



Abstract: *This study aims to investigate primary school students' success and failure in science courses. The participants of the study included 24 students enrolled in the 8th grade of a secondary school and focus group interviews were held. It was observed in the study that the successful students focused more on science and mathematics classes, while the unsuccessful students did more on verbal classes.*

Considering the topics the successful group considered related to the science class, the students in the successful group focused on the knowledge that made their life easier and that they could use in their life, while the unsuccessful group paid more attention to the importance of the topic. Moreover, it was observed that both groups used similar learning strategies. According to the findings of the study, it can be claimed that the interest and the support of the family and social environment play an important role in success in science class.

Key words: *focus group, primary education, science education, science courses.*

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SUCCESS AND FAILURE IN SCIENCE EDUCATION: A FOCUS GROUP STUDY ON TURKISH STUDENTS

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Introduction

In today's world, where development and change is constant, approaches to education and science education are also changing. Science education, which previously focused on training the scientists of the future, changed this trend to train citizens and especially since the 1990s, it has been provided in line with the idea of "science for all". In this context, the basic aim of science education is to help all individuals gain science literacy to their full potential (United Nations Educational, Scientific, and Cultural Organization, 1994). As to cultural anthropology, learning science is to learn the cultures of physical sciences and science (Maddock, 1981; Wolcott, 1991). Learning the culture of science is to ensure that individuals form the interactive bond between the world that they are trained about and the world in their daily life. In this regard, students' flexibility, acting, willingness, and feelings related to facilitating this work are also effective in forming the aforementioned bond (Maddock, 1981; Wolcott, 1991).

Although numerous definitions and generalizations were suggested for science and science education, the most important thing to consider is what the target audience, in other words, students understand from science education. The general conclusion obtained through a body of research is that science is perceived as a collection of scientific knowledge and it is not favored by students. In this vein, the inappropriate educational policies played a role in this trend for years. Being the focus of science, scientific development, and any development in all fields, science, and science education is a field of particular emphasis. Science and science education are one of the most important focal points in the



process of gaining awareness in today's world, where social and individual responsibilities have been attached great importance particularly in the last years.

Science education is important in terms of not only the future of nations but also individuals' realizing themselves, choice of profession, and their own futures (Abd-El-Khalick & Lederman, 2000). Accordingly, individual and social success in science is an issue taken seriously at national and international levels. Such applications as TIMSS-R, PIRLS, and PISA, which are geared towards describing science education through international evaluations, help countries self-evaluate themselves and their own positions compared to other countries, which enables them to make necessary changes and apply new practices in their educational systems. The results of these studies indicate that there has been a sharp decrease in students' success in science and mathematics in the last 15 years and this decrease is in parallel with that in the number of the students that enrolled in similar departments of universities (OECD Technical Report, 2003).

The other research projects on science education are ROSE and IRIS. These projects thus differ from other international comparative studies where the emphasis is on the curriculum as a broad explanatory factor underlying student achievement (TIMSS) or on the extent to which education systems prepare students to become lifelong learners and informed citizens (PISA) (URL 1). The purpose of ROSE (the Relevance of Science Education) is to gather and to analyze information obtained from the learners about several factors that affect their attitudes to science and technology. According to the findings of ROSE, it is obvious that the science and technology sector in Europe (and other OECD countries) is facing a serious problem (Sjøberg & Schreiner, 2010). The other project, IRIS (Interest and Recruitment in Science), addresses the challenge that few young people in general, and women in particular, choose to pursue education in science, technology, engineering, and mathematics (URL 2). All these projects and research show that science education throughout the world has many problems such as teaching methods, attitudes, achievements, and success.

Success in science education is a concept that is generally held equal to the success achieved in examinations. However, some teachers are of the opinion that success in science education means students' skills in transferring what they have learned into their own lives and daily experiences (Goulart & Soares, 2009). The more differences there are between students' use of language in daily life and the language used in a scientific context, the more serious the problem becomes. In this context, success in science depends on the level of the cultural difference perceived by students between students' daily lives and school lives, how effectively students act between daily life in which they learn science and school life, and the assistance that they receive in making these transitions easier (Costa, 1995).

