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TURKISH TEACHERS' OPINIONS ABOUT SCIENCE-TECHNOLOGY-SOCIETY-ENVIRONMENT ACQUISITIONS IN SCIENCE AND TECHNOLOGY COURSE CURRICULUM

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Abstract. *The purpose of this study is to examine teacher opinions about science-technology-society-environment (STSE) acquisitions in Turkish Science and Technology Course Curriculum (TSTC). For this purpose, semi-structured interviews were performed with teachers. The participants were addressed questions about their awareness of STSE acquisitions and their in-class activity about these acquisitions. Learning fields of the teachers, the contents of these fields and the opinions of the teachers about STSE pointed out that their awareness level about STSE acquisitions was low. On the other hand, most of the teachers stated that there was enough and comprehensible information about STSE acquisitions in TSTC. The results of this study revealed that most of the teachers were not able to realize these acquisitions in the courses because of a lack of time or equipment and overcrowded classes.*

Key words: *science and technology course curriculum, science-technology-society-environment acquisitions, teacher opinions.*

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Introduction

Being science literate becomes a must for every individual of our scientifically developing society, which faces a new research or innovation every day. The term "science literate" was first introduced by Paul DeHart Hurd in the late 1950's (Hurd, 1958) and became an international term, slogan and a goal of contemporary education (Laugksch, 2000; Stolz, Witteck, Marks, and Eilks, 2013). DeBoer (2000) states that a review of the history of science education shows that there have been at least nine separate and distinct goals of science education. These goals are: (i) teaching and learning about science as a cultural force in the modern world, (ii) getting prepared for the world of work, (iii) application to everyday living, (iv) teaching students to become informed citizens, (v) learning about science as a particular way of examining the natural world, (vi) understanding reports and discussions of science that appear in the popular media, (vii) learning about science for its aesthetic appeal, (viii) formation of citizens who are sympathetic to science and finally (ix) understanding the nature and importance of technology and the relationship between technology and science. Although there are many goals about being science literate, many researchers stress individual's use of scientific information in their own lives for personal and social benefits (DeBoer, 2000; Hand, Lawrence and Yore, 1999; Hurd, 1998; Stolz, Witteck, Marks, and Eilks, 2013).

A science literate person is an individual who is aware of science, mathematics and technology, with their advantages and limitations, is familiar with the natural world, understands the principles of science, and benefits from scientific approach in making personal and social decisions (American Association for the Advancement of Science [AAAS], 1989). Laugksch (2000), states that a country's economic welfare level improves with science literacy. A particular country should compete with other countries to preserve its

global position. To achieve this goal, a country among all other countries, needs citizens with a level of science literacy. In this context, many countries set 'educating science literate individuals' as one of their prime goals of the education and instruction process.

Teacher is one of the factors that make students acquire information, develop skills, behavior and values toward becoming science and technology literate individuals (Yetisir, 2007). A science-and-technology literate teacher should be able to guide his or her students about learning how and when to ask a question, making decisions according to the realities faced and the causes of these realities instead of emotional reactions to and beliefs about them, analyzing issues related to science and technology, being aware of pre-knowledge through exposure to different methods, exploring why existing knowledge is not always scientifically true, using scientific processes in decision making, and experiencing the STSE relations during education (Ministry of National Education [MNE], 2006).

Position and effect of science and technology in social life can be explained by science-technology-society (STS) approach. STS is defined as the teaching and learning of science-technology in the context of human experience (National Science Teachers Association, 1990-91). STS helps understanding how science and technology affect an individual's life. According to Yager (1993), STS is an appropriate way of teaching and a feasible model for science teaching that provides a learning environment effect for all students. STS approach does not prescribe a specific way of teaching; it describes broader goals that teachers can follow (Lee & Erdogan, 2007). Teacher should stress the STS relations in the science courses and should include them in the program. A sufficient portion of science education should be dedicated to STS issues. One of the best ways to do it is to help a student gain consciousness about events occurring in his or her daily life (Soylu, 2004). Applying STS education in courses has a dramatic effect on increasing the science literacy level of students (Cepni, 2006; Lee, 2003).

STSE is created by adding an environment concept to STS. In STSE, various environmental problems, which are related to education, economy, environment, ethics, and society, are addressed by means of scientific and technological developments (Pedretti, 2005). The purpose of the courses using STSE education is to provide the society with a simpler understanding of science, to encourage different and creative thinking, and to make bored subjects more alert. By STSE education, individuals gain the skills to understand the nature of science, make social decisions, and solve technological problems (Zan Yoruk, 2008). Thus, individual understands the nature of science and technology, how science and technology interact, and how science and technology interact with individuals, society, and environment. One of the most important goals of STSE education is to develop students' scientific, critical and conceptual thinking ability and to improve their problem solving abilities (Tal, Dori, Keiny and Zoller, 2001).

