

Teaching Science to Visual Impaired Students: What They Need?



MUSTAFA SÖZBİLİR,
AYDIN KIZILASLAN & S. LEVENT ZORLUOĞLU

Introduction



- Nature of visual impairment
- Challenges of visual impairment in the classroom
- Impact of visual impairment on educational setting

Paper presented at the 48th IUPAC World Chemistry Congress, Busan, South Korea August 2015

Nature of visual Impairment



Visual impairment refers to «a functional loss of vision» rather than «the eye disorder».

The nature and degree of visual impairment may vary significantly, so each student may require individual adaptations to instructional practices and materials in order to learn effectively.

Paper presented at the 48th IUPAC World Chemistry Congress, Busan, South Korea August 2015

Low Vision vs Blindness



Low Vision is reduced central acuity of 20/70 or less in the better eye after correction.

Most students with visual impairments have low vision. These students should be encouraged to use their residual (remaining) vision, when appropriate, using the necessary optical aids and adaptations.

Blindness ranges from being totally without sight to unreliable vision and primary reliance on other senses. A person with blindness usually uses braille as a reading and writing medium.

Students who are described as blind may have some usable vision.

Legal Blindness ranges from a visual acuity of 20/200 in the better eye after correction, to having no usable vision or a field of vision reduced to an angle of 20 degrees. Visual acuity of 20/200 means that the individual sees at 20 feet what is normally seen at 200 feet.

Paper presented at the 48th IUPAC World Chemistry Congress, Busan, South Korea August 2015

Some causes of the visual impairment



Systemic Conditions

- ✓ Diabetes
- ✓ Hypertension (high blood pressure)
- ✓ Vitamin A deficiency
- ✓ Infections involving the eyes
- ✓ Human immunodeficiency virus (HIV)

Specific Eye Conditions

- ✓ Macular degeneration—deterioration of the central part of the retina
- ✓ Cataracts—clouding of the lens of the eye
- ✓ Eye injuries
- ✓ Tumors involving the eye or surrounding structures in the head and neck
- ✓ Glaucoma—damage to the nerve connecting the eye to the brain caused by increased pressure inside the eye

Paper presented at the 48th IUPAC World Chemistry Congress, Busan, South Korea August 2015

Symptoms of children with visual impairment



During infancy:

- ✓ Lack of eye contact
- ✓ No blinking to bright light
- ✓ Do not look at his/her hands
- ✓ Do not visually follow moving objects in front of his/her face



Paper presented at the 48th IUPAC World Chemistry Congress, Busan, South Korea August 2015

Symptoms of children with visual impairment



During infancy:

- ✓ Slow response to voiceless toys or parents' faces; respond only to sound
- ✓ No imitation of others' expressions and actions
- ✓ Do not actively reach out for his/her favourite toys
- ✓ Fear of gross motor activities, such as crawling



Paper presented at the 48th IAPAC World Chemistry Congress, Busan, South Korea August 2015

Symptoms of children with visual impairment



During early childhood:

- ✓ Often keep his/her head down; lack eye contact with others
- ✓ Limited facial expression and body language
- ✓ Tend to hold objects very close to the eyes when looking at them
- ✓ Abnormal responses to bright light (gazing at light excessively or trying to avoid it)



Paper presented at the 48th IAPAC World Chemistry Congress, Busan, South Korea August 2015

Symptoms of children with visual impairment



During early childhood (cont.)

