Seventh Grade Students' Perceptions of Using Concept Cartoons in Science and Technology Course

Fatma Şaşmaz Ören[*], Gülçin Meriç
Celal Bayar University

Abstract

The aim of this study is to determine the efficiency of use of concept cartoons in elementary school 7th grade students Science and Technology course according to students' perceptions. In terms of this aim, the unit of "Force and Motion" has been taught by concept cartoons and at the end of this period, semi-structured interviews were carried out with 12 elementary school 7th grade students. The interviews have been carried out by giving the students opinion form and interviewing with each of them. Besides, students have kept journals for science and technology course for six weeks. In the study, while opinion form has been analyzed by content analysis, interviews and the student journals have been investigated by descriptive analysis. According to the results that have been attained, students have stated that it was the first time they have encountered concept cartoons and it is necessary to continue using this technique in science and technology course. In addition to this, students have stated that courses taught with concept cartoons are pleasant/enjoyable and there has been deep and long lasting learning. Based on these results, some suggestions have been given for the use of concept cartoons in science and technology courses as a learning technique.

Key words: Science and Technology, Concept Cartoons, Students' Perceptions, Force and Motion

Introduction

In this century as the technological developments have advanced at a great pace and influence of science and technology can be observed in our lives, it is apparent that to learn Science and Technology course is important. In this respect, it can be said that countries have made some changes in their learning program at the light of new advancements. The main aim of the novelties that have been done is to raise thinking, questioning and producing individuals (Balım, Kesercioğlu, İnel and Evrekli, 2009). In Turkey, there have been significant changes in Science and Technology Instruction Program in parallel with these advancements at the base of constructivist approach. This so called program has started to be used gradually since 2005-2006 academic years. According to Watson (2000), in constructivist approach which enhances learning experiences, student himself is active; teacher is responsible for children's interests and their present comprehension and social experiences which are significant parts of learning are very crucial. In constructivist learning approach, students integrate new information with their pre-knowledge and by doing this they involve in learning process as they experience, search and question. In this process, students gain new knowledge based on the pre-knowledge and thus deep and permanent learning are achieved. At this point, approaches, methods and techniques that enable students to involve in learning process actively by associating subjects with everyday life gain importance. One of these techniques is concept cartoons.

Concept Cartoons

Concept cartoons which were introduced to literature by Brenda Keogh and Stuart Naylor in 1990's are interesting, surprising cartoon drawings in which each character illustrates a daily event with different perspectives (Keogh & Naylor, 1999). Ekici, Ekici and Aydın (2007), define concept cartoons as an illustration of dialogues that include three or more than three characters. On the other hand, according to Şaşmaz-Ören (2009), concept cartoon is a strategy with three or more than three characters that enable the association of science topics with daily life and comment, contemplate and discuss on events. According to Uğurel and Moralı

---

[*] Corresponding Author: *Fatma Şaşmaz Ören, fsasmaz@gmail.com*

(2006), these cartoons are pictures that present science subjects with an alternative perspective and include daily events. Evrekli and Balım (2010), define concept cartoons as illustrations that make students involve in the process actively; provide environment in which they can express their knowledge freely; bring out their misinformation and possible alternative concepts. According to Şaşmaz-Ören (2009), concept cartoons are used as a means of learning-teaching and evaluation process in Science and Technology course based on constructivist approach. It is necessary to use visual aids like concept cartoons to make students involve in Science and Technology courses actively (Ceylan-Soylu, 2011). These visual aids especially make contribution to the concretization of abstract science concepts and they play a role in providing students with a deep learning (Kirisçioğlu & Başdaş, 2007). It is thought that the use of concept cartoons creates enjoyable, visual environments in which students can discuss and concentrate on Science and Technology course (Balım, İnel, & Evrekli, 2008). According to Evrekli and Balım (2010), the use of concept cartoons contributes to the development of questioning skills as students can express their perceptions about concept cartoons freely in the course room. Concept cartoons enable the students to concentrate on lessons and provide them with a pleasant studying environment by making them involve in lessons. Together with this, it can be asserted that concept cartoons make students learn Science and Technology topic deeply and permanently.

The focal point of concept cartoons is the events in everyday life (Keogh & Naylor, 1999). Concept cartoons present different perspectives relevant to daily events to the students and also opinions of characters in concept cartoons are put forward in equal status (Uğurel & Moralı, 2006). On these visual aids; any event related to daily life are discussed by three or more characters on condition that opinions must be provided in the speech bubbles (Uğurel & Moralı, 2006; İnel, Balım, & Evrekli, 2009). According to Chin & Teou (2009) while the students are talking about the cartoon by the characters in the cartoon, this situation allows students to focus on the discussion. Concept cartoons can be used for different purposes at different stages of the course. According to Kabapınar (2005), these visual aids can be used as a means of teaching-learning in this course process; according to Uğurel and Moralı (2006), Ekici, Ekici & Aydın (2007) with İnel, Balım & Evrekli (2009), they can be used for the determination of the misconceptions. Şaşmaz-Ören (2009) states that concept cartoons could be used as an alternative means of evaluation her study. According to Ceylan-Soylu (2011), the primary purpose of using the concept cartoons is to start a discussion about a concept, a situation or an event and lead students to search.

There are various studies related to using concept cartoons at different stages of education and different levels of learning in the literature. In one of these studies, Keogh and Naylor (1999) investigated the effects of the concept cartoons on individuals at different levels. Teachers, candidate teachers of elementary education and elementary education students were the participants of the study. The results of observation, written reports, surveys, evaluation questionnaires and interviews were used as means of data acquisition in the study. As a result of research, the concept cartoon was determined as a teaching technique that increased students' motivation and participation during course by providing discussion atmosphere for them. In addition, the researchers expressed that teachers, candidate teachers, and students had positive attitudes toward concept cartoons. Chen, Ku and Ho (2009) examined the effects of concept cartoons on the discussing ability of elementary school students in their studies. The study in which the only group pretest-posttest form was used, was brought out with 21 students for six weeks. In the research, the discussing ability of students was developed by teaching with concept cartoons. Kabapınar (2009) investigated the contribution of features that would increase the effect of the concept cartoons on the course in his study. The research was carried out with the fourth and fifth grade students. The means of data collection were video records of applications, the researcher notes and concept cartoon-shaped probe questions. The findings of the survey showed that the concept cartoons designed in the form of worksheets were as efficacious as the concept cartoons designed in the form of posters on removing misconceptions. The researcher also expressed that naming characters in the concept cartoon facilitated the organization of the debate in the lesson and the names of the characters did not affect the students' responses.

İnel, Balım and Evrekli (2009) sought to determine students' perceptions on the use of concept cartoons in science education in their study. In the study carried out by the seventh grade science students, courses were taught by using concept cartoons for four weeks and at the end of this process, interviews were conducted with 10 randomly selected students. As a result of the interviews, the students indicated that although they encountered concept cartoons for the first time, this technique was useful in many aspects and they stated positive opinions about the use of concept cartoons in courses. Ersoy and Türkkan (2010) examined fourth grade elementary school students' feelings, thoughts and observations about the problems they encounter in their environments and solution suggestions for these problems via students' cartoons. At the end of the study, the researchers concluded that the drawing cartoons about problems they encountered were effective in terms of deciding, creative and critical thinking on the issues, interpretation and developing solution offers. Şaşmaz-

Ören, Ormancı, Karatekin and Erdem (2010) aimed to determine the 6th, 7th and 8th grade students' misconceptions about photosynthesis-respiration with the concept cartoons. Using the concept cartoon test as a means of data collection by the researchers demonstrated that the students had many misconceptions in the photosynthesis-respiration. The authors also concluded that the concept cartoons are effective in determining the students' misconceptions.

As it is seen, there are studies related to that concept cartoons are used for different purposes such as creating discussion atmosphere, leading students to search, determining misconceptions on any subject and as a means of alternative assessment in the literature but it is understood that feedback studies are not enough for determining the effectiveness of the use of these visual aids in course. In this study within this context; effectiveness in terms of learning of the use of concept cartoons as a teaching technique is aimed to determine by identifying students' perceptions.

Method

In this part of the study, information on study methodology, study participants, data collection instruments and the analysis of data is given.

Model of the Study

This study is in the design of phenomenography, which is one of the qualitative researchs. Phenomenography was developed from an empirical educational framework by Ference Marton and coworkers in the1970s (Larsson & Holmström, 2007). In phenomenography research one can identify how key concepts are understood by the learners (Stamouli & Huggard, 2007). As the aim of study is to determine students' perceptions by making use of experiences with concept cartoons and to question what this technique means from different perspectives, phenomenography research design has been used in the study.