A Brief Summary of TSTC from the STSE Perspective

The purpose of the STSE education can be regarded as science for all, and the instrument for this purpose can be regarded as the content of science course which builds STSE relations. This means, the purpose is to make the society science-literate by using science programs based on STSE approach (Zan Yoruk, 2008). Many countries placed this approach in their program with different slogans such as "science for all", "public understanding of science" or "scientific literacy" (Aström, 2008). STS relations are presented as one of the main components in the science curriculum. STS relations are presented as one of the main components in Turkish Science and Technology Course Curriculum (TSTC) (MNE, 2006) implemented between 2006-2013. A similar approach is seen in Turkish science course curriculum (Ministry of National Education, 2013) which was rearranged in 2013. Both curriculums' vision was to educate all students as science literate regardless of their individual differences. TSTC (MNE, 2006) has seven main learning fields. These are: 1. living creatures and life, 2. substance and change, 3. physical events, 4. earth and universe, 5. STSE relations, 6. scientific process abilities and 7.attitude and values. The first four of these fields have science subjects, and the remaining three areas are associated with ability, attitude and values. In TSTC, acquisitions in each learning domain are presented as itemized. Subjects and concepts are organized according to the first four learning fields. Acquisitions of the other three learning fields are distributed to the related parts within the first learning domains. TSTC (MNE, 2006) was prepared according to a STSE-based-approach and STSE relations were included in it as a learning field. STSE acquisitions focused on three main dimensions: (1) nature of science and technology, (2) relations between Science and Technology and (3) social and environmental context of science and technology. There are 38 acquisitions in the STSE learning field. STSE acquisitions are marked with their numbers in parentheses after the acquisitions that are listed in the first four learning fields. In addition, even

in TSTC itself, it is pointed out that STSE acquisitions are not required; teachers are free to insert STSE acquisitions in activities and projects, whenever suitable or required. At this point, teachers need to insert related STSE acquisitions into their courses while teaching subjects related to the planned acquisitions.

Research Focus

In recent years, there have been many studies about STSE both in Turkey (Afacan, 2008; Bagci Kilic, Haymana and Bozyilmaz, 2008; Bulus Kirikkaya and Tanriverdi, 2006; Erduran Avci and Onal, 2013; Sunar and Geban, 2011) and many other countries (Lee and Erdogan, 2007; Pedretti and Bellomo, 2013; Pitiporntapin, Yutakom, Pradermwong and Anderson, 2010; Yager, Choi, Yager and Akcay, 2009). These studies are conducted about student/teacher opinions on science and math curriculum (Amirshokoohi, 2010; Cetinkaya, 2012; Bulus Kırıkkaya, 2009; Pitiporntapin, Yutakom, Pradermwong and Anderson, 2010; Seker, 2007; Yilmaz and Yigit, 2011), STSE acquisitions (Bulus Kirikkaya and Tanriverdi, 2006; Erduran Avci and Önal, 2013), students' learning (Akcay and Yager, 2010; Yager, Choi, Yager and Akcay, 2009), students' attitude (Afacan, 2008; Lee and Erdogan, 2007), teacher education (Dass, 2005; Pedretti and Belloma, 2013), teacher/teacher candidates perceptions (Sunar and Geban, 2011), the effect of STSE learning field on developing environmental consciousness (Aydin, 2010). Researches conducted in Turkey concentrated on teachers' and students' opinions. General applications and views were examined about TSTC (MNE, 2006) in most of these researches. STSE acquisitions should be correctly understood and applied in classrooms in order to reach the STSE goals defined in TSTC (MNE, 2006). In this context, this research aims to find out the awareness of Turkish teachers about STSE acquisitions and the degree of in-class application of the STSE acquisitions. Guided by these purposes, answers to below questions were sought:

i. What are the awareness levels of science teachers about the STSE acquisitions in TSTC?
ii. What are the levels of teachers in science classrooms for realizing the STSE acquisitions?

Methodology of Research

Cross-sectional survey design was used in this research. According to Creswell (2012, p.377-379) the most popular type of survey design used in education is a cross-sectional survey design. In a cross-sectional survey design, the researcher collects data at one point in time. A cross-sectional study can examine current attitudes, beliefs, opinions, or practices. It also provides useful information about evaluating programs in schools. In the procedure, survey researchers collect quantitative, numbered data using questionnaires or interviews. In survey designs, researchers typically collect data using questionnaires or interviews (Creswell, 2012, p.382). In this context, cross-sectional survey design is used to examine science teachers' opinions about STSE acquisitions in TSTC.

Participants

Participants of the study consisted of science teachers from Isparta, Turkey. In 2011-2012 educational years, 78 science teachers were employed in the city-centre of Isparta province. 17 of these teachers did not participate in the study (because of unwillingness, health problems, being out of province etc.) while the remaining 61 of them participated. Demographic features of the participating teachers are presented in Table 1.

Table 1. Demographic features of the teacher participants.

