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Determination of the Contribution of Station Technique in Informal Learning Environments (STiIL) to Learning Domains

Nevzat Yigit[1], Ebru Sivrikaya[2], Ebru Mazlum Guven[3]

[1]Department of Mathematics and Science Education, Fatih Faculty of Education, Trabzon University, TURKEY, ORCID: 0000-0001-7363-1637, nyigit@trabzon.edu.tr
[2]Akçaabat Anatolian High School, Trabzon, TURKEY, ORCID: 0000-0001-9462-7530, ebrusivrikayaebrusivrikaya@gmail.com
[3]Res. Asst., Department of Mathematics and Science Education, Trabzon University, TURKEY, ORCID: 0000-0002-7758-4177, eumazlum@gmail.com

ABSTRACT
The informal learning environment and the station technique provide students with learning environments where they can be active and materialize the abstract terms. With this regard, the purpose of the study was to determine the contribution of activities, which are carried out through the station technique in informal learning environments (STiIL), to the cognitive, affective, and life skills of eleventh-grade high school students. The participants of the study are 26 eleventh-grade students. The "Musculoskeletal System" topic within the scope of the study is addressed through the station technique in the 2018-2019 educational year. The data-gathering tools for the study are semi-structured questionnaires, focus group interviews, and researcher journals. Deductive and descriptive analyses were performed together on the qualitative data. Results showed that teaching with STiIL increases learning and retention of knowledge in the cognitive domain. It improves the affective skills of students in terms of eagerness to learn and makes the teaching and learning process entertaining. Self-confidence and communication skills stand out in the life skills domain.

Introduction

One of the aims of science education, as a requirement of the modern age, is to raise scientifically literate individuals, who produce information, develop decision-making skills, show empathy towards each other, maintain a sense of curiosity about their environments and inner worlds, have the necessary knowledge, skill, attitude, value, competence and understanding about science (Karakaş, 2015) and look at the world from the perspective of a scientist (Dilbaz et al., 2016; MoNE, 2018; Önen, 2013; Tan & Temiz 2003). Scientific literacy is considered the highest level that the students can reach within science education. Therefore, scientifically literate individuals must have various skills. Today, the 21st century skills, which contain the skills and competencies required for lifelong learning, consist of components such as critical thinking, cooperation, creativity, motivation, metacognition (metacognition or learning to learn), the ability to plan to achieve goals, the ability to turn thoughts into action, and entrepreneurship skills, etc. The vision of science education in the world has been established in a manner to embody the skills of the 21st century. Science education programs are revised and updated following the needs of the time (Karakaş, 2015; MoNE, 2018). Accordingly, the science programs in Turkey also have been updated by embodying the skills that

enable access to scientific knowledge and the use of scientific knowledge (MoNE, 2018). Since 21st century skills in science programs contain the skills and competencies necessary for both science education and lifelong learning, it is necessary to make the students gain these skills (Karakaş, 2015). Schools, in addition to providing academic information to the learner as an educational institution, should also contribute to the development of various skills (Bolat & Balaman, 2017) which are affective features such as motivation, interest, curiosity, and willingness (Pedretti, 2002), life skills such as communication, creative and critical thinking (Gürsoy, 2018; WHO, 1997, p.3), and cognitive features such as persistence (Gürsoy, 2018). The students should be allowed to develop communication and creative thinking skills, and the ability to control their learning by self-expression (MoNE, 2018). It is essential for individuals to possess these skills so that they can solve the problems that they encounter in daily life by using the studying systematics of the scientists and understand their inner and outer worlds. In order to gain these skills, station technique gains importance. Station technique allows students to work as a group with a collaborative learning approach under the guidance of a teacher, encounter opportunities for research and exploration, provide rich learning experiences, embody concepts, reinforce what has been learned, help each other in learning, by doing different activities and using different materials. It is also a contemporary teaching technique that contributes to psychomotor skills (Batdı & Semerci, 2012; Benek & Kocakaya, 2012; Bozbolat & Arslan, 2018; Genç, 2013; Kara-Ekemen et al., 2017; Rogayan Jr., 2019; Tseng, 2008). Station technique is usually seen as an in-class teaching method in domestic studies (Bozpolat & Arslan, 2018) however not only in-class learning environments but also the informal learning environments like Z libraries, science laboratories, schoolyards (Karacalı, 2018), where the students can easily express themselves, are places where station technique can place (Gürsoy, 2018). Informal learning environments give students the opportunity to first-hand experience using. It also enables the concretization of abstract concepts (Çobanoğlu & Durmuş, 2019; Çetin & Yalçınkaya, 2019; Ocak & Korkmaz, 2018). Thus, it causes learning to be meaningful and permanent by enabling students to associate subjects with life (Çelik, 2017; Ocak & Korkmaz, 2018). It is known activities that carried out in informal learning environments can be used to reinforce learning (Çetin & Yalçınkaya, 2019; Ocak & Korkmaz, 2018). Informal learning environments provide students opportunities to work with peers and lead to effective communication and cooperation by allowing the students both to structure the knowledge in their minds and to research and question it with their peers (Erdağı & Önel, 2015). As Birdwhistell describes in "the analogy of a rope", the feature of a rope, which is made up of twisting individual fibers, is not only the combination of fibers but also the interaction of them (McDermott, 1993). Peer interaction in the learning process initiates the mental restructuring process in children (Acar & Yaman, 2011; Bilgin & Geban, 2001). The discussions of the students to convince their peers directs the student to contemplate concepts. Thus, the cognitive learning is ensured by using peer discussions within station technique (Alacapınar & Füsun, 2016; Batdı & Semerci, 2012; Benek & Kocakaya, 2012; Erdağı & Önel, 2015; Rogayan Jr., 2019).

Biology is one of the subjects that students have difficulty learning since it consists of various abstract concepts. When the abstract concepts in biology are not able to be associated with daily life, it becomes unsensational, unattractive, and monotonic for students (Aytaç et al., 2001; Brown & Schwartz 2009; Yetkin, 2001). Human Physiology is one of the topics which has seen hard to learn by students and associate the concepts to the daily life. Moreover, it has been seen that students tend to have learning difficulties and misconceptions about the Human Physiology topic (Arslan et al., 2020; Çetinkaya & Taş, 2018; Kumandaş et al., 2019; Lucero & Petrosino 2017; Reinoso-Tapia et al., 2019). Since learning difficulties and misconceptions create an obstacle for effective learning, it is necessary to create learning environments that will enable the effective teaching and learning of the concepts of the subject and to use methods and techniques suitable for the gains in these environments (Yazıcı & Sözbilir, 2020). Station technique, which is one of these methods and techniques, is a contemporary learning approach aiming to provide the opportunity to do activities that will eliminate learning difficulties, allowing students to learn themselves, appealing to all intelligence areas, and gaining cognitive, affective, and psychomotor skills.