- ✓ Often bump into objects or fall over, and get confused with directions
- ✓ Search for his/her way using hands
- ✓ May press on eyeballs with fingers
- ✓ Jerky movements of the eyeballs



Paper presented at the 48th IAPAC World Chemistry Congress, Busan, South Korea August 2015

Challenges of visual impairment in the classroom



- ▶ Fewer opportunities to acquire visual information (i.e. maps, art, materials, ...)
- ▶ Learning Difficulties
 - ▶ may read very slowly therefore fall behind
 - ▶ difficult to meet the demands of general education classroom
- ▶ Social difficulties
 - ▶ can't catch non-verbal cues from others
 - ▶ inability to judge distance (i.e. stand too close when socializing)

Paper presented at the 48th IAPAC World Chemistry Congress, Busan, South Korea August 2015

Impact of visual impairment on educational settings



- ▶ Delays in concept development which severely impact on the student's social, emotional, academic, and vocational development
- ▶ Compromised capacity to be independent, both in immediate learning environment and the wider school community.
- ▶ Reduced reading rates to that of sighted peers, requiring additional time for all reading tasks and regular monitoring of low vision aids.

Paper presented at the 48th IAPAC World Chemistry Congress, Busan, South Korea August 2015


Impact of visual impairment on educational settings (cont.)



- ▶ Required development of alternate mediums, i.e. tactile and auditory sense, for learning;
- ▶ Reduced access to standard learning materials, requiring the development of specialized skills as well as modified specialized books, materials and equipment for learning through alternate modes,
- ▶ Compromised capacity to gather information through observation and therefore reduced incidental learning.

Paper presented at the 48th IAPAC World Chemistry Congress, Busan, South Korea August 2015


Method



- Purpose of the study
- Research design
- Characteristics of the sample
- Data collection

Paper presented at the 45th IUPAC World Chemistry Congress, Busan, South Korea August 2015

Purpose of the study



Education of children with special needs have so many challenges. Modified science curriculum development for example stands as a grand challenge.

- We aimed to analyze visual impaired students' needs in learning science through a qualitative study based on classroom observation and interviewing students and teachers.

Paper presented at the 45th IUPAC World Chemistry Congress, Busan, South Korea August 2015

Research Design









- ✓ This is a case study representing a 8th grade classrom taking science in special school for blind based in Erzurum/Turkey.
- ✓ Case studies are in-depth investigations of a single person, group, event or community. Typically data are gathered from a variety of sources and by using several different methods (e.g. observations & interviews).

Paper presented at the 45th IUPAC World Chemistry Congress, Busan, South Korea August 2015


Turkey-Regional



Scenes from Erzurum

Characteristics of the sample



Students	Gender	Sight Level
S1	Male	No Sight
S2	Male	Severe Myopia
S3	Male	Severe Myopia
S4	Male	50%
S5	Male	50%
S6	Male	20 - 0%

Paper presented at the 45th IUPAC World Chemistry Congress, Busan, South Korea August 2015

Data collection



- ✓ Data were collected through unstructured observation and interviews were carried out with students and the science teacher.
- ✓ Data collected were subjected to descriptive analysis.

Paper presented at the 48th IUPAC World Chemistry Congress, Busan, South Korea August 2015

RESULTS & DISCUSSION



Paper presented at the 48th IUPAC World Chemistry Congress, Busan, South Korea August 2015

Results

Teaching Science to Visual Impaired Students: What They Need?



1. Needs for Classroom Design
2. Need for Effective Teaching
 - a) Need for Assistive Technology (AT)
 - b) Need for Effective Instruction
 - c) Need for Effective Instruction Materials
 - d) Need for Effective Designed Laboratory Experiments
3. Need for Effective Summative Assessment

Paper presented at the 48th IUPAC World Chemistry Congress, Busan, South Korea August 2015

1. Needs for Classroom Design



- ✓ Black board or white board position to students, student-students interaction is not well-arranged.
- ✓ Light comes from window is not suitable for student's need. For example; in the first picture, student is bothered by light and protect his eyes by his hands from light come from windows.



Paper presented at the 48th IUPAC World Chemistry Congress, Busan, South Korea August 2015

1. Needs for Classroom Design (cont.)



- ✓ Comfort and the design of the furniture.

Suggestions: The first step in arranging the classroom is sketch the classroom and include features that can't be moved (windows, doors, built in cabinets, built in counters, etc.).

For students with low vision, provide good contrast in furnitures, walls, and floors.