However, although there are several differences in the students' answers to the questions, there are many similarities observed in these answers as they are affected by the relationships with their parents, friends, school, and daily lives. In this sense, in line with the answers provided by student, Costa divided students into five main categories, namely, potential scientists, other smart kids, "I don't know" students, outsiders, and inside outsiders. *Potential Scientists*: Worlds of family and friends are congruent with worlds of both school and science. *Other Smart Kids*: Worlds of family and friends are congruent with world of school but inconsistent with world of science. *"I Don't Know" Students*: Worlds of family and friends are inconsistent with worlds of both school and science. *Outsiders*: Worlds of family and friends are discordant with worlds of both school and science. *Inside Outsiders*: Worlds of family and friends are irreconcilable with world of school, but are potentially compatible with world of science (Costa, 1995, p. 316, italics added).

There is a lot of research conducted on predicting academic success in science education. These studies reveal that there are many factors that affect success in science, such as fathers' level of education (Anil, 2009), attitudes (Alomar, 2006; McLean, 1997; Abu_Hilal, 2000; House, 1997; Hassan, 2002; McCoy, 2005; OECD, 2003), students' perceptions of failure in science, parents' level of education, loneliness, leisure time activities, teachers' and students' general attitudes (TIMMS), the quality of teaching context (Burgaz, 2002), school culture (Schoen & Teddie, 2008), parents' economic status (Abbott & Fouts, 2003; Anil, 2009; Özgüven, 1998; McCoy, 2005), students' health, emotional space, and social environment (Oğuzhan, 1985).

Causal attribution theory comes to the fore in other studies that investigate students' views of their



success and failure. According to this theory, the students holding the view that success depends on their own effort can learn easier than those thinking that success is due to other factors or their teachers. Moreover, these students come to class having prepared and done their homework (Fidan, 1986). When students feel that they are unsuccessful, their motivation decreases and they find it difficult to learn (Glover & Corkill, 1987). In this context, students have two basic views. One is "can" and the other is "try". "Can" is more related to characteristics such as intelligence and talent, while "try" is dependent on the intent. There are generally high talents and efforts in issues related to success. On the other hand, failure includes low talents and efforts (Weiner, 1972).

Considering all aforementioned studies, this study aims to reveal 8th grade students' success in science and technology course through their own statements. The main reason to conduct the current study is to analyze and reveal students' success and failure in line with their own statements and to contribute towards their success in science.

Methodology of Research

Research Design

In line with the aim of the study, qualitative research methodology was applied in the current study and the data were collected through focus group interviews that included four sessions. Qualitative techniques are most useful and suitable when the aim is to investigate a problem or case that needs to be analyzed objectively or thoroughly. The focus group is an effective research strategy used in interview method and finding out various views and reinforcing interaction (Walden, 2008). Focus group interviews are a series of group discussions that are held with different groups including individuals. These discussions are facilitated and recorded by researchers (Bloor & Wood, 2006). In other words, focus groups are a discussion activity planned and designed seriously to determine group members' perceptions of interesting and clearly defined issues (Langford & McDonagh, 2003). They are interviews held to collect data on group norms that reflect a specific issue or a series of issues and group beliefs (through ensuring in-group interaction) (Bloor & Wood, 2006) and to determine participants' similar and different views related to issues. The most practical aim of focus group interviews is to have a face-to-face meeting with a large group in a limited time. The data collected through the focus group interview were subject to content analysis.

Participants

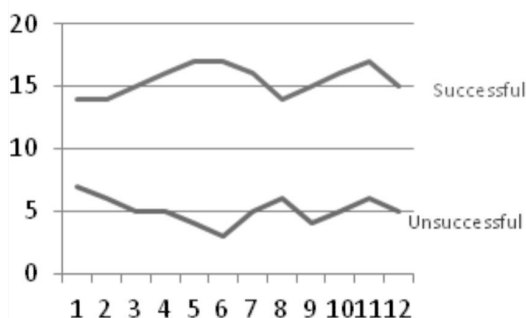
Deviant case sampling method, one of the purposive sampling methods was used to determine the study group (Büyüköztürk et al., 2008) as it was believed that this sampling method would provide the researcher with the opportunity to observe the existing deviant cases related to the issues focused on in the study group. In order to omit the effect of gender in the study, the number of the female and the male students was kept equal. In order to omit the effects of teachers, teaching methods, and schools, the students in both groups were selected from the same school. The participants included 24 students enrolled in the 8th grade in a secondary school in Kırşehir during 2012-2013 academic year. These students were selected as the participants as they had taken science classes for years and they were expected to have the necessary experiences related to science education. Students' GPA, results of the proficiency examinations (SBS) and teachers' views were also taken into consideration. SBS are nation-wide examinations used to select students for high school placements. The study is based on the notion that students successful in science class have higher scores in science compared to other classes and that similarly students unsuccessful in science class have lower scores in science than in other classes.



