tělesnou námahou a zadýcháním (výrazně rychlejší a těžší dýchání než normálně). Berte v úvahu pouze tu pohybovou aktivitu, která trvala nepřetržitě alespoň 10 minut.

1. V kolika dnech, během posledních 7 dnů, jste prováděl/a **intenzivní pohybovou aktivitu**, například zvedání těžkých břemen, kopání (rytí), aerobik nebo rychlou jízdu na kole?

   _____ **dnů v týdnu**

   ☐ Neprovádím žádnou intenzivní pohybovou aktivitu ➞ ***Přejděte k otázce 3***

2. Kolik času jste obvykle strávil/a při **intenzivní pohybové aktivitě** v jednom z těchto dnů (v průměru za jeden den)?

   _____ **hodin denně**

   _____ **minut denně**

   ☐ Nevím/ Nejsem si jistý(á)

Zamyslete se nad veškerou **středně zatěžující pohybovou aktivitou,** kterou jste prováděl/a **v posledních 7 dnech**. **Středně zatěžující pohybová aktivita** se vyznačuje střední tělesnou námahou, při níž dýcháte trochu více než normálně. Berte v úvahu pouze tu pohybovou aktivitu, která trvala nepřetržitě alespoň 10 minut.

3. V kolika dnech, během **posledních 7 dnů**, jste prováděl/a **středně zatěžující** pohybovou aktivitu, například nošení lehčích břemen, jízdu na kole běžnou rychlostí nebo čtyřhru v tenise? Nezahrnujte chůzi.

   _____ **dnů v týdnu**

   ☐ Neprovádím žádnou středně zatěžující pohybovou aktivitu ➞ ***Přejděte k otázce 5***

4. Kolik času jste obvykle strávil/a při **středně zatěžující pohybové aktivitě** v jednom z těchto dnů (v průměru za jeden den)?

   _____ **hodin denně**

   _____ **minut denně**

   ☐ Nevím/ Nejsem si jistý(á)

Zamyslete se nad časem, který jste za **posledních 7 dnů** strávil/a chůzí. Zahrňte chůzi v zaměstnání, v rámci školní docházky i doma, přesuny (cestování) chůzí z místa na místo, ale i jinou chůzi, kterou vykonáváte výhradně pro rekreaci, sport, cvičení nebo vyplnění volného času.

5. V kolika dnech, během **posledních 7 dnů**, jste **chodil/a** nepřetržitě alespoň 10 minut?

   _____ **dnů v týdnu**

   ☐ Nechodil(a) jsem ➞ ***Přejděte k otázce 7***

6. Kolik času jste obvykle strávil/a **chůzí** v jednom z těchto dnů (v průměru za jeden den)?

   _____ **hodin denně**

   _____ **minut denně**

   ☐ Nevím/ Nejsem si jistý(á)

Poslední otázka této části se týká času, který jste strávil/a **sezením v pracovních dnech**, během **posledních 7 dnů**. Zahrňte čas strávený sezením v zaměstnání, v rámci školní docházky, doma, při plnění domácích úkolů a během volného času. Zahrňte také čas strávený sezením u stolu, na návštěvě přátel, u čtení nebo také sezením či ležením při sledování televize.

7. Kolik času **denně** jste obvykle strávil/a **sezením v pracovních dnech** (v průměru za jeden pracovní den)?
   _____ **hodin denně**
   _____ **minut denně**

☐ Nevím/ Nejsem si jistý(á)

DEMOGRAFICKÉ OTÁZKY

1. Pohlaví: ___ Muž
   ___ Žena

2. Kolik vám bylo let při vašich posledních narozeninách?
   ___ Let
   ___ Nevím/Nejsem si jistý/á
   ___ Odmítám odpovědět

3. Kolik let školní docházky máte ukončeno (včetně základní školy)?
   ___ Let
   ___ Nevím/Nejsem si jistý/á
   ___ Odmítám odpovědět

4. Máte v současné době placené zaměstnání?
   ___ Ano
   ___ Ne → *Přejděte k otázce č. 6*
   ___ Nevím/Nejsem si jistý/á → *Přejděte k otázce č. 6*
   ___ Odmítám odpovědět → *Přejděte k otázce č. 6*

5. Pokud ano, kolik hodin týdně pracujete ve všech zaměstnáních?
   ___ Hodin týdně
   ___ Nevím/Nejsem si jistý/á
   ___ Odmítám odpovědět

6. Kam zařadíte místo, kde žijete?
   ___ Velké město (> 100 000 obyvatel)
   ___ Středně velké město (30 000 - 100 000 obyvatel)
   ___ Menší město (1 000 - 29 999 obyvatel)
   ___ Malá obec/vesnice (< 1 000 obyvatel)
   ___ Nevím/Nejsem si jistý/á
   ___ Odmítám odpovědět