Participants

The study group of the research consists of twelve 7th grade students of an elementary school in Demirci town in Manisa at fall period of 2011–2012 academic years. When the qualifications of the participants are taken into consideration, 41.7% (n=5) of them are girls and 58.3% (n=7) of them are boys; 91.7% (n=11) of them are at the age of 13 and 8.3% (n=1) of them are at the age of 14. In this study, science and technology courses have been taught with concept cartoons based on 5E learning model for six weeks. In this process, concept cartoons have been used for discussing and inquiring in the lesson. At the end of the process, opinion form and semi-structured interviews were brought out for identifying the students' perceptions, feelings and thoughts about science and technology course taught with concept cartoons. Opinion form prepared by the researchers was used for all the students and semi-structured interviews were brought out with 10 students.

Data Collection Instruments

In phenomenographic research the main source of data is the semi-structured interviews. In the interviews, the researcher has conducted within the population of interest (Stamouli & Huggard, 2007). Because of this, semi-structured interview has been used in the study among qualitative research techniques. Interviews can be shown as the most frequently used data collection instrument in qualitative research studies (Karasar, 2004). Since the purpose of the research is to study the views related to concept cartoons that are used as a technique in teaching process deeply, semi-structured interviews have been used. In the study, two basic data collection instruments, namely 'opinion form' and 'interviews' have been used. Besides, science journals that students kept throughout concept cartoon practices have been used. In this regard, it can be said that the study has three data collection instruments.

Opinion form

With the purpose of determining student's perceptions of the use of concept cartoons in Science and Technology course, there has been prepared opinion form consisting of fourteen open-ended questions. Questions in the opinion form have been prepared by researchers to obtain students' perceptions, feelings and thoughts about Science and Technology course taught with concept cartoons. In the process of developing semi-structured opinion form, the studies related to concept cartoons were analyzed and the initial state was given to the

questions considered to be in the form. In order to ensure the validity of prepared questions, experts were consulted and the final version of the form was created according to their feedback.

Interviews

Interviews have been done with seventh course students by using the same opinion form questions at the same time. The semi-structured interview questions in phenomenographic research are usually phrased in terms of the students' perceptions, understanding and experience (Stamouli & Huggard, 2007). In this sense, open ended questions that are in the semi-structured opinion form and interviews of the study included student's attitudes towards concepts cartoons; their attitudes towards whether to teach Science and technology course with this technique; its distinction from other lessons; its effect of associating subjects with everyday life; its influence on existing attitudes towards this lesson; its effect on course performance; students' attitudes towards whether to teach other science units or other courses with this technique and whether they had any difficulties with concept cartoons during practices. Opinion form and interview questions are the same in the study and they are given in Appendix 1.

Science journals

Another qualitative data collection instrument that has been used in the study is journals. The science journal, with its emphasis on reflection and the personal voice, has been found by many educators to be an effective instrument. Journals can be defined as a collection (Şaşmaz-Ören, 2005) in which students express their knowledge, ability, experience and attitudes which they learn in lesson can be regarded as a significant data source. In this study, journals were kept by students after each lesson (for six weeks). It is aimed to understand that feelings about the application, knowledge and skill gained in the lesson, events during the lesson they like or they do not like by the journals. Thus, it is aimed to obtain information about effect of the concept cartoons on cognitive (knowledge), affective (experience and attitude) and psychomotor (skill) functions with the help of students' journals.

Reliability and Validity of Data Collection Instruments

Studies on these topics were investigated in the development phase of semi-structured interview form and the initial state was given to the questions which would be placed in the form. Expert opinion was asked in order to ensure the validity of the questions and the final version of the interview form was prepared in accordance with the feedback. Some of the questions in the form changed after expert opinion. Reliability calculation, which was relevant to investigations of interview form carried out by the researchers, was carried out by using "coherence percentage" developed by Miles and Huberman (1994). Firstly, the researchers evaluated the data in the analysis of interview form obtained by the candidate teachers separately. The coherence percentage was above 0.7 for all the questions. Then, the researches took joint decisions about assessments about which the level of coherence was relatively low.

It was marked by two researchers separately that which sentence written in science journal skept by students within the scope of the five basic themes (knowledge, skill, of experience, a positive attitude, negative attitude) determined before the research, belonged to which theme and after that the coherence percentage was calculated. It was determined that coherence percentage is over 0.7 for all themes expect 'Experiences' theme. For this reason, the theme mentioned was re-evaluated on the determination of which sentences would be put into this theme by both of the researchers.

Data Analysis

Content analyses, which were often used in qualitative studies, were used in the analysis of interview form. The data obtained from this study was encoded by two researchers and frequency values were determined. The analysis process of the study, firstly data was analyzed by the researchers and codes were created.

In phenomenographic research, the in-depth interviews are tape recorded and transcribed verbatim quotation (Larsson & Holmström, 2007). In this study, interviews were recorded by voice recording device and conducted face to face separately with each candidate teacher by one of the researchers. Record data was transferred to Microsoft Word and then it was analyzed by the researchers. The names of students, with whom interviews were carried out, were kept confidential and they were reported by encoding like A, B, C ... Descriptive analysis, which was another data analysis method widely used in qualitative researches, was used in the analysis of semi-structured interviews. The results of descriptive analysis were reported together with the results of content

analysis; the citations from the interview responses which were based on supporting the results of content analysis and setting out differences were used directly. The criteria, which were created by benefiting from descriptive analysis, were also based in the analysis of journals. Differently, themes used in the analysis of journals were created before the process and research. The findings of science and technology journals were examined fewer than five headings (knowledge, skill, experience, positive attitudes, and negative attitudes) by analyzing; the frequency and percentage values were calculated and examples of students' perceptions were presented.

The Instruction

Unit 'Force and Motion' was taught based on 5E learning model of constructivist approach with concept cartoons in the research. Lesson plans of Science and Technology were prepared in accordance with the stages of 5E learning model. Model consists of 5 stages. These stages; Engage, Explore, Explain, Elaborate and Evaluate (Carin and Bass, 2005). 5E learning model enables to learn a new concept or comprehend a known concept deeply. Students should use their pre-knowledge for finding out new concepts in order to make them sensible (Ergin, 2012). The concept cartoons prepared for the study were taken place at different stages depending on intended use. So, these concept cartoons were sometimes used for the first phase of the learning circle "engagement" with the purpose of determining students' pre-knowledge on the subject or attracting the attention to the course, "exploration" phase cause of initiating research, "explain" phase as a facilitator for teacher in making scientific labeling of the concept or the concepts the students were expected to learn, "expansion" phase aimed at making effective courseroom discussions and as a means of increasing motivation during doing new experiments on the same subject and sometimes as an alternative means of assessment "evaluation" phase. In total, 19 concept cartoons have been used in the study. One of the concept cartoons that are used to determine student's pre-knowledge is the one below:
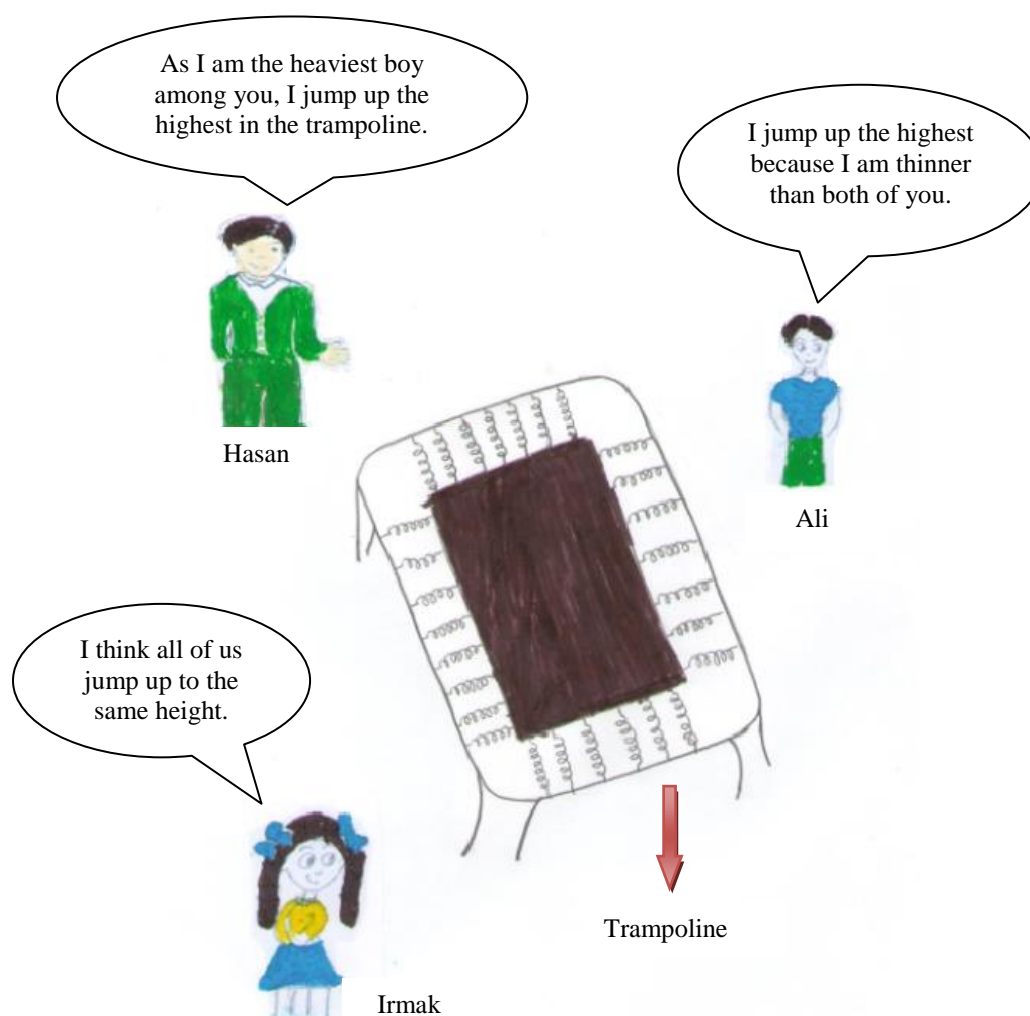

