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Application of the Six Thinking Hats and SCAMPER Techniques on the 7th Grade Course Unit "Human and Environment": An Exemplary Case Study

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This study aims at revealing the efficiency of the application of the instructional design prepared via the Six Thinking Hats and SCAMPER techniques. The question "How do 7th grade students associate the course unit Human and Environment which is taught via the Six Thinking Hats and SCAMPER techniques?" constitutes the problem of the study. For this purpose, the case study method, which is a method of qualitative research, was used in the second semester of the academic year 2012-2013. The study group consists of 20 students in total, including 10 girls and 10 boys studying at the 7th grade at a full time secondary school in Beykoz district of Istanbul province. The primary source of data in the study included observation, open-ended question form and document while interviews were employed as the secondary source of data. The data acquired upon the study were analyzed through content analysis. This study provides awareness to the students with the instructional design prepared via The Six Thinking Hats and SCAMPER techniques. As a result of the study shows that students were seen to have performed improvement in comparing ecosystems in terms of diversity of living creatures and climatic features. It was revealed that majority of the students have a negative/ pessimistic approach regarding the world and the environment in future both before and after the application; and they possessed the main point of view that the "world will be a dirty place" in future.

Introduction

Educational practices in today's world vary in parallel to development of technology. Accordingly, countries embark on new quests to enhance quality of education, acting from the principle that scientific and technological development is possible only by means of education. As the main purpose in education is to teach individuals the paths to access available information rather than directly conveying the information and to guide such individuals and ensure them to adopt ways to generate solutions by using their scientific process skills against new situations they encounter, the mentioned purpose involves, among other courses, teaching of science so as to enable individuals to acquire such qualifications (Güneş, Dilek, Hoplan and Güneş, 2011). As a consequence, science and science teaching has been gradually gaining importance and all nations place a particular importance to improving science education. In line with this purpose, countries endeavour to develop their science

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teaching programs, enhance qualifications of their teachers and provide educational institutions with dedicated devices and equipment (Ayas, Çepni and Akdeniz, 1993). The same situation in Turkey manifests itself through arrangements in educational programs. Science and technology education program, which has been in practice since 2005 and is based upon Theory of Constructivism, has enabled implementation of science education practices by means of a variety of methods and techniques.

When the studies carried out in the field are examined, it is observed that application and functionality of learning and teaching especially aim at highlighting student ideas and improving such ideas through various discussion environments and finally emphasizing the process of introducing an original product on basis of creative thinking (Kaptan and Korkmaz, 2002; İşman et al., 2002; Koray, 2003; Yaman, 2003; Koray, 2004; Aksoy, 2005; Aktamış and Ergin, 2006; Demirci, 2007). These teaching methods are role plays, excursion - observation, projects, discussions and problem - solving method. Moreover, there are also researches studying how frequently these teaching methods and techniques are used and applied. Upon the study performed by Aktepe and Aktepe (2009), student opinions regarding techniques used by science and technology teachers in teaching were acquired and it was found out that the method of "discussion by the entire class on the subject of course" is used on every occasion but ranks fourth among teaching methods. Whereas, Aydede, Çağlayan, Matyar, and Gülnaz (2006) reported that they mainly use the lecture method, not the techniques such as brainstorming and group work, which should actually be used as they emphasized. Nevertheless, results of the research revealed statements by teachers that they do not have adequate knowledge about these techniques. This refers to the requirement that teachers should have competence in fields of efficient teaching methods and technologies (Kılıç, 2001). Moreover, the study performed by Aydede et al., (2006) yielded the result that teachers do not use these techniques as they find them highly time-consuming, class hours are inadequate and course loads are high. However, researches carried out in the field manifested that such methods and techniques are feasible and that they play an efficient role in development of individuals' creativity (Atkıncı, 2001; Dinç, 2000). In this context, the Six Thinking Hats and the SCAMPER (directed brainstorming) techniques were discussed as the teaching techniques, along with the technique described.

The Six Thinking Hats Technique

The Six Thinking Hats technique is a method created by Edward de Bono (1985) and use for presenting thoughts and suggestions in a specific order and systematizing them. The main theme of this method is that it offers "role play" feature. As the self-defence instinct of the individual is the primary obstacle restricting thinking, hats expressly enable consideration and expression of ideas which would otherwise not be thought and stated. In addition, the Six Thinking Hats allows the individual to handle a specific issue from the Six different points by directing attention in order from one point to another (De Bono, 2002; Erginer, 2000). This technique may require the person to think positive or negative, become creative or give an emotional reaction (Erginer, 2000).

The Six Thinking Hats technique prevent people from remaining within a frame in their thinking and seeing events from a unidirectional perspective. As the technique allows thinking from different perspectives, it enables analysis of the issue from every aspect and a correct decision making process. The hats available in the technique cover a large number of ways of thinking. And as the technique is easy and enjoyable to apply, it is quickly adopted by people (Can, 2005, p. 43). During their study, Altıkulaç and Akhan (2010) pointed out that the Six Thinking Hats technique has applicability and this technique assures a more

permanent education and enhanced creativity for students. Moreover, Can and Semerci (2007) reported that this technique provided a higher increase in success, and that students were insistent especially on wearing the white hat. Also, the study performed by Kaya (2013) revealed that the Six Thinking Hats technique has a more positive impact in sustainable development of children compared to other techniques in the teaching program.

