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Science and Technology Teachers' Opinions About Problems Faced While Teaching 8th Grade Science Unit "Force and Motion" and Suggestions for Solutions

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ABSTRACT

The aim of this study is to explore the problems encountered while teaching force and motion unit in 8th grade science and technology course from teachers' perspectives and offer solutions to eliminate these problems. The study was conducted with 248 science and technology teachers working in 7 regions in Turkey in 2012-2013 academic year. Descriptive method was used in the research. The data of the research was obtained with a questionnaire developed by the researchers. Content analysis, arithmetic mean, and standard deviation were used for the analysis of the data. The teachers stated that the problems and solutions in force and motion unit in science and technology course depending on time, text book and work book, lack of connection to daily life, feature of the unit, students and implementations were examined. As a result of the study the teachers justified that abstract and complicated subject, lack of equipment and tools, and students' not being able to use scientific process skills adequately were the problems in force and motion unit in science and technology course. To solve the problems, the teachers suggested that course hours should be increased, labs should be improved, more equipment and tools should be provided and teachers should give more opportunities to the students to do more activities, link the subjects to daily life and materialise them, use technology (video, flash, presentations, sides and so on) in their classes, solve more problems about the topic and the number of activities in workbook should be increased.

Keywords: Science Education; Force and Motion Unit; Problems and Suggestions for Solutions.

INTRODUCTION

Constructivist approach, opposed to learning, has been affecting the national and international education and training over the last decades (Cole, 1997; Malik & Khurshed, 2011). Educators and researchers who are all in substantial agreement about constructivism state that it presents an approach which enables to activate the learner. This approach is based on the belief that learners interact with the outer world based on their existing experiences and learners are the makers of meaning and knowledge.

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Constructivism simply must not be perceived as a transfer of knowledge to one's mind from the outer world (Bodner, 1986; Driver, Asoko, Leach, Mortimer & Scott, 1994). Merrill (1991) draws attention on the following qualities constructivism:

1. Knowledge is constructed from experiences.
2. Learning is an individual interpretation of the world.
3. Learning is an active process relying on experiences.
4. Conceptual understanding results from the individuals' altering their perceptions.
5. Learning can be contextualized in real life environments.

Following the introduction of the positive effects of constructivist approach on student's learning and development in many ways, countries compete with reach other to implement constructivism in their education programs. Turkey is one of the countries which tries to integrate constructivism in its education programs. Turkey has made changes in its education programs via Ministry of National Education (MNE), an institution responsible for the educational policy of the country. In 2004, all the education programs were reorganised according to constructivist approach, MNE started piloting between 2004 and 2005 and they ensured that education programs scattered country-wide between 2005 and 2006 (Çetin & Günay, 2006; Cengiz, Uzoğlu & Daşdemir, 2012).

Science and technology education program is one of the programs reorganized according to constructivist approach. The main goal of science program is to enable all individuals to become scientifically literate (MNE, 2006). Scientific literacy has become a necessity for all the individuals of the society in the world filled with products of scientist research. Human beings feel the need to use scientific knowledge to make choices to meet their needs emerging almost in every stage of their lives and to participate in the public talks and discussions about important issues involving science and technology (National Research Council, 1996). Scientific literacy is defined as "the integration of skills, attitudes, values, understanding, and the knowledge about science required for individuals to develop skills for examination- inquiry, critical thinking, problem solution and decision making , engaging in life long learning, and sustaining their curiosity about their environments and the world" (Ministry of National Education, 2006). According to Norris and Phillips (2003), scientific literacy is understood in two related but different ways. The first one means the ability to read and write and the second one means knowledgeability, learning and education. Hand, Prain, Lawrence & Yore (1999) believe that scientific literacy requires to convince emotional tendencies and skills to construct scientific understanding, interaction to give information about the big ideas of science to others and students to learn the actions given information about. A scientifically literate person understands the nature of science and scientific knowledge, basic science concepts, principals, laws and theories and uses them in appropriate ways; uses scientific process skills while solving problems and making decisions; understands the interaction between science, technology, society and environment; develops scientific and technical psychomotor skills and shows that he has scientific attitudes and values (MNE, 2006).

Science and technology course is the course where students can gain scientific literacy, a very important concept, in schools. It was already stated that the main purpose of science and technology course is to train all the individuals as scientifically literate. Science and technology curriculum renewed in 2005 was composed of learning areas and the related units to these areas. The learning areas in 4^{th}, 5^{th}, 6^{th} and 7^{th} grades were identified as living beings and life, physical phenomenon, matter and change, the Earth and universe. The units and the topics in the units related to each learning areas beginning from 4^{th} grade to 8^{th} grade are tried to be taught in a spiral process (Çepni, Ekiz, Ayas & Akyıldız, 2010; MNE, 2010).