Figure 1: "If people of different heights jump up in the trampoline, do the heights that they jump up to change? If so, how do they change?" themed concept cartoon.

As they were used with the purpose of initiating the study, one of the concept cartoons that were used in 'discovery' phase is given in the Figure 2:
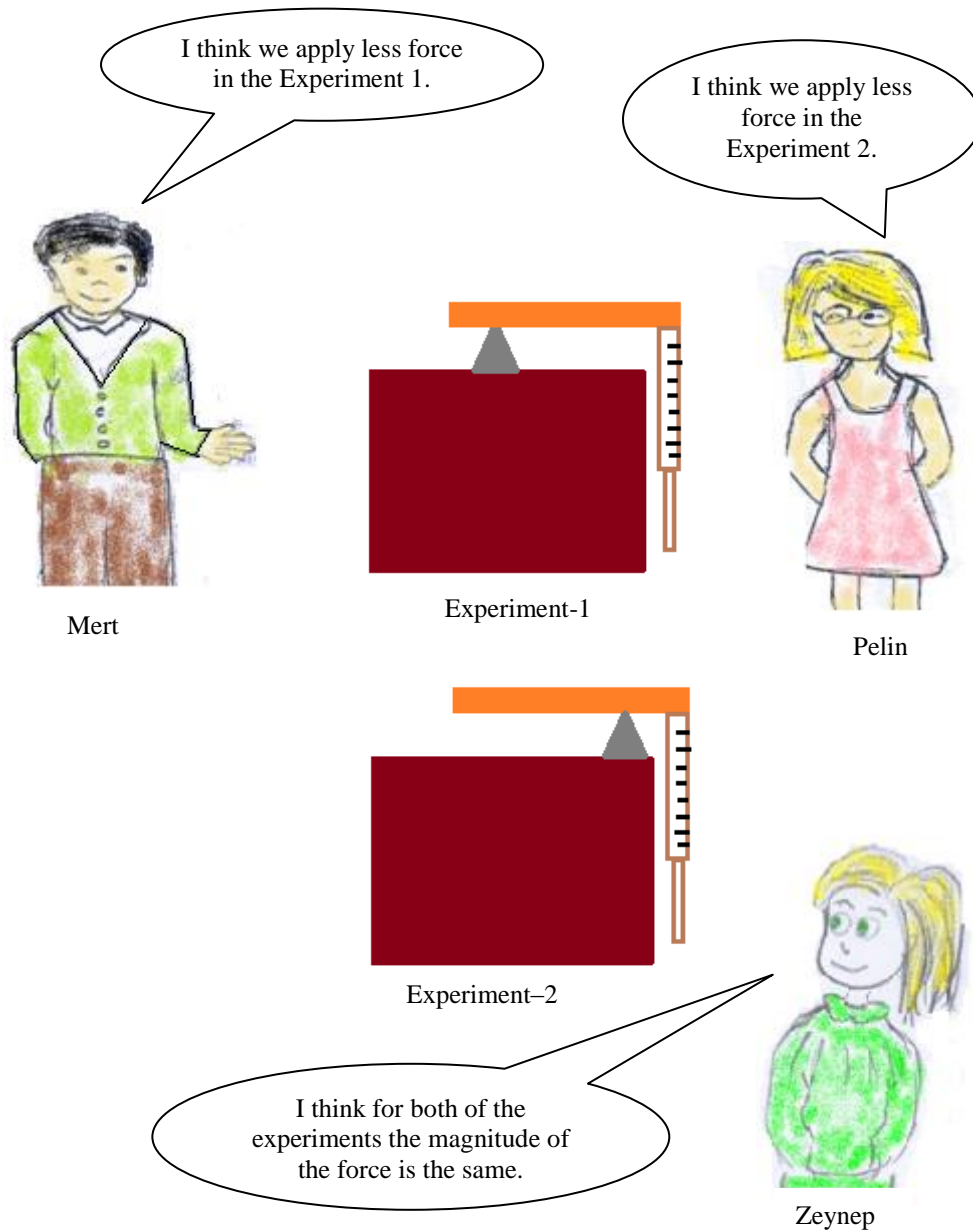

Figure 1: "In which experiment do I apply less force?" themed concept cartoon.

At the end of the process, opinion form that includes open-ended questions was applied to determine the student's attitudes towards the use of concept cartoons; what's more, interviews were done with each of the students. In addition to this, journals kept by the students were evaluated throughout the application of the research. A sample of students' journals is given in Appendix 1.

Findings

This part has been discussed under two basic titles namely "Findings Obtained from Opinion Form and Interviews" and "Findings Obtained from the Journals".

Findings Obtained From Opinion Form and Interviews

In this part, content analysis results obtained from semi-structured opinion forms that were applied to 12 students who study in Science and Technology instructional program supported by concept cartoons have been assessed in the form of frequency and percent value in tables; what's more, results obtained from interviews with students have been evaluated together with these results in the form of quotations.

First impressions/attitudes on towards concept cartoons

In the application of opinion forms and face to face interviews, students were asked the question of 'What did you think of when you saw the concept cartoons for the first time?" The analysis results of the answers that students gave for this question are as they are given in Table 1.

Table 1. Students' attitudes towards what they thought of when they saw the concept cartoons for the first time

Themes	Codes	N	%
Feelings	Astonishment	5	33.3
	Exultation	2	13.3
	Excitement	1	6.8
Thoughts	Enjoyable	5	33.3
	Comprehensible	2	13.3

As it is seen in Table 1, students' perceptions of when they saw the concept cartoons for the first time have been collected under the themes of feelings and thoughts. 33.3% of the students stated that they got astonished and 13.3% of the students expressed that they were pleased. The same results have been obtained from the interviews. For Example:

> Student H: 'When I saw the concept cartoons for the first time, I was pleased and they drew my attention. We had never such a Science course before.'

> Student I: 'When I saw concept cartoons, I was pleased at first; but later I got astonished when I saw that there weren't cartoon men.'

Participants also stated that they got excited (6.7%) when they saw the concept cartoons for the first time. One of the students' perceptions with whom we interviewed as the following:

> Student G: 'I was very excited when I saw it had illustrations, I liked it.'

When the encoded data was analyzed under the theme of 'thoughts', it was observed that some of the students (33.3%) thought lessons would be more enjoyable / entertaining.

> Student G: 'I understood this lesson would be very enjoyable. Firstly, I was very excited when I saw the cartoons and we had very entertaining lessons.'

13.3% of the students stated that they could understand the topic better when they saw concept cartoons.

Perceptions about teaching lesson with concept cartoons

The second question of the interview was 'We used the concept cartoons in science and technology lessons. What do you think about this technique the processing of the course?' Table 2 shows the results of analysis of students' answers to this question.

