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PHYSICS TEACHERS' BELIEFS ABOUT THE ATTAINMENT OF SKILL OBJECTIVES AND THE EXTENT OF THESE BELIEFS' REFLECTION ON TEACHERS' INSTRUCTIONAL PRACTICES

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ABSTRACT
Turkish Ministry of National Education has made important changes in both primary and secondary school curricula in the last decade. The Turkish High School Physics Curriculum (THSPC) after these changes was put into practice first in 2008-2009 education year. Apart from being the first written curriculum with written objectives, this curriculum also contained—differently from other previous physics curricula—skill objectives. This included objectives related to problem solving skills (PSS) and information and communication skills (ICS) and physics-technology-society-environment objectives (PTSEO). No matter how well-prepared a curriculum for a subject is, whether it is implemented effectively depends on the teachers. One of the factors affecting proper implementation of curricula is teachers' beliefs about the curricula as a whole and its constituent elements. Since the curriculum is relatively new, teachers' beliefs and how these beliefs are reflected in their instructional practices are not yet known. Therefore, the purpose of this study was to investigate physics teachers' beliefs about the attainment of PSS, PTSEO and ICS and the extent these beliefs were reflected in teachers' instructional practices. Data were collected by administering an open-ended questionnaire to four in-service physics teachers and observing their instructional practices in the 'nature of physics' and 'energy' units. The results of this study showed that although physics teachers believed that majority of the skill objectives of the THSPC should be attained, they did not teach physics by taking these skill objectives into consideration. The physics teachers inclined more to help students attain PTSEO when compared with PSS and ICS.
Keywords: Teachers' Beliefs, Turkish High School Physics Curriculum, Skill Objectives

INTRODUCTION

Based on the needs of the society, the educational developments in the world and rapid changes in science and technology, a new physics curriculum was prepared (Ministry of National Education [MoNE], 2007). In addition, Turkish students' low scores in the international exams (TIMMS, PISA) also deemed necessary to change curricula. Due to such reasons, the new Turkish High School Physics Curriculum (THSPC) was put into practice in 2008-2009 education-year in Turkey starting with Grade 9. In the following years, consecutively, new curricula for the 10th, 11th and 12th grades were also put into practice. It was thought that the new curricula would enable students to leave memorizing facts or information (Güven & İşcan, 2006).

According to the THSPC, advances and changes in science and technology have changed how a qualified person should be defined. Qualified person is defined as a person who is creative and productive, and learns learning and how to reach knowledge in addition to having information and communication skills and some other basic skills such as using technology effectively (MoNE, 2007). As can be seen in the curriculum documents, developing skills is seen as important as acquiring knowledge. Therefore, the THSPC fosters the attainment of problem solving skills (PSS), physics-technology-society-environment objectives (PTSEO), and information and communication skills (ICS). Having positive attitude and values toward physics, world, life-long learning, themselves, and others is another important emphasis in the THSPC (MoNE, 2007).

When examined closely, one can see that all that is included in THSPC is well-prepared and corresponds well to a certain aspect with what the larger science education community expects. However, no matter how well-prepared a curriculum is, how effectively it is implemented is influenced by teachers (Kelly, 2009; Ogborn, 2002). For example, teachers' beliefs, understandings and decisions are some of the factors that hinder the implementation of curricula in desired manner (Anderson, 1996; Briscoe, 1991; Cheung & Wong, 2002; Grossman & Stodolsky, 1995; Kelly, 2009;

Keys & Bryan, 2001). According to National Research Council of the US, teachers' beliefs and decisions can affect the implementation of curriculum reforms in science education (NRC, 1996). For example, one teacher can believe that studying with group is time consuming and students in the group do not learn anything because he/she thinks that students in the group can have a chat. Not encouraging students to attend group studies can mean that teachers do not follow some of the expected roles from teachers in the curricula due to his/her beliefs. Teachers can take an active role in the decision making and planning of science curriculum innovation, and determining the goals of their science instruction (Keys & Bryan, 2001). In this regard, it is obvious that what a curriculum reform intends is shaped and changed by, among other things, teachers' beliefs (Cheung & Wong, 2002; Keys & Bryan, 2001).