A literature review on the Six Thinking Hats technique proves that this is an important technique for science education which requires individuals to apply the information they learned on facts of daily life as the technique enhances creative thinking.

SCAMPER (Directed Brainstorming)

SCAMPER is defined as "a sort of practical and entertaining brainstorming technique which is inherent in the discussion method, ensuring implementation of the method by putting in into practice" (Yağcı, 2012, s. 486). This originated as a technique initially used by Eberle (1971) to enhance creativity of students. For this technique, an object or a person is chosen and then changed and developed through brainstorming. Common stories well known by everyone can as well be used. To do so, questions are directed to the child. The questions encourage the child to think in such a way that he/she has not been familiar with before. Such questions are, in a sense, a driving force to allow them acquire different thinking skills. They improve thinking in children, encouraging them to discover. The technique also teaches how to think in a flexible fashion and to break patterns (Yıldız and İsrael, 2001). According to Michalko (2000), the basic philosophy of this technique suggests that "Every idea is born out of another existing idea" (as cited in Yıldız and İsrael, 2001). Nevertheless, Serrat (2009) mentioned that SCAMPER technique allows differentiation in thinking ways of students, improving their problem solving skills and creativity. Buser at al., (2011) observed in their study that three themes come in sight. These three themes emerged: SCAMPER model as a method to stretch our thinking; value of structured creativity; and shifting from right or wrong; application to flexibility and flow. Similarly, Gladding (2011) reported that this technique influenced the life of students and ensured them to be better by enhancing their intellectual skills.

Science Education

Science education is a domain which aims at identifying and describing the physical and biological world and is not only a total of facts about the world but is also a field in which students have to develop their power of thinking as it contains in itself a way of thinking requiring logical thinking and continuous questioning. Additionally, it is stated that science education is employed in the individual's decision-making on scientific processes and principles and it allows the individual to participate in discussions on scientific matters and to develop skills to produce ideas on the matters (Akçay and Yager, 2010). Consequently, science education ensure individuals to endeavour to understand the nature, natural phenomena, science, technology and the nature of science; to understand fundamental concepts, principles, laws and theories of science and to use them in a consistent manner; to comprehend the interaction between science, technology, society and environment, to improve their scientific and technical psychomotor skills, to have scientific attitude and values, and to become active individuals generating solutions for problems of daily life through scientific ways of thinking by realizing facts of life and making inferences (Toraman, 2013). This approach indicates the requirement that individuals must learn science and acquire the skills referred to above.

It is considered that the efficient use of an instructional design prepared with SCAMPER and the Six Thinking Hats techniques will guarantee development in students' thinking and problem solving skills and creativity and will enable them to create an original, new, consistent and process-supporting product after creative activities. In this frame, efficiency of the application of "Human and Environment" unit in scope of science and technology class was assessed by using the Six Thinking Hats and SCAMPER (Directed Brainstorming Technique) in the study. The question "How do 7th grade students associate the course unit Human and Environment which is taught via the Six Thinking Hats and SCAMPER techniques?" constitutes the problem of the study. The study is expected to reveal results regarding efficiency of the Six Thinking Hats and SCAMPER techniques in field of science. Moreover, it is considered that the study will contribute to the domain as no application via SCAMPER technique could be found in respect of science education.

Method

Research Model

This research is a case study designed in conformity with the qualitative research paradigm. A case study is defined as an empirical inquiry that investigates a contemporary phenomenon within its real- life context, especially when the boundaries between phenomenon and context are not clearly evident, and that relies on multiple sources of evidence and multiple data collection methods (Yin, 1994, p. 23). An instructional design related to 'Human and Environment' unit was developed for 7th grade students and applied via the Six Thinking Hats and SCAMPER techniques in the study. The instructional design implemented in line with the findings obtained upon the application was assessed in terms of efficiency. In this context, the study comprising an assessment on the teaching process in the view of a number of factors (environment, individuals, cases, processes, etc.) has been ascertained as a case study of inherently qualitative research patterns.

Participants

The study was performed at a public school in Beykoz district of Istanbul province, providing full time mobile education. The application was realized with 7th grade students by their science and technology teacher at the mentioned public school. The researchers acted as observers during the study. Criterion sampling, which is used in qualitative researches, was used in the study. The purpose and the fundamental approach here is to study all circumstances meeting a series of predefined criteria (Yıldırım and Şimşek, 2011, p. 112). The criterion in this study is that the teacher applying the technique is in the first year of teaching in his professional life. The 7th grade students subject to the study are 20 students in total, including 10 girls and 10 boys. 10 out of the students in the study group go to school on foot and the other 10 via transportation system. The average age of the students is 13; the other details about the students are provided in Table 1 below.

