



Science, Movement and Health, Vol. XVI, ISSUE 2 Supplement, 2016  
September 2016, 16 (2, Supplement): 468-476  
Original article

## CONSIDERATIONS REGARDING THE IMPROVEMENT OF COORDINATION CAPACITY IN BLIND CHILDREN

IONESCU Oana-Cristiana<sup>1</sup>, CORDUN Mariana<sup>2</sup>

### Abstract\*

*Aim.* According to the reports of World Health Organization (2014), at a global level it would be 285 million people with visual impairments, of whom 246 million have been diagnosed with amblyopia and the remaining 39 million are suffering from visual blindness. The latter ones, in a percentage of 82%, are aged 50 years or more.

The purpose of the study consists in assessing the coordination level of children with visual blindness. For this, we shall apply a number of tests through which we aim to identify the response (progression/regression) to movement therapy under the form of physical exercises with hand apparatus. The study objectives are the following: improvement of coordination capacity in children with visual blindness; making up the group of subjects; selection and adjustment of the tests for assessing coordination capacity; establishing the hand apparatus specific to rhythmic gymnastics, used to compose programmes for the development of coordination capacity; execution of the required actions by the children with visual impairments, using hand apparatus; collection, processing and interpretation of the data obtained from studying the group of children with visual blindness.

*Methods.* The research methods used in developing this study are represented by: bibliographical study method, case study method, observation and graphical method. To identify the coordination level of children with visual blindness, we assessed: eye-hand ability, static balance, spatial and temporal orientation ability.

*Results.* The study results highlight an improvement of the coordination capacity level in children with visual blindness.

*Conclusions.* These confirm that the application of means specific to rhythmic gymnastics, mainly exercises with hand apparatus, has led to improved coordination for the research subjects. This has the effect of increasing autonomy during the interaction with the surrounding environment for carrying out everyday activities: domestic, professional and leisure time ones.

*Keywords:* coordination capacity, visual blindness, rhythmic gymnastics.

### Introduction

“Vision impairment is a dysfunction in which the visual analyzer is unable to receive, transmit or interpret stimuli in a favorable way for educational and social integration” (Teodorescu, Bota, Stanescu, 2003, p. 88).

The Centers for Disease Control and Prevention (USA, 2015) states that visual impairment occurs when the loss of visual acuity reaches the value of 20/70, after the correction of vision by wearing glasses (<http://www.cdc.gov/ncbddd/developmentaldisabilities/casedefinitions.html>).

Visual acuity is influenced by various factors, such as: age, pupil diameter, eye accommodation etc. This is subjectively measured with an eye chart displaying successive rows of

letters, numbers or figures of different heights. The examined person is positioned at a distance of 33 cm up to 5 m from the chart to be assessed their near or distance vision acuity.

Depending on the limitation of vision acuity, the following visual impairments are described:

- amblyopia – which represents a decrease in visual acuity, but allowing the person to carry out independently everyday activities;
- visual blindness (cecidity) – which consists in the partial or total loss of visual acuity (blind people), an issue which requires the presence of a third person (human, animal etc.) to help them carry out daily activities; the lack of vision can be counteracted by the compensatory development of other analyzers, particularly the auditory and tactile ones.

<sup>1</sup> Doctoral School, National University of Physical Education and Sports, Bucharest, ROMANIA

<sup>2</sup> Department of Special Motricity and Medical Recovery, Faculty of Kinetotherapy, National University of Physical Education and Sports, Bucharest, ROMANIA

E-mail address: oanac.ionescu@yahoo.com

Received 17.03.2016 / Accepted 04.04.2016

\* the abstract was published in the 16<sup>th</sup> I.S.C. "Perspectives in Physical Education and Sport" - Ovidius University of Constanta, May 20-21, 2016, Romania



The term amblyopia derives from the Greek word *amblyos*, which means weak, dull, and *ops*, which means vision, and the term *cecitas* from the Latin word *caecitas*, meaning blindness.

According to the reports of World Health Organization (2014), at a global level it would be 285 million people with visual impairments, of whom 246 million have been diagnosed with amblyopia and the remaining 39 million are suffering from visual blindness. The latter ones, in a percentage of 82%, are aged 50 years or more (<http://www.who.int/mediacentre/factsheets/fs282/en/#>).