Aim

As seen from literature, students' participation in the lesson is not at the desired level, one-way instruction is frequently used in teaching and for this reason, environments, where students can work together and do activities, should be created due to the limited interaction in the lessons (Yazıcı & Sözbilir, 2020). It is known station technique contributes to cognitive, affective and life skills (Batdı & Semerci, 2012; Kara-Ekemen et al., 2017; Rogayan, Jr., 2019), and informal learning environments facilitate effective communication and cooperation, creates less pressure on the achievement and evaluation of learning goals and turns teaching into more entertaining experiences when compared to in-class learning environments (Alacapınar, 2009; Erdağı & Önel, 2015; Karacalı, 2018; Kim & Dopico, 2016). Station technique and informal learning each have both positive influences on learning domains separately as stated. However, as Bozbolat and Arslan (2018) suggested, there is not enough study in which, station technique was performed in informal learning environments, and in what ways this union (STiIL) contributes to students' learning domains remains uncertain. Therefore, this study was thought to contribute to science education by providing a different, effective and practical method and accordingly attempted to find out what kind of contributions using station technique in informal learning environments (STiIL) provide students' cognitive, affective, and life skills. It is known that everything that children learn starting from the preschool period is the basis for the knowledge to be gained in the following years and The Human Physiology topic within the subjects of biology is given at certain grade levels from the pre-school period to the 11th grade of high school. (Çetinkaya & Taş, 2018; Çobanoğlu & Durmuş, 2019, MoNE, 2018). The Human Physiology topic was chosen since different kinds of activities (writing poems, stories, drawing caricatures, etc.) that station technique can offer are suggested to use in the teaching of abstract concepts in the Human Physiology topic. Thus, the concepts are concretized with the activities (Duman, 2018; Yazıcı & Sözbilir, 2020). In this context, the purpose of the study is to determine "Does STiIL have any contributions on learning domains?". Subproblems of the study are identified as "What kind of contributions of the station technique in informal environments (STiIL) have on the learning domains of the 11th-grade students?" and "What are the students' opinions on the STiIL process?"

Methods

In this research, it was aimed to reveal the contribution of activities, which were prepared for station technique, to the cognitive, affective, and life skills of the students. The study has been planned as action research. The most distinctive feature of action research is to involve the active participation of the practitioner in the research process. Active participation intends that the practitioner is part of the research process to change or develop its activities (Ekiz, 2009; Özpınar & Aydoğan-Yenmez, 2014). This research design is also used to eliminate the identified problem and make the application better and improved (Mills, 2003). The existing study is action research in terms of the fact that the teacher, who plans and conducts the research, is a practitioner and researcher. If the teacher does not believe current teaching methods are beneficial to the students in the related topic, the teacher can analyze its effectiveness by trying new teaching methods and as a result of the analysis, the teacher can increase the efficiency of teaching by arranging teaching methods (Ekiz, 2009). Action research is intended to address a specific problem within a classroom, school, etc. while its primary purpose is to improve practice (Fraenkel et al., 2012). Within the scope of this study, the teacher followed a cyclical path in line with his 13 years of experience, observed the problems that arise, collects data for the problem, creates solutions for the problems identified, determines the most suitable solution through these solutions in time, applies solutions and evaluates the results of the application and improves the solutions that she did and used the results of her improvement in planning the next phase. Based on teachers' knowledge of the group, her past experiences, interviews with the students, exam papers, and informal observations, it was determined that the students could not associate the concepts with daily life, they did not like the biology lesson, and were reluctant to participate to the courses. When

these identified problems are examined in the literature, it points to cognitive, affective, and life skills (Gürsoy, 2018), and the research is planned with the assumption that these problems can be solved by STiIL by getting support from the literature. Lewin's model was used in the research. The first step of the Lewin model includes the stages of determining the idea, gathering information, planning, practicing, evaluating, and organizing the plan (Lewin, 1946). According to Lewin's model, the problems related to the topic were first identified in the planned research; the class design, containing activities suitable for STiIL, has been planned and prepared. Thereafter, these applied plans were evaluated, and it has been turned the development stage back again.

Participants

Participants were selected through purposive sampling, which is often preferred in action research. The study group has been designated based on the criteria of having experience regarding the application of the station technique, failure to associate concepts to daily life, having misconceptions related to the aforementioned topic, and failure to pay attention to the class. 26 eleventh-grade students (18 female, 8 male), who meet the criteria and study in Trabzon, constitute the research group of the study.

Data Collection Tools

The data collection tools of the study were chosen as semi-structured interviews, focus group interviews with station chiefs, and researcher journals. Questionnaires can be prepared to obtain data about a thought, phenomena, concept, view, belief, etc. and question types could be both open-ended or close-ended (Hovardoğlu, 2000). The questions for semi-structured questionnaires and focus group interviews were prepared with the support from the literature (Benek & Kocakaya, 2012; Canpolat & Yıldırım, 2017; Erdağı & Önel, 2015; Saraç, 2017). Data collection tools have been examined by two experts in the domain of science education and rearranged after. in terms of intelligibility and content. For instance, draft questions were examined regarding alignment between questions and research questions, some questions in the questionnaire were divided into two in order to obtain neat answers and one question in focus group interview was reorganized to avoid influencing the participant as it appeared to be a leading question. Semi-structured questionnaires were applied after the STiIL and three months after the actual practice focus group interviews have been performed. The purpose of conducting a focus group interview was to obtain in-depth and rich information related to research problems since focus group interviews offer dynamism and creativity compared to individual interviews (Krueger & Casey, 2014). Besides, focus group interviews and researcher journals were used to support the data derived from the semi-structured questionnaires.

In the action research, the observation of the researcher on the problem they wanted to find a solution or the situation he/she examined, is evaluated as data. The researcher journal has been referred to in terms of recording these data systematically and avoiding data loss (Ekiz, 2009). The observations of the action researcher and her opinions on the application have been recorded in the journals before, during, and after the implementation.

Data Analysis

The data from semi-structured questionnaires were subjected to content analysis. Content analysis is one of the qualitative data analysis techniques and, according to Miles and Huberman (1994), it consists of three stages: reduction of data, display, and conclusion. Patton (2014) states that content analysis can be performed in two ways: deductive and inductive. While deductive analysis requires the analysis of data according to an existing structure, inductive analysis is performed according to current theories. In this study, deductive analysis was used as the raw data have been simplified first and coded, and these codes have been collected under categories derived from the

literature. Codes such as active participation, association to daily life, and retention in the cognitive contribution category; attention and curiosity in the affective contribution category; self-confidence, socialization, teamwork, and sense of responsibility are included in the category of life skills. The repetition frequencies of each code and category have been identified and displayed through tables. The focus group interviews have been transcribed simultaneously. After the transcription of students' expressions, which were obtained from the focus group interview, they have been re-edited and confirmed to them (Yıldırım & Şimşek, 2011). Both the focus group interviews, and the researcher journal have been descriptively analyzed.