Table 1. Descriptive statistics regarding the students

Father's Educational Status	**Frequency**
Primary School	12
Secondary School	2
High School	4
Associate's degree	1
Undergraduate	1
Total	20
Mother's Educational Status	**Frequency**

Illiterate	5
Primary School	11
Secondary School	2
High School	2
Total	20
Father's Occupation	**Frequency**
Worker	8
Self Employed	8
Retired	2
Other	2
Total	20
Mother's Occupation	**Frequency**
Housewife	15
Worker	3
Self Employed	2
Total	20
Number of Siblings	**Frequency**
Only child	2
Two siblings	10
Three siblings	4
Four siblings	3
Five siblings	1
Total	20

Data Collection Tools

Having regard to the research questions ascertained in the study, the researchers collected data in the related domain with a view to identify the problem in further detail and to obtain suggestions as to solution of the problem. As mentioned, data triangulation (Yıldırım and Şimşek, 2011, p. 267) was performed in consistence with the nature of the study in order to strengthen the validity of data and enrich the significance of results, as qualitative research model was employed in the study. The researchers used observations, open-ended question form and document as the primary source of data and interviews as the secondary source of data. Data collection tools are described below.

Participant Observation

Participant observation is referred to as the circumstance where the researcher enters the research environment, collects samples at first hand and contributes to source of data. Trying to understand the actual life in the environment in this process, the researcher also records the behaviours displayed in the environment. The researcher listens to conversations of the study group and observes their behaviours during the process of data collection. When required, the researcher builds a communication with the sample and asks questions about the subject in an effort to understand meanings and reasons of the behaviours (Çepni, 2010). In this study, the researcher attended the class throughout the implementation of instructional designs and recorded the observations made.

Open-Ended Question Form

Open- ended question forms were applied in conformity with learning outcomes of the 7th grade students so as to identify their situations before and after the application. The questions were prepared for the 7th grade students by having regard to their learning outcomes and the explanations in 'Human and Environment' unit. The questions prepared by the

researchers were assessed by the experts of the domain and found appropriate. The open-ended question form contains 7 questions.

Document Review

Document review comprises an analysis of written materials containing information about the phenomenon / phenomena subject to research. Yıldırım and Şimşek (2011, p.188) referred to documents as important sources of information which have to be efficiently used in qualitative researches, and they laid stress on the importance of documents in the aspect that they provide the data needed by the researcher without requirement for observations or interviews. Social researchers have various opinions about documents which can be used as documents. Punch (2005) states that documents include diaries, letters, essays, personal notes, biographies and autobiographies, notes and reports, while Böke (2009) states that video and audio records, photographs and drawings can also be used in document review in addition to the mentioned items. Whereas May (1996) and Robson (2001) indicated that letters, compositions, maps, pictures, photographs and diaries collected from students are documents which can be used in document review. In this study, field notes/ researcher's log, products created by students in scope of the research (cardboard activities, banners, posters), letters written by students to their teachers at the end of the period were all considered as documents.

Interviewing

Interviewing is a data collection technique by means of verbal communication (Karasar, 2002, p. 165). Briggs (1986) suggests that interviewing is the most widely applied technique for conducting systematic social inquiry. Semi-structured interviews were held in this study where researchers were participant observers. During the researches held with students, the researchers adopted the principle of "moving with the current" as indicated by Patton (1987, p. 110). The researcher kept notes and voice records during the interviews. Voice records were transcribed and converted into text.

Empiric Process

First, the learning outcomes in the science and technology education program of the Turkish Ministry of Education (MEB) were examined for formation of instructional designs for the Six Thinking Hats and SCAMPER techniques prepared for the 'Human and Environment' unit of Science and Technology class for 7^{th} grade students. Basic concepts regarding the learning outcomes which students were supposed to achieve at the end of the period were focused on acting from the learning outcomes in the science and technology education program of MEB; designs and the open- ended question form were prepared by the researchers by having regard to preparedness and pre-learning of students. The open-ended question form prepared was directed to students before and after the application. In order to find out which of the two techniques in the design affect the associated educational learning outcomes, a table was prepared to show that techniques and associated educational learning outcomes would be included in the instructional design. The details about the techniques, learning outcomes and the associated teaching outcome are submitted in Table-2 below:

Table 2. Technique applied, learning outcome and associated instructional design

Technique Applied	Learning Outcomes	Associated Instructional Design
SCAMPER	**1. With regard to areas in which organisms live and the human impact on such areas, students:** 1.1. Explain the concepts of species, habitat, population and ecosystem with examples.	Instructional Design 1
SCAMPER	1.2. Explain relationship of living organisms in an ecosystem both with each other and non-living factors. 1.3. Make predictions on living creatures which may be existent in different ecosystems. (SPS-9)	
SCAMPER	1.4. Compare ecosystems in terms of diversity of living creatures and climatic features. (SPS – 5, 6). 1.5. Realize the biological diversity in the ecosystem and emphasize its importance.	Instructional Design 2
THE SİX THINKING HATS TECHNIQUE	1.6. Give examples to plants and animals facing the danger of extinction both in our country and worldwide. (SPS -25; STSE – 22, 23, 26) 1.7. Make suggestions as to how plants and animals which face the danger of extinction in our country and worldwide. (SPS–32; STSE – 21, 22, 23, 24, 27)	Instructional Design 3
THE SİX THINKING HATS TECHNIQUE	1.9. Collect and submit information about one of the environmental problems in our country and worldwide, and discuss on its results. (SPS 25, 32; STSE – 18, 20, 21, 26, 27, 29)	Instructional Design 4
THE SİX THINKING HATS TECHNIQUE	1.10. Make inferences of how an environmental problem in the world may affect our country. (SPS, 8; STSE – 18, 20, 21, 28).	Instructional Design 5
THE SİX THINKING HATS TECHNIQUE	1.11. Suggest solutions and attend activities aiming at collaboration against environmental problems in our country and worldwide. (STSE – 20, 21, 22, 23, 24, 26, 27; AV –4)	