Doplňující údaje

Výška (cm): ☐ **Hmotnost** (kg): ☐

Bydliště: okres ☐ obec ☐ **Národnost**: ☐

Způsob bydlení (dům-D, bytový dům-B): ☐ **Kuřák** (ano-A, ne-N): ☐

Způsob života (sám-S, v rodině-R, v rodině s dětmi do 18 let-RD): ☐ **Máte psa** (ano-A, ne-N): ☐

Materiální podmínky: mám k dispozici (ano-A, ne-N) kolo ☐ auto ☐ chatu, chalupu ☐

Organizovanost (pravidelná účast v organizované pohybové aktivitě po většinu roku-organizuje osoba nebo instituce, ne-N, 1x, 2x, více krát - týdně): ☐

Sportovní činnost, kterou během roku nejčastěji provozujete ☐

kterou byste nejraději provozoval/a ☐

Neprovozuji žádnou sportovní aktivitu ☐

Děkujeme Vám za pečlivé a pravdivé vyplnění dotazníku.

Annex 4
Application of YAMAX – SW 700 pedometer

Annex 5
IPAQ-long questionnaire

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE (October 2002)

LONG LAST 7 DAYS SELF-ADMINISTERED FORMAT

FOR USE WITH YOUNG AND MIDDLE-AGED ADULTS (15-69 years)

The International Physical Activity Questionnaires (IPAQ) comprises a set of 4 questionnaires. Long (5 activity domains asked independently) and short (4 generic items) versions for use by either telephone or self-administered methods are available. The purpose of the questionnaires is to provide common instruments that can be used to obtain internationally comparable data on health–related physical activity.

Background on IPAQ
The development of an international measure for physical activity commenced in Geneva in 1998 and was followed by extensive reliability and validity testing undertaken across 12 countries (14 sites) during 2000. The final results suggest that these measures have acceptable measurement properties for use in many settings and in different languages, and are suitable for national population-based prevalence studies of participation in physical activity.

Using IPAQ
Use of the IPAQ instruments for monitoring and research purposes is encouraged. It is recommended that no changes be made to the order or wording of the questions as this will affect the psychometric properties of the instruments.

Translation from English and Cultural Adaptation
Translation from English is encouraged to facilitate worldwide use of IPAQ. Information on the availability of IPAQ in different languages can be obtained at www.ipaq.ki.se. If a new translation is undertaken we highly recommend using the prescribed back translation methods available on the IPAQ website. If possible please consider making your translated version of IPAQ available to others by contributing it to the IPAQ website. Further details on translation and cultural adaptation can be downloaded from the website.

Further Developments of IPAQ
International collaboration on IPAQ is on-going and an ***International Physical Activity Prevalence Study*** is in progress. For further information see the IPAQ website.

More Information
More detailed information on the IPAQ process and the research methods used in the development of IPAQ instruments is available at www.ipaq.ki.se and Booth, M.L. (2000). *Assessment of Physical Activity: An International Perspective.* Research Quarterly for Exercise and Sport, 71 (2): s114-20. Other scientific publications and presentations on the use of IPAQ are summarized on the website.

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** and **moderate** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal.

PART 1: JOB-RELATED PHYSICAL ACTIVITY

The first section is about your work. This includes paid jobs, farming, volunteer work, course work, and any other unpaid work that you did outside your home. Do not include unpaid work you might do around your home, like housework, yard work, general maintenance, and caring for your family. These are asked in Part 3.

1. Do you currently have a job or do any unpaid work outside your home?

☐ Yes

☐ No → ***Skip to PART 2: TRANSPORTATION***

The next questions are about all the physical activity you did in the **last 7 days** as part of your paid or unpaid work. This does not include traveling to and from work.

2. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, heavy construction, or climbing up stairs **as part of your work**? Think about only those physical activities that you did for at least 10 minutes at a time.

_____ **days per week**

☐ No vigorous job-related physical activity → ***Skip to question 4***

3. How much time did you usually spend on one of those days doing **vigorous** physical activities as part of your work?

_____ **hours per day**
_____ **minutes per day**

4. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads **as part of your work**? Please do not include walking.

_____ **days per week**

☐ No moderate job-related physical activity → ***Skip to question 6***

5. How much time did you usually spend on one of those days doing **moderate** physical activities as part of your work?

_____ **hours per day**
_____ **minutes per day**

6. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **as part of your work**? Please do not count any walking you did to travel to or from work.

_____ **days per week**

☐ No job-related walking → ***Skip to PART 2: TRANSPORTATION***

7. How much time did you usually spend on one of those days **walking** as part of your work?

_____ **hours per day**
_____ **minutes per day**

PART 2: TRANSPORTATION PHYSICAL ACTIVITY

These questions are about how you traveled from place to place, including to places like work, stores, movies, and so on.