Demographic Features		N	%
Sex	Female	25	40.98
	Male	36	59.01
Level of Education	Graduate Degree	7	11.47
	Bachelor Degree	54	88.52
Professional Experience	0-5 Years	4	6.56
	6-10 Years	10	16.39
	11-15 Years	15	24.59
	16+ Years	32	52.45

	Demographic Features	N	%
Graduate of	Faculty of Education Dept. of Science Education	17	27.86
	Faculty of Education Dept. of Physics/Chemistry/Biology Education	19	31.14
	Faculty of Science and Literature Dept. of Physics/Chemistry/Biology	11	18.03
	Institute of Education Dept. of Physics/Chemistry/Biology	7	11.47
	Institute of Education Science and Nature	7	11.47

Instruments

Interviews

A semi-structured interview form, which was prepared by the researchers, was used as the data collection instrument. The form had two sections, one for personal information and the other for opinions about STSE acquisitions. There were 4 questions in the personal information section which were designed to find out participants' demographic features. There were 4 open-ended questions to determine the awareness level of teachers about STSE acquisitions in TSTC and 10 more to find out the level of their in-class activity about these acquisitions. Yildirim and Simsek (2005) states that open-ended questions allow researchers develop a flexible approach to the subject to be studied while avoiding the risk of overlooking important variables of the subject. Interview form was inspected by two experts in order to determine the contextual validity of the questions. Experts' advice was sought about the content of the questions and their fitness for the purpose of the study. The questions were rearranged according to the experts' recommendations. Required permissions were granted by Isparta National Education Directorate for applying the interview to the teachers. The interview form was applied to 61 science teachers in the city-centre of Isparta province. Each interview lasted 25 to 30 minutes. The researcher asked the teachers' permission to audio-record the interview but none of the teachers wanted the interview to be recorded. Therefore, the researcher asked the teachers the questions and wrote down the replies. After the interview, the participants were shown their answers for the review. The teachers reviewed the notes written by the researcher and corrected missing or incorrect issues.

Data Analysis

In the beginning, interview forms were numbered from 1 to 61 and each was written and recorded digitally. Recorded data were re-inspected for control. After this process, coding phase began. Main categories were determined during analysis according to similarities and differences and data were grouped into these categories. Then sub-categories were identified within main categories in the same way (Yildirim and Simsek, 2005). In the coding phase, answers to each question were inspected and researchers tried to make proper codes for research topics and in some cases, codes were grouped into themes. Created coding and themes were evaluated by experts separately and only the codes and themes on which experts agreed were taken into consideration. Using these codes and themes, commendation phase was initiated. Codes were tabulated with frequencies and percentages. Comments were made according to the percentages that reflected teachers' opinions for each item in the table. In order to increase the reliability of the study, codes were presented to two field experts. Codes, on which the experts did not agree upon, were dismissed. It was calculated that experts had an agreement rate of 0.92 about the codes (Reliability = Agreement / (Agreement + Disagreement). Since the reliability coefficient was greater than 0.7, coding was accepted to be reliable (Miles and Huberman, 1994, p.64)

Results of Research

Awareness Levels of Science Teachers about the STSE Acquisitions

In order to find out the awareness levels of science teachers about the STSE acquisitions, they were addressed four questions. The answers of teachers who were not aware of STSE acquisitions were not taken into consideration. Findings of this section were analyzed in five sub-categories: (i) Level of expression of learning fields, (ii) explana-

tions about the content of the learning fields, (iii) opinions about the STSE relations, (iv) opinions about the level of the STSE interactions in TSTC, (v) opinions about the level of information for the STSE acquisitions.

Level of Description of Learning Fields

Science teachers were asked which learning fields TSTC included. The answers of the teachers about learning fields are presented in Table 2.

Table 2. Results about describing learning fields and their distributions.

Teachers' level of description of learning fields		N	%
Number of teachers with correct description	Planned learning fields	13	21.30
	Unplanned learning fields	4	6.56
	*All learning fields	9	14.75
Number of teachers with incorrect descriptions	Science literacy	2	3.28
	Learning theory	5	8.20
	Unit subject	25	40.98
Not a proper description	No answers	3	4.92

**: An answer with required information.*

Learning field description levels were coded as "correct description", "incorrect description", and "not a proper description" in Table 2. It was observed from the answers of teachers with correct descriptions that 21.30% of the teachers expressed only the planned learning fields, 6.56% of them expressed only the unplanned learning fields, and the 14.75% expressed all learning fields correctly. Most of the teachers (21.30%) considered learning fields which were limited to planned learning fields such as "living creatures and life", "substance and change", "physical events", and "earth and universe". It was observed from the answers of teachers with incorrect descriptions that the teachers limited learning fields to science literacy, learning theories (e.g. structural approach), or unit subjects (e.g. force, movement, heat, temperature). In addition, 4.92% of the teachers stated that they did not know the learning fields.

Explanations about the Content of the Learning Fields

The teachers, who correctly described the learning fields, were asked to explain the content of the learning fields. Decency of the answers was inspected at four levels. In this context, a correct explanation was classified as "decent", a missing explanation was classified as "indecent", a wrong explanation was classified as "wrong", and no explanations were classified as "no answer". Findings are presented in Table 3.

Table 3. Results about the content of learning fields and their distributions.