Table 2.Perceptions of the students about teaching lesson with concept cartoons

Themes	Codes	N	%
Teaching process	More enjoyable.	5	33.3
	It is different from other lessons.	2	13.3
	It is more impressive.	2	13.3
	It is visual.	1	6.7
	It provides motivation in the lesson.	1	6.7
	The lesson is boring.	1	6.7
Cognitive domain	It provides a better understanding of lesson.	2	13.3
	Permanent learning.	1	6.7

It has been observed that the students said the concept cartoons made the lesson more enjoyable when the perceptions of the students about teaching science lessons with concept cartoons were analyzed. Interviews also support this conclusion. For example;
Student A: *'We were trying to find one who declares valid in course discussions. This was a lot of fun for me.'*

However, 13.3% of students stated that the lessons taught with concept cartoons were different from other lessons and the lesson with this technique was more effective. Two examples of the data obtained from interviews in this matter as the following:

> Student H: 'In fact it will help us better when our lessons are taught with the concept cartoons. They help keeping in mind the concepts and sentences and that lesson is also different from other lessons. So, I answered the questions more easily; the answers came to my mind immediately. Obviously I liked it.'

> Student I: 'I think it's a good technique and impressive. I kept in mind what we learned.'

Only one of the students who joined the interview indicated that teaching lesson with this technique is boring. The same student (student K) in an interview expressed similar thoughts, and explained the reason of this reason as the following:

> Student K: 'I think, teaching lesson may be better but if it is taught orally, it can be better. Because our previous teacher taught the lesson. Sometimes this technique can be boring.'

It has been observed that 13.3% of students indicated they had a better understanding of the lesson taught with concept cartoons when the data encoded under the title of 'cognitive domain' was analyzed. The perception of one of the students agreed on the view is as follows:

> Student D: 'When I see a question in the exams, cartoons we have learned come to my mind immediately so I can answer question. I increased my performance in the exams.'

The influence of concept cartoons on students

Students' answers for the question of 'What kind of effects the Science and Technology courses that were taught by concept cartoons have on students?' have been analyzed and the analysis results are given in Table 3.

Table 3. Students' attitudes towards the impacts of Science and Technology Courses on students

Themes	Codes	N	%
Affective domain	It has positive effects	3	23.1
	More enjoyable	2	15.4
	The interest for the course increases	1	7.7
Cognitive domain	Permanent learning	3	23.1
	It eases the comprehension of the lesson	2	15.4
	It enables the solution of similar questions	1	7.7
	It eases the review of the course	1	7.7

When the Table 3 is examined, it is seen that the science and technology lessons that were taught with concept cartoons have had positive influence on students as they asserted this fact by 23.1% frequency. Besides, it is understood that some students are of the opinion that as concept cartoons offered more enjoyable courses, this created a positive effect on the students. The interviewed students made similar generalizations.

> Student F: 'I think, it has positive influence on students because we comprehended the course easier and the lesson was more fun.'

> Student H:' It might sound more different to the students. The lesson was more different and more enjoyable. This was a better opportunity for the students.'

From the answers of the students, it is understood that, for the data coded under the theme of 'affective domain', the lessons with concept cartoons were more fun by 15.4% frequency and concept cartoons increased the concern for course by 7.7% frequency.

When the data coded under 'cognitive domain' is examined, on the other hand, it is understood that students stated that this technique provided permanent learning. Similar opinions were expressed in the interviews.

> Student B: 'Since visual things are remembered more easily, I think this technique makes it easier to remember the course. You know there was a girl who was performing an action by putting the book over the shelf; when I see a similar question, this girl comes to my mind immediately.'

Besides, some students (15.4%) with whom we interviewed stated that concept cartoons made it easier to comprehend the lesson.

> Student G: 'In my opinion, if a student cannot comprehend the lesson, he/she can do this more easily by remembering and regurgitating concept cartoons. In this way I comprehend the lesson more easily.'

When the students' answers for this question have been analyzed, it can be said that there is no negative perception of concept cartoons.

The difference of the Science and Technology courses taught with concept cartoons from other science and technology courses

Another question in the interview was 'Did the Science and Technology lessons taught with concept cartoons differ from other Science and Technology lessons? If so please explain.' Students' answers that were involved in the study are given in Table 4.

Table 4. Students' attitudes towards the difference of the Science and technology courses taught with concept cartoons from other Science and Technology courses

Theme	Codes	N	%
There was difference;	Contribution to learning	3	33.3
	Interesting and effective	2	22.2
	Being enjoyable	2	22.2
	Providing discussion	1	11.1
	Help for studying	1	11.1

When the Table 4 was analyzed, it is observed that all the students stated Science and Technology lessons taught with concept cartoons were different from other Science and Technology lessons and there was no perception such as supporting there was any difference. So the students' perceptions on this question were grouped under a single theme. When the students' responses were analyzed under the specified codes, it is observed that some of the students (33.3%) stated that concept cartoons had contribution to learning in comparison to other Science and Technology lessons.

> Student D: 'We've never used concept cartoons in the lesson before. There is this aspect. Also we have comprehended the topic better when we have used the projector. There is that aspect too.'

22.2% of the students have often stated the concept cartoons are more enjoyable and interesting compared to other science and technology courses. The perceptions of the students interviewed have supported the explanations of interview form.

> Student L: 'We have used only course book illustrations with our previous teacher. But the lessons have been kept in minds much more cause of the visuality of concept cartoons and they are more enjoyable.'

> Student H: 'I think there was a difference as a cartoon. It was nicer for me when the lesson was taught with cartoons and I was more interested in the lesson. I think my other friends also took part in the teaching activities much more.'

11.1% of the participants stated that the lessons taught by concept cartoons facilitated their studying. Interviews also have similar perceptions. For example, Student J explains his/her perception on this issue as follows:

> Student J: 'We have kept in minds more easily because it is easier to repeat at home. Instead of studying a long time on books, we can study topics more quickly by examining samples on worksheets which you distribute.'

The perceptions on relation between daily life and science topics of concept cartoons

The fifth question of the form of the students is 'Is there any effect on your associating science topics taught with concept cartoons with daily life?' The answers of elementary 7th grade students given to this question of the interview were analyzed and evaluated with the results of the interview. The data of the evaluation results are presented in Table 5.

Table 5. Students' perceptions of relation between daily life and science topics of concept cartoons

Codes	Themes	Examples of Students	N	%
Associating with daily life	General examples	Giving examples of daily life	4	33.3
	Concept examples	Springs	2	16.8
		Kinetic energy	1	8.3
		Simple machines	1	8.3
		Work	1	8.3
Not associating with daily life			3	25.0

When Table 5 has been analyzed, it is obvious that a large number of the students (75%) have stated the lessons taught with concept cartoons provide them to integrate science topics into daily life. These students gave several examples both in their written statements of interview forms and face to face semi-structured interviews. It was observed that 75% of the students presenting opinion which concept cartoons provided them to integrate science topics into daily life gave examples of daily life including concept cartoons for the second part of the question, 'Explain it on an example.' at the rate of 33.3% and 41.7% of examples were related to science concepts. Therefore, the themes related to the question grouped under the titles of "general patterns" and 'concept examples'. As well as, explanation examples of student was included. It was seen that the written statements given to this question have been voiced by the students similarly.

> Student B: 'It happens. The thought of whether I perform an action or not come to my mind for everything. For example, when I am setting the table, I think of whether I perform an action or not.',

> Student A: 'For example, there was a cartoon including trampoline on springs. When I see a trampoline again, I think about how these springs apply force. What's more, we use these springs everywhere in our life. It always comes to my mind.'

> Student D: 'Science topics are already from the daily life. We had a cartoon about a truck and a car's kinetic energy. I always remember it when I see a car.'

> Student H: 'There was a cartoon with a shovel. In the past I was not sure and I used to give wrong answers for the questions related to simple machines. As I have seen the cartoon with a shovel, I do not make any mistakes now.'

Some of the students (25% frequency), on the other hand, stated that lessons which were taught with concept cartoons had no influence on integrating science topics into daily life. Still, there was not such an attitude in the interviews that were done with the students. When the fact that interviews were done after the opinion forms were given is taken into consideration, this situation can be associated either with the fact that students' attitudes changed over time and all of the students have the perception that they can integrate science topics into everyday life owing to concept cartoons or with the fact that, in the interviews, students give answers more easily and they took their time and explained this question by giving examples. As semi-structured interview technique was used and because of this there is the possibility that interviewer was able to give the students the chance of expanding their explanations by asking new questions, it can be inferred that the second possibility is a higher chance.

The influence of concept cartoons on attitudes towards the lesson

Students' answers for the question of 'Did the Science and Technology lessons that were taught with concept cartoons change your attitudes towards this subject? Why?' are given in Table 6.