Although some researchers (e.g., Balta & Eryılmaz, 2011; Baybars & Kocakülah, 2010; Ergin, Şafak, İngenç, 2011) conducted studies related to the THSPC and others (e.g., Akay, 2009; Marulcu & Doğan, 2010; Özdemir et al., 2011) conducted studies related to curricula implemented before 2008, there was little information about teachers' beliefs related to current THSPC. For example, Marulcu and Doğan (2010) investigated views of 70 physics teachers and 1392 students about the physics curriculum which was implemented before 2008 and physics course books which were used before 2008. They found that many of the participants thought that lesson hours were limited for teaching physics according to the curriculum. In addition, they thought that course books and physics curriculums were out-dated. They also mentioned that course books could not meet students' expectations regarding university entrance exam.

Another study, conducted by Akay (2009), explored whether physics curriculum which was implemented before 2008 had expected properties in terms of total quality. The researcher administered an open-ended questionnaire to 34 physics teachers and 16 school managers in his study. For example, he asked them whether the goals of the curriculum are clear, physical facilities are suitable to implement curriculum, and how the society influences the implementation of the curriculum. He found that the objectives in the curriculum were not attainable by students due to inadequate physical and technological facilities in the schools. In addition, written regulations in the schools for more effective teaching negatively affected their teaching. He concluded that the physics curriculum had some deficiencies in terms of total quality.

Özdemir et al. (2011) evaluated the changes in the physics curriculum which was implemented in 2005. They explored views of 80 pre-service physics teachers about the changes in the physics curriculum. They found that participants thought that the physics curriculum in 2005 did not bring innovations in terms of objectives, teaching and learning approaches, content and measurement and evaluation. They indicated that changes in the curriculum were only related to order of the topics.

Ergin et al. (2011) investigated physics teachers' views on current physics curriculum. They administered a questionnaire to 41 physics teachers. The questionnaire aimed to measure teachers' views about objectives in the curriculum, content of the curriculum, teaching and learning activities and measurement and evaluation activities in the curriculum. They found that physics teachers had generally positive views about objectives in the curriculum, and content of the curriculum. However, teachers had partially positive views about suggested teaching and learning methods and measurement and evaluation activities in the curriculum. For example, many of the participants thought that lesson hours were not enough to implement the curriculum by considering suggested teaching and learning methods and measurement and evaluation activities.

Baybars and Kocakülah (2010) examined 44 physics teachers' views about the current Grade 9 physics curriculum. They administered a questionnaire to in-service teachers to collect data. They found that many participants thought that the approaches in the curriculum were clearly defined. In addition, many of the participants did not believe the applicability of the suggested instructional methods in the curriculum. They indicated that physical facilities of the school were insufficient and lessons hours were limited to implement the physics curriculum as it should be.

Balta and Eryılmaz (2011) investigated physics teachers' views about the changes in the current physics curriculum and in-service training needs related to the new topics added to the physics curriculum. They administered a questionnaire to 104 physics teachers to investigate their views. They found that physics teachers' views about changes in the physics curriculum were positive and they thought that they did not so much need to attend in-service training programs for the newly added concepts into the curriculum. It is obvious that teachers believe that they have sufficient knowledge about these concepts in the curriculum.

As can be seen, albeit from a very limited number of studies, physics teachers' views about the changes in current THSPC were generally positive (Balta & Eryılmaz, 2011; Ergin et al., 2011). However, physics teachers had some difficulties in teaching physics according to the current THSPC (Baybars & Kocakülah, 2010; Ergin et al., 2011). For example, limited lesson hours (Baybars & Kocakülah, 2010; Ergin et al., 2011) and inadequacy of physical facilities (Baybars & Kocakülah, 2010) were the obstacles to teach physics according to the current THSPC. Similar findings were also found for the THSPC which was implemented before 2008. For example, physics teachers thought that limited lesson hours (Marulcu & Doğan, 2010), inadequacy of physical and technological facilities (Akay, 2009) affected the implementation of the THSPC negatively.