Table 1. Participants' Demographic Characteristics.

Gender	Successful	Unsuccessful
	N	N
Female	6	6
Male	6	6
Total	12	12

As indicated in Table 1, the study group included 24 students, 12 of whom are successful and 12 of whom are unsuccessful and the gender distribution is equal (50% each). Four focus groups were organized, each of which consisted of about six students as participants. Each group includes three girls and three boys.

**Figure 1: Students' success graphic based on the average number of questions.**

The responses provided to the SBS exam are also provided in the graphics. There are 16 questions in science in the SBS exam for 6-grade students. On the other hand, there are 18 questions for 7-grade students. Students' success was calculated based on the average number of questions, which were 17 in this study.

Procedure and Data Collection Instrument

Focus Group Interview questions that were created by the researcher were used to collect data. During this process, the problem was defined, and the questions both in focus group interviews and in the studies that investigated success and failure were surveyed in the related literature. Afterwards, the questions were created, followed by a draft form, which was analyzed by five expert academicians. The form was evaluated by the academicians and scored as "suitable (2)", "can be edited and used (2)", and "not appropriate (0)" and re-designed based on the feedback provided. Furthermore, the form included a section on which the experts were asked to provide their comments and suggestions. Based on the feedback provided by the experts and the comments regarding the content validity and its coverage of the problems, the form was finalized. The expert views were calculated using the formula, $[\text{Agreement} / (\text{Agreement} + \text{Disagreement}) \times 100]$, and the reliability coefficient was determined as 0.96. In this formula, the value, which is above 0.90, is generally defined as acceptable (Miles & Huberman, 1994). In this context, the following questions were edited and piloted:

1. What are your hobbies?
2. What is the class that you like/dislike most, why?
3. Are topics in science class related to daily life?
4. How do you study science and technology?
5. Do you follow any publication/broadcast on science?



Before the pilot study, the place and the technology were planned. In this regard, focus group interviews were conducted in a sunny, airy, and a quiet room that can host at least 10 individuals that was specifically designed for "Guidance and Psychological Counselling" services at the students' school. This room was equipped with the necessary materials (paper, pencils, rubbers, water, ID cards, video recorder) for the focus group interviews. Furthermore, in each session, two academicians and two university students accompanied the researcher. The interviews were conducted in four sessions and six students participated in each session. Finally, the data were processed and analyzed. During this stage, the verbal data recorded were carefully converted into texts. The data collected through this way were subject to content analysis. The results of the analysis were presented in graphics and tables and in order to support the comments provided by the researcher, quotations from the participants' statements were provided. In these quotations, successful groups were coded as S1 and S2; unsuccessful groups were coded as U1 and U2. Furthermore, of the participants, female students were coded as F, and male students were coded as M. For instance, of the unsuccessful group 1, the male students with number 3 were coded as U1M3.

The Reliability of the Study

The findings of the study, which was conducted through the qualitative study, were presented using numbers. According to Yıldırım (2010), the aim of using numeric data is to present data as objectively as possible, not for the purpose of generalization. As another way of increasing the reliability of the study, the results were shared with the participants. The results of the study were shared with four of the participants (one student in each focus group) and they were asked to confirm these results. Furthermore, in order to increase the generalizability of the study, all the details about the study (data collection instrument, study group, the process of focus group interviews, data collection and analysis, and reports) were provided.

Finally, the data collected throughout the study were shared with an independent researcher that investigated science education. The results of the study were compared and contrasted with the evaluations provided by the independent researcher. The results that were in alignment with the independent researchers' evaluations were used as they were; however, the results that were different from the evaluations were reviewed and revised.

