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INTRODUCTION



Students with visual impairments include those with low vision and totally blind. It is accepted that students with visual impairments have the same range of cognitive abilities as their peers, but they learn through sensory channels other than vision, primarily hearing and touching. But the concepts in science and mathematics have been found inaccessible to students with visual impairment due to vast use of figures, equations and graphs, so visually impaired students often have less opportunities for incidental learning and the reinforcement of concepts.

Education processes and teaching methods should be organized by taking the visual needs of the students into consideration in the education environments where visually impaired students are realization of a more effective learning should be ensured. Therefore, individual needs of the students should also be determined and education methods according to these needs should be selected. The use of materials and tools in Science lessons is considerably important.



METHOD

Being as part of a large project, this study aimed to develop an activity for teaching the concept of thermal insulation and materials that could be used for visually impaired students. For this purpose, we have designed an activity based on using tactile materials for making science more accessible to 6th grade visually impaired students. Participant of the study were eight visually impaired students including three blind students. The activity is designed with simple, economical and easily accessible everyday materials.

Student No	Vision Level	Study group for the last stage
Ö1	Low Vision	
Ö2	Blind	
Ö3	Low Vision	
Ö4	Blind	
Ö5	Blind	
Ö6	Low Vision	
Ö7	Low Vision	
Ö8	Low Vision	

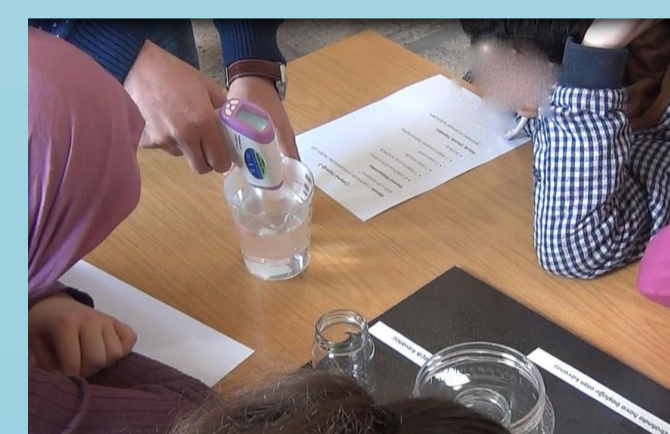
Implementation



Two glass jars with lid, one of which is placed inside another bigger jar were used to represents single glazed and double glazed windows.



Both glass jars were filled with hot water. The initial temperature of the water was measured with an infrared speaking thermometer and recorded by the students and then lids of the jars were closed.



Then students were questioned about relative decrease in the temperature of water in the jars during the following 20 minutes through inquiry questions.



After 20 minutes the lids of the jars were opened, the final temperature of the water in the jars was measured (initial temperatures were the same) and temperature changes of the small jars were compared to the one

which was placed inside another bigger jar. Five minutes was given the students to discuss and think about their answers. All of the students actively involved the activity and follow up interviews indicated that this activity significantly contributed to the students' concept understanding of thermal insulation and the use of double glazed windows.

RESULTS AND DISCUSSION



Teacher: What were the initial temperature of waters?
Ö3, Ö4, Ö7: Temperature of both glass jars were 78 °C.
Teacher: Ok. What is the last temperature?
Ö1, Ö4: It is 59 °C.
Ö3, Ö7: It is 54 °C.
Ö4: hmmm, last temperature is 54 °C in small glass jar. Temperature is 59 °C in small glass jar placed inside another bigger jar.
Teacher: Ok. Temperature dropped to 59 °C from 78 °C. Can you compare temperature change of the small jar with temperature change of small glass jar placed inside another bigger jar?
Ö4: So, temperature change of small glass jar placed inside another bigger jar is less. Because there is gap between jar.
Ö7: The small jar contact with air. There are gap in the other jar. The gap blocked cooling of water.



Teacher: Ö5 tell me: What were the initial temperature of waters?
Ö5: 78 °C.
Teacher: Ö8 and Ö6 tell us: What were the initial temperature of waters?
Ö8: It was 78 °C.
Ö6: Single jar was 78 °C. Other jar was 78 °C.
Teacher: What is the last temperature?
Ö5, Ö6, Ö8: Small jar is 55.9 °C. Other jar is 60 °C.
Teacher: Can you tell me which jar is cold?
Ö6: small jar is cold.
Teacher: why?
Ö6: Big jar and gap are provided thermal insulation.
Teacher: Ö8 tell us: What is result to be drawn from activity?
Ö8: Temperature decrease was less in the glass jar that was placed into big plastic jar. Because plastic jar behaved as an insulator. It reduced the amount of heat transferred through the environment. The air between the jar become an insulator.

- This study aimed to develop an activity, as part of a large project, which is accessible to visually impaired students in teaching thermal insulation concept which is found difficult to comprehend even by the sighted students. For this purpose we have designed an activity based on using tactile and audial materials for making science more accessible to 6th grade students in a special school for visually impaired.
- The activity is basically consists of simple, economical and easily accessible everyday materials.
- Then students were questioned through inquiry based questions during the following 5-10 minutes. In the follow up interviews two hours after the activity took place nearly all of the students were able to answer questions about thermal insulation concept.
- The result of learnings happening in the environments where the students are made to participate actively in the lessons being more effective.
- With this study, the result of lack of vision senses of low vision and blind students not causing any obstacle to instruction of these students, necessary knowledge may be brought to students by using appropriate methods and techniques and adaptations suitable to vision disability levels was reached.

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