The content of the instructional design was prepared by means of the Six Thinking Hats and SCAMPER techniques in conformity with the learning outcomes addressed on unit basis. Students in scope of the designs prepared through the Six Thinking Hats technique were divided into groups by the teacher in such a way that they would have hats which are opposite of their own personal features. As the study group consisted of twenty students, three groups were obtained in the designs prepared through the Six Thinking Hats technique. The remaining two students observed each group in the development stages in the implementation of designs took notes of their discussions and gave feedbacks to the groups in the discussion

processes. The same practice was applied in every teaching design implemented through the Six Thinking Hats technique; it was ensured that there were different students observing the groups and taking notes in each design. All materials to be used in the courses (worksheets, cardboards, etc.) were prepared by the researcher. Visual materials were supplied to support group studies; additionally, newspaper reports, documentaries, journals and photographs containing examples of daily life were also provided to attract higher interest of the students. Such tools were used as the introduction activities. During the development activities, students were asked to choose a situation on the visual tool employed, and to assess that situation in conformity with the Six Thinking Hats method. For the evaluation dimension of design, students were expected to create a variety of products to confirm their learning outcome in conformity with each design. Those products formed documents such as banners, posters, etc.. Tools such as cardboard, craft papers, etc. were supplied by the researchers for the materials/ products which are planned for assessment as documents in scope of designs in courses. Moreover, students were asked to provide their teachers with projection regarding the process of learning and education after completion of the unit for the evaluation dimension of design. Students were assessed in their groups and provided with orientation during the process. Ideas produced after the lessons provided via the Six Thinking Hats technique were evaluated in the class and recorded during the course period. In addition to the records kept in the courses, products created by students were also assessed in terms of whether the educational learning outcome ascertained was achieved. Additionally, interviews were held with students and teachers; field notes of the teacher and observations of the researcher were evaluated as data. Unlike the Six Thinking Hats technique, courses in the designs prepared through SCAMPER technique were provided for individual students without grouping them. However, the practices are alike in terms of the content, process and evaluation.

Process Steps of the Research

The following steps were pursued in implementation of the instructional design practice prepared via the Six Thinking Hats and SCAMPER methods:

(1) Prior to application of the instructional design, demographic information were obtained regarding the individuals receiving education in the class subject to the application and observation was made in the classroom. Inquiries were made for the teacher's practices in scope of science and technology courses.
(2) Prior to application of the instructional design, an open-ended question form prepared by the researchers and consisting of seven questions was applied to determine preparedness of all students in the classroom.
(3) Application of the open-ended question form was followed by application of the instructional designs.
(4) The application took 3 weeks (12 course hours). During the period of application, one of the researchers made an observation and an evaluation in terms of the conformity of the applied program with principles of the instructional design. As mentioned earlier, the application was not performed by researchers but by the science and technology teacher performing duty at the school subject to the application. Nevertheless, the practice teacher who took an active role in the period of application was ensured to take field notes.
(5) At the end of the practice, the open- ended question form applied before the application of instructional design was re-applied and students were interviewed.

Data Analysis

In their natural course, qualitative researches incorporate different perspectives towards social life, types of analysis and a variety of perspectives and practices in analysis of qualitative data. Yıldırım and Şimşek (2011) indicate that each researcher is expected to develop a data analysis plan for their own research by acting not only from properties of research but also from properties of data collected and reviewing existing methods of analysis.

At the end of the research, the data to be obtained under the light of the open-ended question form, documents, observations and interviews was interpreted through a content analysis. The main purpose is to have access to concepts and relationships that will be capable of explaining the data collected. Data are subject to a more thorough process in content analysis; concepts and themes which cannot be realized with a descriptive approach may be revealed upon such analysis. In this context, the content analysis of the data obtained upon the research was examined by three science education experts of the domain, and the data were inspected in terms of relevancy.

Findings

Findings Regarding the Instructional Design-1

In the first instructional design prepared via SCAMPER technique, the aim was to provide students with the following learning outcome: "Explain the concepts of species, habitat, population and ecosystem with examples.", "Explain relationship of living organisms in an ecosystem both with each other and non-living factors." and "Make predictions on living creatures which may be existent in different ecosystems. (SPS – 9)" In this frame, two questions were directed to the students. The analysis of the answers given to these questions by the students is presented below.

In conformity with the learning outcome: "*Explain the concepts of species, habitat, population and ecosystem with examples.*", students were asked to give examples to these concepts and explain them. Prior to the application, it was observed that 14 students gave unsuitable/ wrong answers regarding the concepts. The expression *"Habitat: Van cat, because it exists only in Van"* by E_5 constitutes an example to unsuitable answers. It was observed that two students knew only the concept of habitat but did not give examples to that concept. The expression "*Habitat is a place where living creatures can survive and reproduce."* by E_3 was submitted as an example to this concept. One student knew only ecosystem but could not give examples. The answer "*Ecosystem is a community in which living and non-living creatures exist.*" K_1 is an example to this situation. It was observed that (K_5) knew all the concepts but did not give examples. However, after the application, it was seen that all students knew the concepts in response to the questions directed and gave suitable examples to the concepts.