Results of Research

Hobbies

When the hobbies of both groups are considered, it is seen that there is not a significant difference in terms of hobbies between the groups. It has been observed that the successful group spend most of their time by playing computer games/surfing the Internet, playing basketball/football/handball and reading, while the unsuccessful group spend most of their time by, respectively, reading, listening to music and playing computer games/surfing the Internet. It has been further revealed that the hobbies of the successful group include physical activities more than those of the unsuccessful group.

The Class that Students Like/Dislike Most

Most of the students in successful group state that science and technology is the course that they like most, while there is no feedback on this course provided by the unsuccessful group. The courses that the successful students like most are Mathematics and English. In the group determined as unsuccessful, the most liked courses are Turkish, Atatürk Principles, and History of Turkish Revolution (APHTR), verbal courses and English. As to the data collected, science and Mathematics courses are the most liked courses in the successful group, while there is no feedback provided on these courses. The group determined as unsuccessful focused mostly on Turkish, Turkish revolution, and verbal courses.



The least liked courses as stated by the successful group are Turkish revolution, English, and Turkish, while the unsuccessful group states that Science and technology and Mathematics are the least liked courses. Both groups provided an equal number of responses to the question whether they liked English or not. None of the students in the successful group stated that they did not like Mathematics. Taking into consideration teaching methods and the contents of the topics, the successful students explained that they liked science and technology topics as they were based on observation and experiments. They further added that they liked learning topics in Chemistry and Biology. The unsuccessful students, on the other hand, explained that they did not like science and technology topics as they did not like quantitative topics and added that they did not or could not understand, thereby leading to their failure.

The students in the successful group explained the reasons why they like science and technology as follows:

S2M1: *"I like it because it is based on observation"*

S1F2: *"I like trying something and seeing things happen"*

S1M2: *"I feel close to it; the topics are enjoyable for me"*

B1F1: *I have a heartfelt love of Mathematics and science. I always want to study them. The more I study and become successful, the more I want to study."*

The students in the unsuccessful group explained the reasons why they do not like science and technology as follows:

U1M1: *"Science is the course of which I am most afraid. I miss a topic in the very beginning. I want to try learning it; however, when I try to study it, I get bored. I cannot do it. As I try to learn, I come up with different interpretations, which generally turn out to be wrong. The wrong interpretations lead to inaccurate knowledge, which leads me to failure."*

U2F1: *"When I miss a class, I cannot review it. I cannot put any interpretation. As I do not know the topic, I cannot start."*

U1F2: *"As I do not review as much as possible and do not focus on the class, I cannot study and I cannot like it."*

U2M3: *"When I study the science class, I cannot spare time for Mathematics or vice versa."*

U1M3: *"I think we do not study efficiently. We miss some topics, and when we do so, we lack these topics. Accordingly, we cannot learn the topics no matter how much we like them."*

U2M3: *"I cannot do it as the course is quantitative. I do not understand quantitative topics. I am not that good in Mathematics, either."*

Similarly, U1F3, one of the students in the unsuccessful group, stated that *"... There is something like this. Before I enter the class, I begin to have feelings such as "I cannot do it" and "How will it go today?"*

Topics that Students Like/Dislike in the Science Class

The primary school curriculum of Science and technology is treated in five theme patterns in the Program of National Education. These patterns are Living Things and Life, Earth and Universe, Physical Events, and Matter and Change. These patterns are defined in detail as follows. Living things and Life includes the topics of organs and systems in our body as a spiral, living species, reproduction and development, genetics, ecosystems, and chains. Earth and Universe covers the topics of the shape and structure of the world, what makes the crust, the earth, the sun, and the moon, space and natural processes. Physical events consist of the topics of force and motion, electricity, light and sound. Matter and Change cover the topics of the structure of matter, change, atoms, elements, periodic table, heat, and temperature.

When the topics of science and technology that are most and least liked are considered in successful and unsuccessful groups, it is observed that the successful group likes most the themes of living things, life, matter, and change, while the unsuccessful group likes most the units of living things, life, matter and change, followed by physical events.

When the topics that are least liked are considered, it appears that both groups do not like the units in the theme of physical events. Furthermore, it is seen that the unsuccessful group do not like the unit of matter and change, either. Neither of the groups has been found to have any negative feelings towards



the units in the themes of living things and life, and the earth and the universe. Considering the related literature, students are known to have more positive attitudes towards Biology topics.