It is a known fact that there are difficulties encountered in science and technology course, where scientific literacy is attempted to be acquired. Both national and international

indicators reveal that science education in Turkey is inadequate when compared to other countries (Özden, 2007). Especially national and international examinations such as TIMSS, PISA and SBS (a national standardized test) have revealed the failure of primary school students in science education (Cengiz, Uzoğlu & Daşdemir, 2012).

Although there has been generally a growing increase in understanding of science and technology course and student success in the course with the recent changes in curriculum, this increase is not at a desired level. However, the students' negative attitudes still continue and their success levels are quite low (Ünal & Ergin, 2006; Avcı, 2006). When literature is analysed, many studies conducted about the implementation of the new curriculum and the problems encountered draw attention (Riess, 2000; Ünal & Ergin, 2006; Avcı, 2006; Özdemir, 2006; Özden, 2007; Yangın, 2007; Şengül, Çetin & Gür, 2008; Güven, 2008; Aydın & Çakıroğlu, 2010; Doğan, 2010; Küçüköner, 2011; Cengiz, Uzoğlu & Daşdemir, 2012; Geçer & Özel, 2012).

Geçer & Özel (2012) in their study identified the problems encountered in science and technology course such as crowded classrooms, inadequate laboratory and equipment and tools, lack of time, using blackboards and textbook to teach the course. Cengiz, Uzoğlu & Daşdemir (2012) revealed that teachers indicated the following points for the failure in science and technology course: lack of time for implementation of activities, broad subjects, parents' lack of interest in students' studies, teachers' not familiarizing with the curriculum, students' not having opportunities to practise the activities one on one, and not taking into consideration the level of students adequately. Moreover, they suggested that most teachers stated their problems while teaching science subjects related to mathematics and abstract subjects. Küçüköner (2011) conducted a study to explore the difficulties encountered while implementing science and technology curriculum and offer solutions for the problems expressed by the teachers and indicated that the problems arose due to providing equipment and tools and the content of the curriculum. Doğan (2010) stated that the teachers indicated the following points as very important problems: parents' lack of interest in students' studies, the identification of the subjects by the Ministry of National Education, lack of time, crowded classrooms, inadequate physical conditions of laboratory, classrooms and libraries.

Aydın & Çakıroğlu (2010) pointed to crowded classrooms and inadequate in-service training and Güven (2008) detected lack of equipment and tools and course hours. On the other hand, Şengül, Çetin & Gür (2008) stated that graduating from different departments (physics, chemistry, biology) affected education negatively, and teachers faced problems with completing the curriculum on time, doing laboratory work, and doing evaluation. Özden (2007) identified the main problems in science and technology education as lack of teachers who are actively responsible for developing curriculum, inadequate training of teachers about the program during the transition process, crowded classrooms, training students for the exams, lack of connection with the other lessons, and inadequate physical conditions of the school. Yangın (2007) in his study classified the most important problems while teaching science and technology subjects as lack of teaching materials, a large number of students and lack of physical conditions of the classrooms, and teachers' lack of knowledge about curriculum. Özdemir (2006) grouped the problems the teachers faced while teaching the course in his study: problems with students, textbooks, student' parents, teachers' themselves, curriculum, physical conditions and equipment. Riess (2000) defined the following as important problems in his study: science and technology curriculum's ignoring the development of science history and philosophy, and lack of student motivation and interest in the subject. On the other hand, suggestions have been made in literature to solve the problems encountered while teaching science and technology course (Yılmaz & Morgil, 1992; Özdemir, 2006; Özden, 2007; Şengül, Çetin & Gür, 2008; Doğan, 2010; Küçüköner, 2011; Geçer & Özel, 2012; Cengiz, Uzoğlu & Daşdemir, 2012). Küçüköner (2011) suggested

that the activities done to reach learning outcomes should be connected to daily life, in-service training based on practise should be offered to the teachers, class size should be adapted to implement the renewed curriculum and guide books consisting of evaluation criteria and concrete assessment and evaluation applications should be developed. Doğan (2010) emphasized that there are not many subject and they are precise and simplified, parents are involved in education and training process, class size (the number of students) is reduced, laboratory, equipment and tools are supplied, and the physical conditions of the school is improved. Yılmaz and Morgil (1992) in their study suggested a decrease in number of students, training qualified teachers, and equipment and tools' being compatible with the curriculum. Özdemir (2006) recommended that the number of students should be decreased in crowded classrooms, teachers should be valued both financially and spiritually, adequate equipment and tools should be supplied, cooperation between school and family should be established, libraries should be developed, and the laboratory facilities should be improved and experiments should be carried out. Şengül, Çetin & Gür (2008) asserted that science and technology courses must be taught by science and technology teachers, not by teachers who graduated from different departments and drew attention by adding that teachers use portfolio and projects in evaluation and follow the new technologic developments. Geçer & Özel (2012) stated that textbooks should be simplified because of time constraints, computer labs should be established, centres should be set for choosing, repairing, and using laboratory equipment and tools. Cengiz, Uzoğlu & Daşdemir (2012) stated the importance of visual lessons, providing cooperation of student's parents and training teachers with methods and techniques. Özden (2007) suggested the following as precautions to be taken to solve the problems: decrease in class size, not evaluating success with only examinations, and improving education system.