Physics curriculum developers in Turkey argue that they prepared a curriculum by considering needs and realities of Turkey. They took into account the views of teachers, students, families, school administrations and Ministry of National Education before the preparation of the THSPC (MoNE, 2007). However, how much attention was given to teachers' beliefs is still questionable even after the preparation of the THSPC. In addition, although some researchers (Balta & Eryılmaz, 2011; Baybars & Kocakülah, 2010; Ergin et al., 2011) attempted to investigate teachers' views about the THSPC, no research studies on teachers' beliefs about the attainment of skill objectives in the THSPC and to what extent they are reflected in their instructional practices have been conducted. Therefore, this study aims to investigate four in-service physics teachers' beliefs about the attainment of PSS, PTSEO and ICS and the extent of how these beliefs are reflected in their teaching. There were two research questions in this study as follows;

> RQ1: What beliefs do physics teachers have about the necessity and possibility of the attainment of PSS, PTSEO, and ICS in the THSPC?
>
> RQ2: To what extent are physics teachers' beliefs about the necessity and possibility of the attainment of PSS, PTSEO, and ICS in the THSPC reflected in their instructional practices?

METHOD

Research Design

Multiple case study design was used to be able to answer the research questions of this study. Without observing teachers' instructional practices in the classroom, it will not be possible to answer the research questions. In addition, using multiple case designs in educational studies enhances the external validity or generalizability of findings (Merriam, 1998). However, using single cases makes generalizability difficult. Therefore, multiple case study designs can be preferred for replication aims. Same procedures can be replicated for each case to generalize cases with each other (Yin, 2003). Due to these advantages of multiple case study design, four teachers were chosen as cases.

Sample

Four physics teachers from different schools participated in this study. The following is a presentation of a detailed account of background information about each participant.

Teacher 1 – Sinan

Sinan was 27 years old. He was in the first year of teaching profession when the data collection of this study began. He has been working in Anatolian High School since September 2010. He graduated from the department of secondary science and mathematics education as a physics teacher in 2009. He has been a MS student in the department of physics since 2009. He did not attend any in-service training programs or seminars related to physics education or the THSPC. Moreover, during his pre-service teacher training years, in none of the courses he was taught about the THSPC.

Teacher 2 – Fatih

Fatih was 35 years old. Like Sinan, Fatih was in the first year of teaching profession when the data collection of this study began. He has been working in Anatolian High School since January 2010. He graduated from the department of physics in 1998. He had a non-thesis master's degree in physics education. However, he has never worked as a physics teacher until January 2010. In addition to his current position, he was also the physics teacher of another, vocational school in the city center. He, similar to Sinan, did not attend any in-service training programs or seminars related to physics education and/or the THSPC.

Teacher 3 – Tarık

Tarık was 33 years old. He graduated from the department of secondary science and mathematics education in 2001. He has been working as a science and physics teacher for nine years. He had four years of teaching experience in primary schools and five years of teaching experience in high schools. He has been a physics teacher of Science High School since September 2010. He attended some seminars, one of which is the regional workshop of TÜBİTAK. In addition, he had a certificate of computer literacy. He did not attend any in-service training programs related to physics education or the THSPC.

Teacher 4 – Altan

The last teacher of this study was Altan. He was 29 years old. He was graduated from the department of secondary science and mathematics education in 2006. He has worked as a physics teacher for six years in private institutions which offer private preparatory courses (dershane) and public schools. He has started working as a physics teacher during the last two years of his university education. He has been a physics teacher of Anatolian Teacher High School since January 2010. He was, at the time of data collection, a graduate student studying towards MS degree in the department of physics. Like other participants, he did not attend any in-service training programs or seminars related to physics education or the THSPC.

Data collection

Before beginning to collect data, seven teachers were interviewed. Four of them were chosen as cases whom we believed that we could reach rich information. All of the teachers, students and school principles were informed about the purpose of the study and data collection procedure. The data collection included an administration of an open-ended questionnaire at the beginning of the semester and non-participant classroom observations of teachers' instructional practices during the teaching of 'nature of physics' and 'energy' units.