The statements provided on the most liked topics by the successful groups are presented as follows.

S2F2: Regarding the topic of sound in the pattern of physical events, *"I like the topic of sound most. I can answer any question that comes from that topic."*

S2F1: *"I like Biology a lot. Biology is not like Chemistry. Biology is observable and I can easily see what it is. In Chemistry, I cannot observe on my own; however, you can see what is happening outside in Biology."* A similar statement comes from S1M2 in the successful group: *"I like Biology topics a lot, too. I can observe my relatives by looking at the colors of their eyes. My father's eyes are colorful; my mother's eyes are brown. Ours are brown. I can just look at somebody's eyes and say that this can be this person's child. It is so enjoyable."*

S1M1: *"I like the topics of force and movement. I see this topic everywhere. For instance, when I make tea using tea bags in the mornings, I can observe the tension of the rope in that teabag."* Considering these statements, it can be stated that the students demonstrate their knowledge in their daily life or choose the topics that reflect what they observe in their life. There are also some students that they choose the topic in question, as they are successful.

The statements provided on the most liked topics by the unsuccessful groups are presented as follows.

U1F3: *"I like Biology a lot. I very much like such topics as DNA and cloning."*

U1F1: *The class that I like most is Chemistry. I can answer the questions. My father is a teacher of Chemistry. He helps me with that. That is why I can do it.*

U2M2: *"I like the units that are not quantitative, such as Biology."*

The statements provided on the least liked topics by the successful group are presented as follows:

S1M2: *"I don't like the topics of heat and temperature. I cannot do. As I cannot do and understand, they seem complicated to me. I think there is some kind of logic error."*

S1M1: *"I do not like the topics of force and motion. I do not understand them."*

The statements provided on the least liked topics by the unsuccessful group are presented as follows.

U1M1: *"I do not like the topics of force and motion. Everyone is successful. Therefore, I have lost my self-confidence. Then, I have not tried again ..."* Related to the same issue, U1F3 stated, *"I do not like the topics of force and motion. They seem complicated to me. There are formulas etc."* and U1M2 explained that *"I do not like the topics of force and motion. I do not know why. I cannot understand although I have done much revision and practice."*

U2F2: *"I do not like the topic of electricity; there are many circuits etc.; it is complex"*

U2FU3: *"I do not like the topic of chemical reactions; there is balancing etc"*

Study Strategies

The students were asked how they studied science and technology class and it was found out that the successful group studied science and technology class by underlining the important topics, writing down the notes on these topics, reading these notes, taking down notes and later listening to them. However, the unsuccessful group was found to study science and technology class by first reading the notebook, and respectively, writing, revising, asking questions to the teacher and doing a test.

Topics Related to Daily Life

The students were asked the question whether the topics in science class are related to their daily lives. The successful students stated that the topics of physical events (17) and then all topics (8) were most related to daily life. The unsuccessful group, on the other hand, stated that the topics of physical events and matter and change (4) were most related to daily life. While the successful group provided



views on the themes of living things and life, and earth and universe, the unsuccessful group did not provide any feedback on these themes.

When the students were asked about the topics that they found unrelated to daily life, the majority of the successful group again provided views on the theme of physical events (7). The successful group viewed this theme as an example of topics that are both related and unrelated to daily life. This might be attributed to the fact that the patterns of the theme are comprehensive. From the quantitative perspective, the number of the successful students that find this theme related to daily life is found to be larger than that of the unsuccessful students (7). This theme includes the units of force and motion, electricity, light and sound. There are also students that find the patterns of living things and life unrelated to daily life. The students in the unsuccessful group provided an equal number of views (3) indicating that the themes of earth and the universe, physical events, and matter and change were unrelated to daily life.

The successful students provided the reasons why they found the topics related to daily life as follows.

S2F3: *"I think it is useful in each part of our life. For instance, when I start doing something, my father gets angry and asks me the question whether I have not ever taken Physics. I think Physics is useful at home, or it is useful for what we use in our daily life and in the science class. We must benefit from Physics."*

S2F3: *"I think we are not aware of it, but it is useful knowledge for us."*

S2F2: *"Regarding the topic of pressure, I can give the example of how a cleaner works etc."*

The following are the views of the students in the unsuccessful group.