Implementation Process

The activities and practice times related to the implementation process have been provided in Table 1.

Table 1

Application Flow

| Activity	Start Date	Executer	Explanations
Designation of the participants for the pilot study	2017 Autumn	Teacher	Determination of goals and targets, Literature review related to station technique, pre-interview, and observation
Development of materials and pilot study	2017-2018 Educational Year	Teacher	Detection of the defective aspects of the implementation and reorganization
Performance of the main study	2018 Spring	Teacher	Performance of the station activity in informal learning environments following the results obtained in the pilot study
Data gathering and analysis	2018 Spring 2019 Autumn (Focus group interviews)	Teacher	Conducting semi-structured questionnaire, content, and descriptive analysis
Reporting	2019-2020 Educational Year	Teacher Academician	Interpreting and reporting the obtained data

The pilot study has been carried out with 11th and 12th grades. After the pilot study, the necessity to get information for the retention of the study has occurred and the focus group interviews have been included in the main study. The pilot study was performed through five stations however, stations in the main study have been reduced to four to use time effectively. The pilot study indicated ST improves students' creative writing skills. Literature also suggests writing poetry (Kiras & Akçay, 2015) and drawing cartoons among the active learning techniques are used (Özay-Köse, 2013) in teaching biology concepts from literature, and contribute to the creativity of students (Çakmak & Demir, 2016; Maden & Durukan, 2010). Besides, writing fairy tales, stories and poems is effective in teaching biology concepts (Yalçın, 2013). Herewith, the activities in stations in the main study were chosen as drawing cartoons, writing stories, and poems. The pilot study has been performed in the classroom environment; however, the main study has been performed in the Z library. Z libraries are

one of the out-of-class learning environments that are specially designed to be used under the topics in science lessons due to its structure and nature (Aslan & Demircioğlu, 2019; Çetin & Yalçınkaya, 2019; Kızılay et al., 2019; Okvuran & Karadeniz, 2019). Z libraries include a variety of other teaching materials as well as printed resources (Ocak & Korkmaz, 2018), provide ease of access to resources, and appropriate physical environment to perform the station technique (Bozbolat & Arslan, 2018) and to produce various course materials (Karadoğan, 2016). Besides the aforementioned reasons, since it is essential to ensure the appropriateness of topic, space, and method-technique in teaching science concepts (Aslan & Demircioğlu, 2019), the main study was performed in Z libraries.

The main study was practiced as 4 stations at the Z library of the school for 105 minutes. The groups have studied the Musculoskeletal system of the human physiology lesson in the 11th-grade curriculum at the poetry, story, slogan, and cartoon creation stations for 20 minutes. The action plan of the research is provided in Figure 1.

Figure 1

Research Action Plan
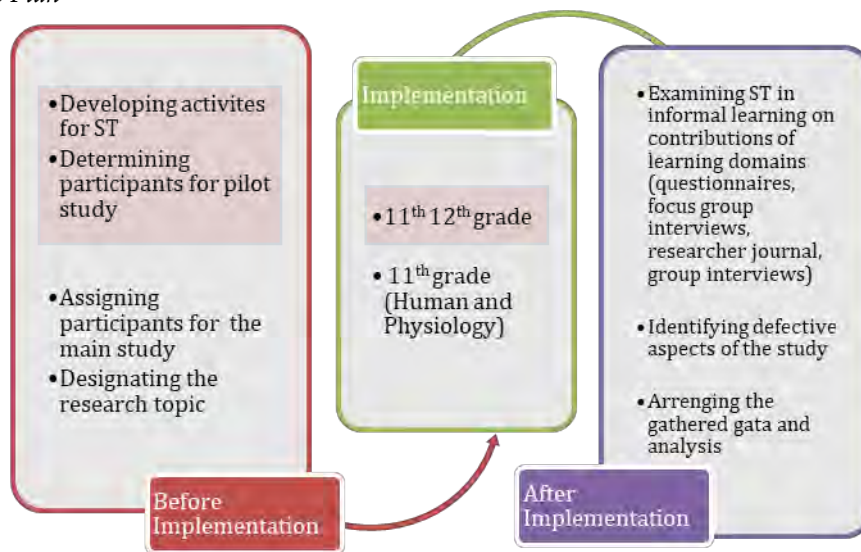
Shaded parts in the figure indicate the actions performed in the pilot study, while the other parts indicate the main study. The actions after the implementation are common both for the pilot study and the main study.

Quality in the Qualitative Research

The quality of study in qualitative research is about credibility, transferability, dependability, and confirmability of the research (Lincoln & Guba, 1985). The credibility is related to the fact that the findings are sound and believable to the reader and whether the findings are the true explanation of the researched. To ensure the credibility in this study, the data was member checked and different data collecting tools (triangulation) and expert reviews were applied (Başkale, 2016; Saban & Ersoy, 2017; Yaşar, 2018; Yıldırım & Şimşek, 2011). Since the findings should include participants' expressions instead of prejudices or opinions of the researcher (Başkale, 2016), the expressions of the students have been directly quoted to increase credibility in research.

It is important to gather detailed data and to analyze them simultaneously in action research throughout the process. So, the effectiveness of the process, the problems encountered during the process, and solution suggestions can be examined in detail. One of the important data-gathering tools for the management of this process is the researcher journal that ensures the systematic reflection of the application process, which consists of the authentic expressions of the researcher, and the

revelation of the researcher's feelings related to the process. The journal kept by the researcher ensures the implementation process to be transcribed and allows the researcher to re-examine, analyze and evaluate it. This situation both gives flexibility to the researcher and enables the process to be re-examined (Erdoğan & Akbaba, 2019). In this study, including pilot studies, the researcher has kept a journal of observations after each practice to increase credibility.

A detailed description is important for increasing the transferability (Yıldırım & Şimşek, 2011). Therefore, the concepts and themes that come up from the raw data were tried to be transferred to the reader, without any interpretation and by sticking to the nature of the data. The raw data obtained within the scope of the study and coding have been saved for confirmability and created matrices have been included in the findings section. While performing content analysis, data could be analyzed by two different researchers or the same data could be analyzed by the same researcher at different time periods (Bilgin, 2000; Jonsson & Svingby, 2007). To ensure consistency in the study, data has been re-analyzed by the same researcher at different times. Consensus between two analyses has been calculated as % 91 by using Miles and Huberman's (1994) formula. Since another factor that determines the quality of qualitative studies related to the ethics of the study, consents of the participants have been obtained and their names have been concealed.