Open-ended questionnaire

An open-ended questionnaire was prepared in order to answer RQ1. In the questionnaire, next to each skill objective related to the 'nature of physics' and 'energy' units, teachers were asked their agreement or disagreement, first, on about the necessity of attainment of the skill objectives by students; and then on whether it was possible for students to attain those skill objectives in the teaching and learning process. In the questionnaire, teachers were also required to explain their reasons why they agree or disagree.

Video-recorded classroom observations

The second data source for this study included observations of the teachers' instructional practices on the 'nature of physics' and 'energy' units during the fall semester of 2010-2011 education-year. Each teacher was observed from the start of these units until they were completed and each observation was video-recorded. To be able to answer RQ2, skill objectives of 'nature of physics' and 'energy' in the Grade 9 THSPC (see Table 1, 2 and 3) units were the foci of the observations. Teachers' attempts to help students attain these skill objectives were tallied by observing their instructional practices. Table 1 presents the problem solving skills expected from teachers to help students attain in the 'nature of physics', and 'energy' units and the related codes.

Table 1: Problem solving skills expected from teachers to help students attain in the 'nature of physics', and 'energy' units and the related codes

Problem solving skills	Code
Distinguishing scientific knowledge, view and values from each other	PSS1
Formulating a testable hypothesis for an identified problem	PSS2
Determining appropriate measurement tool to measure variables	PSS3
Recognizing appropriate experimental equipment or tools and using them safely	PSS4
Making experimental setups to test the formulated hypothesis	PSS5
Performing adequate number of measurements to reduce measurement errors	PSS6
Analyzing data collected in experiments and observations by using tables, graphs, statistical methods or mathematical calculations	PSS7
Using calculator, calculation sheet, graphing software etc. when performing numerical calculations in the process of analysis and modeling	PSS8
Expressing findings obtained after the analysis of data as models such as mathematical equations	PSS9
Realizing the probable sources of error during problem solving	PSS10

It was also expected from teachers to help students attain physics-technology-society-environment objectives in their teaching. Table 2 presents physics-technology-society-environment objectives expected from teachers to help students attain in the 'nature of physics', and 'energy' units and the related codes.

Table 2: Physics-technology-society-environment objectives expected from teachers to help students attain in the 'nature of physics', and 'energy' units and the related codes

Physics-technology-society-environment objectives	Code
Defining physics and comprehending it as one of the basic sciences helping to understand the events in the universe	PSTEO1
Comprehending testable, questionable, falsifiable and evidence-based structure of physics	PSTEO2
Realizing that knowledge in physics increases in an accelerated way	PSTEO3
Realizing that scientific knowledge in physics is not always absolutely true; it is valid under certain conditions and limitations	PSTEO4
Explaining the role of evidences, theories and/or paradigms (ideas agreed upon by consensus by scientists) in change of scientific knowledge in physics	PSTEO5
Realizing that the change of scientific knowledge in physics is generally continuous, but it sometimes occurs as a paradigm shift	PSTEO6

Realizing that existing scientific knowledge, when a new evidence arises, is limited, corrected or renewed by testing	PSTEO7
Realizing key physics concepts (change, interaction, force, field, conservation, measurement, probability, scale, equilibrium, matter-energy relationships, space-time structure, resonance, entropy etc…)	PSTEO8
Relating physics to other sciences in terms of scientific and technological applications	PSTEO9
Examining the historical development of interaction between physics and technology	PSTEO10
Determining and explaining with examples the contribution of a technological innovation to development of scientific knowledge in physics	PSTEO11
Determining and explaining with examples the contribution of scientific knowledge in physics to development of technology	PSTEO12
Comprehending the importance of relationship between physics and technology in solving problems in daily life	PSTEO13
Explaining the working principle and/or function of technological tools used in daily life by using scientific knowledge	PSTEO14
Examining the past, present and future, positive and negative effects of physics and technology on the individual, society and environment (on social, cultural, economic, political, ethical etc. issues)	PSTEO15
Understanding that precautions can be taken against negative effects of technology, these effects can be reduced and eliminated again with technological and physical innovations	PSTEO16
Participating in contemporary discussions based on physics and technology that can affect the future of individual, society and environment	PSTEO17
Comparing the benefits of technology in terms of its balancing effect on economic, environmental and social costs	PSTEO18
Observing how physics and technology is used by society while deciding in environmental problems	PSTEO19
Offering a solution by considering needs of individual, society and environment to social problems by using physics and technology for better life	PSTEO20
Knowing necessary basic principles for safe use of equipment and devices	PSTEO21

The THSPC also gives importance to attainment information and communication skills by students. Table 3 presents the information and communication skills expected from teachers to help students attain in the 'nature of physics', and 'energy' units and the related codes.

