Views and Recommendations about 9th Grade Force and Motion Unit from Physics Teachers who studied with Visually Impaired Students

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Abstract

The purpose of the study is to put forward the view of five physics teachers that have visually impaired students, about the 9th grade physics topics that visually impaired students have difficulty and about how to teach 9th grade "Force and Motion" unit to visually impaired students. First six objective of "Force and Motion" unit that includes motion concepts are in the focus of the study. After taking the views of five physics teachers that work in Ankara and have visually impaired students, one to one interviews are made with them. Teachers commented on each objective in terms of four main topics, namely: appropriateness of the objective to the visually impaired students, materials that can be used while giving the related objective, recommendations about technique that can be used and recommendations about assessment-evaluation techniques. Although teachers in general stated that objectives are not appropriate for visually impaired students, they give recommendations that are easy to apply. Teachers were asked to consider both knowledge and skill objectives while describing their view, but views and comments were generally focused on knowledge objectives.

Key words: Visually impaired students, Blinds, Physics education, Inclusive education.

Introduction

Visually impaired students have to learn motion topic in 9th grade physics course, including some basic definitions and interpretations of graphs, as every student. According to new physics curriculum, force and motion unit includes motion in one dimension topic considering some basic descriptions and interpretations of "velocity vs time" graphs for linear motion. Ünlü, Pehlivan and Tarhan (2010) studied with 24 visually impaired students, from various high schools in Ankara, who had taken physics lesson before and got their views on physics course. In this study, students stated that although physics is difficult, it has a learnable

content via appropriate material and instruction methods. This study is significant in terms of both including new curriculum content and reflecting teachers' views.

Bülbül and Eryılmaz (2012) examined 40 materials with visually impaired students. Although four materials belong to force and motion unit, only one of them is related to motion concepts in 9^{th} grade. Fourth material is in line with teachers recommendations, so it is crucial to take teacher opinions in material development. In addition, Bülbül, Garip, Cansu and Demirtaş (2012) developed a material (needle page) to learn mathematics including graphs. This material is tactile form of squared pages used by sighted students and is made of regularly and frequently arranged needles.

In the light of these researches, it is necessary to choose unit or topic that visually impared students will have difficulty and their teachers need to support among the 9^{th} grade physics topics. In addition, it is aimed at showing what teachers did and will do for this unit. At a conclusion our research questions are given as:

1) What do teachers think for requiring to support for them when teaching the units of 9^{th} grades?
2) What do teachers think for difficulties of visually impaired students among the units of 9^{th} grades?
3) What do teachers propose about training practices to be applied for force and motion unit?

Method

Hence, the main aim of this study is to put forward the experiences of physics teachers having visually impaired students. These experiences are important with the aspect of exhibiting how visual impaired students learn, and also being guidance what other teachers can do. In line with mentioned purpose, five physics teachers' comments have been taken firstly in writing then orally.

It is asked teachers to investigate knowledge and skills objectives (in Table 1) considering their visually impaired students. If any of the 6 knowledge objectives and 27 skill objectives in Table 1 is matched, they make a combination; therefore, teachers should aim to reach that combination in his/her lectures. Teachers participated in the study are asked to

consider these combinations while making recommendations. In this study, these combinations will be only mentioned in the respect of knowledge objectives.

Table 1. Matching of knowledge and skill objectives of "Force and Motion" unit in 9th grade