Findings

Findings from the analysis of the data obtained have been gathered under the theme of "contribution to learning domains". Three main categories have emerged from the codes such as the cognitive contribution, affective contribution, and contribution to life skills. Tables have been created to display the findings. Codes obtained from the questionnaires and the quotations for these codes have been included in the text. The quotations that are seen in the tables have been obtained from the interviews. In terms of providing a total perspective, the findings obtained from semi-structured interviews and focus group interviews have been provided together in the tables.

Cognitive Contribution of STiIL

The codes of the cognitive contribution category from the analysis of written opinions obtained from written statements of the students, frequency of the codes, and sample quotations from interviews have been provided in Table 2.

Table 2

Cognitive Contribution, Codes, and Frequencies Obtained from the Analysis

Category	Codes	f	Sample Quotations
Cognitive Skills f (98)	Retention of knowledge	20	Poetry increased retention. It is more useful to study in such activity after the class rather than to repeat lessons in the classroom.
	Acquisition of new knowledge	12	I did not know the bands of the sarcomere, I learned them there... I did not know that there was red bone marrow in the cancellous bone tissue.
	Increasing learning	17	Everyone teaches each other something because everyone says what they know.
	Realization of missing information or misinformation	7	We have become aware of what we know or do not know.

Reinforcement	13	Since we repeat the information in the book while in the activity, we recalled them and our learning was reinforced.
Association to daily life and Materialization	12	It was easier to adapt the information to daily life.
Active Learning	17	We have created beautiful presentations by blending our ideas with the ideas of groups other than our group.

The answers of the students among the three categories have mostly focused on cognitive contribution. The findings show that the station technique in informal learning environments helps to provide active participation in classes, contribute to materialization by associating concepts to daily life, make the knowledge retentive through the exchange of ideas and increase learning. Examples of students' statements related to these codes are as follows "I learned the concepts I did not know thanks to the study and I still remember them (S21)", "since it was not an individual study but a group study, multiple ideas were put forward and we have worked with these ideas in many ways (S2)", "since we associate our knowledge to funny events from daily life, they stuck in mind more. The different and funnier view came up because we studied with my friends (S22)", "frankly, I realized with this study that muscles were not such a difficult topic. For example, I did not know the band names, but through this activity, they stuck in my mind. Also, I would never think of writing a poem about biology (S3)".

It has been stated that the STiIL allows to exchange ideas as well as its application is also effective in ensuring the retention of the concepts after classes. The students have stated that creative visuals such as writing story, poetry, slogan, and drawing cartoon, affected the retention of knowledge, made learning easier, offered the opportunity to refresh knowledge and to question what has been learned, and thereby, the retention of what has been learned was increased by realizing their deficiencies. It was also seen STiIL can be used for reinforcement purposes. Example expressions of participants related to findings as follows "I had the chance to repeat my knowledge with a story, poetry, and painting. So, the knowledge became more retentive (S7)", "A mini test was performed before starting the activity, we saw our deficiencies in that test and cover them up during the event. (S2)", False facts were corrected, and it helped us to learn the topic we do not know (S3)", "…This technique should be applied after very important issues (S25)". It was seen from Table II that STiIL mostly contributed to the retention of knowledge.

Affective Contribution of STiIL

The codes of the contribution to the affective domain, one of the learning domains of STiIL, have been provided in Table 3. These codes have been determined as an entertaining informal learning environment, attention to biology, and eagerness to learn. Mostly repeated code within the affective contribution category intends that the STiIL makes the learning environment more entertaining. The following expressions of the students related to their thoughts of this are as follows "It was remarkable because it was different and entertaining. The fact that the activity did not take place in the classroom, and drinking tea and coffee made us feel as if we were in a comfortable environment. That's why we didn't behave shy and we had an entertaining and instructing time with our friends (S10)", "Being in an entertaining environment made me feel more comfortable. So, I was able to express my ideas easily (S7)", "We did better because the library environment was beautiful. If the same activity was performed in the classroom, the same could not happen (S2)". Besides making the learning environment, in which the lesson is taught, entertaining, it has been observed that STiIL increased the attention and eagerness to the lesson and the repetition frequency of these codes is very close to each other. The expressions of the participant related to the affective contribution category and codes of this category are as follows; "We had activity by actively participating in the lesson. I

attend classes at the same desk and in the same order every day. At least being in a different environment increased my attention to the lesson (S18)", "While waiting for a break under normal conditions, even though we had a block class there, we never wanted the class to end (S26)", "Studying with our friends by forming a group has increased our motivation. If it was made individually, we would get bored and we wouldn't know what to write (S8)". The findings also indicate that ideas were expressed more easily in entertaining and comfortable learning environments so that, the self-confidence of the students increased, thinking ability and vocabulary were improved by the increasing attention to biology class.

Table 3

Affective Contribution Codes and Frequencies Obtained from the Analysis

Category	Codes	f	Sample Quotations
Affective Contribution f (67)	Entertaining environment	24	It was a more entertaining lesson when the environment changed. It was more fun to be able to chat with our peers.
	Attention to biology	21	Our presence in different learning environments has increased our attention to biology.
	Eagerness to learn	22	Our time was fruitful in the library. We were able to present our ideas clearly. Studying in a group increased our efficiency and our eagerness for the lesson.

Contribution to Life Skills of STiIL

The codes that appear under the life skills category of the participants have been provided in Table 4. It is seen from Table 4 that communication is the most focused one among these skills. The following expressions are examples for the communication;

"It enabled us to share knowledge while learning to learn by enjoying … Communication between us increased with sharing. We made comments together and covered our deficiencies up together. In some parts, we gained appreciation in tasks by sharing the things that we would not prefer to share with our teachers, with our friends (S17)."