Also, the World Health Organization states that amblyopia is currently the main impairment leading, in a 50% percentage, to the loss of vision. This is the consequence of degenerative physiological processes, coupled with the increasing number of ageing population at a global level (demographic ageing). Other conditions which lead to blindness are represented by: trachoma, glaucoma, diabetes etc. (<http://www.who.int/mediacentre/factsheets/fs213/en/>)

To prevent the increasing number of blind people, regular ophthalmological examination is

### Methods

- Bibliographical study method - aimed at examining some interdisciplinary informative materials in the fields of physical education and sports, medicine (ophthalmology) and psycho-pedagogy.
- Case study method - applied to a group made up of 5 children with visual blindness.
- Observation - focused on exploring the motor behavior of subjects included in the study and conducted during both the physical education classes and other curricular and extracurricular activities.
- Graphical method - materialized in drawing up some column charts, which have the advantage of quickly revealing the coordination capacity reaction (progression/regression) to the applied programme of physical exercises with hand apparatus.

All these methods fall into the quantitative and qualitative types.

### Assessment tests

required, and if some eye disorder is detected, the complex treatment should be applied as early as possible.

The study purpose is to assess the level of coordination capacity in children with visual blindness. For this, we shall apply a number of tests through which we aim to identify the response (progression/regression) to movement therapy under the form of physical exercises with hand apparatus.

The study objectives refer to the following aspects:

- improvement of coordination capacity in children with visual blindness;
- making up the group of subjects;
- selection and adjustment of the tests for assessing coordination capacity;
- establishing the hand apparatus specific to rhythmic gymnastics, used to compose programmes for the development of coordination capacity;
- collection, processing and interpretation of the data obtained from studying the group of children with visual blindness.

Assessing the level of coordination capacity was achieved based on some tests, as follows: eye-hand coordination test, spatial orientation test and Romberg test.

To establish the score for each test, we developed a number of assessment scales, taking as a landmark the results (trial/error) obtained in a test conducted prior to the application of the respective testing.

- The *eye-hand coordination test* consists in throwing rhythmic gymnastics balls (3) into a space delimited by means of a hoop. The hoop is positioned on the ground, at a 3-meter distance from the launching area. The time for achieving the three throws is 1 minute.

Score scale:

0 points = subject does not reach the target in the three attempts and fails to fall within the time frame;

1 point = subject does not reach the target in the three attempts, but falls within the time frame;

2 points = subject reaches the target once in the three attempts and fails to fall within the time frame;

3 points = subject reaches the target once in the three attempts, but falls within the time frame;

4 points = subject reaches the target twice in the three attempts and fails to fall within the time frame;



5 points = subject reaches the target twice in the three attempts, but falls within the time frame;

6 points = subject reaches the target three times in the three attempts and fails to fall within the time frame;

7 points = subject reaches the target three times in the three attempts, but falls within the time frame.

- The *spatial orientation test* involves marking on a line two points, A and B, found at a 2-meter distance. Starting from point A, the subject with visual blindness must cover the 2 meters so as to stop in point B. Scores are awarded as follows: exceeding point B is marked with +, and not reaching it is marked with cu -. Measurements were performed in centimeters.

*Score scale:*

0 points = exceeding/not reaching point B by +/- 100 cm;

1 point = exceeding/not reaching point B by +/- 75 cm;

2 points = exceeding/not reaching point B by +/- 50 cm;

3 points = exceeding/not reaching point B by +/- 25 cm;

4 points = reaching point B (0 cm).

- The *Romberg test* assesses static balance; the position that the subject must hold for 1 minute is represented by standing, with the upper limbs flexed at 90° in the scapular-humeral joint. It was assessed the total number of deviations and steps during the trial.

*Score scale:*

1 point =  $\geq 20$  deviations;

2 points =  $\geq 10$  deviations;

3 points =  $\geq 5$  deviations;

4 points =  $< 5$  deviations;

1 point is added for each stepping.

The overall score represents the sum of points obtained for deviations and stepping.

The three tests were applied to children with visual blindness, in dynamics. The initial assessment was carried out before applying the gymnastics programme and was aimed at determining the coordination level, which has become a landmark for the final assessment applied 6 months later, a time frame during which the subjects have learnt to perform various actions with the selected hand apparatus (rope, hoop, ball).

Research subjects and location: The subjects, 5 in number, were selected among pupils from Special Middle School for Visually Impaired, Bucharest, being enrolled in the 3<sup>rd</sup> grade.