The problems in science and technology education will hinder students' critical thinking, curiosity, creativity and attitudes towards nature (Özden, 2007). Therefore, many studies have been conducted to reveal how to deal with learning difficulties in science and technology courses. When the studies conducted were analysed, it was found that all the studies attempted to explore the general problems and their solutions. When detecting the problems in curriculum, units were not encountered. Therefore, the problems and the solutions related to science education will be attempted to be studied on unit basis in this study. It is a known fact that both students and teachers have difficulty in learning and teaching the 8^{th} grade force and motion unit from physical phenomenon field. Thus, after the views of teachers working in seven regions of Turkey are received via questionnaire developed for this study, the problems and the suggestions for solutions related to force and motion unit will be determined. The following research questions were sought answers in the study:

1. What do science and technology teachers consider as problems while teaching force and motion unit depending on time, textbook, not being able to connect it to daily life, features of subjects, students and implementation?

2. What do science and technology teachers suggest for the solution of problems in force and motion unit?

METHODOLOGY

a) Research model

Descriptive method was used in the study. This method is used to illuminate a phenomenon, to make evaluations in line with the standards and to reveal the possible relations between the events. In such research the main purpose is to identify and define the phenomenon investigated (Çepni, 2007). This method was used in the study to explore and

identify the problems which science and technology teachers encounter within the context of "Force and Motion" unit included in the 8th grade "Physical Phenomenon" learning field.

b) Population

Snowball sampling, one of the non-probability sampling techniques, was used for the selection of the population (Tanrıögen, 2009). Within this context, each science and technology teacher chosen from 49 cities randomly out of 7 regions was contacted and the other science and technology teachers recommended by them were included in the study. The population of the research composed of teachers chosen across Turkey in 2012-2013 education year. The data of the research were collected from 248 science and technology teachers, 127 males and 121 females, chosen in 49 cities out 81 cities. The distribution of science and technology teachers participating in the study by cities and regions **(shown in black)** was given below.

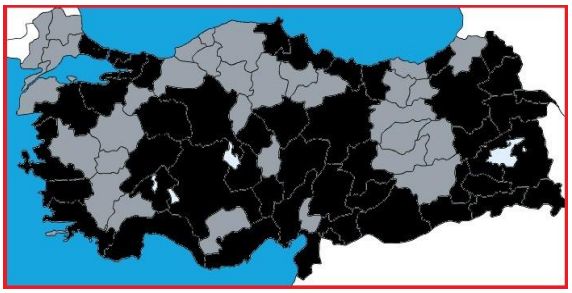

Figure 1. *Distribution of the cities where the study was carried out*

Table 1. *Distribution of the population*

Regions	Number of cities	Number of teachers
Marmara	7	33
Aegean	5	19
Mediterranean	5	43
Central Anatolia	9	28
Black sea	6	45
Eastern Anatolia	12	54
South eastern Anatolia	5	26
TOTAL	**49**	**248**

c) Data Collection Tools

The following steps were involved during data collection process.

1. Interviews were carried out by randomly selected two in-service science and technology teachers who taught primary education science and technology courses and the problems encountered while teaching "Force and Motion" were presented. The teachers who were interviewed were asked what kind of problems they had encountered while teaching force and motion unit and in the light of the responses, the questionnaire form was divided into 6 headings with the help of the experts from the field (Table 3).
2. Questionnaire form was developed to explore the problems encountered while teaching 8th grade "Force and Motion" unit. Content validity was tried to be obtained by receiving the opinions of experts from two fields, one in-service science and technology teacher and one language expert for each questionnaire form.
3. The questionnaire form developed by the researchers consists of demographic information, total 34 items using a five point Likert type scale on a continuum from strongly agree to strongly disagree and 3 open ended questions. The interval width the Likert type scale was computed with a formula (a= range width / number of groups) and the choices and borders of the range were formed in the scale composed.