Teachers with correct learning field descriptions	Decent		Indecent		Wrong		No Answer	
	N	%	N	%	N	%	N	%
Planned learning fields	7	26.92	3	11.54	2	7.69	1	3.85
Unplanned learning fields	1	3.85	2	7.69	-	0	1	3.85
All learning fields	4	15.38	3	11.54	-	0	2	7.69

According to Table 3, about planned learning fields, 26.92% of the teachers gave a decent explanation, 11.54% of them gave an indecent explanation, 7.69% gave a wrong explanation, and 3.85% gave no explanations. For unplanned learning fields, 3.85% of the teachers gave a decent explanation, 7.69% of them gave an indecent explanation, and 3.85% gave no explanation. For all learning fields, 15.38% of the teachers gave a decent explanation, 11.54% of them gave an indecent explanation, and the 7.69% gave no explanation. There were four teachers who correctly described all learning fields in TSTC and gave a decent explanation about them.

Opinions about the STSE Relations

Teachers were asked about their opinions about the relations between STSE concepts. Acquired themes and their distributions are given in Table 4. When Table 4 is inspected, one can see that relations between STSE concepts were considered in different ways. Relations between these concepts were mostly (18.03%) defined as "individuals relating social events to environmental conditions and connecting them to technology". Many of science teachers simply considered STSE relations as relating to social events, scientific research, information gained during science and technology courses, and technological developments, and products in daily life. Besides, a portion of teachers (13.11%) stated that they had no idea about the relationship between STSE concepts.

Table 4. Distribution of opinions about the STSE relations.

Relations between STSE concepts	N	%
Individuals relating social events to environmental conditions and connecting them to technology.	11	18.03
Individuals' use of products, which are designed based on scientific research, by individuals.	9	14.75
No idea.	8	13.11
Society's awareness of scientific research and the use of it in daily life.	7	11.47
Use of concepts learned in science and technology courses in daily life.	7	11.47
Individuals' understanding of the events surrounding them and the ability to relate them to science and technology.	7	11.47
Relating science to daily life.	6	9.84
Keeping up-to-date about technological improvements and related nearby events toward becoming a science-literate person.	3	4.92
Complying with social rules.	1	1.64
Unbiased application of scientific research for social purposes.	1	1.64
Making students gain self-confidence, motivation, and inquisitive mind during the education process.	1	1.64

Opinions about the Level of STSE Interactions in TSTC

After teachers were asked about their opinions on the relations between STSE concepts, they were inquired about their level of STSE interactions in TSTC. Teachers, who stated that they had no idea about the relationships between STSE concepts (13.11%), were not asked any questions from this sub-category. Acquired themes and their distributions are given in Table 5.

Table 5. Results about the level of STSE interactions in TSTC and their distributions.

They exist		They partially exist		They do not exist	
N	%	N	%	N	%
30	56.60	17	32.08	6	11.32

Answers of the teachers, who think that interactions between STSE concepts are included in TSTC, were coded as "they exist", answers of the teachers, who think that interactions between STSE concepts are partially included in TSTC, were coded as "they partially exist", and answers of the teachers, who think that interactions between STSE concepts do not take place in TSTC, were coded as "they do not exist". It is clear from Table 5 that most of the teachers (56.60%) think that the interactions between STSE are mentioned in TSTC.

Level of Teachers' Application of STSE Acquisitions in Science Classrooms

Science teachers were asked questions about in-class application of STSE acquisitions in TSTC. These questions were not asked of 12 teachers who declared they did not have enough information on the subject. Findings of this section were analyzed in nine sub-categories: (i) Content of STSE acquisitions and the level of their inclusion in TSTC, (ii) teachers' opinions on explanations about STSE acquisitions, (iii) comprehensibility of STSE acquisi-

tions, (iv) relating STSE acquisitions to other learning fields, (v) reliability of STSE acquisitions, (vi) effects of time, equipment, number of students, and socio-cultural status of students to the application of STSE acquisitions, (vii) appropriateness of STSE acquisitions for students' development level and pre-information, (viii) decency of activities related to the STSE acquisitions in the science course textbook, (ix) evaluated levels of STSE acquisitions and the evaluation methods used.

(i) Content of STSE Acquisitions and the Level of their Inclusion in TSTC

The participants were asked about the content of STSE acquisitions and the level of their inclusion in the program. The 55.10% of the teachers reported the level of the content of STSE acquisitions and the level of their inclusion in the program as decent, the 36.73% as partly decent, and the 8.16% as indecent. Teachers, who said that the level of the content of STSE acquisitions and the level of their inclusion in TSTC were partially decent, also reported that some science subjects were abstract, that time dedicated to the course was limited, that no similarity existed in inter-course relations, that the equipment was lacking, that the STSE acquisitions were not stressed completely in TSTC and some acquisitions were unnecessarily repeated. Teachers, who said that the level of the content of STSE acquisitions and the level of their inclusion in the program were indecent, stated that it was due to the fact that there were no questions in the national high school entrance exams about the STSE acquisitions, so they did not mention them in the courses. In addition, it was noted as an interesting fact that some of the teachers complained about the high number of STSE acquisitions which by some others were found to be low in number.