In conformity with the following learning outcomes: "Explain relationship of living organisms in an ecosystem both with each other and non-living factors." and "Make predictions on living creatures which may be existent in different ecosystems.", students were asked the following question. "*Select one of the ecosystems such as lake, sea, forest, etc. and explain the relationship of living and non-living creatures in these ecosystems with each other.*" When the answers obtained before the application were examined, it was found out that 5 students gave unsuitable answers. The answer "*Sea: It is actually transparent but it is seen in blue colour as the colour of the sky is reflected on the sea*." by the student with code E_4 constitutes an example to unsuitable answers. On the other hand, it was found out that 1

student selected one of the ecosystems and gave only one example which was for relationship of living creatures with each other; and 14 students selected one of the ecosystems and mentioned only the living creatures in that ecosystem but did not comment on the relationship between them. After the application, it was found out that 19 of the students answered to the same question and only 1 student did not. All of the 19 students who gave answers to the question were seen to have selected an ecosystem to explain and properly described relationships of living and non-living creatures with each other. The expression by K_1 is an example to this situation after the application: *In a forest ecosystem, grass is fed by the energy that it receives from the sun. Grass is eaten by grasshopper. Snake preys on grasshopper and owl preys on snake. These creatures live in such a relationship.*

With regard to the three learning outcomes referred to in the instructional plan implemented via SCAMPER technique, the music of a forest ecosystem was played in the classroom. By asking them to know which ecosystem the music they heard belongs to, students were ensured to have access to the concept of "ecosystem"; they were also asked to choose a creature during Substitute stage, and were ensured to acquire the knowledge during the Combine stage that the mentioned concept is "species"; that the community formed by creatures coexisting in a specific area with selected the creature (species) is "population"; and during the Adapt stage, they were ensured to acquire the knowledge that that the environment in which the selected creature (species) exists is "habitat" and they were enabled to build the relationships between living creatures. The results obtained upon the application revealed the efficiency of the instructional design prepared and applied through scamper technique. Additionally, it was observed in paintings drawn by students which form the evaluation stage of the instructional design that students drew paintings of the forest ecosystem that they discussed upon; and they properly showed the relationships between living and non-living creatures. During interviews with the students, 4 themes emerged in respect of this instructional design and the technique applied. These are: a different application (frequency rate of 18), learning by having fun and discussing (frequency rate of 15), imagination and creativity (frequency rate of 8) and empathy (frequency rate of 3). The expression by E_5, which contains multiple themes, is as follows: *We had too much fun. We have never taken such a different science class before. We learned by discussing.* Stating that taking a course accompanied by music has a positive influence on his imagination and creativity and a discussion environment contributed to his attitude, K_3 reported: "*We stated our opinions, I closed my eyes while the music was playing, and I dreamt of being there. It worked a lot. I felt as if all creatures were with me. And we also learned to respect each other while discussing the matter".* Whereas, the practice teacher İ.P. reported: "*I had never applied this technique before.. First I hesitated as I feared to experience any problem in application. But I received very good feedbacks from my students. They enjoyed the lesson very much. They realized that this is the only way for them to learn that they have to listen to each other even when the tension of debate is increased. Finally their attitude towards the lesson changed; their effort to express themselves as individuals improved their self -confidence and decision- making abilities."*

Findings Regarding the Instructional Design-2

The aim in the second instructional design prepared via SCAMPER technique was to ensure students to acquire the following learning outcomes in relation to areas in which organisms survive, and human impact on such areas; "Compare ecosystems in terms of diversity of living creatures and climatic features (SPS-5,6)." and "Realize the biological diversity in the ecosystem and emphasize its importance.". In this frame, one question was directed to the students. The analysis of the answers given to this question by the students is presented below.

It was found out that the question "Write about the biological diversity in ecosystems by comparing them in terms of diversity of organisms and climatic features." was answered as "I don't know" by 14 students. Also, three students gave unsuitable answers. The statement by E_{10} "For instance, fish is consumed in high amounts as it is abundant in Black Sea climate. Whereas, tourism is more feasible in Mediterranean climate." is an example to unsuitable answers. Moreover, three students gave their example in response to this question only on basis of the survival condition of a single species. This was exemplified by K_7's statement: "Penguins can't survive in a desert. Likewise, camels can't survive."

Students were handed out worksheets in relation to the two learning outcomes indicated in the instructional plan subject to SCAMPER technique. Worksheets contain a list in which there are three different ecosystems and different groups of species. Students were asked to match the species in the worksheets with the ecosystem which is suitable for the respective species. Later, each student was ensured to select one ecosystem and one species. Accordingly, each student was ensured to answer the questions arranged according to the stages: substitute, combine, adapt, modify, magnify, put to other uses, eliminate, reverse or rearrange.

When answers given by the students during and after the application were examined, it was found out that 9 out of the students often mentioned about forest ecosystem, 9 often mentioned about desert ecosystem and 2 often mentioned about tundra ecosystem. All of the students were seen to have included land ecosystems in their paintings which they drew for evaluation at the end of the instructional design, and to have also prepared cartoons and acrostic about land ecosystems. Materials prepared by the students were exhibited in the science and technology corner at the school. During interviews held with the students, they reported that they enjoyed drawing cartoons and painting (frequency rate of 18), that the lesson is much more fun and enjoyable for them (frequency rate of 20), and presentation of the materials produced by themselves at the science and technology corner to the entire school made them very proud of themselves (frequency rate of 11).

