ISSN:1306-3111
e-Journal of New World Sciences Academy
2012, Volume: 7, Number: 1, Article Number: 1C0505

NWSA-EDUCATION SCIENCES
Received: May 2011
Accepted: January 2012
Series : 1C
ISSN : 1308-7274

M. Şahin Bülbül
Middle East Technical University
msahinbulbul@gmail.com
Ankara-Turkey

MAKING WAVE CONCEPT TANGIBLE

ABSTRACT

This study includes efficiency of some designed materials and activities for the students with special needs (blind students) about wave concept. In 9th grade Turkish High School Physics Curriculum, all the students have to learn wave concept because physics course is compulsory and wave concept was prepared as a unit. Generally, blind students only memorize some definitions about period, frequency and amplitude in that unit. This seems the easiest way for both teacher and students. Observing a wave may be impossible for a blind student, however an appropriate activity with tangible materials like pliable wire and beads on a rope should be adapted to the curriculum. This study fills this gap (needs of special students) in physics education about wave. It was tested with a totally blind student and her three other visual impaired friends and noticed the interview about suggested materials' usability and instructional dimensions.

Keywords: Physics Education, Special Education, Blind Students, Wave Concept

DALGA KAVRAMININ DOKUNULABİLİR HALE GETİRİLMESİ

ÖZET

Bu çalışma özel gereksinimleri olan öğrenciler için 9. Sınıf dalgalar konusu hakkında tasarlanmış material ve etkinliklerin verimliliğini içermektedir. Fizik öğretim programında bu kavram tüm öğrencilerin öğrenmesi gereken bir özelliğe sahip olduğundan görme engelli öğrenciler sadece bazı tanımları ezberlemekle yetinmektedirler. Bu öğrenci ve öğretmenler için kolay olan yoldur. Bird alga gözlemlemek görme engelli bir öğrenci için imkansız olsa da kıvrılabilir tel ya da boncuklu iplerler gibi basit malzemeler kullanılarak bu açık kapanabilir. Bu çalışmada tamamen görme engelli olan bir öğrenci ve üç arkadaşı ile yapılan etkinlikler mülakatlar ışığı altında ve materyallerin kullanışlılığı ile öğreticiliği üzerine olmuştur.

Anahtar Kelimeler: Fizik Eğitimi, Özel Eğitim, Görme Engelli Öğrenciler, Dalga Kavramı

1. INTRODUCTION (GİRİŞ)

In 9^{th} grade physics course wave concept is given with earthquake context. This context includes types of seismic waves and body waves. Other wave concepts are related with waves on spring, basic wave concepts like period, frequency, and amplitude and principle of superposition. It was thought that these basic concepts are adequate to reach the instructional objectives in Turkish high school physics programme.

In different physics area like optics (1) and mechanics (2) were studied with blind students. For optics course a basic material was developed to understand the behavior of light on curved mirrors. A blind student who used the optic material solved the question from university entry examination correctly. Other study about mechanics proved that three basic unit (mass, length, and time) are measurable for blind students with same materials which you may buy or prepare yourself. This study expressed that all mechanic subjects are built on these three basic units and if a blind student can measure these, he or she may do different kind of mechanical experiments.

2. RESEARCH SIGNIFICANCE (ÇALIŞMANIN ÖNEMİ)

About wave concept and for blind students the only study we have found is prepared by Capra, Logiurato, Danese, and Gratton (3). The topic was about optic but there were some other activities which were related with wave concept. For example; there is an tactile exploration of vibrating string, they used touchable ripple tank and prepared clay model of a plane wave. Additionally, they used waves of cardboard to touch and explore the interference. These activities were developed to discuss the optics in terms of waves. However, earthquake and superposition concepts were ignored. Also some suggested materials like clay model of waves seems more difficult to prepare.

It may easily see that studies about blind students based on materials' effectiveness for their learning physics concepts. The reason for this situation may be the small population of blind students; the number of students is not enough to do a correlational or experimental studies. The materials in this study were aimed to fill the gap in Turkish Physics Programme in terms of blind students' needs to understand the wave concept.