U1F1: *"I think electrical conductivity and insulation is very important. We can act accordingly."*

U2M2: *"We learned some topics like the directions of the electrical current last year. In our daily life, it is not useful, but we can use this knowledge in an invention."*

U2F1: *"There may be many examples, but I cannot tell now. There are some examples related to our bodies"*

Considering the topics that the successful students find unrelated to daily life, the following statements were provided.

S2F2: *"For example, why do we learn about electricity? It would be no use in daily life. It is OK if we are going to be electrical engineers in the future, but for now it sounds nonsense to me."*

S2F1: *"It would be no use learning how to create an electrical circuit"*

S2M1: *"Are we going to clone anything after we learn about the structure of DNA?"* The unsuccessful students, on the other hand, provided their views as follows.

U1F1: *"Natural processes, for example, the structure of rocks, does it matter if we know about it? What about learning about the magma of the earth?"*

U1M1: *"Does it matter if we know the symbols of gold and silver?"*

Considering the topics that the successful group considered related to the science class, the students in the successful group focused on the knowledge that made their life easier and that they benefited from in their life. However, the unsuccessful group paid attention to the importance of the topic and provided evaluations such as "I think this topic is very important. I do not have any example in my mind now, but there must be. We can use it in the future."

Considering the statements related to the topics that they find unrelated to daily life, both groups were found to choose the topics that they thought would not be useful in their daily lives.

Publications/Broadcasts on Science

10 participants in the successful group stated that they subscribed to the journal of *Bilim Çocuk* (Science for Children) at some time in their life; the journals of *Meraklı Minik* (Curious Little Child), *Bilim Teknik* (Science and Technology), and *Atlas* (Atlas) were each subscribed by one student. Moreover, 2 students stated that they bought popular science books whenever possible. 8 students in the same group explained that they watched with pleasure the TV program entitled *Arka Bahçede Bilim* (Backyard Science) in which children made scientific experiments. Only 3 participants in the unsuccessful group stated that they did not subscribe to any of these journals but sometimes purchased them.



The journal of *Bilim Çocuk* (Science for Children) is a monthly scientific journal which is published by The Scientific and Technological Research Council of Turkey (STRCT) and which aims to satisfy the interest and curiosity for science-savvy children that are in more concrete period. *Bilim Teknik* (Science and Technology) is a journal published by the same council for the younger generation.

The successful group provided their views on the aforementioned journal and program as follows.

S1M1: *"I always bought the books of Bilim Çocuk (Science for Children). I used to like playing with the science cards provided with these books."*

B1F1: *"I once had a group of friends, five people. I first saw it when one of them bought it. Then, I always bought it."*

S1F2: *"My elder sisters used to buy it. Then, I continued to buy it."*

S2F2: *"My mother first bought it for me. Thanks to her, I subscribed to it. I used to be very happy when it was delivered home. I used to feel as if I were an adult."*

S1M2: *"My father used to bring Bilim Teknik (Science and Technology) home. Then, when I started to read, he bought Bilim Çocuk (Science for Children) for me."*

S1F2: *"I first watched how an experiment was conducted on Arka Bahçede Bilim (Backyard Science) on TV. I tried to do the same, but I always failed. I was just enjoying myself."*

Discussion and Conclusion

When the findings of the study are generally evaluated, hobbies viewed as a predictor that describes the participation in the social activities or an individual social aspect bear close similarities in both groups. It has been found that students spend their time most by reading, listening to music, and playing computer games or surfing the Internet and that the successful group spare more time to sports activities compared to the unsuccessful group. The out of school activities that students engage in are one of the most important issues for educational researchers (National Research Council, 2004). The studies conducted in the related literature indicate that students generally have hobbies such as watching TV, reading, and listening to music, that while reading and cultural activities affect students' success positively, playing computer games, watching TV, and listening to the radio affect their success adversely (Joun Won & Han, 2010; Kim, 2003). Considering the leisure time activities of the students in both groups, it is observed that these activities are more non-literacy oriented. Although there are studies that stress that reading activity has a positive effect on students' success (Hofferth & Sandberg, 2001; Powell et al., 2002; Anderson et al., 1988; Kim, 2003), the majority of the reading activities in the books include extracurricular topics. It has also been found out that the successful group focused more on the sports activities that require physical activities. Physical activities are believed to play an important role in helping students overcome the boredom caused by students' high concentration and to increase individuals' self-esteem and thus, classroom performance (Shephard, 1996). According to the report of Trends in International Science and Mathematics Study (TIMSS), it has been emphasized that there is a decrease, though slight, in their success in science as the time spent outside of school increases (Ceylan & Berberoğlu, 2007). This can be attributed to the fact that the science curriculum in Turkey is extensive and topic-oriented, and therefore, the students that engage more in activities outside of school cannot spare enough time for the curriculum and topics.