Findings Regarding the Instructional Design-3

The aim in the third instructional design prepared via the Six Thinking Hats technique was to ensure students to acquire the following learning outcomes in relation to areas in which organisms survive, and human impact on such areas; "Give examples to plants and animals facing the danger of extinction both in our country and worldwide." and "Make suggestions as to how plants and animals which face the danger of extinction in our country and worldwide.". In this frame, one question was directed to the students and the analysis of answers to the question is presented below.

It was found out that one student gave an unsuitable answer to the question "Give examples to plants and animals facing the danger of extinction both in our country and worldwide and write what can be done for conservation of these species" which was directed to the students before the application. The answer by E_2 "Results can be achieved by planting more trees and organizing a campaign to prevent environmental pollution." exemplifies this situation as it is rather related to solution of environmental pollution than creatures in danger of extinction. Also, seven students answered "I don't know" to this question. Frequencies of the examples given by twelve students in relation to creatures in danger of extinction and frequencies related to encodings including solution offers are submitted in Table 3.

Table 3. Analysis of answers regarding species in danger of extinction and their conservation

Species in Danger of Extinction		**Solution Offers for Conservation of Species**	
Encodings Before Application	**Frequency**	**Encodings Before Application**	**Frequency**
Seal	7	Preserving habitats	8
Penguin	2	Hunting ban	6
Polar bear	2	Making them breed	1
Hermit ibis	1		
Van cat	1		
Kangaroo	1		
Panda	1		
Ostrich	1		

K_1 gave the following answer as an example to the answers received prior to the application: Seals are creatures that live in the sea and that face the danger of extinction. We should keep habitats of seals clean and create healthy living spaces for them so that they will survive and be conserved. The student with code E_{10} answered: "Hermit ibis is in danger of extinction. So hunting must not be uncontrolled and it must be banned."

News reports, journals and photographs were handed out to the students with regard to the two learning outcomes mentioned in the instructional plan subject to the Six Thinking Hats technique. Later, the students were let to watch a documentary about the life story of penguins in danger of extinction, which they had seen in the photographs. Once the students completed the discussion process regarding protection of species in danger of extinction through the Six Thinking Hats technique, they were asked to prepare materials reflecting their solution offers and ideas, such as posters, banners, etc.

After the application, frequency rates of the examples given by students for species in danger of extinction and frequency rates of encodings containing solution offers under the light of the students' materials, open-ended question form and interviews are submitted in Table 4 below.

Table 4. Analysis of answers regarding species in danger of extinction and their conservation

Species in Danger of Extinction		**Solution Offers for Conservation of Species**	
Encodings After Application	**Frequency**	**Encodings After Application**	**Frequency**
Penguin	13	Preserving habitats	15
Seal	6	Hunting ban	9
Polar bear	6	Making them breed	3
Hermit ibis	5		
Anatolian leopard	2		
Short-beaked common dolphin	1		
Panda	1		

It was found out at the end of the application that all students gave suitable answers to the question. Unlike before the application, it was seen that the codes "*Anatolian leopard*" and "*short- beaked common dolphin*" appeared after the application; whereas, frequency rates of other encodings were seen to have increased. Moreover, it was found out that encodings

regarding solution offers for conservation of the species did not change but increased in terms of frequency.

The practice teacher İ.P. evaluated the instructional design and reported his observations of the students as follows: "*I had already used the Six Thinking Hats technique before. However, this instructional design impressed the children in a very different way probably as it contained many attractive visual elements. I closely examined their facial expressions while they were watching the documentary. They seemed to have a great wonder and interest. I think this proves that the instructional design is good and qualified. Another point that attracted my attention about the children was that this made a great contribution to improvement of their empathy skills. Also I am happy to see the positive change in their attitude towards the lesson.*"

Findings Regarding the Instructional Design-4

The aim in the fourth instructional design prepared via the Six Thinking Hats technique was to ensure students to acquire the following learning outcome in relation to areas in which organisms survive, and human impact on such areas; "Collect and submit information about one of the environmental problems in our country and worldwide, and discuss on its results.". In this frame, the question: "*What are the environmental problems in our country and in the world*? *Explain with examples*" was directed to the students and the analysis of answers to the question is presented below.

Table 5. Analysis of answers regarding environmental problems in our country and in the world

Environmental Problems			
Encodings Before Application	**Frequency**	**Encodings After Application**	**Frequency**
Environmental pollution	12	Air pollution	9
Destruction of forests	4	Stream pollution	8
Air pollution	3	Natural disasters	5
Global warming	1	Acid rains	5
Soil pollution	1	Global warming	5
Noise pollution	1	Nuclear pollution	4
Water pollution	1	Soil pollution	4
Unanswered	1	Water pollution	3
		Noise pollution	2
		Affective approach	3

As it is seen in Table 5, the codes observed in relation to the environmental problems in our country and in the world include "environmental pollution" with a frequency rate of 12, "destruction of forests" with a frequency rate of 4, "air pollution" with a frequency rate of 3, "global warming" with a frequency rate of 1, "soil pollution" with a frequency rate of 1, "noise pollution" with a frequency rate of 1 and "water pollution" with a frequency rate of 1. Also, 1 student left the question unanswered. When the student answers exemplifying the code "Environmental pollution" was examined, it was seen that all answers given by the students were the same and similar to the statement by the student with code E_1 "*People pollute the environment by dropping litter. I think this is the biggest problem both in our country and in the world."*

A news report was handed out to the students with regard to the learning outcome mentioned in the instructional plan subject to the Six Thinking Hats technique and they were asked to think and discuss on the subject. Later, the students were asked to write a composition containing their suggestions regarding environmental problems in line with the opinions they infer.