Knowledge & Skills objectives	*Realize that motion is relative event*	*Explain position, distance and velocity concepts*	*Interpret by drawing position-time, and velocity-time graphs for uniform linear motion*	*Calculate velocity in motion by using position-time graphs for uniform linear motion*	*Calculate distance in motion by using velocity-time graphs for uniform linear motion*	*Define acceleration by giving daily-life examples*
PSS-1a: Define problems to be solved.		X				
PSS-1b: Collect information from different sources to begin research by using pre knowledge and experiences..		X				
PSS- 1c: Differentiate from scientific knowledge and views, value		X				
PSS- 1d: Costruct testiable hypothesis for determined problem.		X				
PSS-1e: Identify dependent, independent and control variables for problem in question or in investigation		X				
PSS-1f: Identify appropriate measurement vehicle for measuring variables.		X				
PSS-1g: Plan for suitible solution to the problem.		X				
PSS-3a: Analysis data taken from experiment and observations by using table, graphic, statistical methods or mathematical procedures			X			
PSS-3b: Use calculator, spreadsheet, graphic program etc. while doing numerical operation during the anaysis and modelling process.			X			
PSS-3c: Express findings with as mathematical equations models at the end of data analysis.			X			
PSS-3d: Interpret findings or creating models.			X			
PSS-3e: Adapt creating models to the different solution of problems.			x			
PSS-3e: Adapt creating models to the different solution of problems.				X	X	
PSS-3f: Realize possible sources of error during problem solving process				X	X	
PSS-3g: Get to use mathematical operations as a way of life dur,ng the problem solving prosess.				X	X	
PSS-3h: Use the limitations of the research when interpreting the results.				X	X	
PSS-3i: Relate to among them by comparing to own results with other results.				X	X	
STSE-1c: Identify the improvemen of knowledge in physics with acceleration		X				
ICS-1a: Use different sources of knowledge		X	X			X
ICS-1b: Control to sources of knowledge whether they are dependible and valid eder.		X	X			X
ICS-1c: Use multiple search criteria.		X	X			X
ICS-1d: Search, find and select relevant knowledge		X	X			X
ICS-1e: Identify dependent, independent and control variables for problem in question or in investigation.			X			
ICS-1f: Identify appropriate measurement vehicle for measuring variables.			X			
ICS-1g: Plan for suitible solution to the problem			X			
ICS-4c: Use appropriate terminologies in communications(oral, written, visual etc.) related to physics.		X	X			X
ICS-4d: State complex knowledge clearly, core. understandable		X	X			X

* PSS; problem solvin skills-STSE; science, technology, society and environment- ICS; information and communication skills

Instrument

Written document includes two parts; first part reveals concepts in which visually impaired students have difficulties. Also, with this part teachers indicate some concepts that they ask for support. Data taken from this part was used to response for first research question. Second part consists of four-stage questions asked for motion concept objectives. For all objectives, it is asked that whether those objectives are appropriate for visually impaired and then which material or method they can learn easily. Finally, it is asked how they can be measured visually impaired students' learning. Considering to interview results, it is tought that teachers understood all of the questions. In addition, questions were appropriate to collect data for answering research problems.

Findings

Teachers' experiences (in table 2) indicated that visually impaired students had difficulty mostly on "force and motion", "electricity and magnetism" and "waves" units respectively (in table 3). However, waves unit could not be completed since it is the last unit of the curriculum; and for electricity and magnetism unit, all students have lots of difficulties; so the support for teachers is more meaningful for force and motion unit (in table 4). Interviews with teachers indicated that they mean only motion when they expressed the difficulty of force and motion unit.

Table 1. Number of visually impaired students of the participant physics teachers

Teacher	Number of visually impaired students of the teacher
T1	11 +
T2	1-5
T3	6-10
T4	1-5
T5	1-5

Table 3. The distribution of teachers' responses to the question "In which units of 9th grade physics do you think visually impaired students have difficulty?"

Unit Name	Number of teachers
Nature of Physics	-
Energy	2
Properties of Matter	-
Force and Motion	4
Electricity and Magnetism	2
Waves	3

Table 4. The distribution of teachers' responses to the question "For visually impaired students to be successful in physics, in which unit/units you may want to get support?

Unit Name	Number of teachers
Nature of Physics	-
Energy	2
Properties of Matter	-
Force and Motion	4
Electricity and Magnetism	2
Waves	4

Teachers recommended using tactile graphs and walking in class by stepping per seconds and some more like these (table 5, 6, 7, 8, 9 and 10) for better learning in this unit. Teachers stated that they had difficulty while recommending since they had problems in teaching force and motion to visually impaired students.

Table 5. The distribution of teacher recommendations about materials, techniques and assessment-evaluation techniques for the first objective of the Force and Motion unit.

Teacher	View about appropriateness of the objective to the visually impaired students	Materials	Technique	Assessment-evaluation technique
T1	Positive	Talks about car/travel experiences	Comparison of a car in motion and a stable place	-
T2	Positive	Toy cars	Observation-experiment	Self-evaluation
T3	Negative	-	-	-
T4	Negative	Travelling with vehicle	Encourage to run while holding his/her hand	Questioning and written exams with someone to help
T5	Undecided	-	-	-

Table 6. The distribution of teacher recommendations about materials, techniques and assessment-evaluation techniques for the second objective of the Force and Motion unit.

Teacher	View about appropriateness of the objective to the visually impaired students	Materials	Technique	Assessment-evaluation technique
T1	Positive	Any object that can be moved	Making definitions in terms of stable points in the environment	-
T2	Positive	Map, ruler, string, watch	Presentation, inquiry, experiment and observation	Performance evaluation, self evaluation
T3	Positive	Embossed figures	Relating to number of step in unit of time	-
T4	Positive	-	-	Writing exam permitting to use assistant
T5	Positive	-	Providing to improve by taking a certain step in certain time	Explaining graphic curves plotted as embossing graphic by using string

Table 7. The distribution of teacher recommendations about material, techniques, assessment-evaluation techniques for third objective.

