

## A Description of a Blind Student's Science Process Skills through Health Physics

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### **Abstract**

This study describes an approach for blind students thought health physics about how they could set a hypothesis and test it. The participant of the study used some health materials designed for high school blind student and tested her hypothesis with the data she gathered with those materials. It was asked that she should hypothesize which could be tested with the given material and reflected her own interest. At the last step of the case study she asked an expert to construct the data meaningful and tested her hypothesis. Positive expressions of blind student after her hypothesis testing, indicates that blind students possible use and develop their science process skills through health physics.

**Keywords:** Blinds, health physics, science process skills (SPS).

### **Introduction**

Turkish Physics Curriculum has been revised in recent years. The new curriculum includes objectives such as the Science Process Skill (SPS). Every 9<sup>th</sup> grade student has to pass the compulsory physics course, and naturally has to drop SPS into a habit. There are some blind students who wish to attend high school but their teachers are not aware of how to help them to reach all objectives (SPS and others). Therefore, they ignore blind students, and unfortunately, encourage memorization of some general physics concepts, which will be enough as a course requirement. Thus, this study presents useful information for physics teachers to manage such cases. Because context based approach makes the subject matter more meaningful, the researcher chose to pick health physics as a context to work on which has also been proven to be one of the students' favorite topics (Serin, 2009). Roth and Roychoudhury (1993) highlighted the importance of real and life connected contexts for developing SPS. Bülbül and Eryılmaz (2010a) suggested to present physics subjects though human context and there are some studies (Bülbül & Matthews, 2012; Elmas, Bülbül & Eryılmaz, 2011) supporting their suggestion that students interest human context and it is one of the rare multidisciplinary context. Moreover, developing a student's skills in SPS requires posing problems. Hence, in this study, students were first familiarized with the materials such as an audible scale, audible thermometer, and audible tension meter, then immediately asked to come up with a problem in the health physics. The subject student is informed about how to use and where to use the material.

Dillashaw and Okey (1980) suggest a way to measure SPS with a test. Their instrument includes formulating hypothesis, operationally defining variables, controlling and manipulating variables, planning investigations, and interpreting data. The test is not found applicable for blind students. Otherwise, Mabie and Baker (1996) suggested using observation to evaluate SPS. Observation is also not appropriate for this study because they decide when and where they will collect data. Out of these two studies about how to measure SPS, we chose self-evaluation method.

On the other hand, Germann, Haskins and Auls (1996) indicate that directed-inquiry have no significant effect. However, doing science is richly based on inquiry and for our purposes there should be some directions such as how to use materials or how to record the data.

## Research problem

The purpose of this study is to investigate the difficulties that a blind student could possibly face. Therefore, the main question was about what kinds of difficulties blind students face while they are engaged with the scientific activities. Additionally, whether they believe that the methodology is helpful for their SPS. Discussing the problems of blind students about science process skills seems more complex huge research project; however, we preferred to focus on a single case, which will be lighted for further studies.

## Methodology

The target population was four blind students enrolled in a 9<sup>th</sup> grade physics course at a High school in Ankara, Turkey. They are about 10-15 students in different cities according to experts' informal expressions from Ministry of National Education. Therefore, Because of the fact that there are currently only four 9<sup>th</sup> grade blind students in Ankara, selecting one 9<sup>th</sup> grade blind student for the sake of purposes for this study seems meaningful.

The selected student is defined as a moderate during her courses according to her teachers. She was 13 years old at that time. Her physics scores were near to average. She enjoys asking questions, being participant of the course and doing something different with respect to her explanations. She has a few close friends in the class. Her school is considered as a moderate level educational institution by them and it is specialized for blind and female students due to dormitory.

Analyzed data is collected from the blind student's self-evaluation report according to KWL meta-cognitive questioning approach (Hershberger, Zembal-saul & Starr, 2000; Ogle, 2009) and her comments about the expert's evaluation. KWL is a combination of key letters of three questions (what I know, What I wish to know, What I learned) for self-evaluation. Content analysis of her expressed views were categorized based on only difficulties while doing science and her opinions about them.