(ii) Teachers' Opinions on Explanations about STSE Acquisitions

In this sub-section, teachers' opinions on explanations about STSE acquisitions were inspected. The 65.30% of the teachers considered the explanations about STSE acquisitions in TSTC as "decent", 18.37% of the teachers considered them as "partially decent", and 16.33% of the teachers considered them as "indecent". Teachers, who said that explanations about STSE acquisitions in TSTC were partially decent, stated that they did not have TSTC booklet, and that explanations in teacher guide books about STSE acquisitions were not clear and/or shallow. Teachers, who said that explanations about STSE acquisitions in TSTC were indecent, stated that in-service training about TSTC was not enough and there were no explanations about STSE acquisitions in teacher guide books. A group of teachers marked explanations in teacher guide books about STSE acquisitions as partially decent while another group marked them as indecent.

(iii) Comprehensibility of STSE Acquisitions

There are 38 STSE acquisitions in TSTC. Teachers were asked if these acquisitions were clear and comprehensible. The 67.35% of the teachers considered STSE acquisitions as comprehensible. The 18.37% considered them as partially comprehensible, and the 14.28% considered them as incomprehensible. Some of the teachers expressed that explanations about the STSE acquisitions in TSTC were not enough so they were partially comprehensible. Some others stressed that explanations about STSE acquisitions in TSTC were not enough so they were incomprehensible. This meant that the decency of explanations about the STSE acquisitions in TSTC affects their comprehensibility.

(iv) Relating STSE Acquisitions to Other Learning Fields

As stated in previous sections, TSTC consists of seven learning fields. Teachers were asked about their opinions about the level of relating STSE acquisitions to other learning fields during lessons. Most of the teachers (67.35%) answered that they easily related STSE acquisitions to other learning fields during the lessons. The 26.53% of the teachers said that they could partially relate them to other learning fields while the 6.12% answered they could not. Teachers who built partial relations expressed the following justifications: "...STSE acquisitions were explained pretty abstractly. They cannot be made concrete in the class always.", "...STSE acquisitions are not suitable for every grade level.", "...subjects and concepts do not match with STSE acquisitions.", "we do not have enough equipment in our laboratories to realize these acquisitions.", "...the connection between theoretical and practical information cannot be strongly built."

(v) Reliability of STSE Acquisitions

Teachers were asked whether STSE acquisitions in TSTC were realized enough or not. The 32.65% of the teachers said that they could realize the STSE acquisitions in classes, the 61.22% said that they could partially realize them in classes, and the 6.12% said that they could not realize them in classes. Teachers, who said that they could partially realize the STSE acquisitions in classes, stated that when below conditions took place, they managed to realize them decently: (i) When the students were willing, (ii) when the subject was concrete and attractive, (iii) when the teacher provided enough explanation, (iv) when time and equipment were enough, (v) when readiness level between rural and urban students were brought to a minimum. Teachers, who considered the realization of STSE acquisitions as impossible, said that the main reason for it was lack of time and equipment. Another reason was that the prime goal of the students was the high school entrance exam. Some teachers said that this exam included questions from planned learning fields, therefore students focused on solving test questions to practice for these exams. They expressed that they could not spare much time for activities, projects, experiments etc., so they did not think that STSE acquisitions were realizable.

(vi) Effects of Time, Equipment, Number of Students, and Socio-Cultural Backgrounds of Students to Application of STSE Acquisitions

Teachers mentioned facing difficulties in the realization of STSE acquisitions during interviews. Most of the difficulties rooted in time, crowded classes, and socio-cultural backgrounds. Teachers' opinions about time, crowded classes, and socio-cultural backgrounds are presented in Table 6.

Table 6. Effects of time, equipment, number of students, and socio-cultural backgrounds of students to application of STSE acquisitions.

Codes	Level of Decency					
	Decent		Partially Decent		Indecent	
	N	%	N	%	N	%
Time	10	20.41	13	26.53	26	53.06
Equipment	19	38.77	12	24.49	18	36.73
Number of students	19	38.77	9	18.37	21	42.86
Socio-cultural backgrounds	11	22.45	13	26.53	25	51.02

For the application of STSE acquisitions, the 20.41% of the teachers said the time for science courses was enough, the 26.53% said it was partially decent, and the 53.6% of the teachers said it was indecent. The 38.77% of the teachers considered equipment and laboratories as decent, the 24.49% of the teachers considered them partially decent, and the 36.73% of the teachers considered them indecent. Most of the teachers (42.86%) stressed that the classes were crowded and that it affected the realization of STSE acquisitions negatively. The 38.77% of the teachers said that classes had enough students to realize STSE acquisitions, and the 18.37% considered the number of students in the class as partially decent toward realizing STSE acquisitions. The 22.45% of the teachers considered the socio-cultural background of the students as decent, the 26.53% of the teachers considered it as partially decent, and the remaining 51.02% considered it as indecent.