Table 3: Information and communication skills expected from teachers to help students attain in the 'nature of physics', and 'energy' units and the related codes

Information and communication skills	Code
Using different sources of information	ICS1
Controlling whether the sources of information is reliable and valid	ICS2
Using multiple search criteria	ICS3
Searching, finding and choosing the information appropriate for one's aim	ICS4
Synthesizing information and obtaining new information	ICS5
Preparing presentations with correct outputs and appropriate for one's aims	ICS6
Using different formats such as text, number, picture, graph, diagram or table as much as possible while preparing presentation	ICS7
Making an effective presentation by using appropriate technological media and devices (internet, computer, projection device, overhead projector, slide, etc.)	ICS8

Using appropriate terminologies in their communications (written, verbal and visual) related to physics	ICS9
Expressing complex information in a clear, understandable and concise way	ICS10

Validity and reliability

Some of the tactics to enhance internal validity in qualitative studies were long term observations and peer examination (Merriam, 1998). Therefore, all of the lessons of participants during one semester were observed by the first author. In addition, after the analyses of data by first author, the second author examined the results to increase the internal validity.

For the external validity, replication strategy suggested by Yin (2003) was used. Yin (2003) proposed that "a theory must be tested by replicating the findings in a second or even a third neighborhood, where the theory has specified that the same results should occur" (p. 37). Therefore, four case teachers were chosen to compare the results obtained from an open-ended questionnaire and classroom observations.

For reliability, the inter-rater reliability coefficient was calculated. One research assistant watched two-hours of video-recordings of each participant to compare results obtained by the first author. It was requested from him to calculate the occurrence frequencies of each code in Tables 1, 2 and 3 by observing two-hours of video-recordings of each participant. As he watched video-recordings of four participants, he came up with 184 observations for the 46 codes. 161 observations were agreed on. According to Marques and McCall (2005), the formula to calculate the inter-rater reliability is (Total number of agreements) / (Total number of observations) x 100. We found the inter-rater reliability as 88% for the video-recordings. The values above the 80% for the inter-rater reliability were in acceptable level (Marques & McCall, 2005). Therefore, the values found in this study are in acceptable level for the inter-rater reliability.

RESULTS

For revealing teachers' beliefs about the attainment of skill objectives, teachers were asked, in the open-ended questionnaire, if students should attain skill objectives related to the 'nature of physics' and 'energy' units. I also asked them if students could attain skill objectives in the classroom. After coding the video-recordings of teachers' instructional practices on the 'nature of physics' and 'energy' units, we calculated the frequencies of teachers' attempts to help students attain PSS, PTSEO and ICS. In the following sub-sections, the results related to PSS, PTSEO and ICS in separate sections were presented.

Beliefs about the attainment of PSS and the extent of reflection of these beliefs in teachers' instructional practices

Participants indicated whether they agreed on the necessity and possibility of attainment of PSS in the open-ended questionnaire. Each attempt of teachers' to help students attain PSS was counted. Table 4 presents teachers' beliefs about the attainment of PSS and how many times each teacher attempted to help students attain problem solving skills.

As can be seen in Table 4, Sinan believed, as revealed from his answers to the open-ended questionnaire, the necessity of attainment of all PSS by students except 'PSS1' which is "distinguishing scientific knowledge, and view and values from each other". Other teachers, Fatih, Tarık and Altan, believed in the necessity of attainment of all PSS. They believed that students should and could attain 'PSS1'. However, only Fatih among these three teachers attempted to help students attain this skill. Additionally, although Sinan did not believe that students should and could attain 'PSS1', Sinan attempted to help students attain 'PSS1'.