As is seen in Table 5, it was observed that a number of differences emerged in the encodings achieved regarding environmental problems in our country and in the world and their frequency. Unlike before the application, the codes "*Natural disasters*", "*Nuclear pollution*", "*Acid rains*" and "*Stream pollution*" were also observed after the application. Additionally, an increase was observed in frequency of the codes achieved after the application. The statements by three students at the end of the application were encoded as "*Affective approach*". The following answer by K_2 containing multiple codes exemplifies the situation: "*Air pollution, sea pollution, natural disasters and partly negligence of people are examples to environmental problems. For example, air pollution is caused by fumes emitted from factories. Sea pollution is also caused by our negligence. Pouring waste vegetable oil from kitchen basins causes sea pollution.*" .

During the interviews held, the students reported that the Six Thinking Hats technique had also been used in courses before but the current applications were different from the former ones. Moreover, students indicated that their observation, research and questioning skills developed, reporting: "*We started to think and question a lot more. For example, we observe the environment more often since we first experienced these applications. We examine more."* The practice teacher İ.P. supported such statements of the students, indicating that their awareness was raised.

Findings Regarding the Instructional Design-5

The aim in the fifth instructional design prepared via the Six Thinking Hats technique was to ensure students to acquire the following learning outcomes in relation to areas in which organisms survive, and human impact on such areas; "Make inferences of how an environmental problem in the world may affect our country." and "Suggest solutions and attend activities aiming at collaboration against environmental problems in our country and worldwide*"*. In this frame, two questions were directed to the students and the analysis of answers to the question is presented below.

The students were asked: "*What kind of a world (environment) will be waiting for us and the next generations in the next 2 decades? Why?"* Themes obtained from answers before and after answers and their frequencies are submitted in Table 6 below.

Table 6. Analysis of answers regarding the future of the world (environment) for the next generations in the next 2 decades

World in the Next 2 Decades (Environment)			
Themes Before Application	**Frequency**	**Themes After Application**	**Frequency**
Negative/ Pessimistic approach	16	Negative/ Pessimistic approach	15
Positive/ Optimistic approach	1	Positive/ Optimistic approach	3
Measure	1	Measure	2
Unanswered	2		

As is seen in Table 6, three themes emerged out of the data obtained from students' answers before the application. Theme "*negative/ pessimistic approach*" was observed with a frequency rate of 16; while theme "*positive/ optimistic approach*" was observed with a frequency rate of 1 and theme "*measure*" with a frequency rate of 1. Two students did not answer this question. E_2's following answer exemplified theme "*negative/ pessimistic approach*": "*I think that a more technological but a more heavily polluted world will be waiting for us.*"; whereas E9 answered: "*Everything will change for the good and the world will be a clean place*.". The answer by E_3 exemplifying theme "*Measure"* is as follows: "*A clean environment will be waiting for us if we take measures already.*"

When answers by the students after the application were examined, theme "*negative/ pessimistic approach*" was observed with a frequency rate of 15; while theme "*positive/ optimistic approach*" was observed with a frequency rate of 3 and theme "*measure*" with a frequency rate of 2. Also, all students were observed to have answered to this question. K_3 stated: "*A world lack of green environment will be waiting for us. This is because more buildings are constructed as the population grows, and people cut the trees to find more space for buildings.",* which exemplified theme "negative/ pessimistic approach". The answer by K_7 exemplifies the same theme: *What will be waiting for us is a world which is heavily polluted, and under the greenhouse effect, which is more easily exposed to harmful sun beams and acid rains. This is because we cause great damage on the environment by using things causing environmental pollution.*

Another question directed to the students was: "*What kinds of activities are being performed to address environmental problems in our country and in the world (ozone layer depletion, nuclear pollution)? What kind of activities do you additionally suggest?"*. Themes obtained before and after answers and their frequencies are submitted in Table 7 below.

Table 7. Analysis of answers regarding activities addressing environmental problems

Activities Regarding Environmental Problems			
Themes Before Application	**Frequency**	**Themes After Application**	**Frequency**
Ozone- friendly products	3	Ozone- friendly products	11
Use of perfumes	1	Planting trees	10
Planting trees	1	Recycling	9
I don't know	16	Renewable sources of energy	6

Before the application, three themes emerged in answers given by the students regarding activities to address environmental problems. Theme "*ozone - friendly products*" was observed with a frequency rate of 3; while theme "*use of perfumes*" was observed with a frequency rate of 1 and theme "*planting trees*" with a frequency rate of 1. Also, 16 students stated that they don't know the answer. Exemplifying themes "*Ozone friendly products*" and "*planting trees*" E_8 answered: "*Ozone friendly products are used. One shouldn't use perfumes which have any warning about ozone layer damage on their bottles".* Whereas, the student K_2 stated: "*trees are the source of life, this is way trees are planted"*, exemplifying theme "*planting trees*".