Teachers stated that, because of the fact that acquisitions were time consuming, and that there was no time left for STSE acquisitions outside the time devoted for solving multiple-choice test questions, class activities included covering excessively detailed levels of topics. Some acquisitions were not proper for student levels. Time variable was partially decent for the application of STSE acquisitions. They explained the indecency of time by the presence of large number of subjects and activities, activities requiring high details, and the long time required to help students understand certain topics, all of which were considered not to be suitable for students' acquisition levels. High details of topics and handling activities which are not suitable for students' levels may be considered as negative factors for teaching acquisitions. Teachers, who thought that the equipment was partially decent,

expressed that they did not have proper equipment for each activity and that they suffered from lack of visual materials in their schools. Teachers, who thought the equipment was indecent, said that they did not have proper equipment for each activity, the equipment they possessed was not suitable for the acquisitions, and that they suffered from lack of visual materials in their schools. Teachers, who stated that the number of students in the class was partially decent or indecent, said that the classes were overcrowded. They also stressed that the socio-cultural backgrounds of the students did not prepare them well for acquisitions. They stated that the causes of this were divorced parents, low socio-economic levels of their families, and wrong pre-information.

(vii) Appropriateness of STSE Acquisitions for Students' Development Levels and Pre-Information

Findings, which were acquired by asking teachers about the appropriateness of STSE acquisitions for students' developmental levels and pre-information, are presented in Table 7. The 75.51% of the teachers considered the developmental level of students from the perspective of STSE acquisitions as decent, the 16.33% considered it as partially decent, and the 8.16% considered it as indecent. The 61.22% of the teachers stated that students' pre-information was decent, the 20.41% stated that they were partially decent, and the 18.37% stated that they were indecent.

Table 7. Level of appropriateness of STSE acquisitions for students' development level and pre-information.

Codes	Level of Decency					
	Decent		Partially Decent		Indecent	
	N	%	N	%	N	%
Development Level	37	75.51	8	16.33	4	8.16
Pre-information	30	61.22	10	20.41	9	18.37

Teachers explained the inappropriateness of STSE acquisitions for students' development levels by students' personal differences. Teachers with this opinion thought that the causes of this were the following: Some students had attention deficit, most were unconcerned, problem students negatively affected the class unity, some students had low self-confidence, STSE acquisitions were above the level of the students, the students came from low-educated families, and each student possessed a different style of intelligence. They stated that the group study and alternative activities aimed at facilitating acquisitions would prove useful toward lessening the effect of personal differences. Teachers, who stressed that STSE acquisitions were not suitable for students' pre-information, said that it was because students easily forgot topics, students did not build up enough background in their previous grades, they had a low level of finding communalities between courses, and their individual differences affected their pre-information.

(viii) The Level of the Decency of Activities Related to STSE Acquisitions in the Science Course Book

Teachers were asked about the level of decency of activities related to STSE acquisitions in the science course book. Teachers evaluated the level of the inclusion of STSE acquisition activities in textbooks as decent, partially decent, and indecent as 75.51%, 20.41%, and 4.08%, respectively. Teachers, who expressed that the level of the inclusion of STSE acquisition activities in textbooks was partially decent or indecent, stated that possible causes for it were: There were too few activities to make students really involved, post-unit questions included very few activities, and they experienced difficulties in doing activities due to the lack of appropriate laboratory equipment. In addition, they stressed that more understandable and extensive activities are required rather than more activities to make STSE acquisitions reach their goal. Teachers, who stated that textbooks included partially decent or indecent activities, were asked what sort of activities they held for STSE acquisitions. They answered that they performed different experiments and activities from different books, websites, or education CDs.

(ix) The evaluation level of STSE Acquisitions and the Evaluation Methods Used

Teachers were asked two questions about the evaluation of STSE acquisitions. The first of these is about the level of evaluation for STSE acquisitions. Teachers answered this question about the degree of STSE acquisitions by students (Table 8). According to Table 8, 40.82% of the teachers considered acquisitions as measurable, the 44.90% considered acquisitions as partially measurable, and the 14.29% considered acquisitions as immeasurable. Teachers, who considered STSE acquisitions as partially measurable or immeasurable, said that the measurement instruments in the teacher guide book were indecent. Because acquisitions targeted behavior, it was hard or impossible to record and observe.

Table 8. Level of evaluation of STSE acquisitions.

Evaluation of STSE acquisitions					
Measurable		Partially Measurable		Immeasurable	
N	%	N	%	N	%
20	40.82	22	44.90	7	14.29

Finally, teachers were asked which techniques they benefited from in the evaluation of STSE acquisitions (7 teachers, who stated that STSE acquisitions were immeasurable, were not asked this question). Findings are presented in Table 9. Answers were grouped according to the measurement and evaluation techniques in TSTC. The 11.90% of the teachers used traditional measurement and evaluation techniques, 33.33% of the teachers used alternative measurement and evaluation techniques, and 54.76% of the teachers used both techniques.

Table 9. Measurement techniques used in evaluation of STSE acquisitions.