8. During the **last 7 days**, on how many days did you **travel in a motor vehicle** like a train, bus, car, or tram?

_____ **days per week**

☐ No traveling in a motor vehicle → ***Skip to question 10***

9. How much time did you usually spend on one of those days **traveling** in a train, bus, car, tram, or other kind of motor vehicle?

_____ **hours per day**
_____ **minutes per day**

Now think only about the **bicycling** and **walking** you might have done to travel to and from work, to do errands, or to go from place to place.

10. During the **last 7 days**, on how many days did you **bicycle** for at least 10 minutes at a time to go **from place to place**?

_____ **days per week**

☐ No bicycling from place to place → ***Skip to question 12***

11. How much time did you usually spend on one of those days to **bicycle** from place to place?

_____ **hours per day**
_____ **minutes per day**

12. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time to go **from place to place**?

_____ **days per week**

☐ No walking from place to place → ***Skip to PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY***

13. How much time did you usually spend on one of those days **walking** from place to place?

_____ **hours per day**
_____ **minutes per day**

PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY

This section is about some of the physical activities you might have done in the **last 7 days** in and around your home, like housework, gardening, yard work, general maintenance work, and caring for your family.

14. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, chopping wood, shoveling snow, or digging **in the garden or yard**?

_____ **days per week**

☐ No vigorous activity in garden or yard → ***Skip to question 16***

15. How much time did you usually spend on one of those days doing **vigorous** physical activities in the garden or yard?

_____ **hours per day**
_____ **minutes per day**

16. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** activities like carrying light loads, sweeping, washing windows, and raking **in the garden or yard**?

_____ **days per week**

☐ No moderate activity in garden or yard → ***Skip to question 18***

17. How much time did you usually spend on one of those days doing **moderate** physical activities in the garden or yard?

_____ **hours per day**
_____ **minutes per day**

18. Once again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** activities like carrying light loads, washing windows, scrubbing floors and sweeping **inside your home**?

_____ **days per week**

☐ No moderate activity inside home → ***Skip to PART 4: RECREATION, SPORT AND LEISURE-TIME PHYSICAL ACTIVITY***

19. How much time did you usually spend on one of those days doing **moderate** physical activities inside your home?

_____ **hours per day**
_____ **minutes per day**

PART 4: RECREATION, SPORT, AND LEISURE-TIME PHYSICAL ACTIVITY

This section is about all the physical activities that you did in the **last 7 days** solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.

20. Not counting any walking you have already mentioned, during the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **in your leisure time**?

_____ **days per week**

☐ No walking in leisure time → ***Skip to question 22***

21. How much time did you usually spend on one of those days **walking** in your leisure time?

_____ **hours per day**
_____ **minutes per day**

22. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **vigorous** physical activities like aerobics, running, fast bicycling, or fast swimming **in your leisure time**?

_____ **days per week**

☐ No vigorous activity in leisure time → ***Skip to question 24***

23. How much time did you usually spend on one of those days doing **vigorous** physical activities in your leisure time?

_____ **hours per day**
_____ **minutes per day**

24. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like bicycling at a regular pace, swimming at a regular pace, and doubles tennis **in your leisure time**?

_____ **days per week**

☐ No moderate activity in leisure time → ***Skip to PART 5: TIME SPENT SITTING***

25. How much time did you usually spend on one of those days doing **moderate** physical activities in your leisure time?
_____ **hours per day**
_____ **minutes per day**

PART 5: TIME SPENT SITTING

The last questions are about the time you spend sitting while at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television. Do not include any time spent sitting in a motor vehicle that you have already told me about.

26. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekday**?

_____ **hours per day**
_____ **minutes per day**

27. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekend day**?

_____ **hours per day**
_____ **minutes per day**

This is the end of the questionnaire, thank you for participating.

Annex 6
Draft match record sheet for brennball for the visually impaired

Adapted match record sheet for brennball			
List of players on the bat (team A)		List of players on the bat (team B)	
1.		1.	
2.		2.	
3.		3.	
4.		4.	
5.		5.	
6.		6.	
7.		7.	
8.		8.	
9.		9.	
10.		10.	
11.		11.	
12.		12.	

Získané body v poli				
	2	Catching a flying ball	2	
	1	Catching a rolling ball	1	
	1	Loss of orientation – runner	1	
	5	Running ahead	5	
	6	Nobody on the bat	6	
Bat points				
	1	Home	1	
	6	Home run – whole round	6	
	1	Loss of orientation – fielder	1	
	4	Crossing the main line	4	
		Points first half		
		Points second half		
		Points total		

Subject index

Name index

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