A worksheet about environmental problems encountered worldwide was handed out to the students with regard to a learning outcome mentioned in the instructional plan subject to the Six Thinking Hats technique. Accordingly, students were asked to select an environmental

problem, think on it and discuss on the subject after performing research through tools provided for them. They were asked to write compositions reflecting the ideas they inferred after the design.

When the answers were examined, all students were seen to have answered the question. Also, themes "*recycling*" and "*renewable sources of energy*" were seen to have emerged. Theme "*Ozone friendly products*" was observed with a frequency rate of 11; theme "*planting trees*" was observed with a frequency rate of 10, theme "*recycling*" was observed with a frequency rate of 9 and theme "*renewable sources of energy*" with a frequency rate of 6. When the compositions reflecting ideas inferred by the students after their discussion were examined, it was found out that their sensitivity towards the environment increased and their comments reflected their observations. As an example to this situation, K_5 wrote the following text which contained multiple themes: *We human beings are being too selfish. We think only about ourselves. We should leave next generations a beautiful environment which is worth to live. On the contrary, we are using products that will harm ozone layer. People are causing more exhaust gas emission to the air and harming the environment by going to work by their own cars. We should give importance to using renewable sources of energy and use recycle bins in conformity with their purposes.*

After the application, materials prepared by the students were exhibited at the school at an event organized in scope of "June 5 World Environment Day". Students were proud of the materials they prepared; and they said they were also happy to raise awareness of other people around them. Interviews held with the students, field notes of the teacher and observations of the researcher revealed that the instructional design prepared via the Six Thinking Hats and SCAMPER techniques ensured the student to develop a positive attitude towards the lesson and to show empathy and also improved their research and questioning skills. Additionally, the teacher reported that the designs prepared via these techniques raised awareness of the students regarding "Human and Environment" unit.

Discussion and Conclusion

Conclusions based on research findings can be summarized as follows;

As a result of the practices in frame of the instructional designs prepared via SCAMPER technique, improvements were observed in the students' opinions as to what the habitats in which organisms live are and what the concepts related to these areas are; the relationship of living organisms in an ecosystem with each other and with non-living factors and also creatures which may exist in different ecosystems. It can be suggested that the SCAMPER technique can ensure cognitive development of the students in the related subjects by providing them with the opportunity to act beyond mental patterns, and encouraging them to think creatively by motivating them to change or combine their opinions. Also, they were seen to have performed improvement in comparing ecosystems in terms of diversity of living creatures and climatic features. As also mentioned by Serrat (2009), it can be said that this situation arises from the fact that SCAMPER technique ensures an individual to question a situation, produce solutions for the problem, and enable the individual to carry out individual work, group work and exchange of ideas during the process of producing solutions.

As a result of the application of instruction designs prepared via the Six Thinking Hats technique, it was revealed that students could give examples to plants and animals facing the danger of extinction in our country and in the world; their awareness on environmental problems in our country and in the world were raised and they could make different suggestions regarding these problems. As also stated by De Bono (2002), it can be argued that

this situation is due to the fact that the Six Thinking Hats technique prevents ego from being active during thinking activities of individuals so that creative brains which are thus set free find an opportunity to examine and evaluate the subject completely. Moreover, it can be considered that diversity emerged in solution offers of individuals at the end of the process owing to the fact that this technique prevents different opinions from coalescing into one. On the other hand, it was revealed that majority of the students have a negative/ pessimistic approach regarding the world and the environment in future both before and after the application; and they possessed the main point of view that the "world will be a dirty place" in future. It can be argued that opinions related to the world and the environment vary as the Six Thinking Hats technique allows the thinker to experience different ways of thinking rather than a single one.

In this study, the students developed not only their psycho-motor skills by using colored cardboards, scissors, craft papers, crepe papers, modeling clay, pastels, dry paints, adhesives, cardboard, markers, colored pencils etc., but also their cognitive skills by preparing acrostic, pictures, poems and cartoons. It was found out that some students with low rate of success and low attendance rate actively attended this process and had an increased interest in the lesson, displaying their creativity especially in events such as writing acrostic, drawing cartoons and paintings. Works performed by Thomas (2000), Coşkun (2004), Aladağ (2005), Çıbık (2006), Yılmaz (2006), Görecek (2007), Uzun (2007) and Feyzioğlu et al., (2012) support this result. It was found out that the students who actively implemented the activity of achieving and sharing the knowledge made a progress in their skills to share their opinions through group works, to discuss, to make presentations, to defend their opinions, to express their ideas, to respect their friends' opinions and to ask questions. It can be said that both techniques provided students with these skills through different ways. The study by Arslan and Şahin (2004) supports this result. The students with interest in studying reported that their sensitivity increased and their points of view changed. Therefore, it can be argued that contribution was also made to affective development of the students.

Suggestions

These applications realized through instructional designs prepared through the Six Thinking Hats and Scamper techniques can as well be performed at different learning steps and in different units. Nevertheless, when the period in the instructional program for the "Human and environment" unit is considered, it can be said that the applications remain limited and action plans regarding the environment and the nature cannot be adequately implemented. For this reason, it can be suggested that future studies should cover such applications whereby individuals can focus on the solution of environmental problems and put them into action.

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