Table 2. *Score Interval of Measurement Tool*

Rating	Choices	Border
5	Strongly agree	4.21- 5.00
4	Agree	3.41- 4.20
3	Don't know	2.61- 3.40
2	Disagree	1.81- 2.60
1	Strongly disagree	1.00- 1.80

4. The distribution of items in Likert-type measurement scale according to the titles were shown in Table 3.

Table 3. *Distribution of Questionnaire items*

Sections in the Questionnaire	Number of items
1. Problems about time	3
2. Problems about textbook and workbook	6
3. Problems about connection to daily life	4
4. Problems about the features of the subject	1
5. Problems about students	15
6. Problems about implementation	5
TOTAL	**34**

d) Data Analysis

Arithmetic mean ($\overline{X}$) and standard deviation, descriptive statistical methods, were used for the statistical analysis of the qualitative data gathered to seek answers for the sub-problems within the context of the general purpose of the research. The data related to numerical developments were tabularised and interpreted. The data obtained from the open ended questions were analysed via content analysis. The main purpose of content analysis is to gain concepts and relations which can explain the data gathered. The data gathered are first conceptualised, organized logically and the themes which define the data were identified. Content analysis involves the following order: coding of the data, organising codes, defining themes, and themes and identifying findings and interpreting (Yıldırım & Şimşek, 2004). Within this framework, the data obtained from the teachers were coded by two researchers and themes were composed by taking into consideration their common features. Within this framework, the first stage is coding of data and in this stage, two researchers examined the responses given to the open ended questions in the questionnaire and they coded them by dividing them into meaningful sections. In the second stage, common aspects were found by gathering the codes and the themes were composed. In the third stage, the data were organized according to the themes revealed and in the last stage, the data were tabulated and interpreted. After the operations which were performed by two experts separately, the analyses of two experts were compared and the points where they had reached consensus and where they had divergent point of views were identified. The internal consistency reliability of the research (Reliability: Consensus view/ Consensus view + Divergent views) was calculated. As a result of calculation, it was found that there was a 88% agreement.

Tables were composed to understand the themes and their frequency distributions were given. Below the tables were given the teachers' statements which express their opinions without making any changes.

FINDINGS

The problems science and technology teachers encountered while teaching 8th grade science unit called "Force and Motion" were examined and they were presented in Table 4.

Table 4. *Arithmetic Mean Distribution of Problems Encountered While Teaching 8th Grade Force and Motion Unit*

		$\overline{X}$	Ss	$\overline{X}$ t
A. Time Oriented Problems				
1.	Time given for **"Buoyant Force"** is not sufficient.	3.98	1.027	
2.	Time given for **"Why do some objects float?** is not sufficient.	3.64	1.147	**3.71**
3.	Time given for **"Pressure"** is not sufficient.	3.52	1.179	
B. Textbook and Workbook Oriented Problems				
1.	Examples and activities in the textbook are not sufficient for **"Ascending force"**.	3.98	0.979	
2.	Examples and activities in the textbook are not sufficient for **"Why do some object float?"**	3.82	1.051	
3.	Examples and activities in the textbook are not sufficient for **"Pressure"**.	3.68	1.087	**3.76**
4.	Examples and activities in the workbook are not sufficient for **"Ascending force"**.	3.82	1.015	
5.	Examples and activities in the workbook are not sufficient for **"Why do some objects float?"**	3.70	1.124	
6.	Examples and activities in the workbook are not sufficient for **"Pressure"**.	3.58	1.153	
C. Problems Oriented with connection To Daily Life				
1.	Examples of force and motion in 4th and 5th grade cannot be connected to daily life.	3.06	0.930	
2.	Examples of force and motion in 6th grade cannot be connected to daily life.	2.89	1.122	
3.	Examples of force and motion in 7th grade cannot connected be related to daily life.	2.91	1.129	**2.96**
4.	Examples of force and motion in 8th grade cannot be connected to daily life.	2.96	1.137	
D. Problems Oriented with the Features of the Unit				
1.	Because force and motion units are abstract, students have difficulty in connecting them to the concepts.	4.10	0.841	**4.10**
E. Student Oriented Problems				
1.	**Students' lack of knowledge about concepts in force and motion unit.**			
	*1a. Students **lack knowledge** about liquids subject.*	*3.72*	*0.984*	**3.84**
	*1b. Students **lack knowledge** about gas subject.*	*3.74*	*1.009*	
	*1c. Students **lack knowledge** about mass, volume and density..*	*4.06*	*0.941*	
2.	**Students' various misconceptions about concepts in force and motion unit according to teachers.**			
	*2a. Students have **misconceptions** about mass and weight.*	*4.15*	*0.976*	
	*2b. Students have **misconceptions** about volume and weight.*	*3.42*	*1.260*	
	*2c. Students have **misconceptions** about the force of gravity acting on objects in the liquid.*	*3.45*	*1.078*	
	*2d. Students have **misconceptions** that buoyant force acting on the object has more weight than the weight of the object.*	*3.78*	*1.038*	**3.76**
	*2e. Students have **misconceptions** about liquid pressure depending on amount of the liquid.*	*3.81*	*1.034*	
	*2f. Students have **misconceptions** that the diameter of the tube is important in Torricelli experiment.*	*3.60*	*1.016*	
	*2g.Students have **misconceptions** that objects sink due to their weight.*	*4.15*	*0.841*	
3.	**Students cannot use scientific process skills adequately with the activities in force and motion unit.**			
	*3a. Students have difficulty with **mathematical calculations.***	4.42	0.791	
	*3b. Students have difficulty with **comparing process.***	4.06	0.885	**4.06**
	*3c. Students have difficulty with doing the **measurements** related to experiments.*	3.91	0.904	
	*3d. Students have difficulty with **interpreting and inferring** process.*	4.08	0.895	
	*3e. Students have difficulty with **recording data properly** process.*	3.85	0.929	
F. Problems oriented with Implementation				
1.	Within the context of the unit, activities cannot be done properly due to lack of equipment and tools.	3.97	0.675	**3.97**