The process in this study consists of four main steps:

- Introducing the materials with spotting a meaningful and feasible question based on one's own curiosity related with the health physics materials,
- Experiencing the question,
- Evaluating the results (self-evaluation),
- Consulting an expert for the conclusion (expert evaluation).

At the beginning, all the materials designed for blinds were introduced and the subject student was asked what she wishes to learn about health physics. This may be the limitation of the study because she has to pose a research question depending on the features of materials. The better way will be preparing and producing materials in terms of her defined questions. She chooses to experience what would happen in terms of body temperature and blood pressure after eating something (15 minutes before and after intervals).

After deciding the question she tried to find out the answer of her research question. This is the second step of our study. She tested her question in three days. This was also her choice. She explained that single measurement may be wrong and they need to get more than one data about the problem.

Collecting the data is followed by evaluating the results as the third step. It was asked her to mining the data. This preparation phase is needed to compare her opinion with an expert's view. Taking an expert's evaluation about problem, data and conclusion is the last part of the methodology of the study.

The learning methodology of blind students may be defined as transforming the used explanations and materials into a tactual or vocal form (Bülbül, 2009; Bülbül, 2012). Apart from this requirement all studies and methodologies about SPS are valid for blind students. For instance; Hırça (2013) suggested hands on activities with low cost materials instead of laboratory equipment. Similarly, Bülbül and Eryılmaz (2010b) recommended some low cost materials for blinds to measure basic units in mechanics without classical laboratory equipment.

## Materials

There were three materials which the student was used; namely, audible scale (figure 1), audible thermometer (figure 2) and audible tension meter (figure 3).



*Figure 1. Audible scale*



*Figure 2. Audible thermometer*



Figure 3. Audible tension meter

These three blind user based materials were used during the study. These materials are very popular, widely used in the country and last version products according to experts about blindness. The common property of selected materials is being audible machines. You may hear the measured data by pushing on one button. For instance, audible tension meter works automatically after attaching the arm. It presses your arm and speaks loudly the degree of your tension. Similarly, audible scale speaks the weight of things whatever you put on. Blind user only needs one or two testing process to understand how to get the value.

### Limitations of the study

Formal educational system includes curriculum and teachers are responsible to finish all contents in it. This obligation may inhibit teachers to focus on skill development of all students in the class. Accordingly skill development should be performed in an informal way for why individual process let learners work with long duration. It should be better whether this suggested model should be used in a class environment with all students. However, it seems impossible that students will set a hypothesis and test it after and before eating something in many times during the course hours.

The methodology of this study is aimed as design research. This methodology is generally followed to develop a theoretical framework, define students' outcomes or test a design (Siu, 2010; Wang & Wang, 2010). For this study, the way of testing a design is preferred and byproducts like students' interests or feelings study are ignored to report. Therefore, the study is focused on the difficulties of blind student faced during the design.

The last limitation of this study is about the weakness of the subjects' expressions during the design. Whether the design is worked as planned or not is based on her perceptions. In other words, it is impossible to observe what is happening at any moment around her during her data collecting process and if there is any undeclared event which she had difficult.

### Findings

It is found that there was no inflector factor for her; she had some difficulties while learning how to use tools and recording data by using tape recorder; however, she used tools and recorded data as expected. Moreover, she indicated that this kind of out-of-school experiences and health based subjects are easy to do and helpful to understand.

Her hypothesis was “there will be no change after and before eating in terms of body temperature and small tension” and recorded results were given for body temperature (figure 4) and small tension (figure 5) with graphs. She used weighing scale to prepare same weighted meals.