The least repeated code is the sense of responsibility. The following expressions are the examples for this sense of responsibility; "Our adaptation to each other had a great contribution to such a beautiful activity (S5)", "We did teamwork to create beautiful products. To puzzle our brains for this and exchange ideas has improved us positively (S16)", "Other ideas came up by overlapping ideas and our ability to learn have increased with this overlapping. If these activities continue, it will be very productive in terms of repetition (S9)", "The reason why it is entertaining is that we have friends in our study and we expressed thoughts more comfortably. This also enabled us to see the mistakes and ask more easily. (S6)" The group study code is one of the frequently repeated ones. Besides, it has emerged as a code that enables the communication and learning environment to be entertaining as well as contributes to learning new things. This can clearly be seen from the expressions of the participants as follows; "I learned different things while dealing with something because I'm not doing it alone (S22)", "Since it was a group study, I was able to communicate more effectively. There was an exchange of ideas. Our knowledge of the things I didn't know was completed by other friends. (S7)". Furthermore, the findings of the increase in self-confidence of the students by practicing station technique in classes and delivery of creative products by the students,

have been obtained. The expressions of the participant related to self-confidence and creative thinking are as follows; "We felt more confident because we had this activity together with the people who are at the same age as us. (S2)", "A lot of ideas gathered on the same target with the station technique, and we created much more interesting and beautiful products than we would create individually. (S5)", "The poetry section at the station activity was the part that mostly enables creativity. (S6)", "The poems and stories that we wrote were more retentive and entertaining than the memorization we did at home. (S24)".

Table 4

Contribution to Life Skills, Codes, and Frequencies Obtained from the Analysis

Category	Codes	f	Sample Quotations
Life Skills f (80)	Communication	21	We were much more comfortable than in the class while expressing the ideas.
	Group Study	18	If it was individual, we could get bored. Collectively, different ideas came up.
	Self-Confidence	17	It made me social, it made me talk, and this gives me self-confidence.
	Creative thinking	14	Creative ideas came up with interaction. We were happy.
	Sense of Responsibility	10	As the station chief, we were responsible for all the groups, and we should have done our duty well then.

When all three tables created from the analysis of the data are examined, the most repeated code that emerges where the STiIL is applied appears to be in the domain of cognitive contribution. The students have stated that teaching a class in a different informal environment increased the attention and make the lesson entertaining and that the environment exerts an influence over generating different ideas. They have expressed that funny and creative ideas enabled learning, the creative ideas were revealed through the interaction, and that they regarded the STiIL as an activity that could replace repetition after classes. They have expressed that they gained the ability to realize right and wrong with their friends. They also indicate that adapting their knowledge to daily life has become easier. These opinions of the students support the opinions obtained from written statements.

Findings Related to the Implementation of STiIL

Three months after the application, a semi-structured focus interview has been conducted with six students, who were appointed as chiefs at each station, to get students' opinions about the activity and to examine the process thoroughly. The codes created from the data analysis have been collected under four categories: effects of station technique on learning, contributions to the individual, practicality, and comparison to the conventional methods. Although focus group interviews were conducted three months after application, the obtained findings support the data from semi-structured interviews and classroom interviews. This creates a quite positive impression related to the effectiveness and retention of the STiIL.

The participants have pointed out that writing poetry, story, slogan, and drawing cartoon and funny expressions emphasized by writing and drawing increased the creativity and ensured retentive learning. The opinions of the students are as follows:

"The station where was chief was the poetry. We had written poetry and made-up funny things to make it retentive and made it stick in our minds... (S1)."

"Today my friend said, 'I still remember what we wrote'. Even I remember. We made the child there, we named it Osman. He was falling, breaking himself, going to the doctor for bone marrow. In other words, it is more retentive when we learn something in a different language by drawing something rather than showing it in verbal or visual language. (S4)."

Causing the class to be liked, providing self-confidence, seeing different perspectives, generating new ideas, and learning from peers are the ones that are discoursed among those that the application brought in the individual. The following quotations can be given as an example for the respective opinions;

"I feel more social by this means ... because you cannot communicate with some people or want to establish a communication, but for example, because I was a chief and I visited all groups... You have to talk" (S4)

Being a leader of a group or a club already gives people confidence in every aspect. Here, everyone can learn something from everyone. The thing that is not known by one can be known by the other. So, we transfer the information to each other (S1)

"The thing that cannot be seen by one can be seen by the other. In this way, everyone can learn from each other." (S1)

The participants have elaborated that the STiIL is more attention-grabbing when compared to conventional methods in the classroom under normal conditions and they can generate new ideas, especially when practiced in an informal learning environment. Besides, the STiIL has been recommended to be applied in other disciplines, topics, and in the laboratories, in the schoolyards, or informal learning environments (greeneries, beaches, etc.).

The researcher has kept a journal related to the students' activities in the pilot studies and main study at the time of practice and immediately after the practice for the contribution to the process thoroughly. The findings obtained from the researcher's journal support the findings obtained from the semi-structured questionnaires and focus group interviews. This creates a positive impression in terms of increasing the effectiveness and credibility of the implementation.

It has been determined from the researcher journal that the students discussed with each other in the group, exchanged ideas, and shared jobs among themselves. As the station chiefs arrived at the station, they considered the explanations of the station chief. Students were more comfortable in the Z library and spoke quietly despite the crowd. All students complied with the instructions given before the practice starts, the inter-conceptual relations were established at the stations, these were reflected on a story, a poem slogan by them, students could easily share their ideas in groups, and they cared about group interaction. The researcher journal provides important data regarding the proper use of the STiIL and the improvement of the process by being followed up. The reflections from the researcher journal have been provided below:

"…the students were taken to the Z library of the school for the informal implementation of the learning technique at stations. The students were divided into groups ... It was observed that the students were comfortable and studied in the discipline in the Z library and the students spoke silently. Despite the crowd, there was no noise in the Z library ... It was observed that the students in the groups participated in the activity. The students, who helped the researcher in the process, gave feedback by visiting the groups... the station chiefs informed the group about the station by visiting each group... Some students who were silent in the classroom were found to be active in the group. It was observed that each group discussed and exchanged ideas with its members. By calling up the instructions at the beginning of the application, it was reminded how many minutes the application will take and how many minutes each station has. Despite the 15-minute break, the students didn't go out after 40 minutes lesson in the Z library and continued

the activity ... While the station chiefs were making their presentations at the end of the practice, it was observed that the students listened carefully ..."