When Table 4 is analysed, it is found that the most common problem science and technology teachers encountered while teaching 8th grade science unit called "Force and Motion" was due to the features of this unit ($\overline{X}$ =4.10). Because the subjects were abstract, the teachers stated that the students had difficulties in connecting them to the concepts. The second biggest problem the teachers encountered was that the students could not use scientific process skills adequately in the activities of the unit ($\overline{X}$ =4.06). Within this framework, the teachers stated that the students had great difficulty in mathematical calculations ($\overline{X}$ =4.42),

interpreting and inferring ($\overline{X}$ =4.08), and comparing ($\overline{X}$ = 4.06) processes. In addition, due to lack of equipment and tools, the teachers stated that they could not adequately do the activities ($\overline{X}$ =3.97). The other problems the teachers encountered were lack of student knowledge about the concepts in force and motion unit ($\overline{X}$ =3.84) and their misconceptions ($\overline{X}$ = 3.76), lack of examples and activities in the textbook and workbook ($\overline{X}$ =3.76) and lack of course hours ($\overline{X}$ =3.71), respectively. The least important problem teachers encountered was that the students could not make the link between the examples about force and motion and daily life ($\overline{X}$ =2.96).

The distribution of the problems science and technology teachers encountered while teaching 8th grade science unit called "Force and Motion" in terms of teachers' gender, graduation, and years of experience was examined and presented in Table 5.

Table 5. *The distribution of the problems science and technology teachers encountered while teaching 8th grade science unit called "Force and Motion" in terms of teachers' gender, graduation, and years of experience*

Problems	Gender		Graduation				Years of Teaching Experience			
	Male (127)	Female (121)	Physics (20)	Chemistry (23)	Biology (20)	Science (185)	1-5 years (108)	6-10 years (50)	11-15years (31)	16 years and above (59)
1. Lack of course hour s	3.72	3.70	3.45	3.73	4.13	3.69	3.65	3.88	3.72	3.68
2. lack of activities and examples in the textbook and workbook	3.78	3.74	3.85	3.51	4.19	3.73	3.75	3.87	3.80	3.66
3. Not connecting subjects to daily life	3.01	2.90	3.48	3.06	3.40	2.84	2.72	3.01	3.08	3.29
4. Abstract and complicated subjects	3.98	4.23	3.87	4.08	4.35	4.10	4.20	4.02	4.20	3.94
5. Lack of knowledge in students	3.82	3.86	3.56	3.65	3.80	3.90	3.96	3.88	3.96	3.52
6. Some misconceptions with students	3.78	3.74	3.80	3.82	3.68	3.76	3.78	3.92	3.79	3.58
7. Students' not being able to use scientific process skills adequately	4.11	4.01	3.87	3.88	3.90	4.13	4.08	4.24	4.09	3.88
8. Not being able to do the activities due to lack of equipment and tools	3.98	3.97	3.97	3.93	3.91	3.98	4.03	4.08	3.85	3.84

When Table 5 was analysed, the most frequently encountered problems by female teachers were complicated and abstract subjects ($\overline{X}$ =4.23), students' not being able to use scientific process skills adequately ($\overline{X}$ =4.01) and not being able to do the activities due to lack of equipment and tools ($\overline{X}$ =3.97). The most frequently encountered problems by male teachers were students' not being able to use scientific process skills adequately ($\overline{X}$ = 4.11), complicated and abstract subjects ($\overline{X}$ =3.98) and not being able to do the activities due to lack of equipment and tools ($\overline{X}$ =3.98). It was found that both the female and male science and technology teachers suffered from the same difficulties during teaching. It was revealed that the least important problem both the female ($\overline{X}$ =2.90) and male ($\overline{X}$ =3.01) science and technology teachers had while teaching the unit was that subjects were not linked to daily life.