Measurement and evaluation techniques	N	%
Traditional	5	11.90
Alternative	14	33.33
Traditional and alternative	23	54.76

Techniques, which were said to be preferred by teachers who used traditional measurement and evaluation techniques, were multiple-choice tests, true-false questions, matching questions, blank filling questions, question-answer or long-answer written exams. Alternative techniques which were preferred by the corresponding group of answerers were performance evaluation, student product file, concept maps, projects, drama, written reports, group or peer evaluation, and self evaluation. Techniques, which were said to be preferred by the teachers who used both classes of techniques, were multiple choice tests, true-false questions, matching questions, blank filling questions, question-answer or long answer written exams, structured grid, word relation, performance evaluation, student product file, concept maps, projects, drama, written reports, group or peer evaluation, and self evaluation.

Discussion

Results of the present research will be discussed in two sections: Teachers' awareness about STSE acquisitions and teachers' handling STSE acquisitions in classes. First section covers teachers' awareness levels about STSE acquisitions. The awareness level of teachers about these subjects were explored through an inspection of their opinions on learning fields and their contents, STSE relations, existence of STSE interaction in TSTC, and STSE acquisitions. Most of the teachers misstated the learning fields. Only 14.75% of the teachers expressed all

learning levels correctly. Most of the teachers belonging to this group only mentioned the planned learning fields which included only information. Only 6.56% of the teachers mentioned STSE acquisitions. It was observed that more than half of the participating teachers confused learning fields with the concepts of science literacy or learning theories. The 34.61% of the teachers explained the contents of all learning fields and the 15.38% gave decent explanations. It was an interesting fact that most of the explanations were about informative learning fields. These results indicated that teachers did not have enough information about the learning fields in TSTC as well as their contents.

Teachers had various opinions about STSE relations. For some teachers, STSE relations were "individuals relating social events to environmental conditions and connecting them to technology", for others "individuals' use of products", and still others "society's awareness about scientific research" or "relating science to daily life". Pedretti and Belloma (2013) who had similar results also suggested that STSE is a complex construct that unfolds in different ways for different teachers. As a result of the impact of science and technology on our daily lives and students' consideration of science and technology in a larger perspective, it became very important to relate information from science and technology to the world outside school (MNE, 2006). The 56.60% of the teachers thought that the level of STSE relations was enough in TSTC, the 32.08% of them considered it as partially decent, and the 11.32% of them considered it as indecent. Teachers, who thought that the level of STSE relations was not or partially decent in TSTC, considered the following factors to justify their opinions: There were abstract subjects in the program, there were fewer topics related to technology than desired, there were not enough activities in the textbooks, parents were not aware of STSE interactions, the examples were lacking about social values and environmental sensitivity, poor family support was present about interactions, there were no topics about the relations in the program, and students could not relate the topics to their daily lives and could not practice them. Yilmaz and Yigit (2011) emphasize that students experience difficulties in learning abstract subjects, which leads to a decrease in their interest in the course. In addition, most of the teachers (55.74%) considered their level of information about STSE acquisitions decent. When the results about STSE awareness levels were summed up, it was found out that there was a dilemma: The number of teachers who correctly explained all of the learning fields was very small, but most of the teachers stated that the occurrence of STSE acquisitions in TSTC was decent, as well as their information levels about them. This dilemma was explained by the fact that teachers considered STSE acquisitions and information-based unit acquisitions as the same. Erduran Avci and Onal (2013) studied distributions of STSE acquisitions in TSTC to classes and learning fields. It was interesting that some STSE acquisitions were stressed too often and some were too rare in both class and learning levels. Generally, the most repeated acquisitions were related to science and nature of science. The least repeated acquisitions were about "human, society and technology" subjects. Bardak, Caliskan and Ezberci (2012) concluded that teachers did not inspect the STSE acquisitions well in parallel to this study.

Secondly, the level of incorporating STSE acquisitions specified in TSTC to courses was inspected in nine subsections. The 55.10% of the teachers considered the content and inclusion level of STSE acquisitions in programs as decent. The 65.30% of the teachers found the explanations about STSE acquisitions in TSTC as decent, while the 44.89% did not. Teachers, who said that explanations about STSE acquisitions were indecent, listed the following facts as justification: They did not have TSTC booklet, they could not find or could only find limited explanations about STSE acquisitions in the provided teacher-guide books, and the in-service trainings were not supportive of STSE acquisitions enough. Different results were found in the literature on this subject. For example, Kaptan (2005) stated that teachers found explanations about the context of TSTC, where Seker (2007) stated that teachers found general structure of TSTC clear and comprehensible, and they thought that acquisitions were in line with the general goals. Most of the teacher participants (67.35%) considered STSE acquisition descriptions as comprehensible. Similarly, Bayrak and Erden (2007) found the acquisition descriptions in the program to be comprehensible, consistent with the goals of the course, and related to the daily life activities. Most of the teachers (67.35%) depicted that STSE acquisitions combine well with the other learning fields. Similar to this result, Demirbas (2008) and Bayrak and Erden (2007) stressed that the content of TSTC combines well with the general goals of the courses.