Discussion and Conclusion

In this study, where 11th-grade high school students were taught of "Human Physiology" topic by using STiIL within the Biology class. The data, which were obtained from the written statement of the students related to the technique, the focus group interviews conducted with station chiefs, and the researcher's journal have been examined. Accordingly, it was seen the learning technique at stations applied in Z library, which is an informal learning environment, contributes to the learning domains of students' cognitive, affective, and life skills, as seen in Table 2, Table 3, and Table 4 (Alacapınar, 2009; Ertaş et al., 2011; Gürsoy, 2018). When the opinions obtained from the written statements of the students are examined, it has been seen that the data obtained for the cognitive domain in Table 2 are; retention of knowledge, acquisition of new knowledge, increasing learning, the realization of missing information or misinformation, reinforcement, association to daily life and materialization and active learning. The most common code in the cognitive domain is determined as the retention of knowledge, which is strongly coherent with the literature (Albayrak et al., 2017; Demir & Gürol, 2015; Koca & Türkoğlu, 2019; Morgil et al., 2002). Following the retention of knowledge, the most common cognitive contribution found as an increase in learning (Albayrak, 2016; Albayrak et al., 2017; Mergen, 2011) and active learning (Genç, 2013). The fact that the students create their products by drawing cartoons, writing slogans, stories and poems through station technique is thought to support active learning and to contribute to their ability to associate their knowledge to daily life through the creative study they put forth. The findings also indicate that the entertaining expressions that students use in their products increase the retention of the concepts and develop their creativity. It is thought that the images picturized and drawn like poetry, stories, cartoons, slogans contribute to the establishment of a relationship between concepts (Erdağı & Önel, 2015). Besides, it is known that the products created at stations, enable the existing information to be restructured (Erdağı & Önel, 2015) and thus, affect the retention of what has been learned positively (Koca & Türkoğlu, 2019). An important element that enhances the retention can be the expression of activities carried out at the stations by associating the biology concepts to daily life and the thought that these activities are entertaining for students. It is stated in the literature that such activities particularly materialize abstract concepts and contribute to the cognitive learning domain (Karacalı, 2018; Yılmaz & Güven, 2015).

As STiIL allows students to work in groups in a collaborative environment, the learning activities at the stations within the cognitive domain has indicated that using this technique for reinforcement would also be beneficial (Yüksel, 2017), and performing activities together improve students' cognitive learning results (Saputri & Corebima, 2020).

The findings have indicated that the STiIL is very entertaining in terms of affective contribution and these environments increase the eagerness to learn and the attention to biology class (Alacapınar, 2009). The realization of the importance of informal learning environments by the students and the increase of their attention to biology class and their eagerness to learn can contribute to students' high-level mental skills and life skills in many ways (Ertaş et al., 2011; Gürsoy, 2018). They have stated that making the learning environment active, entertaining, and comfortable increased the eagerness to study and the motivation, and intimate and comfortable environments would be effective in increasing the attention to the school and the class. The literature predicates that the attention of the students, who study in cooperation with their peers, to the class has increased and their eagerness to learn have raised by the emergence of new ideas. They have also stated that they could easily express their ideas in entertaining and comfortable environments, and thereby, they felt confident; also, the

attention to biology improved the thinking ability and vocabulary (Erdağı & Önel, 2015). Alacapınar (2009) stated that the station technique was an important feature for providing learning and the technique increased the motivation towards learning. The findings also in this study show that the STiIL made the biology class to be liked and the learning was performed increasing the attention to the lesson liked. Since teaching lesson with entertaining and interesting techniques increases the eagerness to learn, it can be concluded that the station technique is an effective technique to increase success (Batdı & Semerci, 2012; Benek & Kocakaya; 2012; Erdağı & Önel, 2015; Genç, 2013).

The categories of group study, communication, creative thinking, and responsibility awareness within the life skills domain are included in Table 4. The fact that the students discuss with their peers and take the opportunity to do creative writing studies during the activity may influence the emergence of these categories. Considering the contribution of students tolife skills, it is observed that the group study increases communication, facilitates learning different knowledge, increases the eagerness to participate, and is effective in learning. This may result from the fact that the students express themselves more comfortably as the teacher had the role of a guide than a knowledge transferring figure. Besides, the students communicate more easily with their peers, discuss with each other in order to find the best way which leads them to enrich scientific knowledge and learn new concepts (Fernández-González & Franco-Mariscal, 2021; Mazlum & Yiğit, 2017).

The data obtained indicate that the group study is effective in delivering creative products since it facilitates to exchange of ideas. Besides, findings obtained on discussing with peers have been found in the literature in terms of reinforcing the topic and making the students active (Töman, 2018). From which it is concluded that the interactions of individuals in the same age group both increase self-confidence and contribute to learning. The findings obtained within the scope of the study indicate that the learning technique at stations ensures to create environments of taking responsibility, studying in collaboration within the group, expressing oneself during the discussion, developing one's imagination, positive attitude towards the lesson, and convenience learning (Albayrak, 2016; Genç, 2013; Koca & Türkoğlu, 2019; Rogayan Jr., 2019).

In the research where the action method was used, the data for the application process were taken from the observation notes of the teacher, who was present in the process and designed the application. The disadvantages, as well as the benefits of station technique, have been reported in various research contained in the literature. The station technique may cause noise in crowded classrooms, and the teacher should plan the activity very well before the application to prevent this (Batdı & Semerci, 2012; Benek & Kocakaya, 2012; Çakmak & Demir, 2016; Yüksel, 2017). It has been confirmed in the observations of the application teacher that the students did not make noise during the application, they spoke quietly in the group, that all students knew and followed the instructions well, and thereby there was no disorder during the application. This is thought to have resulted from the fact that the requirements of long-term action study are fulfilled, the activity is well-planned before the application, the teacher has strong classroom management skills and guides the students effectively, and that the students know their duties well (Çakmak & Demir, 2016).

Within the scope of the study, the informal learning environments have been observed to contribute domains of students' cognitive, affective, and life skills. The results obtained, comply with the literature (Gürsoy, 2018). The implementation of the STiIL is considered as the contribution of the study to the literature and it is thought that it contributes to students' cognitive, affective, and life skills. In this regard, it is recommended to apply the technique in different classes and topics.

It was seen findings emerged from the data which shows StiIL has positive effects on students' cognitive, affective, and life skills. For the development of students' discussion skills as well as the determination of its effect on retention, it was found out that STiIL is beneficial to use in the classes. Therefore, it is offered to investigate the effect of using STiIL in other disciplines and an introductory implementation guide can be developed for the teachers in this regard. The students come to school

with prior knowledge and if this prior knowledge is not structured properly, they might have misconceptions in older ages. Therefore, future studies might be performed for other science concepts. Activities that ensure the association of the topics to daily life should be designed and informal learning environments should be organized.

Since STiIL requires group works, the students, who do not participate in peer discussions within the process, are suggested to be encouraged and promoted.

As related to the process of implementation, the studies of the students can be displayed on the school board, brochures can be designed, creative writing activities of students can be arranged. The poems composed by the students can be converted to known songs to be more memorable. A magazine can be designed in which all activities take place and students share their experiences. Contests about station techniques can be organized between different schools and student interaction can be provided. Thereby, the other students can learn the technique and generate new ideas in creative writing activities. In this study, station technique has been integrated into informal environments; the planning has been done through action research. In other research, STiIL can be combined with different methods and techniques to contribute to a theory to be created related to the topic.