When the teachers' graduation from the departments is taken into consideration, different findings draw attention. It was determined that the teachers who graduated from physics had fewer problems than the other teachers who graduated from different departments while teaching the unit. The teachers who were physics graduates mostly complained that

they could not adequately do the activities due to lack of equipment and tools ($\overline{X}$ =3,97). The teachers who were biology graduates draw attention as they encountered a lot of problems. The teachers who were biology graduates encountered the following problems: complicated and abstract subjects ($\overline{X}$ =4.35), lack of examples and activities in the textbook and workbook ($\overline{X}$ =4.19) and lack of course hours ($\overline{X}$ =4.13). The teachers who were chemistry graduates had mostly problems about complicated and abstract subjects ($\overline{X}$ =4.08). It was determined that the problems encountered by the teachers who are graduates of science teaching department were mostly students' not being able to use scientific process skills ($\overline{X}$ =4.13), complicated and abstract subjects ($\overline{X}$ =4.10), and not being able to do the activities due to lack of equipment and tools ($\overline{X}$ =3.98). In addition, it was pointed out that the least important problem all the teachers encountered while teaching the unit was that subjects were not linked to daily life.

When the problems encountered by the teachers in terms of their years of teaching experiences were analysed, it was found that experienced teachers with 16 and more years of teaching experience had encountered the fewest problems. It was found that novice teachers (1-5 years) complained about complicated and abstract subjects ($\overline{X}$ =4.20), students' not being able to use scientific process skills ($\overline{X}$ =4.08), not being able to do activities due to lack of equipment and tools ($\overline{X}$ =4.03) and lack of student knowledge ($\overline{X}$ =3.96). The same condition was observed with the teachers with teaching experience between 6 and 10 years and between 11 and 15 years.

The distribution of problems the teachers encountered while teaching 8th grade force and motion unit in terms of teachers' region of service was analysed and presented in Table 6.

Table 6. *The Distribution of Problems the Teachers Encountered While Teaching 8th Grade force and Motion Unit in terms of Teachers' Region of Service*

Problems	**Region of Service**						
	Marmara (33)	Aegean (19)	Mediterranean (43)	Central Anatolia (28)	Black sea (45)	Eastern Anatolia (54)	South-eastern A. (26)
1. Lack of course hours	3.60	4.40	3.79	3.52	3.96	3.32	3.80
2. Lack of activities and examples in the textbook and workbook	4.07	3.65	3.84	3.72	3.86	3.56	3.58
3. Subject's not making links with daily life	3.15	3.19	3.15	3.01	2.80	2.83	2.69
4. Abstract and complicated subjects	4.28	4.36	3.91	4.14	4.22	3.88	4.21
5. Lack of knowledge in students	3.93	3.64	3.79	3.80	3.96	3.77	3.92
6. Some misconceptions with students	3.75	4.06	3.54	3.62	3.95	3.69	3.91
7. Students' not being able to use scientific process skills adequately	4.08	3.97	3.88	4.12	4.25	4.01	4.13
8. Not being able to do the activities due to lack of equipment and tools	3.91	4.01	3.80	3.82	4.15	4.02	4.05

When the problems encountered by the teachers while teaching the unit in terms of region of service were analysed, it was determined that the teachers who encountered the most problems were working in Black sea and Aegean regions and the teachers who encountered the fewest problems were working in Eastern Anatolia, Mediterranean, and Central Anatolia regions (Table 6).

The teachers' views for the solutions of the problems in 8th grade Force and Motion unit were explored and presented in Table 7.

Table 7. *Frequency distribution of the suggestions made according to teacher views to solve the problems in 8th grade Force and Motion unit*