3. MATERIALS (MATERYALLER)

There were four main materials about wave concept; named as definitions about wave, spring waves, seismic waves, and superposition.

- **Definitions about wave:** For basic wave concepts the material given figure 1 was used. Small beads on a rope are formed to make the material similar as wave. There were some pliable wires to make their own spring. The definitions of period, frequency, wavelength and amplitude are discussed with these materials.

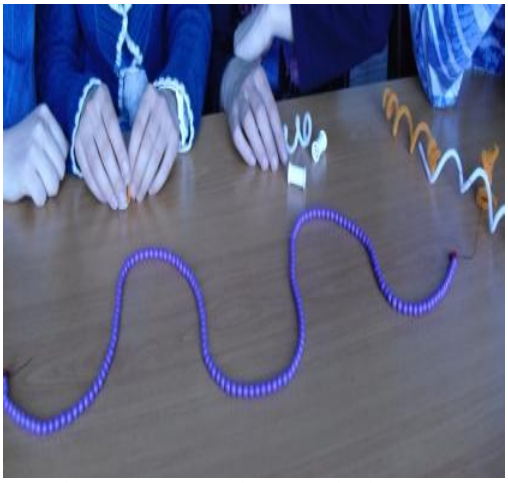

Figure 1. Material for basic definions of wave concept
(Şekil 1. Dalga kavramının tanımı için material)

- **Spring waves:** To make the Transverse or Longitudinal waves and reflections on a spring clear for blind students iron made spring was used first. Comments from blind students about the dangerous of using iron made sprig are directed us to use plastic springs (figure 2) and put a stick in the centre of spring to demonstrate amplitude of wave and transverse waves. Transverse wave is a wave in which the particle displacement is perpendicular to the direction of wave propagation. On the other side longitudinal wave may define as a wave in which the individual particles of a medium vibrate back and forth in the direction in which the wave travels.

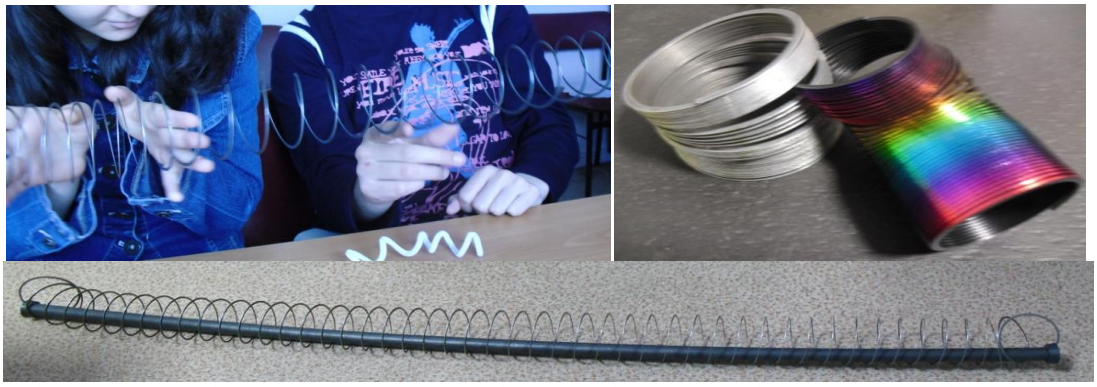

Figure 2. Blind students are discovering the different springs and waves
(Şekil 2. Görme engelli öğrenciler farklı yay ve dalgaları keşfederken)

- **Seismic waves:** There are several different kinds of seismic waves, and they all move in different ways. The two main types of waves are body waves and surface waves (figure 3). Modeling surface waves may be more difficult than others because they are combination of Secondary (S) and Primary (P) waves. Surface waves are analogous to water waves and travel just under the Earth's surface. They travel more slowly than body waves. Because of their low frequency, long duration, and large amplitude, they can be the most destructive type of seismic wave.