Teacher	View about appropriateness of the objective to the visually impaired students	Material	Technique	Assessment-evaluation technique
T1	Negative	-	-	Graphically analysis
T2	Negative	-	Designing and performing experiment	Designing and solving problem
T3	Negative	-	-	-
T4	Negative	-	-	-
T5	Positive	String	Interpreting to embossing graphics	-

Table 8. The distribution of teacher recommendations about material, techniques, assessment-evaluation techniques for fourth objective.

Teacher	View about appropriateness of the objective to the visually impaired students	Material	Technique	Assessment-evaluation technique
T1	Negative		-	-
T2	Negative	Embossing graphics	Experiment, solving problem	Solving problem, presentation and discovery strategies
T3	Undecided	-	-	-
T4	Negative	Simple velocity-time formula	Lecturing at definition level	-
T5	Undecided	-	-	-

Table 9. The distribution of teacher recommendations about material, techniques, assessment-evaluation techniques for fifth objective.

Teacher	View about appropriateness of the objective to the visually impaired students	Material	Technique	Assessment-evaluation technique
T1	Negative	-	-	-
T2	Positive	Map, ruler, string, watch	Presentation, Designing and solving problem	Question & Answer
T3	Undecided	-	-	-
T4	Negative	-	-	-
T5	Positive	-	-	-

Table 10. The distribution of teacher recommendations about material, techniques, assessment-evaluation techniques for sixth objective.

Teacher	View about appropriateness of the objective to the visually impaired students	Material	Technique	Assessment-evaluation technique
T1	Positive	Car and watch	Keeping alive situations that two cars can get same point to point distance in different time.	-
T2	Positive	Inclined plane car, masses, string, ruler, stop-watch	Experimentation, observation	Reporting, self-evaluation
T3	Positive	Pointing to changes in pulse beat	Using verbal warning in motion	-
T4	Positive	-	Lecturing	As understood only by reading It is enough to embossing writing
T5	Positive	Sonorous vehicles while moving inclined plane.	For different ways	-

Conclusion

The statements of physics teachers that have visually impaired students show that both the topic that visually impaired students have difficulty and the teachers need support is same and it is "Force and Motion" unit; especially the motion topics which involves graphs. Two outcomes of the study expose the necessity to further study about making "Force and Motion" unit accessible to visually impaired students: Not all of the views about appropriateness of "Force and Motion" unit's objectives to the visually impaired students are negative and the given recommendations about making the objectives more accessible are superficial.

Another important result of the study is showing that teachers do not have creative ideas about lecturing these topics and their recommendations are superficial. Teachers recommend either to use verbal explanations like giving examples from daily life and giving definitions or to use three dimensional materials around like toy cars, watch, ruler etc. These recommendations are not sufficient to provide visually impaired students to reach the related objectives; besides, they may cause distinctions between visually impaired students and sighted peers; in other words, these recommendations are not totally appropriate for inclusive education.

The results of the study reveal that teacher needs support in two points: developing activities that also involves skill objectives and developing evaluation-assessment techniques and instruments to assess knowledge and skills of visually impaired students. Although teachers do not take skill objectives into account while giving recommendations which shows teachers give priority to knowledge objectives, skill and knowledge objectives should be considered together. Moreover, while making assessment and evaluation both skill and knowledge objectives should be assessed and visually impaired students should be assessed without favoritism or pressure and with equivalent techniques with their peers. Otherwise, in inclusive education peers will sit together but they may not work together and have equal opportunities (Bülbül, 2011).

References

Bülbül, M. Ş. (2011). Inclusion: Something more than sitting together. *International Centre for Innovation in Education* (p. 7). İstanbul. Retrieved from http://eric.ed.gov/PDFS/ED523205.pdf

Bülbül, M. Ş. & Eryılmaz, A. (2012). *Görme engelli Öğrenciler için fizik ders araçları*. Murat Kitabevi: Ankara.

Bülbül, M. Ş., Garip, B., Cansu, Ü. & Demirtaş, D., (2012). Mathematics instructional materials designed for blinds: Needle page. *İlköğretim-Online Dergisi,* ISSN: 1305-3515, (Basımda).

Ünlü, P., Pehlivan, D. & Tarhan, H. (2010). Ortaöğretim kurumlarında öğrenim gören görme engelli öğrencilerin fizik dersi hakkındaki düşünceleri. *Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi, 30*(1), 39-54.