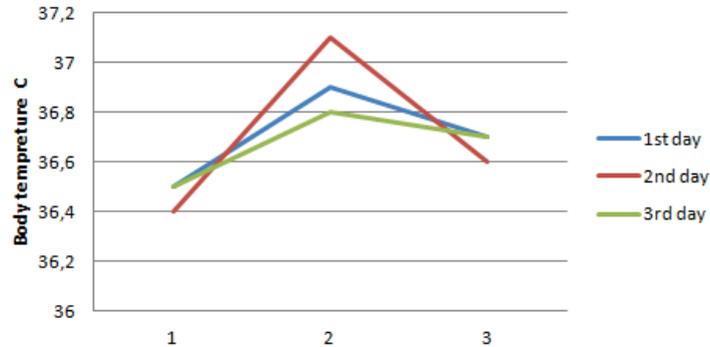


Figure 4. Body temperature values 15 minutes before (1) and after (3) eating

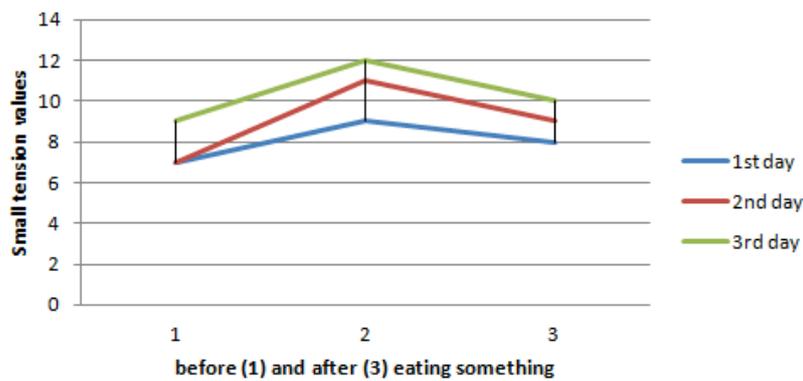


Figure 5. Small tension values vs time graph

The last step was “expert evaluation” and the medicine expert from a university in Ankara explained it natural phenomena that after eating something your blood tension and body temperature may change in a small numbers. This explanation was satisfied the blind student according to her expressions.

According to her responses to KWL questions, she had never think physics through her health; for instance, nutrition she got transformed to energy and affected the pressure of blood and changed her body temperature with minimal values. The important idea that she mentioned is about her awareness; she started to believe that there are a lot of subject waiting to be searched.

The steps given at the beginning of the study and all scientific process skills reviewed by Anagün and Yaşar (2009) are matched in table 1. This table indicates that all followed process is parallel to the defined science process skills in the literature. There is no missed process in the study. For instance, she measured and observed something while experiencing the question. Additionally, process of consulting an expert for the conclusion is included communicating and interpreting skills. The table verifies the validity of methodology of the study in terms of science process skills.

	Introducing the materials with spotting a meaningful and feasible question	Experiencing the question	Evaluating the results	Consulting an expert for the conclusion
<i>Observation</i>		✓		
<i>Comparison and classification</i>			✓	
<i>Communication</i>				✓
<i>Measurement</i>		✓		
<i>Prediction</i>	✓			
<i>Inference</i>			✓	
<i>Forecasting</i>	✓			
<i>Posing a hypothesis and testing</i>	✓			
<i>Determining variables</i>	✓			
<i>Designing an experiment</i>	✓			
<i>Collecting data</i>		✓		
<i>Data processing and forming a model</i>			✓	
<i>Interpretation</i>				✓

Table 1. Science process skills and four main steps of this study

## Discussion

This study reveals that society should give blind students a chance about doing science like scientists' natural methods; more time, flexible research and meaningful data for everyday life. This study also indicates that a blind student can follow these defined skills and cope up with especially three important components in learning health physics, which are materials, process and subjects like mathematical sufficiency. Our study supports the approach of Bülbül and Şık (2011) which discussed taking lab materials out of school and doing experiments more flexibly.

She all used SPSs during this experience like data collecting, hypothesis testing and evaluating the results. These mentioned skills can easily be seen on blind student through a subject from her real life. The context was her health and she decided the question. This is appropriate to current approaches like what scientists really do that students should learn and practice processes more than content-based activities (Tifi, Natale & Lombardi, 2006). During her investigation, materials were useful and she feels free to study on; she had chosen when she will collect data. She was pleased involving the study.

There should be more studies about blind students' experience with SPS to put forth their needs in different subjects and the results of defining all steps should be discussed in terms of SPS.

This kind of skill based and self learning materials will be enriched with explanations about principles and concepts for any content like motion or electrostatics because of the fact that formally inclusive class are not really inclusive; blind students generally sit and do not participate the course (Bülbül, 2011) and so this kind of self learning materials may support blinds students to learn the subject and encourage them to involve class discussions.

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