As a thumb of rule, avoid excessive furniture, materials and equipment.

Paper presented at the 48th IUPAC World Chemistry Congress, Busan, South Korea August 2015

2. Need for Effective Teaching



- a) Need for Assistive Technology (AT)
 - ✓ Students we observed have difficulties in drawing or analyzing graph for time vs temperature, reading text, doing calculations and performing experiments without assistive technologies. For example, in the first picture students try to draw a graph and in the second one they try to take notes



Paper presented at the 48th IUPAC World Chemistry Congress, Busan, South Korea August 2015

2. Need for Effective Teaching



a) Need for Assistive Technology (AT) (continue)

- ✓ Students that we observed lack AT to do homework, do research, take tests, and read books, draw graphs, etc.

Suggestions: Technology has removed many barriers to education and employment for visually impaired individuals.

Some assistive technologies such as: screen magnification software, magnification with speech, braille printers, screen reading software (jaws), screen magnification / reading software (zoomtext), could be used to reduce these barriers.

Paper presented at the 48th IUPAC World Chemistry Congress, Busan, South Korea August 2015

2. Need for Effective Teaching



b) Need for Effective Instruction

- ✓ The teacher, we observed, usually use direct instruction. The difficulties of learning science concepts can be reduced by use of activity based teaching, but the teacher didn't use any activity during the whole course.
- ✓ For example in the first picture teacher use direct instruction to teacher concept, in the second one he use memorization technique.



Paper presented at the 48th IUPAC World Chemistry Congress, Busan, South Korea August 2015

2. Need for Effective Teaching



b) Need for Effective Instruction (cont.)

While students with low vision need a larger print documents, blind students need tactile documents. But the teacher didn't use any instructional materials.

Suggestions: Students who are blind or visually impaired exhibit a functional vision loss and generally are unable to see or read standard print-based materials.

Especially in science lesson students need the specialized formats (such as braille, large print, audio, and digital text) in order to access the information it contains

Paper presented at the 48th IUPAC World Chemistry Congress, Busan, South Korea August 2015

2. Need for Effective Teaching



d) Need for effective designed laboratory experiments

The course instructor didn't do any experiment, but it is easy to teach some concept (heat transfer and differences between heat and temperature) with easy experiments.

Suggestions: Science laboratory experiences that allow to use the laboratory equipment, perform experiments, and take data, helps visual impaired students to make connections between concepts

Three strategies (concrete experiences, learning by doing, and unifying experiences) in modified laboratories are very helpful to make science concept understandable regarding students visual deficit.

Paper presented at the 48th IUPAC World Chemistry Congress, Busan, South Korea August 2015

3. Need for effective summative assessment



- ✓ The teacher only use traditional assessment techniques such as; multiple-choice tests, fill-in-the-blanks, true-false, matching
- ✓ All these assessment techniques are vision-based, so it is difficult to evaluate students' concept learning

Suggestions: Students can evaluate their own learning by alternative assessment techniques such as; doing the oral examination or performance based evaluation

Paper presented at the 48th IUPAC World Chemistry Congress, Busan, South Korea August 2015

Recommendation: What should be considered?



- ▶ Reduced volume of work;
- ▶ Uses concrete/tactile materials
- ▶ Modified assessment delivery e.g. Auditory, performance based
- ▶ Alternative format presentation e.g. Braille, large print, auditory
- ▶ Extra time to comprehend and process work

Paper presented at the 48th IUPAC World Chemistry Congress, Busan, South Korea August 2015

Contact & Thank You



Sponsors

This Project was financed
by TÜBİTAK under the
contract number 114K725.

Contact

Prof. Dr. Mustafa SÖZBİLİR
Atatürk University
Kazım Karabekir Education Faculty
Department of Secondary
Science & Mathematics Education
Chemistry Education
25240- Erzurum/TURKEY
sozbilir@atauni.edu.tr

Paper presented at the 49th IUPAC World Chemistry Congress, Busan, South Korea August 2015