Suggestions	A f	B f	C f
Suggestions for course hours			
Course hour must be increased	56	34	34
There must be a separate applied course	6	3	3
Suggestions for curriculum			
The scope of the subject must be narrowed and science and technology courses must be scattered in curriculum.	13	---	---
Some concepts (mass, density, volume, weight, force, balanced force, resultant force) must be taught at primary education level.	5	4	---
Formulas must be included in curriculum.	2	5	1
Subjects must be removed from the curriculum and must be taught in the later years.	2	1	2
This subject must be taught in the second term.	3	1	1
Science-technology-society-environment gains must be included more about this topic.	1	1	1
"Buoyant force and why some objects float" subjects must be replaced.	1	1	---
Within the context of the subject, density must be given in a common unit.	---	1	---
Within the context of the subject, volume must be taught under a different title.	---	1	---
Solid pressure must be taught.	---	---	1
Buoyant force of the liquid and liquid pressure must be taught in different months.	---	---	1
Suggestions for the content of the textbook and workbook			
More activities must be included in the textbooks.	11	11	11
Interesting and remarkable knowledge, activities, visuals, and cartoons must be included in the textbooks.	8	8	11
The examples in the text must be increased and suited to LDE.	9	1	2
MNE books must be used.	3	3	3
Supplementary materials must be used due to inadequate textbooks.	3	2	3
Evaluation questions in the textbooks must be appropriate to the students' level.	2	---	2
Gas pressure in the textbooks must be explained in detail.	---	---	2
The number of activities about combined vessels and U pipes must be increased.	---	---	2
Activities about manometer and barometer must be added.	---	---	2
Suggestions for physical opportunities			
Laboratories must be improved and lacking equipment and tools must be supplied.	44	25	23
There must be ready experiment kits about the subjects.	3	3	4
Precision measuring tools must be used (dynamometer, scales.)	1	1	---
Central laboratories must be established in the cities and towns and must be put into service.	1	---	---
Course materials must be easy to reach, cheap and available in the market.	1	---	---
Small pools must be built in the school garden.	---	1	---
Teachers' suggestions for in-class implementations			
Teachers must provide students more opportunities to do more activities as far as possible	39	30	21
Teachers must link the subjects to daily life and concretize them.	26	15	19
Teachers must use technology (video, flash, presentations, slides..etc)	15	18	22
Teachers must solve many questions about the subjects	19	9	11
Teachers must explain the key points of the subjects without teaching the theoretical subjects much.	16	3	---
Teachers must use alternative methods and techniques (brainstorming, excursions to science museum, sea, and lakes) for permanent learning.	6	6	4
Students must be assigned original performance tasks about the subject and teachers must have the students do additional work.	2	8	1
First level teachers must have the students gain scientific process skills such as doing observation, and reading graphs.	3	---	---
Teachers must explain the subjects in detail.	---	3	---
Teachers must be given seminars and practical training about how to teach these subjects	2	---	1
Teachers must receive help from the trainers in the field.	---	1	1
Teachers must teach buoyant force and the position of the object in the liquid together	1	---	---
Teachers must use different evaluation methods at the end of the course	1	---	---
Teachers must help the students to understand the relations between the concepts	1	---	---
Student			
Students' operational skills must be developed with mathematics teachers	13	9	10
Students' readiness level towards a subject must be controlled and their motivation must be promoted.	5	3	2
Student number must be reduced	5	2	2
Students' misconceptions must be identified and they must be eliminated.	2	2	2

A. Buoyant force subject B. Subject of Why do some subjects float? C. Pressure subject

In order to solve the problems encountered while teaching 8th grade science unit called "Force and Motion", %68 of the teachers offered suggestions on the subject of "Buoyant Force", %55 on "Why Do Some Objects Float?", and %48 on "Pressure". The most important suggestions offered by the teachers were that due to comprehensive subjects, "course hours must be increased", "Laboratories must be improved and lacking equipment and tools must be supplied" and also "Teachers must provide students with more opportunities to do more activities as far as possible". Following the suggestions above, these were given respectively: "Teachers must link the subjects to daily life and concretize them", "Teachers must use technology (video, flash, presentations, slides etc.) in their courses", "Teachers must solve many questions about the subjects", "More activities must be included in the textbooks", "Students' operational skills must be developed with mathematics teachers", and "Interesting and remarkable knowledge, activities, visuals, and cartoons must be included in the textbooks". In addition to the most frequently mentioned suggestions, it was discovered that teachers offered interesting suggestions such as "Formula must be included in curriculum", "Subjects must be removed from the curriculum and must be taught in the later years", "MNE books must be used", "Central laboratories must be established in the cities and towns and must be put into service", and "Small pools must be built in the school garden".

Some teachers proposed the following suggestions to solve the problems related to buoyant force.

"This unit must be studied in the 2nd term because when students learn force-motion unit, they have problems with calculations as they have not learned equation with one unknown completely in mathematics course" (M_7, M_{45}, M_{58}, M_{90}, M_{148}, F_{25}, F_{34}, F_{243}).

"I suggest that two-hour hands-on training must be added in addition to 4 hour science course" (M_{88}, M_{100}, M_{125}, M_{227}, M_{235}, F_{99}, F_{110}, F_{115}, F_{116}).

"Subject must be linked to daily life" (M_{56}, M_{66}, M_{85}, F_{55}, F_{215}, F_{210}).

"More exercises and activities must be included in the textbook" (M_{33}, M_{98}, M_{103}, M_{122}, M_{128}, F_{34}, F_{68}, F_{79}, F_{105}).

"Formulas must be included in curriculum. It is sometimes difficult to explain the logic behind some questions without a formula." (M_{16}, M_{30}, M_{35}, M_{41}, M_{67}, M_{98}, M_{101}, F_{33}, F_{39}, F_{110}, F_{118}, F_{116}).