The students were asked which classes they liked most at school and it was observed that the successful students focused more on science and mathematics classes, while the unsuccessful students did more on verbal ones such as Turkish and Social Studies classes. The classes included in the school such as liberal arts, language, and natural and applied sciences are classes that differ in terms of application and measurement of success (Hativa & Marincovich, 1995). The core process in science education is based on procedural knowledge and this knowledge consists of a whole of knowledge that is connected to each other and developed during the process. However, this clear and basic process is not shared by other courses. Unlike the courses related to reading, the science curriculum renews itself each week and requires that individuals have the skill of making a connection between concepts and facts (Vannest,



Parker, & Dyer, 2011). The same effect is seen to dominate the statements provided by the students on why they did not like the science class.

The unsuccessful students explained the reasons why they did not like the science class as *they were not successful* and stated that they provided the reasons as *"I cannot study, I cannot understand, I miss some lectures, I cannot revise ..."*, indicating that they held the responsibility for the failure. None of these 12 students attributed their failure to external factors. Students generally account for their success through reasons such as efforts, luck, ability, and difficulty (Weiner & Kukla, 1970; Önder-Yücel, 1982). Attribution of cause of a phenomenon or situation (casual attribution) is an individual's reasoning about the reasons of his/her behavior based on the process Bar-tal, 1978). In this sense, an individual can make inner- and external-oriented inferences during the process of attributing causes to facts. While Inner-oriented individuals associate the causes and the consequences of events with themselves, external-oriented individuals associate them with luck and other factors, except themselves, such as *"The questions were from the topics that I did not study"*, *I was unlucky"*, and *"I was sick that day"* (as cited in Mueller & Thomas, 2000). In the situation above, successful students tend to account for their success through their abilities and efforts and account for their failure through not being able to make enough efforts, which helps these students to be proud of themselves. The unsuccessful students thinking that they will be successful as long as they make necessary efforts to adopt positive attitudes towards themselves (Cortes-Suarez, 2004). The students stated that they did not like science and technology, and mathematics classes viewed as quantitative subjects as *they cannot do, understand, and feel that they are unsuccessful*.

There is a relationship between the success in a class and the value attached to it (Yayan, 2003; Koca & Şen, 2002). The statements provided by the successful students such as *"There is science in every part of our life whether we are aware of it or not"* and *"Science is important in our daily life"* might be considered as a sign of the relationship between the value attached to science and success. The statements provided by the unsuccessful students such as *"It is OK if I am going to be an electrical engineer, but I think there is no need for subjects that we do not utilize now"* and *"I want to be a doctor or a genetic engineer. What use are the topics of electricity?"* seem to support this fact. In general, some of the students claimed that science would play an important role in the choice of profession, while some stated that they would face science in any field (Osborne & Collins, 2011).

The students were asked to state the topics that they most and least liked and it has been observed that the successful group likes most the themes of living things, life, matter and change, while the unsuccessful group likes most the units of living things, life, matter and change, followed by physical events. When the topics that are least liked are considered, it appears that both groups do not like the units in the theme of physical events. Furthermore, it is seen that the unsuccessful group do not like the unit of matter and change, either. Neither of the groups has been found to have any negative feelings towards the units in the themes of living things and life, and the earth and the universe. Considering the related literature in general, it is seen that students adopted more positive attitudes to Biology topics and favored Biology, Chemistry, or Physics in general. Moreover, it is also observed that they like the topics as they find them related to their life or do not like them as they do not consider them related (Bennett & Hogarth, 2005). It is also seen that the studies conducted in other countries indicate similar findings and reveal that students have difficulty in understanding some topics. Moreover, teachers have been found not to be aware of these issues (Nott & Wellington, 1998). In line with this, it has been realized that the majority of the science programs must be revised and that teachers, students, and parents find some of the science topics unnecessary (Nott & Wellington, 1998).