Table 4: Beliefs about the attainment of PSS and occurrence frequencies of attempts of teachers to help students attain PSS in their instructional practices

	Sinan			Fatih			Tarık			Altan		
Skill Objectives	Believing the necessity	Believing the possibility	Frequency of attempts	Believing the necessity	Believing the possibility	Frequency of attempts	Believing the necessity	Believing the possibility	Frequency of attempts	Believing the necessity	Believing the possibility	Frequency of attempts
PSS1	N	N	1	Y	Y	1	Y	Y	0	Y	Y	0
PSS2	Y	Y	0	Y	N	1	Y	N	0	Y	Y	0
PSS3	Y	Y	0	Y	Y	0	Y	N	0	Y	N	0
PSS4	Y	N	0	Y	N	0	Y	N	0	Y	N	0
PSS5	Y	N	0	Y	N	1	Y	N	0	Y	N	0
PSS6	Y	N	0	Y	Y	0	Y	N	0	Y	N	0
PSS7	Y	Y	0	Y	N	0	Y	N	0	Y	Y	0
PSS8	Y	N	0	Y	N	0	Y	N	0	Y	N	0
PSS9	Y	N	0	Y	N	0	Y	N	0	Y	N	0
PSS10	Y	Y	0	Y	N	0	Y	N	0	Y	N	0

*Y: believing the necessity or possibility of the attainment of the skill
**N: not believing the necessity or possibility of the attainment of the skill

Finally, although teachers believed that students should attain almost all of PSS, Sinan attempted to help students attain only 'PSS1' one time; Fatih attempted to help students attain 'PSS1', 'PSS2', and 'PSS5' one time; and Tarık and Altan did not make any attempt to help students attain any of PSS.

Beliefs about the attainment of PTSEO and the extent of reflection of these beliefs in teachers' instructional practices

Participants indicated whether they agreed on the necessity and possibility of attainment of PTSEO in the open-ended questionnaire. Each attempt of teachers' to help students attain PTSEO was counted. Table 5 presents teachers' beliefs about the attainment of PTSEO and how many times each teacher attempted to help students attain PTSEO.

Table 5: Beliefs about the attainment of PTSEO and occurrence frequencies of attempts of teachers to help students attain PTSEO in their instructional practices

	Sinan			Fatih			Tarık			Altan		
Skill Objectives	Believing the necessity	Believing the possibility	Frequency of attempts	Believing the necessity	Believing the possibility	Frequency of attempts	Believing the necessity	Believing the possibility	Frequency of attempts	Believing the necessity	Believing the possibility	Frequency of attempts

PTSEO1	Y	Y	1	Y	Y	1	Y	Y	1	Y	Y	1
PTSEO2	Y	Y	2	Y	N	1	Y	Y	1	Y	Y	2
PTSEO3	Y	Y	0	Y	Y	0	Y	Y	0	Y	Y	0
PTSEO4	Y	N	0	Y	Y	2	Y	Y	1	Y	Y	0
PTSEO5	Y	Y	0	Y	Y	0	Y	Y	1	Y	Y	0
PTSEO6	Y	Y	0	Y	Y	0	Y	Y	0	Y	Y	0
PTSEO7	Y	Y	1	Y	Y	0	Y	N	0	Y	N	0
PTSEO8	Y	Y	3	Y	N	5	Y	Y	1	Y	Y	2
PTSEO9	Y	Y	1	Y	Y	0	Y	Y	2	Y	Y	0
PTSEO10	Y	Y	1	Y	Y	1	Y	Y	1	Y	Y	0
PTSEO11	Y	Y	1	Y	Y	1	Y	Y	2	Y	Y	0
PTSEO12	Y	Y	8	Y	Y	4	Y	Y	5	Y	Y	0
PTSEO13	Y	Y	7	Y	Y	13	Y	Y	3	Y	Y	2
PTSEO14	Y	Y	9	Y	N	3	Y	N	2	Y	N	2
PTSEO15	Y	Y	5	Y	Y	4	Y	Y	5	Y	Y	0
PTSEO16	Y	Y	1	Y	Y	0	Y	Y	1	Y	Y	0
PTSEO17	Y	Y	1	Y	Y	0	Y	Y	0	Y	Y	0
PTSEO18	Y	Y	2	Y	Y	3	Y	Y	0	Y	Y	0
PTSEO19	Y	N	0	Y	Y	0	Y	Y	0	Y	Y	0
PTSEO20	Y	Y	0	Y	Y	0	Y	Y	0	Y	Y	0
PTSEO21	Y	N	0	Y	n	0	Y	Y	0	Y	Y	0