In order to make up the group of subjects, we applied the following criteria:

- Inclusion criteria:*
  - diagnosis: visual blindness;
  - age: 9-11 years;
  - good physical condition.
- Exclusion criteria:*
  - diagnosis: bilateral amblyopia;
  - age: under 9 years;
  - age: over 11 years;
  - poor physical condition;
  - participation in previous studies.

To conduct the study, we developed the research ethics rules. The subjects were included in the research based on the consent of the school leadership and parents (a written consent given after being informed).

Data regarding the investigated subjects are presented in table no. 1.

Table no. 1 – Data on the research subjects

Subjects	Gender	Age	Diagnosis
----------	--------	-----	-----------



		(years)	
<b>Subject 1</b>	F	9 years	BE – Proliferative retinopathy; BE – Surgical aphakia; RE – Vitrectomy; LE – Corneal transplant, vitrectomy.
<b>Subject 2</b>	M	10 years	Leber congenital amaurosis
<b>Subject 3</b>	M	10 years	NLP, total retinal detachment; LE – Uveitis sequelae, surgical aphakia; Mental retardation
<b>Subject 4</b>	M	9 years	Congenital nystagmus, optic nerve hypoplasia; Neuro-psychomotor retardation; Autistic spectrum disorders; Post hypoxic brain injuries.
<b>Subject 5</b>	M	9 years	LE – NLP; BE – Optic nerve atrophy.

**Legend:**

- LE – left eye;
- RE – right eye;
- BE – both eyes;
- NLP – no light perception.

The programme applied: During the study, there were conducted 10 lessons which included various exercises with the following hand apparatus:  
Table no. 2 – Work programme

rope, hoop and ball. Table no. 2 shows how the means used were staggered throughout the 11 weeks of work.

Week no.	Means	Dosage
<b>Week 1</b>	<i>Exercises for getting familiar with the selected hand apparatus:</i> - Learning the apparatus grip – rope; - Learning the apparatus grip – hoop; - Learning the apparatus grip – ball.	5 minutes 5 minutes 5 minutes
<b>Week 2</b>	<i>Exercises performed with hand apparatus – rope:</i> - Standing, rope grip with one end in each hand, the apparatus is carried to the frontal plane; - Standing, rope grip with one end in each hand, the apparatus is carried to the sagittal plane; - Backward movement, executing snake-shaped drawings on the ground.	3x8, 1-minute break between series 3x8, 1-minute break between series 5 minutes
<b>Week 3</b>	<i>Exercises performed with hand apparatus – hoop:</i> - Standing, swing on the frontal plane, hoop grip with the right hand; - Standing, swing on the frontal plane, hoop grip with the left hand; - Standing, hoop is passed from one hand to the other; - Standing, hoop is rolled on the ground with the skillful hand.	3x8, 1-minute break between series 3x8, 1-minute break between series 3x8, 1-minute break between series 5 minutes
<b>Week 4</b>	<i>Exercises performed with hand apparatus – ball:</i>	