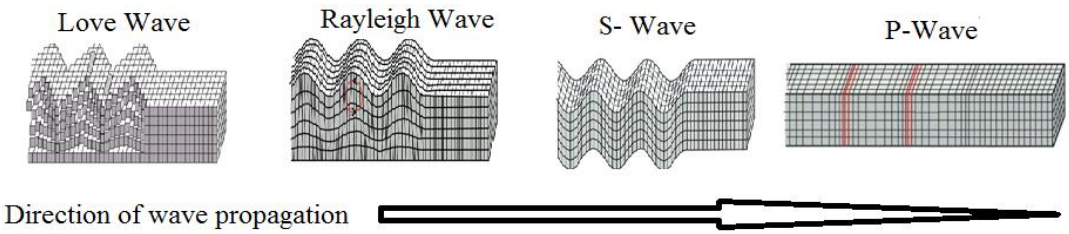

Figure 3. Types of seismic waves
(Şekil 3. Sismik dalgaların tipleri)

To demonstrate the wave propagation, needles, sponge and dough were used (figure 4). To explain the motion of points on the earth, two sponges were used. Upper one has needles on it and they grouped by two to discuss relative motion of points.

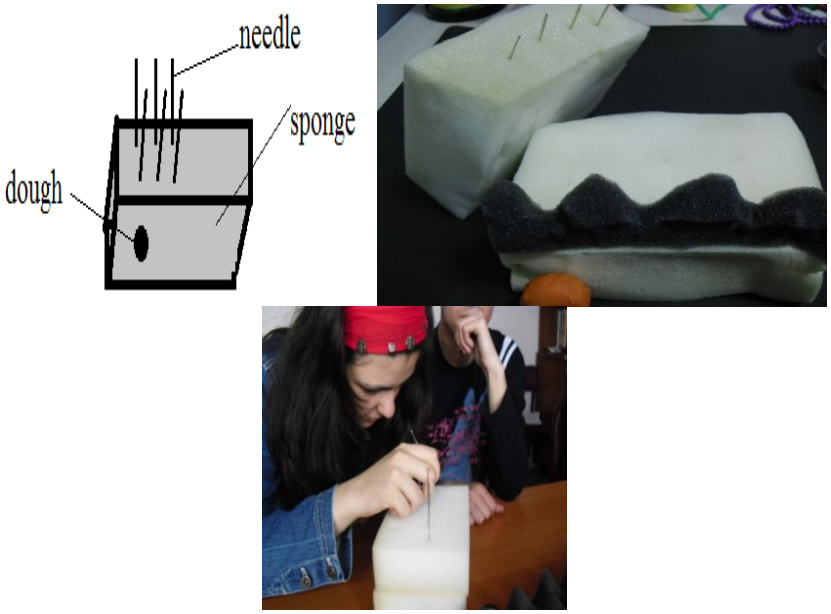

Figure 4. Seismic wave materials
(Şekil 4. Sismik dalga materyalleri)

- **Superposition:** When two of more waves combine, the resulting disturbance or displacement is equal to the sum of the individual disturbances (figure 5). This principle of superposition was demonstrated with needles on a egg-sponge. Needles were represented the top or down point of any wave. The motion of needle means that wave is going at the same way and the combination of waves will be occur on any point of egg-sponge (figure 5).

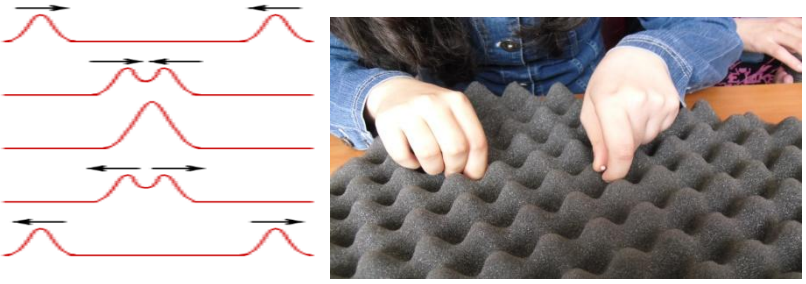

Figure 5. Demonstrating superposition
(Şekil 5. Süperpozisyonun gösterimi)

There should be some crests and troughs on a wave and the resultant amplitude will be formed according to these crests and troughs. If the amplitude of two waves are "a" then the superposition of two crests will have "2a" amplitude. On the same way, the amplitude of one crest and one trough will be zero.