*Y: believing the necessity or possibility of the attainment of the skill
**N: not believing the necessity or possibility of the attainment of the skill

As shown in Table 5, all teachers believed the necessity of attainment of all PTSEO. They also believed that it is possible for students to attain majority of PTSEO in the classroom. However, although they believed the necessity of students' attainment of all PTSEO and they believed that it was not possible for students to attain all of them. Contrary to their beliefs about the necessity and possibility of attainment of PTSEO, their attempts to help students attain those skills were limited as can be seen from the above table. For example, all teachers believed that students should and could attain 'PTSEO3' (realizing that knowledge in physics increases in an accelerated way), 'PTSEO6' (realizing that the change of scientific knowledge in physics is generally continuous, but it sometimes occurs as a paradigm shift), and 'PTSEO20' (offering a solution by considering needs of individual, society and environment to social problems by using physics and technology for better life); however, none of the teachers made an attempt to help students attain them.

None of the participants helped students attain 'PTSEO19' (observing how physics and technology is used by society while deciding in environmental problems), and 'PTSEO21' (knowing necessary basic principles for safe use of equipment and devices).

Additionally, although three teachers, namely Fatih, Tarık and Altan, believed that students could not attain 'PTSEO14' (explaining the working principle and/or function of technological tools used in daily life by using scientific knowledge), they still have attempted to help students attain this objective. Another important finding was that Sinan and Fatih, who were in the first year of their teaching profession, made more attempts to help students attain PTSEO than the other two relatively more experienced teachers.

Beliefs about the attainment of ICS and the extent of reflection of these beliefs in teachers' instructional practices

Participants indicated whether they agreed on the necessity and possibility of attainment of ICS in the open-ended questionnaire. Each attempt of teachers' to help students attain ICS was counted. Table 6 presents teachers' beliefs about the attainment of ICS and how many times each teacher attempted to help students attain ICS.

Table 6: Beliefs about the attainment of ICS and occurrence frequencies of attempts of teachers to help students attain ICS in their instruction practices

	Sinan			**Fatih**			**Tarık**			**Altan**		
Skill Objectives	Believing the necessity	Believing the possibility	Frequency of attempts	Believing the necessity	Believing the possibility	Frequency of attempts	Believing the necessity	Believing the possibility	Frequency of attempts	Believing the necessity	Believing the possibility	Frequency of attempts
ICS1	Y	N	1	Y	N	0	Y	N	0	Y	Y	0
ICS2	Y	Y	0	Y	N	0	Y	Y	0	Y	N	0
ICS3	N	N	0	Y	N	0	Y	N	0	Y	N	0
ICS4	N	N	0	Y	N	0	Y	N	0	Y	Y	0
ICS5	N	N	0	Y	N	0	Y	Y	0	Y	N	0
ICS6	N	N	1	Y	Y	0	Y	Y	0	Y	Y	0
ICS7	Y	Y	2	Y	N	0	Y	Y	0	Y	N	0
ICS8	Y	N	0	Y	N	0	Y	Y	0	Y	N	0
ICS9	Y	Y	0	Y	Y	0	Y	Y	0	Y	Y	0
ICS10	Y	N	0	Y	N	0	Y	Y	0	Y	Y	0

*Y: believing the necessity or possibility of the attainment of the skill
**N: not believing the necessity or possibility of the attainment of the skill

Sinan, as can be seen from Table 5, believed that students should attain many of ICS. Other participants believed the necessity of attainment of all ICS by students. However, all teachers believed that they could not help students attain many of ICS.