References

Acar, B. & Yaman, M. (2011). The effects of context-based learning on students' levels of knowledge and interest. *H. U. Journal of Education*, *40*, 01-10.

Alacapınar, G. F. G. (2009). Students' views on studying lessons with station technique. *Abant İzzet Baysal University Journal of Education*, *9*(1), 137- 146.

Albayrak, H. (2016). *The effect of the station technique to students' academic achievement in astronomy topics and students' attitudes to astronomy* [Unpublished master's thesis] Erzincan University, Erzincan.

Albayrak, H., Yalçın, P., & Altun-Yalçın, S. (2017). To determine how the effect of station technique on students' achievement in astronomy subjects. *Journal of Human Sciences*, *14*(4), 4561-4578. https://doi.org/10.14687/jhs.v14i4.5005

Arslan, K., Boz, V. & Çoştu, B. (2020). How the support and movement system is perceived and associated with students' minds? *Turkish Scientific Research Journal*, *5*(1), 50-67.

Aslan, A. & Demircioğlu, G. (2019, December). *Kimya öğretmenlerinin sınıf dışı öğrenme ortamlarına yönelik görüşlerinin belirlenmesi.* Paper presented at the meeting of the 1st International Congress on Informal Learning. http://kongre.okuldisiogrenme.com/wpcontent/uploads/2020/01/proceedings_book.pdf

Aytaç, Ö., Kete, R. & Yıldırım, A. (2001, September). *Biyoloji öğretiminde kalıcı bilgiler oluşturma.* Paper presented at the meeting of Yeni Bin Yılın Başına Türkiye'de Fen Bilimleri Eğitimi Sempozyumu. Maltepe University, İstanbul.

Başkale, H. (2016). Determination of validity, reliability and sample size in qualitative studies. *Dokuz Eylul University E-Journal of Nursing Faculty*, *9*(1), 23-28.

Batdı, V. & Semerci, Ç. (2012). Reflective inquiry of the station teaching method in lessons. *Bartın University Journal of Faculty of Education*, *1*(1), 190-203.

Benek, İ. & Kocakaya, S. (2012). Students' opinion on learning in stations technique. *Journal of Research in Education and Teaching*, *1*(3), 8-18.

Bilgin, N. (2000). *İçerik analizi* [Content analysis]. Ege Üniversitesi Edebiyat Fakültesi Yayınları.

Bilgin, İ. & Geban, Ö. (2001). The use of analogy to remove 10th grade students' misconception related to chemical equilibrium concepts. *H.U. Journal of Education*, *20*, 26-32.

Bolat, Y. & Balaman, F. (2017). Life skills scale: Validity and reliability study. *Journal of the Human and Social Science Researches, 6*(4), 22-39.

Bozpolat, E. & Arslan, A. (2018). A Qualitative Study on the Use of Station Technique in Turkish Teaching. *Balıkesir University The Journal of Social Sciences Institute*, *21*(39), 55-97. https://doi.org/10.31795/baunsobed.437727

Brown, M. H., & R. S. Schwartz. (2009). Connecting photosynthesis and cellular respiration: preservice teachers' conceptions. *Journal of Research in Science Teaching*, 46, 791–812.

Canpolat, N. & Yıldırım,T. (2017). Students' views about the effectiveness of peer instruction. *Bayburt Journal of Educational Faculty*, *12*(24), 515-526.

Çakmak, M. & Demir, C. (2016, December). *6. sınıf fen bilimleri dersi yaşamımızdaki elektrik ünitesinin istasyon tekniği ile öğrenilmesine yönelik öğrenci görüşlerinin belirlenmesi*. Paper presented at International Engineering, Science and Education Conference. Diyarbakır.

Çelik, Ö. (2017). *Evaluation of the science subject for 6th grade curriculum in middle school in terms of the systems in our body: Konya sample* [Unpublished master's thesis], Necmettin Erbakan University, Konya.

Çetin, O. & Yalçınkaya, E. (2019, December). *Evaluation of informal learning preferences of pre-service science and social sciences teachers by fuzzy multi-criteria decision making*. Paper presented at the meeting of the 1st International Congress on Informal Learning. http://kongre.okuldisiogrenme.com/wp-content/uploads/2020/01/proceedings_book.pdf

Çetinkaya, M & Taş, E. (2018). The effect of activity based web material on eliminating the misconceptions in 6th grade "systems in our body" unit. *Internationale Journal of Educational Studies*, *2*(4), 92-113 https://doi.org/10.31458/iejes.428319

Demir, S. & Gürol, M. (2015). The effect of differentiated learning on the retainment scores of deep and surface learners. *Pegem Journal of Education and Instruction*, *5*(2), 187-206. https://doi.org/10.14527/pegegog.2015.010

Dilbaz, G, Yelken, T. & Özgelen, S. (2016). The effects of inquiry-based learning on attitude towards science and technology course and inquiry skills. *Elemantary Education* Online,15(2), 708-722. http://dx.doi.org/10.17051/io.2016.52134

Duman, B. (2018). Metaphorical perceptions of prospective teachers on station technique and teacher - student concepts in the scope of station technique. *Turkish Studies*, *13*(4), 499-518. http://dx.doi.org/10.7827/TurkıshStudies.13048

Ekiz, D. (2009). *Bilimsel araştırma yöntemleri* [Scientific research methods]. Anı Yayıncılık.

Erdağı, S. & Önel, A. (2015). Evaluation of student opinions and performances in science and technology courses taught via station technique. *e-Kafkas Journal of Educational Research*, *2*(1), 28-37.

Erdoğan, E. & Akbaba, B. (2019). Developing secondary school students' academic success of social studies course with flipped classroom model. *Cumhuriyet International Journal of Education*, *8*(1), 193-213. http://dx.doi.org/10.30703/cije.465095

Ertaş, H., Şen, A. İ., & Parmasızoğlu, A. (2011). The effects of out-of school scientific activities on 9th grade students' relating the unit of energy to daily life. *Necatibey Faculty of Education, Electronic Journal of Science and Mathematics Education*, *5*(2), 178-198.

Fernández-González, C., & Franco-Mariscal, A. J. (2021). Teaching the plant kingdom using cooperative learning and plants elements: A case study with spanish secondary school students. *Journal of Turkish Science Education*, *18*(1), 17-31.

Fraenkel, J. R., Wallen, N. E., & Hyun, H. H. (2012). *How to design and evaluate research in education* (8th ed.). McGraw–Hill.

Genç, M. (2013). Prospective teachers' views about using station technique at environmental education course. *Erzincan Üniversitesi Eğitim Fakültesi Dergisi*, *15*(2), 188- 203.