4. METHOD (YÖNTEM)

The set of these wave materials are used by blind students. They expressed their views about whether they use and learn easily during their experiences. Their views about usability and whether they learn by using these materials are given in findings part with a table for scores and comments. There were two questions asked for them; what score do you give from ten about the usability of the material and they help your learning of the mentioned concepts.

5. FINDINGS (BULGULAR)

Students' views are given in table 1. Generally, they enjoyed the materials and expressed that they may use the set of materials and learn with them. This result may be reached by the help of their comments given below.

Table 1. Students' opinion about materials' usability and whether they may learn with those materials ("+" represents positive, "-"symbolizes negative and "?" means unknown comments).
Tablo 1. Öğrencilerin materyalin kullanışlılığı ile bu materyalle öğrenip öğrenemeyecekleri hakkındaki görüşleri ("+" olumlu, "-" olumsuz ve "?" sınıflandırılamamış yorumları belirtmektedir.)

Student	Definitions		Spring waves		Seismic waves		Superposition	
	I may use	I may learn	I may use	I may learn	I may use	I may learn	I may use	I may learn
Totally blind (S1)	(8/10)	+	(8/10)	+	(8/10)	+	(8/10)	+
1st Visual impaired (S2)	(9/10)	+	(9/10)	+	(7/10)	-	(7/10)	+
2nd Visual impaired (S3)	(9/10)	+	(8/10)	-	(9/10)	+	(8/10)	+
3th Visual impaired (S4)	(8/10)	+	(7/10)	+	(8/10)	+	(7/10)	?

Comments of blind and visual impaired students;

S1: "All the materials were nice. The wave concept was far for me before this experience"

S2: "I couldn't connect the material and the seismic waves in a meaningful way. Others were clear for me"

S3:"The iron spring may be dangerous for us (after this comment, we redesign the material)"

S4:"The material seemed more complex for me. I may need more exercises"

6. CONLUSION (SONUÇ)

Although there are some negative comments, the set mentioned in this study may be suggested to blind students to learn basic wave concepts. Blind students need this kind of sets, so there will be some other studies about mechanical or electrical sets. Group studies bring some difficulties like affecting others. For further studies, individual sets may be more effective to understand the blind students' view about the material. It seems that near studies will be same as this one in terms of material testing because of the small blind student population and there are no adequate materials for them.

NOT (NOTICE)

Bu çalışma, 22-24 Eylül 2011 tarihleri arasında Elazığ'da düzenlenen "(ICITS-2011) 5. Uluslararası Bilgisayar ve Öğretim Teknolojileri Sempozyumu"'nda sözlü bildiri olarak sunulmuştur.

REFERENCES (KAYNAKLAR)

1. Bulbul, M.S., (2009). The possiblity of learning Curved Mirrors' Structure By Blind Inborn Students. *26th International Physics Conference* (p. 225). Bodrum: Turkish Physics Society. Retrieved from http://www.metu.edu.tr/~sahin/yayin/2009b1.pdf
2. Bulbul, M.S. and Eryilmaz, A., (2010). How does a blind student measure three basic units in mechanics. *27th International Physics Congress Book of Abstracts* (p. 352). Istanbul: Turkish Physical Society.
3. Capra, N., Logiurato, F., Danese, B., and Gratton, L.M., (2006). Laboratory Activities in Physics Education - Optics For the Blind (pp. 362-369). Trento: GREP. Retrieved from http://www.girep.org/proceedings/conference2006/Neva_Capra_-_Optics_for_the_Blind.pdf