Although Fatih, Tarık and Altan believed that students should attain all ICS, they did not make any attempt to help students attain them in their instructional practices. Only Sinan attempted to help students attain some of ICS. Additionally, all teachers believed that they could help students attain 'ICS9' (using appropriate terminologies in their communications (written, verbal and visual) related to physics), however they did not make any attempts in their instructional practices to help students attain this skill.

DISCUSSION

According to results of this study, it was obvious that participating teachers believed the possibility of the attainment of small number of skill objectives by students. Especially, they believed that they could not help students attain the problem solving skills and information and communication skills. When the teachers in this study explained their reasons why they could not help students attain these skills in the open-ended questionnaire, they indicated that inadequacy of technological and physical facilities in the schools affected their instruction negatively by considering these skills. The studies (e.g., Akay, 2009; Baybars & Kocakülah, 2010; Ergin et al., 2011) also discussed these factors which are barrier to implementation of physics curriculum effectively and they argued the necessity of some changes in the schools in terms of technological and physical facilities. Therefore, developing the physical and technological facilities of the schools can help teachers consider these skills in their instructions and teach according to them. In addition, teachers indicated that it was necessary to help students attain these skills; therefore, expecting teachers to teach physics according to these skills is logical after the development of physical and technological facilities.

The results of this study also showed that although participating teachers in this study believed both necessity and possibility of attainment of majority of the skill objectives in the 'nature of physics' and 'energy' units, their attempts were limited and only for some of the skill objectives. Several researchers (e.g., Bryan & Abell, 1999; Levitt, 2001; Mansour, 2009; Mellado, 1998; Richmond & Anderson, 2003; Rubba, 1991; Simmons et al., 1999; Smith & Southerleand, 2007; Uzuntiryaki et al., 2010; Tondeur, Braak, & Valcke, 2007) also found that sometimes there could be inconsistencies between teachers' beliefs and their instructional practices. In this study, we also found such inconsistencies. This can be due to teachers' insufficient knowledge about how to teach physics according to the THSPC or their misinterpretation of some of the skill objectives in the THSPC. Considering the fact that none of the teachers received in-service training about the new curriculum, this is a plausible result.

Another important finding related to attainment of skill objectives was that although participants believed both the necessity and possibility of attainment of some skill objectives, they did not help students attain them. For example, all teachers believed that students should and could attain the skill objectives "realizing that knowledge in physics increases in an accelerated way", "realizing that the change of scientific knowledge in physics is generally continuous, but it sometimes occurs as a paradigm shift", "offering a solution by considering needs of individual, society and environment to social problems by using physics and technology for better life" and "using appropriate terminologies in their communications (written, verbal and visual) related to physics"; however, they did not attempt to help students attain them. There can be some reasons why teachers did not attempt to help students attain these skills. For example, it is possible that teacher might not have understood the skill objectives in the THSPC. The content of the 'nature of physics' and 'energy' units cannot be appropriate to help students attain these skill objectives. For one reason or another, participants might have ignored these skill objectives.

CONCLUSIONS AND SUGGESTIONS

- Although all participants believed in the necessity of attainment of majority of PSS, and ICS in the 'nature of physics' and 'energy' units, they seldom attempted to help students attain them in their instructional practices.
- All participants believed in both the necessity and possibility of attainment of majority of PTSEO by students; however, they did not attempt to help students attain many of them.
- All participants gave more importance, as perceived by the number of attempts, to students' attainment of PTSEO than attainment of PSS and ICS.
- All participating teachers in this study believed that students should and could attain some skill objectives "realizing that knowledge in physics increases in an accelerated way", "realizing that the change of scientific knowledge in physics is generally continuous, but it sometimes occurs as a paradigm shift", "offering a solution by considering needs of individual, society and environment to social problems by using physics and technology for better life" and "using appropriate terminologies in their communications (written, verbal and visual) related to physics" in the THSPC. However, they did not help students attain them. It was possible that they could not understand that these skill objectives mean. Therefore, in the revision of the THSPC in the following years, the meanings of these objectives should be considered again. If there is actually a problem in the meaning of these objectives, they can be written more clearly.

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