Most of the teachers (61.22%) considered acquisitions as partly realizable in the courses. When students were eager for the courses, when there were topics that attracted students' attention, when acquisitions were remembered outside the school, when time and equipment were decent, when abstract subjects were minimal, when the readiness level between students from urban and rural areas is minimal, the teachers stated that acquisi-

tions would be more realizable. Bulus Kirikkaya (2009) also expressed that teachers considered STSE acquisitions as realizable. Yilmaz and Yigit (2011) stressed that since secondary school students were in a transitional period from concrete operations to abstract ones, they had trouble in understanding abstract topics. Because, generally, teachers do not have enough resources, background (Tsai, 2001), and professional development opportunities (Pedretti, Bencze, Hewitt, Romkey and Jivraj, 2008). Pedretti and Belloma (2013) suggest that teachers need resources, discourse communities, and opportunities to engage in professional growth over time.

Most of the teachers thought that course hours, students' socio-cultural level, materials, and equipment were decent to allow for an application of STSE acquisitions. But overcrowded classes were considered as a problem for realizing these acquisitions. In literature, there were many studies pointing out the same issues (Bakar, Keles and Kocakoglu, 2009; Cetinkaya, 2012; Bulus Kirikkaya, 2009; Henno, & Reiska, 2013). It is prevalent that the teachers who do not have enough experience in STSE teaching will take more time to plan and practice (Pitiporntapin, Yutakom, Pradermwong and Anderson, 2010). According to Pedretti and Belloma (2013), STSE is a complex construct with multiple interpretations, forms, and functions, so STSE processes include difficulties —both theoretically and practically.

Most of the teachers said that the development level of the students and their pre-information were enough for an application of STSE acquisitions. Some of the studies from literature support this result (Bagdatli, 2005; Seker, 2007). In addition, Cetinkaya (2012) indicated that many problems were encountered in the learning-teaching process and some of these were caused by disinterested parents and unprepared students for the courses.

Most of the teachers (75.51%) thought activities in the science course books were decent. Teachers built up a relation between decent examples about STSE acquisitions and comprehensibility and the scope of acquisitions. Teachers, who stated that the activities were partially decent or not decent (24.49% in total percentage), said that they closed this gap by conducting different experiments or performing different activities which they found from various books, websites, and CDs. Bakar (2010) stated that the level of handling STSE acquisitions in science and technology course books in Turkey is 50% at maximum. Yilmaz and Yigit (2011) similarly indicated that problems were experienced during the application of the curriculum due to a lack of entertaining activities which attract students' attention.

The 40.82% of the teachers stated that STSE acquisitions were measurable. The 44.90% of the teachers stated that they were partially measurable, and the 14.29% stated that they were immeasurable. Most of the teachers said that they used traditional and alternative measurement and evaluation techniques for the evaluation of STSE acquisitions. Aktepe and Aktepe (2009) described that the most used teaching methods in science and technology education were both traditional and alternative evaluation techniques, which confirm our findings. When all the results about the level of STSE acquisitions in courses were combined, it was found that teachers considered STSE acquisitions in TSTC enough, decent in content, comprehensible, and related to the other learning fields. However, majority of the teachers stressed that they could not apply these acquisitions in courses at a decent level. They thought that causes of this were students' socio-cultural backgrounds, and lack of materials, equipment, and activities in the books.

Below suggestions can be made based on the results of the present research:

- Learning fields outside the planned learning fields, as well as the planned ones that are information-based, have great importance for making individuals science literate. Teachers should actively make place for each learning field during the courses. Therefore, learning fields in TSTC, especially the unplanned ones, might be emphasized and applications about these fields might be conducted during in-service trainings.
- STSE explanations in TSTC might also be given in the teacher guide books in detail. Or TSTC book might be given to the teachers.
- There might be more activities related to STSE acquisitions in the course books.
- Teachers stated that the socio-cultural status of students, duration of the class time and the number of students in the classrooms are not appropriate for realizing all acquisitions in all learning fields during classes. This should be considered in the future curriculum studies.
- Evaluation scales might be developed to assess STSE acquisitions. Teachers might be encouraged to use these scales.

Conclusions

Turkey made an important reform in the science curriculum in 2006. One of the most crucial parts of this reform was STSE that was included as a learning field in TSTE. This study reveals science teachers' level of awareness and application of STSE acquisitions in TSTC, which have been implemented for the last five years. The results indicate that teachers did not have enough information about the learning fields in TSTC as well as their contents. They considered STSE acquisitions and knowledge-based unit acquisitions as the same. Moreover, some of them were not aware of STSE acquisitions. The results also reveal that science teachers had problems about the content of STSE and how they apply them in classrooms. It is seen that inadequate in-service trainings, resources and explanations in TSTC booklets about STSE are the most common causes of this problem.

Solomon stated (1993, p. 29) that there are four types of agencies (government, research, curriculum developers and teachers) which can set out to produce changes in science curriculum. Teachers have more effects on classroom teaching and pupils' learning than other people. Rubba (1991) emphasized that the development and implementation of an STS curriculum necessitates compatibility between teachers' beliefs and the goals of STS education. The reformed preparation of science teachers is indeed vital for the vision of science teaching to be realized (Dass, 2005). However, changing the traditional science curriculum into a humanistic one (like STSE) seems painful for most teachers (Aikenhead, 2006, p. 75). It is obvious that all agencies should put more effort than what is usual.

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