	<ul style="list-style-type: none"> <li>- Standing, swing on the sagittal plane, ball is held with the right hand;</li> <li>- Standing, swing on the sagittal plane, ball is held with the left hand;</li> <li>- Standing, bounces are performed with the right hand;</li> <li>- Standing, bounces are performed with the left hand.</li> </ul>	<p>3x8, 1-minute break between series</p> <p>3x8, 1-minute break between series</p> <p>3x8, 1-minute break between series</p> <p>3x8, 1-minute break between series</p>
<b>Week 5</b>	<p><i>Exercises performed with hand apparatus – rope:</i></p> <ul style="list-style-type: none"> <li>- Standing, rope grip with one end in each hand, the apparatus is wrapped around the body;</li> <li>- Standing, circular horizontal swing overhead, performed to the right, rope grip with one end in each hand;</li> <li>- Standing, circular horizontal swing overhead, performed to the left, rope grip with one end in each hand.</li> </ul>	<p>5 minutes</p> <p>3x8, 1-minute break between series</p> <p>3x8, 1-minute break between series</p>
<b>Week 6</b>	<p><i>Exercises performed with hand apparatus – hoop:</i></p> <ul style="list-style-type: none"> <li>- Standing, hoop rotation around the vertical axis from support to the ground, performed with the right hand;</li> <li>- Standing, hoop rotation around the vertical axis from support to the ground, performed with the left hand;</li> <li>- Standing, hoop is held with double grip overhead, passing through the hoop;</li> <li>- Standing, hoop rotation on the frontal plane, around both hands, to the right;</li> <li>- Standing, hoop rotation on the frontal plane, around both hands, to the left.</li> </ul>	<p>3 minutes</p> <p>3 minutes</p> <p>3 minutes</p> <p>3x8, 1-minute break between series</p> <p>3x8, 1-minute break between series</p>
<b>Week 7</b>	<p><i>Exercises performed with hand apparatus – ball:</i></p> <ul style="list-style-type: none"> <li>- Standing, bounces are performed with alternating hands;</li> <li>- Travelling with bounces performed alternately;</li> <li>- Travelling with bounces performed with the right hand;</li> <li>- Travelling with bounces performed with the left hand.</li> </ul>	<p>4x8, 1-minute break between series</p> <p>3 minutes</p> <p>3 minutes</p> <p>3 minutes</p>
<b>Week 8</b>	<p><i>Exercises performed with hand apparatus – rope:</i></p> <ul style="list-style-type: none"> <li>- Standing, circular swing on the frontal plane, performed to the right, rope grip with one end in each hand;</li> <li>- Standing, circular swing on the frontal plane, performed to the left, rope grip with one end in each hand;</li> <li>- Standing, stepping forward over the rope with the right foot;</li> </ul>	<p>3x8, 1-minute break between series</p> <p>3x8, 1-minute break between series</p> <p>3x8, 1-minute break between series</p>



<b>Week 9</b>	- Standing, stepping forward over the rope with the left foot.	3x8, 1-minute break between series
	<i>Exercises performed with hand apparatus – hoop:</i>	
	- Standing, hoop rotation forward on the sagittal plane, around the right hand;	3x8, 1-minute break between series
	- Standing, hoop rotation forward on the sagittal plane, around the left hand;	3x8, 1-minute break between series
	- Standing, hoop rotation on the transverse plane (overhead), around both hands, towards the skillful side;	3x8, 1-minute break between series
<b>Week 10</b>	- Standing, hoop rotation on the frontal plane, around both hands, towards the skillful side.	3x8, 1-minute break between series
	<i>Exercises performed with hand apparatus – ball:</i>	
	- Standing, ball rolling on the right arm;	3 minutes
	- Standing, ball rolling on the left arm;	3 minutes
	- Standing, ball rolling forward on both arms;	5 minutes
- Travelling with ball passing from one hand to the other, around the body.	4 minutes	

**Results**

In tables no. 3, 4 and 5, we present the data obtained from the assessments in dynamics,

performed on the basis of tests described in the general part.

Table no. 3 – Eye-hand coordination test

Subjects	Initial assessment				Final assessment			
	Number of failed attempts	Number of successful attempts	Time (in seconds)	Score	Number of failed attempts	Number of successful attempts	Time (in seconds)	Score
Subject 1	3	0	30	1	3	0	26	1
Subject 2	3	0	70	0	3	0	54	1
Subject 3	3	0	86	0	3	0	72	1
Subject 4	3	0	58	1	3	0	40	1
Subject 5	3	0	51	1	2	1	52	3

In table no. 3, it is noticed that the data obtained for the eye-hand coordination test have improved from one assessment to the other in the case of three subjects (2, 3 and 5). The other two

subjects (1 and 4) have not shown progress at the assessments in dynamics following the application of rehabilitation programme.

Table no. 4 – Spatial orientation test

Subjects	Initial assessment		Final assessment	
	Distance travelled to point B (in centimeters)	Score	Distance travelled to point B (in centimeters)	Score
Subject 1	- 48	2	- 27	2
Subject 2	- 10	3	0	4
Subject 3	+ 100	0	- 53	1
Subject 4	+ 26	2	0	4
Subject 5	+ 44	2	+ 31	2

Table no. 4 shows the data obtained by assessing the spatial orientation of subjects with

visual blindness. Three of the 5 subjects (2, 3 and 4) have progressed after learning to handle the apparatus

specific to rhythmic gymnastics. The increased scores highlight an improvement in the tests performed, as a

response to the application of the rehabilitation programme.