The students were asked how they studied science and technology class and it has been found that both groups used similar learning strategies. Learning strategies and the behavior and opinions used by students aiming to affect the coding process during learning (Weinstein & Mayer, 1986) are defined as students' making necessary efforts to attach meaning to and internalizing the knowledge provided to them during learning-teaching process or individual work by exposing it to their mental processes (Tay, 2005). Learning strategies are perceived as a schematic structure that combines a set of learning processes used by a student to acquire new knowledge and emerge in five dimensions. These



are revising, interpreting, critical thinking, organizing and metacognitive-self-regulated learning strategies (Pintrich, 1989; Pintrich et al., 1991).

Revision strategies are activities such as memorization, copying, underlining the texts used in the class and describing and note taking. Interpretation strategies include forming new connections between existing knowledge, experience, and new knowledge, explaining through different words, summarizing and defining the relationship between existing knowledge and new knowledge. On the other hand, critical thinking strategies are to what extent students adapt their existing knowledge to new knowledge. Organizing strategies include selecting the appropriate knowledge that will help form relationships between other concepts and existing knowledge, writing a draft a paragraph, and activities such as classifying a topic; the last strategy is linked with planning knowledge gain, checking, and organizing (Pintrich, 1989; Pintrich et al., 1991). In this context, both groups stated that they used learning strategies such as underlining, writing, and reading notebooks. Furthermore, there are also effective strategies that support learning strategies and that feed students' processes of being curious, comfortable, and decreasing levels of anxiety (Weinstein & Mayer, 1983). Learning strategies include cognitive, metacognitive, and affective strategies. Viewing study habits as an integration, repetition, listening-monitoring, and coping (Virginia & di Vesta, 1991), it is seen that students study for their classes more through repetition.

Academic success was also sometimes explained through personal characteristics and thus it was put forward that loneliness, and shyness affected success (Güngör, 1989; Ishiyama, 1984). Issues such as test anxiety (Yalçın & Açıkgöz, 2009) and social support are sometimes viewed as the predictor of success (Cutrona et al., 1994; Meeus, 1993). In this regard, the successful group's suffering often to parents during the interviews is a characteristic that receives attention. Statements related to their parents such as *"Like my father says, while doing something with my mother, the journal that I bought thanks to my cousins and my mother has taken action on .."* are frequently stated. Considering that the successful group subscribed to the journal of *Bilim Çocuk* (Science for Children) thanks to friends, relatives, and parents, it can be claimed that the interest and the support of the family and social environment play an important role in success in science class.

Another finding of the study is that while unsuccessful students state that they get bored in science classes, successful students state that they enjoy themselves although they have the same teacher. This can be attributed to their motivation. Motivation is the key term in learning and without motivation, students cannot focus on topics and accordingly, they get bored while learning (Chiczenmihail et al., 1993). In this regard, various strategies can be proposed to help teachers use them to motivate their students. According to the report in which Turkey's success in TIMSS is evaluated, the students whose teachers ask questions through explaining the principles and definitions related to the class, solve problems and guide while solving questions, and ask what students know about the topic become more successful. During this process, it is an important issue whether students understand the feedback provided by their teachers. Several studies indicate that students do not know how to evaluate the feedback provided by their students and how to act accordingly (Weeden et al., 2002).

Suggestions

Individuals and institutions have different expectations of science education. Students, teachers, parents, schools, institutions, and governments attach different meanings to science education in line with their aims. These aims are generally based on gaining success. In this regard, in line with the results of the study, the following suggestions can be put forward:

- Students should be encouraged to engage in extracurricular activities in addition to the ones in the classroom so that they can overcome stress, explore, and improve themselves.
- Students should be provided with the opportunity to observe and make experiments whenever possible considering the topics of the science class.
- The topics of the science curriculum that seem abstract to students or are not viewed useful



in their daily lives should be included in the high school curriculum and the course books should include topics that will get students' interest as well as questions and materials that are more related to daily life.

- The guidance and counselling services of the schools or the experts in the field should inform students about the effective study habits and learning strategies to encourage them to study and manage their time effectively.
- Parents are advised to be attentive and selective about the TV programs or the publications that they buy and to encourage their children.

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