Some teachers stated the following suggestions to solve the problems related to why some objects float.

"There must be more visual things. Textbooks are inadequate" (M_{76}, M_{88}, M_{102}, M_{212}, M_{245}, F_{30}, F_{65}, F_{78}, F_{92}, F_{102}, F_{234}).

"Course hour is inadequate to do activities and solve problems" (M_{88}, M_{101}, M_{112}, M_{114}, F_{55}, F_{76}, F_{200}).

Some teachers offered the following suggestions to solve the problems related to pressure.

"Better exemplifications must be provided and enough time must be allocated for the solution of the questions" (M_{85}, M_{103}, M_{228}, M_{201}, F_{59}, F_{114}, F_{116}, F_{243}).

"Pressure, especially gas pressure, is not covered much in the textbook. Supplementary materials about gas pressure must be developed and told" (M_{19}, M_{45}, M_{75}, M_{112}, F_{55}, F_{110}, F_{118}).

"Simpler and clearer examples must be included in the textbooks" (M_{88}, M_{103}, M_{139}, M_{155}, K_{85}, F_{102}, F_{210}, F_{229}, F_{248}).

DISCUSSION, CONCLUSION and IMPLICATIONS

Science and technology teachers stated that students have difficulty in making links between the concepts because the subjects in "Force and Motion" unit are abstract, they could

not use scientific process skills (mathematical calculations, interpreting, inferring and comparing) adequately in these activities and they could not do the activities within the context of the unit due to lack of equipment and tools. This result indicates a parallelism with many studies conducted about the problems encountered in science and technology course in literature (Riess, 2000; Ünal & Ergin, 2006; Avcı, 2006; Özdemir, 2006; Özden, 2007; Yangın, 2007; Şengül, Çetin & Gür, 2008; Güven, 2008; Aydın & Çakıroğlu, 2010; Doğan, 2010; Küçüköner, 2011; Cengiz, Uzoğlu & Daşdemir, 2012; Geçer & Özel, 2012).

Teachers stated that students had lack of knowledge and misconceptions. They also reported that the least frequently encountered problem was that they could not link the examples in force and motion unit to daily life. Unlike this study, some studies revealed that the most common problem encountered was not being able to make links between the course and daily life (Cengiz, Uzoğlu & Daşdemir, 2012).

Science and technology teachers' views were examined in terms of different variables and it was reported that the most frequently encountered problems both by female and male teachers included the complicated and abstract subjects, students' not being able to use scientific process skills adequately and not being able to do the activities due to lack of equipment and tools. It was determined that the least frequently encountered problems both by female and male teachers included not being able to link subjects to daily life. When the teachers' departmental graduations were taken into consideration, different results emerged. It was found that the teachers who were graduates of Physics department/ teacher education encountered very few problems while teaching the unit, but the teachers who were graduates of biology department encountered a lot of problems. This result partially corresponds with the views of Şengül, Çetin & Gür (2008) who stated that graduates from different departments of the university (physics, chemistry, biology) affected teaching negatively. When the problems teachers encountered due to their years of teaching experience were examined, it was discovered that the experienced teachers who have been working 16 years or more encountered the fewest problems. This result is compatible with the studies of Kabakçı, Akbulut & Özoğul (2009) which revealed that experienced teachers had fewer problems. When the problems teachers encountered due to their region of service were examined, it was determined that the teachers working in Black Sea and Aegean regions encountered many problems whereas the teachers working in East Anatolia, Mediterranean, and Central Anatolia regions did not encounter as many problems as they did.

The main suggestions offered by the teachers to solve these problems included "an increase in class hours due to complicated subjects", "improving laboratories and supplying more equipment and tools", and "teachers' giving students more opportunities to do exercises". Besides these suggestions, the following solutions were offered respectively: " Teachers must connect the subjects to daily life and concretize them", "Teachers must use technology (videos, flash, presentations, slides, etc) in their lessons", " Teachers must solve more problems about the subject", "More activities must be added in the textbook", "Students' operational skills must be developed through cooperation with maths teachers", and " Textbooks must include interesting information, activities, visuals, and cartoons." When the literature is analysed, similar suggestions offered in this study to solve the problem draw attention (Yılmaz & Morgil, 1992; Özdemir, 2006; Özden, 2007; Şengül, Çetin & Gür, 2008; Doğan, 2010; Küçüköner, 2011; Geçer & Özel, 2012; Cengiz, Uzoğlu & Daşdemir, 2012). Küçüköner (2011). In addition to the most frequently mentioned suggestions, it was identified that teachers offered interesting suggestions such as "Formulas must be included in curriculum", "Subjects must be removed from the curriculum and taught in later grades", "Central laboratories must be established in the cities and towns and must be put into service", "MNE books must be used", and "small pools must be built in the school garden".

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