Table 6. Students' attitudes towards the influence of Science and Technology lessons that were taught with concept cartoons on the perceptions of the students

Themes	Codes	N	%
	Enjoying more	4	33.3
Changed	Getting pleasant	2	16.7
	Permanent learning	2	16.7
Did not change		4	33.3

In this question, it has been aimed to learn whether concept cartoons changed students' attitudes towards Science and Technology lessons or not. Students stated that their attitudes by 66.7% frequency changed in a positive way. Students explained the reason for this, by 33.3% frequency, with the fact that they began to love Science and Technology lessons more. Interviews also support this result.

> Student I: 'Our interest for concept cartoons increased. I began to enjoy Science and Technology lesson more. Our previous teacher also taught well but I am satisfied now as the courses are better with concept cartoons.'

> Student C: 'Thanks to the pictures, I began to love this course more. I think we had a lot of fun in the lesson.'

> Student E: 'Yes my attitudes changed. I began to comprehend the course in a better way. I can remember the pictures easily. The number of true answers that I give increased in pilot tests.'

> Student H: 'Yes, it changed my attitude. It made me remember the topics thanks to the pictures. As a result I observed that I was more successful in the course.'

Some of the students (by 33.3% frequency) on the other hand expresses that they had loved Science and Technology lessons before and concept cartoons did not change their attitudes towards this lesson.

The influence of concept cartoons on motivation for the course

Students' answers for the question of 'Did concept cartoons have any influence on your motivation for the course? How? Please explain.' are given in Table 7.

Table 7. Students' attitudes towards the influence of concept cartoons on motivation for the course

Themes	Codes	N	%
	Increase in success	6	40.0
It had influence	Providing permanent learning	4	26.7
	Being interesting/exciting /enjoyable	2	13.3
	Enabling discussion	1	6.7
No Influence		2	13.3

It was asked in the question 7 of the interview if there was an effect of concept cartoons on students motivations for Science and Technology lessons or not , if there was what kind of an effect it was, and students stated there was a positive effect of concept cartoons on their motivation at the frequency of 83.3%. Students declared that concept cartoons increase their achievements of science and technology lesson at the frequency of 40%. Similar perceptions were presented in the interviews. Student D explained his/her perception of this issue as follows:

> Student D: 'I did it. It is in terms of my success. My mistakes have decreased in the exams. I think the success of my friends also has increased and so my motivation has improved.'

In addition, students expressed their perceptions of permanent learning was the reason of increasing their motivation of concept cartoons at the frequency of 26.7%. The perceptions of some of the students interviewed were as follows:

> Student H: 'It may have had an effect on my motivation. Because I could visualize the topic in my mind by looking at cartoons. I have remembered the information more easily cause of illustration. It has had an impact on the motivation because I love pictures.'

> Student C: 'Yes, I concentrated on the lesson much more. I paid attention much more when the lesson was taught.'

> Student E: 'Yes, I comprehended better because it was more enjoyable.'

> Student B: 'For example, I used to love Maths, I did not use to like Science. But I have been interested in Science much more when we have used concept cartoons in the lesson. I love Science anymore.'

Two of the students who participated in the application of interview form stated that the lessons taught with concept cartoons did not have extension on their motivation for science and technology lessons. However, it has not been understood clearly that concept cartoons have no difference on their motivation whether due to the fact that the students' have already had a high motivation for Science and Technology lesson or concept cartoons do not have an impact on this issue. Because all the students interviewed reported a positive opinion about it and there was no students declaring that it did not affect his/her motivation.

The influence of the concept cartoons on lesson success

The eighth question asked to the students is 'Do you think is there an impact of teaching lessons with this technique on your success? 'Why?' and students' answers to the question are given in Table 8.

Table 8. Students' perceptions of impact of the concept cartoons on their lesson success

Themes	Codes	N	%
	It contributes learning	8	57.2
It has an effect	It provides permanent learning	3	21.4
	It provides learning and having fun at the same time	3	21.4

It is obvious that all the students participated in interview agree on that there is a positive impact of the concept cartoons on their lesson success. Students participated in the application of interview form have declared that concept cartoons have a positive effect on their learning at the frequency of 57.2%. Interviews also support this view. Two of the students participated in the interview explained their perceptions on this issue as follows:

> Student B: 'Yes, my performance has increased. For example, I used to give wrong answers up to five in this unit in advance. Now it is two or three at most.'

> Student G: 'For example, our previous teacher was teaching lesson but I used to give wrong answers in the exams. But you came and I began to understand the course. Last week, We had an exam and I had a few wrong answers.'

In addition, one of the students expressed the opinion that using the concept cartoons longer would increase their success. The same student's statement in the interview is as follows:

Student J: 'Yes, I think if lesson is taught with concept cartoons for a long time, our success will increase more.'

Participants by 21.4% frequency associated the increase in their success with the fact that teaching the course with this technique provided them with a permanent learning. For example, one of the students whom the interview was done expressed his/her perception like this:

Student L: 'When I encountered a similar question related to the topic, I remembered what that character had said.'

Besides this, the fact that concept cartoons give students the opportunity to learn and have fun at the same time has been explained as a reason for their success. One of the students with whom the interview was done explained this situation like this:

Student F: 'It is possible because we had a lot of fun when we were discussing in the course room. While I was solving the questions, these things came to my mind and because of this, I think, my performance in the course room increased.'

The influence of concept cartoons on learning of concepts

One of the questions that students answered in the interviews was 'Did this exercise have influence on learning concepts that you either did not know or you knew imperfectly?' Students' answers for this question are given in Table 9.

Table 9. Students' perceptions of the influence of concept cartoons on learning the concepts that they do not know/know imperfectly

Code	Themes	N	%
It has an influence	Kinetic energy and potential energy	6	37.5
	Springs	5	31.2
	Simple Machines	3	18.8
	Work	2	12.5

In table 9, it is observed that students expressed that to have a course with concept cartoons had an effect on learning the concepts that they did not know or they knew imperfectly. It has been revealed that students knew the concepts of "kinetic energy and potential energy", "springs", "simple Machines" and "work" imperfectly by 37.5%, 31.2%, 18.8% and 12.5% frequencies respectively. Interviews were more effective in getting deeper information from the students for this question. Because, while some of the participant students wrote their names on opinion form and left it, they made more detailed explanations as the interviewer asked them questions like "how?", "why do you think so", "can you explain a bit more?". For example, some of the students with whom the interviews were done expressed their perceptions like this:

Student H: 'Actually, yes it had an influence. There was a question with a shovel. The question was asking which shovel is pointing the direction of force. I had known that the shovel changed the direction of force but I was not quite sure. It became more interesting when I saw in the cartoon and I learned perfectly.'

Student C: 'For example, I had not known the concepts of kinetic energy and potential energy. Concept cartoons helped me learn these concepts.'

Student F: 'yes, it had an influence. I had known that basic machines save the energy. Still, concept cartoons showed me the fact that in they do not save energy, in fact.'

Student B: 'I learned what work means thanks to concept cartoons. There was a girl there performing an action. I had not known the concept of work, before.'

Student L: 'Yes, it had an influence. We learned kinetic and potential energy in the course room but I was still confusing them. But when I saw the concept cartoons, I learned perfectly.'

Student G: 'Yes, it had an influence. I had not known levers before. When I saw the example of levers, I learned it.'

Attitudes towards teaching other Science and technology lessons with concept cartoons as well

Students' answers for the question of 'Would you like to learn other Science and technology units with concept cartoons as well? Why? Please explain.' have been examined and the analysis results are shown in Table 10.

Table 10. Students' attitudes towards the use of concept cartoons in other Science and Technology Units

Themes	Codes	N	%
I would like	Contribution to learning	4	33.3
	Being enjoyable/ amusing	3	25.0
	Providing motivation for the course	2	16.7
	Enabling concretization	2	16.7
I would not like	Spending too much time	1	8.3

It was observed that almost all of the students (91.7%) expressed they wanted to continue using concept cartoons in other units of Science and Technology when students' responses to the10th question of the interview were analyzed. They stated the reason for this as concept cartoons contribute comprehending the topics at the frequency of 33.3%. The interview with the students also supported this notion. For example;

Student F: 'It may be true, because we have fun in the lessons. There are different ideas and we learn them in concept cartoons. I think, ones who can understand better visually can be more successful in Science and Technology lessons taught with concept cartoons.'

Student D explained his opinion on the subject as 'I think, if there are concept cartoons in other units too, it will be nice and we can understand better.'