Table no. 5 – Romberg test

Subjects	Initial assessment						Final assessment					
	Deviation distribution	Total number of deviations	Deviation score	Stepping	Stepping score	Overall score	Deviation distribution	Total number of deviations	Deviation score	Stepping	Stepping score	Overall score
<b>Subject 1</b>	4 r	4	4	1	1	<b>5</b>	1 r	1	4	0	0	<b>4</b>
<b>Subject 2</b>	9 r + 12 l	21	1	4	4	<b>5</b>	7 r + 8 l	15	2	3	3	<b>5</b>
<b>Subject 3</b>	11 r + 13 l	24	1	6	6	<b>7</b>	6 r + 11 l	17	2	4	4	<b>6</b>
<b>Subject 4</b>	4 r + 11 l	15	2	3	3	<b>5</b>	4 r + 11 l	15	2	2	2	<b>4</b>
<b>Subject 5</b>	4 r + 3 l	7	3	2	2	<b>5</b>	4 l	4	4	1	1	<b>5</b>

**Legend:**  
 r – right;  
 l – left.

As regards the assessment of static balance (table no. 5), the obtained results prove that three of the 5 subjects (1, 3 and 4) have recorded progress from the initial assessment to the final one after participating in the study and performing various actions with hand apparatus specific to rhythmic

gymnastics. The decreased scores emphasize an improvement in the tests performed, as a response to the application of the rehabilitation programme.

Based on the graphical method (charts no. 1, 2 and 3), we present the progress recorded by the subjects throughout the study.

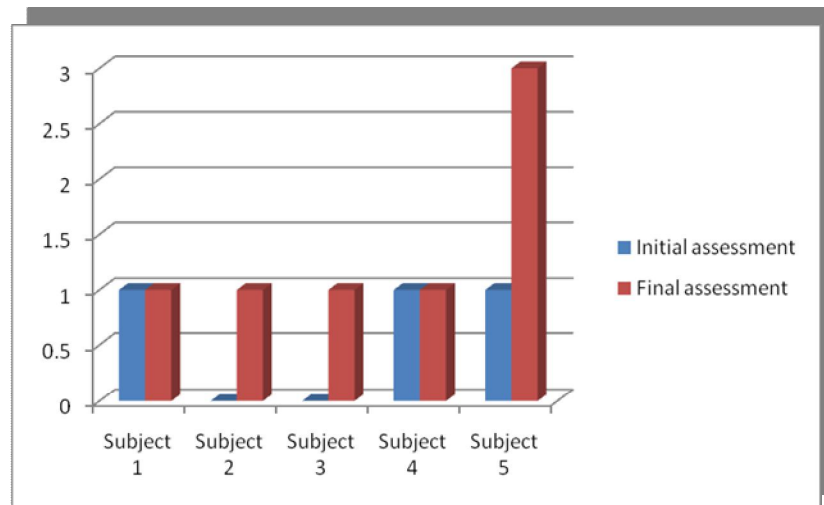


Chart no. 1 – Scores recorded by the subjects (Eye-hand coordination test)

Chart no. 1 shows the scores obtained by the participants in the study following the assessments in dynamics of their eye-hand ability. If, in the initial assessment, it has been noticed that all three attempts were unsuccessful, in the final assessment, it has been found that only one of the 5 subjects managed once to reach the target positioned on the ground. As

regards the execution time, most children with visual blindness succeeded in achieving the three throws within the time frame allotted for the test, even if, in the initial assessment, two pupils had exceeded the 60 seconds. However, three subjects made progress (subjects 2, 3 and 5), recording a higher score in the second assessment.

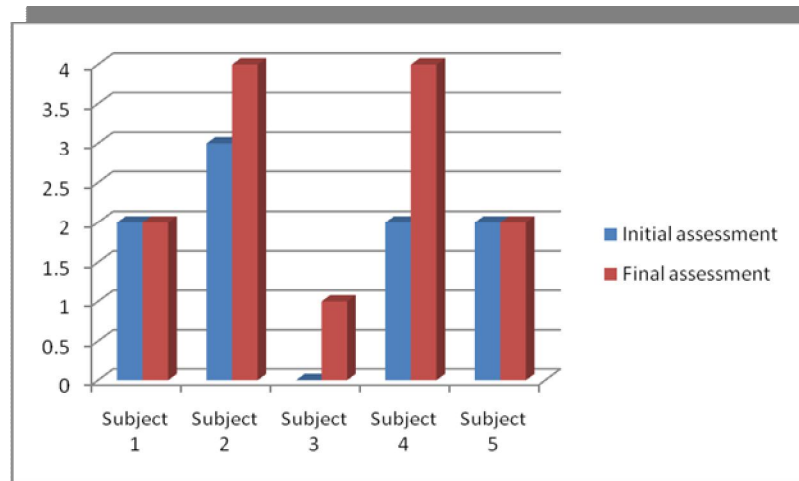


Chart no. 2 – Scores recorded by the subjects (Spatial orientation test)