Some of the students (25%) stated that they want for the other science units would continue to be taught with this technique because the lessons with the concept cartoons were entertaining. The perceptions of some of the students participated in the interview are as follows:

Student C: 'Yes, I would. Because lessons taught with this were very nice, I had so much fun.'

Student G: 'Yes, I would. I believe that if teachers continue to teach lessons with concept cartoons, lessons will be enjoyable.'

However, some students based their opinions on that the concept cartoons embodied subjects (at the frequency of 16.7%). The students participated in the interview presented similar perceptions. Two of these were as follows:

Student J: 'Yes, I would. Teaching science lessons with concept cartoons would be better because some topics are abstract. For example, it can be applied for the Unit of Electric or the Unit of Our Body. We can understand better because it will be tangible when the lesson is taught visually.'

Student E: 'I would like. Because We can motivate for the lesson more and it is more enjoyable.'

Student L: 'Some of the topics are very difficult so they can be taught like this. For example, I did not understand the variety of electrification. That topic would be taught with concept cartoons.'

One of the students took part in the interview form expressed the opinion that he does not want that the lessons would continue be taught with concept cartoons. The same student (student K) explained the reason for this in the interview as follows:

Student K: 'I do not want it so much. Sometimes we occupied with a cartoon too much, it took time a lot.'

The perceptions of teaching other lessons with concept cartoons

Another question of the interview is as follows: 'Do you want processing other courses with the concept cartoons? Why? Explain.' Participants' perceptions on this question are shown in Table 11.

Table 11. Students' perceptions of teaching other lessons with concept cartoons

Themes		Codes	N	%
It should be used	All the lessons	For all the lessons	4	23.5
	Some lessons	For Social Studies	4	23.5
		For English	4	23.5
		For Turkish	4	23.5
It should not be used		For only Science and Technology	1	6.0

It has seen that almost all of the students (at the frequency of 94%) want to use the concept cartoons when the interviews have been analyzed. For example;

Student A and Student E: 'I would like to use concept cartoons in all subjects.'

It has been understood that the students who answered the interview form explained this technique can be used especially in verbal lessons. The students presented similar perceptions in interviews. For example;

Student G: 'I would like to use it in Turkish and Social Studies lessons. We can understand paragraph questions in Turkish lesson more easily. I would like to use them in the Unit of Journey to the Turkish History in Social Studies.'

Student D: 'It can be used in Social and Turkish lessons but I think it can be used in Maths because there are mathematical processes.'

Student L: 'I don't want to use them in Maths. I think it would be incomprehensible because mathematic numerical. But I would like to use concept cartoons in other lessons.'

Student J: 'For example I would like to learn English lessons with concept cartoons because we can learn English better when it is visual.'

Besides, one student thinks that concept cartoons cannot be used in other courses and they should only be used in Science and Technology courses.

Perceptions about difficulties that were encountered in the use of Concept cartoons

Students' answers for the question of 'Were there any difficulties that you encounter in the application of concept cartoons?' have been analyzed and the analysis results are given in Table 12.

Table 12. Students' attitudes related to the difficulties that they had in the application of concept cartoons

Themes	Codes	N	%
There were difficulties	When I was doing by myself	3	25.0
	During the discussions	3	25.0
	In some questions	3	25.0
	In the group works	2	16.7
There were no difficulties	There was no difficulty that I had	1	8.3

In the 12. question, students were asked the difficulties that they had in concept cartoon applications and students by 25% frequency stated that they had some difficulties when they were answering questions related to cartoons individually. Similar perceptions that the students stated in opinion forms were also expressed in one-to-one interviews. For example:

Student E: 'I had no difficulty when I was discussing with the group. However, when I was alone, I had some difficulty.'

Besides this, students who participated in the interview stated that, by 25% frequency, they had some handicaps during course discussions or while answering some questions that they encountered in concept cartoons. For example, some of the students with whom the interview was done explained this situation like this:

> Student B: 'I had difficulty in answering some questions. What's more, all of us were sometimes talking at the same time without asking for permission and then we could not understand anything. We should have talked one by one.'

> Student D: 'When we were studying in a group, my friend once said something different and my answer was something else. On that day, I discussed a lot with my friend and had a lot of difficulty.'

> Student L: 'For example, there was a case in which a child was carrying a bag. At first I could not understand the cartoon but later when you explained it to us, I understood it.'

> Student I: 'Sometimes, we discussed a lot when we were talking about cartoons. Still, it is better to study in a group because each of us expresses different perceptions and it becomes easier to find the correct answer. Sometimes, you remain in between two characters and you cannot find which of them tells the truth.'

> Student H: 'Sometimes, I had. For example, in one question it sounded as if both of the characters told the truth. Still, when we were studying in a group, it was far better. We were able to answer the questions by getting help from our friends.'

For this question, while students stated in the opinion forms briefly that they had difficulty; they made more detailed explanations in the interviews. From these explanations, it can be inferred that students gained profits from studying in a group as far as the application of concept cartoons is concerned or they would rather study in a group rather than study individually.

Perceptions of deficient aspects in concept cartoons

Another question that was asked in the study was 'Were there any deficient aspects of the lessons that were taught with this technique?' and percentage- frequency values related to students' perceptions are given in Table 13.

Table 13. Students' attitudes towards deficient aspect of concept cartoons

Themes	Codes	N	%
No there is not	There was not a deficient aspect	11	91.7
Yes there is	Not liking discussions	1	8.3

In this question, the students were asked whether they observed any deficient aspects related to Science and Technology lessons taught with concept cartoons. The majority of the students (91.7%) asserted that they observed no deficient aspects related to this technique. In the interviews, students expressed this situation with these comments:

> Student J: 'I think there isn't. It is a good technique.'

> Student A: 'No, there isn't. I am pleased to understand better with cartoons.'

> Student H: 'I think there isn't. Because we used to do only pre-book activities in advance. Now the lessons are more enjoyable with the cartoons. We understand Science lessons more easily.'

For this question, the students taking part in interview form expressed only once (8.3%) that there was an incomplete way. This opinion was expressed in the interview by the student D:

> Student D: 'Yes, actually. Sometimes I find the answer of the cartoon question but my friends still continue to argue the answer. Then, it was boring for me.'

Thoughts wanted to add about the concept cartoons

The answers of the students for the last question of the interview, 'Do you have anything to add about the concept cartoons? If yes, explain.' were analyzed and results of the analysis of the answers is shown in Table 14.

Table 14. Perceptions wanted to add about the concept cartoons by the students

Themes	Codes	N	%
Yes,there is	It is a enjoyable technique	2	16.7
	It enables understanding easily	2	16.7
No,there isn't		8	66.6

It has been asked to the students whether there is something to add about concept cartoons. The students have stated that there is not something to add and it is a good technique. Interview results support this conclusion. For example;

Student H: 'Actually, there is not really. Because we have had entertaining lessons.'

Student B: 'No, there is not. I think it's a good technique.'

Student F: 'No, there is not. Concept cartoon is a good and enjoyable technique.'

The students expressed that there was something they want to add at the frequency of 16.7% and they interpreted concept cartoons as a technique enjoyable and enabling to understand easily. The interviewee; Student L has explained that he wants to use the concept cartoons in other courses and said *'Yes, there is. I would like to use this technique in other subjects, especially for verbal courses.'*

As it is seen, both the students said 'yes' and the students said 'no, I do not want to add anything.' have made some comments about the concept cartoons. As a result of these comments, it is able to say that the students participated have positive perceptions of concept cartoons.

Findings from Journals

The students studied with science and technology education program supported by concept cartoons were asked to keep a journal for each lesson at the end of day. Findings obtained by students' journals for Science and Technology lesson were analyzed and examined fewer than five titles; they were in the form of frequencies and percentages and examples of students related to these sub-titles were included. The findings mentioned are shown in Table 15.

Table 15. The results of descriptive analyze of findings obtained by students' journals

Themes	F	%	Examples of Students' Perceptions
Knowledge	28	21.9	*'We have learned inclined plane. I understood inclined plane very well. Later we were taught friction gear machines. If the spring between gears is direct, it turns in a direct way; if it is cross, it turns in a reverse direction. And also small gear turns much more than big gear.'*
Skill	12	9.4	*'Today we did a cartoon paper in Science and Technology lesson. After that our teacher told us to do graphic activities in our books. We did those activities in group and then we did them on the board. Later we did weight measurement activities with the projector and the lesson was over. Today our teacher gave a cartoon to us.'*
Experience	40	31.3	*'Our teacher gave us cartoons in today's lesson. We learned the amount of spring elongation with respect to masses. We also learned where we can use them. We calculated the amount of mass and elongation for the spring. What is more important, we observed that the amount of elongation for springs varies with respect to the mass that is put.'*
Positive attitude	46	35.9	*'We learned springs today. We looked at the cartoons and it was so pleasant. We discussed with each other. I went to the blackboard and I answered one question correctly, one question incorrectly.'*
Negative attitude	2	1.5	*'Today we had the course with cartoons. For me it was not that enjoyable because I had an headache. I could not answer the questions related to opposite directions in our workbook. The teacher helped me.'*

When the Table 15 is examined, it is understood that what we encounter in the students' journals is mostly positive attitude and experiences. Still, students used statements of knowledge and skill by 21.9% and by 9.4% frequencies respectively. Students made statements related to negative attitudes in a very low rate (1.5% frequencies). As it is understood from this fact, students expressed positive attitudes related to the use of concept cartoons in Science and Technology courses for six weeks.

Discussion and Conclusion

In the study that has been done, Science and Technology courses were taught with the help of concept cartoons and attitudes towards this technique have been collected by means of semi-structured opinion forms, one to one interviews and journals that students kept for each of the Science and Technology courses. Most of the students who were interviewed in the study stated that they were astonished when they saw concept cartoons for the first time and they thought courses would be more enjoyable. It can be said that similar expressions were also in the students' journals. Besides this, students stated that they thought they would comprehend courses far better when they saw the concept cartoons. Özüredi (2009), in his similar study, reached the conclusion that students find concept cartoons more enjoyable and interesting. Besides, the fact that this technique enables students to comprehend the lesson better which is another conclusion that has been reached.

When students' perceptions of teaching Science and Technology courses with concept cartoons are examined, it is understood that the majority of them gave positive statements related to this and they found these lessons more enjoyable. Moreover, students stated that concept cartoons helped them comprehend the lessons better and enable permanent learning. Nayl or and Keogh (2010) say that concept cartoons make students think and reason. Thus, it can be inferred with concept cartoons, students comprehend subjects better and this idea is quite acceptable. Similarly, Kuşakçı-Ekim (2007) and Ayva (2010) reached the conclusion that in the interviews that were done with the students, students stated concept cartoons were pleasant and enjoyable and thus they learned permanently and more easily. What's more, another significant conclusion that has been reached is that none of the students made negative statements related to concept cartoon technique. The research of Kılıç-Özün (2010) also supports this conclusion. Likewise, Ekici, Ekici and Aydın (2007) in their study reached the conclusion that almost all of the students made positive statements related to concept cartoons.

The majority of the students interviewed (by 75% frequency) expressed the fact that lessons taught with concept cartoons enabled them to integrate science topics into everyday life. The students also write sentences exemplifying the association with everyday life in their Science journals. Similarly, Cengizhan (2011), in his study, has reached the conclusion that students are of the opinion that concept cartoons which he used in his study were integrated into everyday life. Çiçek (2011) also indicates that the students with whom he made interviews described concept cartoons as including everyday situations, making discussion possible and being enjoyable and being the reason for permanent learning. Besides, İnel, Balım and Evrekli (2009) have revealed similar results in their study.

Another conclusion that was reached is the fact that concept cartoons changed student' perceptions about Science and Technology course in a positive way to a great extent. Students asserted that Science and Technology courses which were taught with concept cartoons increased their interest for the course. Moreover, they stated that they did not forget what they learned in the lesson which also provided consisted learning. In this sense, findings obtained from the interview have similar results with İnel, Balım and Evrekli (2009) and Kuşakçı-Ekim (2007)'s studies.

When the influence of concept cartoons on students' motivation for the course is examined, it is observed that the students by 83.3% frequency stated that this technique contributed to their motivation in a positive way. The students used some expressions like 'I listened to the teacher more willingly', 'the lesson was more enjoyable' and 'I was able to pay attention to the lesson today' which could be interpreted as a positive contribution to the students' motivation in their journals. Similarly Özüredi (2009) has concluded that concept cartoons have a positive effect on motivation of students in his study.

All of the students interviewed stated that the concept cartoons have a positive contribution to their success. Concept cartoons are effective methods in improving students' success (Durmaz, 2007; Özyılmaz-Akamca, Ellez & Hamurcu, 2009; Evrekli, Balım, 2010; Gölgeli & Saraçoğlu, 2011; Kılıç-Özün, 2010; Evrekli, İnel, Balım, 2011). In addition, Students involved in the study stated that especially this technique contributes to their learning. When the studies on this subject have been examined, any negative perception have not been encountered related to the concept cartoons stated by the students. It is seen that the students involved in the

studies of Ekici, Ekici, & Aydın (2007); Kuşakçı-Ekim (2007); İnel, Balım & Evrekli (2009); Özüredi (2009); Yarar (2010) and Çiçek (2011) expressed concept cartoons have an impact on their success. In addition, it is a remarkable finding that the students have informed that the lessons taught by concept cartoons have an effect on their learning concepts they know partially or they do not know. In this case, it can be said that the concept cartoons help learning new information students encounter and contribute to increase their success. The majority of students have reported that concept cartoons contribute to learn the lesson with having fun and increase their success (Yarar, 2010).

It is seen that the students interviewed expressed their desire to continue to have other units of Science and Technology taught with concept cartoons at the frequency of 91.7%. It is understood that students prefer especially abstract topics to be taught with this technique when the perceptions of students have been analyzed. In this case, it can be concluded that the concept cartoons embody students' abstract information. Similarly Kuşakçı-Ekim (2007) stated that the students wanted to see concept cartoons in Science and Technology courses in her study. However, it is seen that the students also want to use the concept cartoons in other lessons.

Some of the students expressed their desire to use the concept cartoons for all lessons. The results of the studies of Kuşakçı-Ekim (2007); İnel, Balım and Evrekli (2009) and the Çiçek (2011) supported the students' perceptions of this issue. The students wanted to use this technique for especially verbal courses, but they expressed it cannot be used in Maths. Some of the students expressed their desire to use the concept cartoons for all courses. The results of the studies of Kuşakçı-Ekim (2007); İnel, Balım and Evrekli (2009) and Çiçek (2011) supported the students' perceptions of this issue. The students wanted to use this technique especially for verbal courses, but they expressed that it cannot be used in Maths.

When the difficulties encountered in the practice of concept cartoons during the course were asked to the students, some of the students stated that they had difficulty in doing the concept cartoon activities individually and some of them stated that they had difficulty in doing concept cartoons in a group. In this case, it can be said that some of the students enjoy studying alone, and some of them like studying in a group. Almost all of the students (at the frequency of 91.7%) stated that there was not an incomplete aspect of this technique. One student expressed that he/she did not like only the discussions in the course room. In addition, students stated that they had fun while their teacher was teaching lesson with concept cartoons and this technique made easier to their understanding.

The most important finding from students' journals is that students have used a large number of positive sentences for this technique. Students also have presented many examples of experience, knowledge and skills in their journals. This also shows that they have learned a lot about the subject by concept cartoons and they have developed a positive attitude towards Science courses.

According to the findings of the study, elementary 7th grade students stated concept cartoons have many beneficial effects on Science and Technology courses. Students expressed that this technique aroused their interest, provided a better learning and enabled a permanent learning. The students stated that the concept cartoons were enjoyable and pleasurable in their science journals and the interviews. In addition, almost all of the students interviewed expressed their desire to continue to learn subjects with the concept cartoons in Science and Technology courses. Similar perceptions were also stated in the students' journals.

Recommendations

As a result, it is able to suggest that concept cartoons should be used in educational programs related to science courses in accordance with the data obtained from the students' journals and their perceptions of the practice of concept cartoons in science and technology courses. However, candidate teachers should be given opportunity to do practices with concept cartoons in such courses as special teaching methods, teaching methods and techniques, and material design. It may also be suggested that animated concept cartoons could be presented in the virtual environment. In addition, the following suggestions can be put forward for researchers who want to study on this subject:

- Research studies can be done to determine the effectiveness of the practice of concept cartoons in other courses,
- Similar researches can also be done in different grades of education.
- This study was carried out in the unit "Force and Motion" of 7th grade. The effectiveness of this technique can be evaluated by practicing education program supported by concept cartoons in different units and subjects.

- More extensive researches can be done by using different means of data collection such as teacher observations and video recording.

Acknowledgements or Notes

References

Ayva, Ö. (2010). Student views about learning and teaching process of social sciences. *International Conference on New Trends in Education and Their Implications,* Antalya, Turkey.

Balım, A. G., İnel, D. & Evrekli, E. (2008). The effects the using of concept cartoons in science education on students' academic achievements and enquiry learning skill perceptions. *Elementary Education Online, 7*(1), 188–202.