In chart no. 2, we can notice the scores obtained by the subjects in the assessment of spatial and temporal orientation ability. The columns indicate that three children with visual blindness have

managed to progress following the application of the movement therapy programme. We mention that two subjects (2 and 4) have stopped just at the point marked on the ground, within the final assessment.

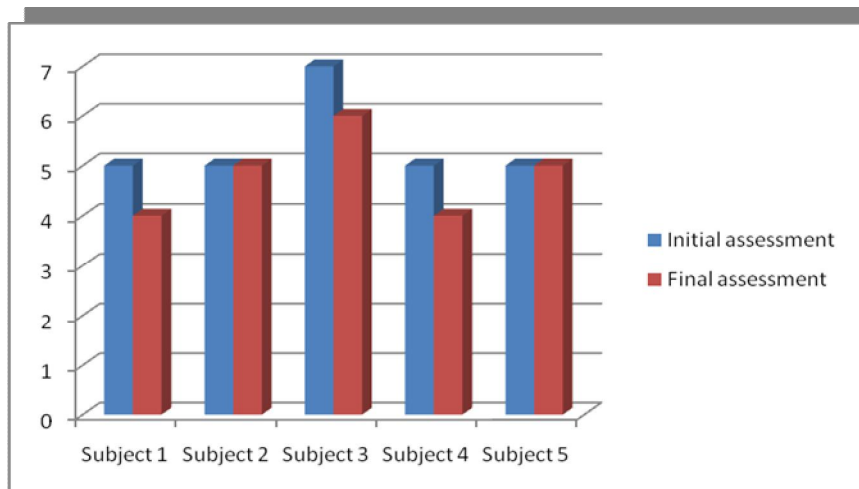


Chart no. 3 – Scores recorded by the subjects (Romberg test)

În chart no. 3, we notice the progress made by the subjects in Romberg test, which assesses static balance. Following the assessments in dynamics, we observe that three pupils (subjects 1, 3 and 4) have recorded progress highlighted by a higher score in the initial assessment compared to the final one. This progress proves the efficiency of the rehabilitation programme for the static balance of the investigated subjects.

### Conclusions

1. Of the total number of subjects included in the study, 60% have progressed after the treatment, an assertion supported by the

results obtained at the assessments in dynamics. This demonstrates that the means specific to rhythmic gymnastics can contribute significantly to the improvement of coordination capacity.

2. The process of learning the required actions was difficult, because the subjects included in the research were suffering from visual blindness.
3. Children with suppressed visual function cannot perceive through the analyzer the demonstrations performed by the physical education teacher, therefore his/her presence is compulsory to explain them the test





- requirements and to compensate for their visual impairment through a tactile-kinesthetic intervention.
4. Exercises with hand apparatus can develop the motor background of children with visual impairments, especially those with visual blindness, can increase the coordination capacity and therefore the quality of life for these categories of people with special educational needs.

### **Acknowledgements**

For all of our participants from my study I want to say thank you.

### **References**

- Cordun M, 2009, Kinantropometrie, Editura CD Press, București
- Dumitrache M, 2015, Compendiu de patologie oftalmologică, Editura Medicală, București
- Grigore V, 2003, Gimnastica: manual pentru cursul de bază, Editura Bren, București
- Macovei S, 2007, Exerciții cu obiecte portative pentru educația fizică adaptată și incluzivă, Editura Didactică și Pedagogică R. A., București
- Teodorescu S, Bota A, Stănescu M, 2003, Educație fizică și sport adaptat pentru persoane cu deficiențe senzoriale, mintale și defavorizate social, Editura Semne, București
- <http://www.cdc.gov/ncbddd/developmentaldisabilities/casedefinitions.html>
- <http://www.who.int/mediacentre/factsheets/fs282/en/#>
- <http://www.who.int/mediacentre/factsheets/fs213/en/>  
Blindness: Vision 2020 - The Global Initiative for the Elimination of Avoidable Blindness