Balım, A. G., Kesercioğlu, T., İnel, D & Evrekli, E. (2009). Researching the opinions of pre-service science teachers about constructivist approach according to different variables. *Ondokuz Mayıs Üniversitesi Eğitim Fakültesi Dergisi, 27*, 55-74.

Carin, A. & Bass, J. (2005). *Teaching science as inquiry.* Upper Saddle River, New Jersey: Pearson Prentice Hall.

Ceylan-Soylu, H. (2011). *An activity example prepared based on 7e teaching model of concept cartoons in science and technology teaching: electricity in our life.* 2nd International Conference on New Trends in Education and Their Implications. Antalya.

Chen, W., Ku, H. & Ho, Y.C. (2009). *Applying the strategy of concept cartoon argument instruction to enpower the children's argumentation ability in a remote elementary science courseroom.* Hollanda, Amsterdam: 13th European Conference for Research on Learning and Instruction.

Chin, C. & Teou, L. Y. (2009). Using concept cartoons in formative assessment: scaffolding students' argumentation. *International Journal of Science Education, 31*(10), 1307–1332.

Cengizhan, S. (2011). Prospective teachers' opinions about concept cartoons integrated with modular instructional design. *Education and Science, 36*, 93-104.

Çepni, S. (2007). *Introduction to research and project studies*, Celepler Publishing, Trabzon.

Çiçek, T. (2011). *The effect of concept cartoons on student achievement, attitude and permanence in science and technology courses in elementary school 6th grade.* (Unpublishing master's thesis). Celal Bayar University, Manisa, Turkey.

Durmaz, B. (2007). *The effects of the concept cartoons to the success of the students and sensory features in the constructivist science teaching (Muğla provincial, administrative district sample).* (Unpublishing master's thesis) Muğla University, Muğla, Turkey.

Ersoy, A. F. & Türkkan, B. (2010). Analyzing social and enviromental issues elementary school students reflect in their cartoons. *Education and Science, 35*(156).

Ekici, F., Ekici, E. & Aydın, F. (2007). Utility of concept cartoons in diagnosing and overcoming misconceptions related to photosynthesis. *International Journal of Environmental & Science Education-IJESE, 2*(4), 111-124.

Evrekli, E. & Balım, A. G. (2010). The effect of use mind mapping and concept cartoons in science and technology education on students' academic achievements and inquiry learning skill perceptions. *Western Anatolia Journal of Educational Sciences, 1*(2), 76-98.

Evrekli, E., İnel, D. ve Balım, A. G. (2011). A research on the effects of using concept cartoons and mind maps in science educations. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education,, 5*(2), 58-85.

Gölgeli, D. ve Saraçoğlu, S. (2011). The effect to students' academic success of the use of concept cartoons in teaching of "light and sound" unit of science and technology course. *Erciyes University Journal of the Institute of Social Sciences, 2*(31), 113-124.

İnel, D. & Balım, A. G. (2011). The effect of concept cartoons assisted problem based learning method on motivation about science learning of secondary students. *Uşak University Journal of Social Sciences, 4*(1), 169-188.

İnel, D., Balım, A. G. ve Evrekli, E. (2009). The opinions' of students about the use of concepts cartoon in science and technology education. *Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education, 3*(1), 1-16.

Kabapınar, F. (2005). Effectiveness of teaching via concept cartoonsfrom the point of view of constructivist approach. *Educational Sciences: Theory & Practice, 5*(1), 101–146.

Kabapınar, F. (2009). What makes concept cartoons more effective?: Using research to inform practice, *Education and Science*, *34*(154), 104-118.

Karasar, N. (2004). *Scientific research methods*. Nobel Publishing, Ankara.

Keogh, B. & Naylor, S. (1999). Concept cartoons, teaching and learning in science: an evaluation. *International Journal of Science Education*, *21*(4), 431-446.

Kılıç Özün, S. (2010). *The effects of concept cartoon approach to student achievement and attitude in life science teaching*. (Unpublishing master's thesis). Zonguldak Karaelmas University, Zonguldak, Turkey.

Kirisçioğlu, S. & Başdaş, E. (2007). *Concept cartoons and activity examples that can be used in science and technology lessons in constructivist learning environment.* Ankara, Özel Tevfik Fikret Okulları: Eğitimde Yeni Yönelimler IV: Yapılandırmacılık ve Öğretmen.

Kuşakçı-Ekim, F. (2007). *The effectiveness of concept cartoons on overcoming students' misconceptions in elementary science teaching.* (Unpublishing master's thesis). Ankara University, Ankara, Turkey.

Larsson, J. & Holmström, I. (2007). Phenomenographic or phenomenological analysis: does it matter? examples from a study on anaesthesiologists'work. *International Journal of Qualitative Studies on Health and Well-being,* 2, 55-64.

Miles, M. B., & Huberman, A. M. (1994). *An expanded sourcebook qualitative data analysis.* California: Sage.

Naylor, S. & Keogh, B. (2010). *Concept cartoons in science education.* Millgate House Publishers.

Özüredi, Ö. (2009). *The effects of concepts cartoons in elementary educations 7th grade science and technology lesson, in "food chain" subject of human and environment unit on students' academic achievements.* (Unpublishing master's thesis). Celal Bayar University, Manisa,Turkey.

Özyılmaz Akamca, G. ve Hamurcu, H. (2009). Analogies, concept cartoons and forecast observation-explanation technigues supported science and technology education. *E-Journal of New World Sciences Academy, 4*(4), 1186-1206.

Stamouli, I & Huggard, M. (2007). *Phenomenography as a tool for understandıng our students*. International Symposium for Engineering Education, Dublin City University, Ireland. 08.07.2013 obtained from http://doras.dcu.ie/447/1/Stamouli-huggard_ISEE07.pdf on.

Şaşmaz-Ören, F. (2009). Evaluation of prospective teachers' abilities of forming concept cartoon with rubric. *E-Journal of New World Sciences Academy-NWSA, 4*(3), 994–1016.

Şaşmaz-Ören, F., Karatekin, P., Erdem, Ş. & Ormancı, Ü. (2012). Determining of teacher candidates' level of knowledge on the issue of plant respiration-photosynthesis through concept cartoons and its analysis depending on different variables. *Ahi Evran Üniversitesi Kırşehir Eğitim Fakültesi Dergisi,* 13(3), 155-174.

Uğurel, I. & Moralı, S. (2006). Cartoons and their use in mathematics teaching. *National Education, 35*(170), 32–47.

Yarar, S. (2010). *The using of learning objects prepared in flash program and supported by the concept cartoons in social studies.* (Unpublishing master's thesis). Rize University, Rize, Turkey.

Watson, J. (2000). Constructive instruction and learning diffuculties. *Support for Learning,* 15(3).

Appendix 1: Opinion Form Used in the Study and Interview Questions

Dear students,

These interview questions have prepared in order to take your opinion about Science and Technology courses taught with concept cartoons in the unit of "Force and Motion". Your answers for the questions will have no effect on your academic success as a value of mark. For this reason, it is very important to express your views on questions in a clear way for interpreting the results of the study correctly.

If you do not mind, I want to record this interview with a video recorder. These records will only be used to evaluate your statements. Our speech and your name will be definitely confidential.

Thanks for the answers in advance…

1. What did you think of when you saw concept cartoons for the first time?
2. We taught Science and Technology courses using concept cartoons. What do you think about teaching lessons with this technique?
3. What do you think about the effects of Science and Technology courses taught with concept cartoons on students?
4. Were the Science and Technology lessons taught with concept cartoons different from other science and technology lessons? If yes, Can you explain it, please?
5. Did the lessons that you had with concept cartoons have any influence on associating Science topics with everyday life? Why? Can you explain it with an example?
6. Did Science and Technology lessons taught with concept cartoons change your attitudes towards this school subject? Why?
7. Did concept cartoons have influence on the motivation for the course? How? Can you explain it, please?
8. Do you think having courses with concept cartoons have any influence on your success? Why?
9. Did this study have any influence on learning concepts that you did not know or knew imperfectly? If yes, can you give an example?
10. Would you like to learn other units of Science and Technology units with concept cartoons as well? Why? Can you explain?
11. Would you like to have other courses with concept cartoons as well? Why? Can you explain?
12. Did you have any difficulties in concept cartoon applications during the courses?
13. Do courses taught with concept cartoons have any deficient aspects? If yes, what are they?
14. Is there anything you want to add related to concept cartoons? If yes, can you explain it, please?

Appendix 2: An Example of the student journals