Gürsoy, G. (2018). Outdoor Learning Environments in Science Education. *Turkish Studies Educational Sciences*, 13 (11), 623-649. http://dx.doi.org/10.7827/TurkishStudies.13225

Hovardoğlu, S. (2000). *Davranış bilimleri için araştırma teknikleri* [Research techniques for behavioral sciences]. VeGA Basım Yayın Dağıtım.

Jonsson, A., & Svingby, G. (2007). The use of scoring rubrics: Reliability, validity and educational consequences. *Educational Research Review*, *2*(2), 130-144.

Kara-Ekemen, D., Atik, D. A. & Erkoç, F. (2017). Teaching ninth grade "biological diversity and protection" topic using stations technique and satisfaction of the students from the implementation. *Adıyaman University Journal of Educational Sciences*, *7*(2), 318-339. http://dx.doi.org/10.17984/adyuebd.316623

Karacalı, K. (2018). A review of studies conducted in learning stations in turkish science teaching. *Journal of Education in Eskisehir Osmangazi University Turkic World Apply and Research Center*, *3* (2), 59-77.

Karadoğan, S. (2016). *Türkiye'de eğitim sorunlarına yönelik akademik değerlendirmeler ve çözüm önerileri* [Academic assessments and solutions for educational problems in Turkey]. Maya Akademi Yayıncılık.

Karakaş, M. M. (2015). *Investigation of the eight - grade secondary school students' levels of 21st century skills in science education*. [Unpublished master's thesis]. Eskişehir Osmangazi University, Eskişehir.

Kızılay, E., Sevgi, S. & Saylan-Kırmızıgül, A. (2019, December). *Instructional motivation scale in out-of-school environments*, Paper presented at the meeting of the 1st International Congress on Informal Learning. http://kongre.okuldisiogrenme.com/wp-content/uploads/2020/01/proceedings_book.pdf

Kim, M., & Dopico, E. (2016). Science education through informal education. *Cultural Studies Of Science Education*, *11*(2), 439-445.

Kiras, B. & Bezir Akçay, B. (2015). The effect of active learning methods on student's achievement and attitude in teaching body systems unit. *İstanbul Journal of Innovation in Education*, *1*(3), 103-124.

Koca, M. & Türkoğlu, İ. (2019). The effect of the application of station technique in teaching the 6th grade science lesson cell topic on the academic achievement of students, permanence and attitudes. *Fırat University Journal of Social Sciences*, *29*(1), 91-106. https://doi.org/10.18069/firatsbed.538653

Krueger, R. A. & Casey, M. A. (2014). *Focus groups: A practical guide for applied research*. Sage publications.

Kumandaş, B., Ateskan, A., & Lane, J. (2019). Misconceptions in biology: a meta synthesis study of research, 2000–2014. *Journal of Biological Education*, *53*(4), 350-364.

Lewin, K. (1946). Action research and minority problems, *Journal of Social Issues 2*(4), 34–46.

Lucero, M. M., & A. J. Petrosino. (2017). A resource for eliciting student alternative conceptions: examining the adaptability of a concept ınventory for natural selection at the secondary school level. *Research in Science Education 47* (4), 705–730.

Lincoln, Y. S. & Guba, E. G. (1985). *Naturalistic inquiry*. Sage.

Maden, S. & Durukan, E. (2010). The effects of station technique on creative writing ability and its attitudinal effect on Turkish lesson. *Journal of Turkology Research*, *28*(28), 299-312.

Mazlum, E & Yiğit, N. (2017). Examining indicators of knowledge of light concept through peer tutoring applications. *H.U. Journal of Education*, *32*(2),295-311. https://doi.org/ 10.16986/HUJE.2016019933

McDermott, R., (1993). The acquisition of a child by a learning disability. In S. Chaiklin & J. Lave (Eds), *Understanding practice*. (pp.269- 305). New York: Cambridge University Press.

Mergen, H. H. (2011). *The effects of learning stations technic on academic success and permanence in social sciences lesson in 5th classes of primary school.* [Unpublished masters's thesis]. Afyon Kocatepe University, Afyonkarahisar.

MoNE [Turkey Ministry of National Education], (2018). Science course curriculum (Primary and Secondary 3, 4, 5, 6, 7, & 8. Grades) http://mufredat.meb.gov.tr/ProgramDetay.aspx?PID=325

Miles, M. & Huberman, A. (1994). *Qualitative data analysis: An expanded source book*. Sage.

Mills, G. E. (2003). *Action Research: A Guide for the Teacher Researcher* (2nd ed). Merrill Prentice Hall.

Morgil, İ., Yılmaz, A. & Yavuz, S. (2002). The learning in stations in chemistry education. *H.U. Journal of Education*, *22*, 110- 117.

Ocak, İ. & Korkmaz, Ç. (2018). An examination of the views of science and pre-school teachers on non-formal learning environments. *International Journal of Field Education*, *4*(1), 18-38.

Okvuran, A. & Karadeniz, C. (2019, December). *methods and techniques used in museums in informal learning process.* Paper presented at the meeting of the 1st International Congress on Informal Learning. http://kongre.okuldisiogrenme.com/wp-content/uploads/2020/01/proceedings_book.pdf

Önen, F. (2013). Preservice science teachers views towards the activity based nature of science teaching and the effect of this teaching on their science attitudes and process, *International Journal of Social Science 6*(7), (843-868).

Özay-Köse, E. (2013). Effects of cartoons on students' achievement and attitudes in biology teaching (endocrine system). *Kastamonu Education Journal*, *21*(3), 931-944.

Özpınar, İ. & Aydoğan-Yenmez, A. (2014). Action research. M. Metin (Ed.), In *Research methods in educaiton* (s. 441-467). PegemA.

Patton, M. Q. (2014). *Qualitative research and evaluation methods: Integrating theory and practice*. Sage publications.

Pedretti, E. (2002). T. Kuhn meets T. Rex: Critical conversations and new directions in science centres and science museums. *Studies in Science Education, 37*, 1-42.

Piaget, J. (1974). *Understanding causality*. W. W.

Reinoso Tapia, R., Delgado-Iglesias, J., & Fernández, I. (2019). Learning difficulties, alternative conceptions and misconceptions of student teachers about respiratory physiology. *International Journal of Science Education*, *41*(18), 2602-2625.

Rogayan Jr., D. V. (2019). Biology learning station strategy (BLISS): Its effects on science achievement and attitude towards biology. *International Journal on Social and Education Sciences*, *1*(2), 77-89.

Saban, A. & Ersoy, A. (2017). *Eğitimde nitel araştırma desenleri* [Qualitative research designs in education]. Anı Yayıncılık.

Saputri, W. & Corebima, A. D. (2020). The correlation between metacognitive skills and cognitive learning results of biology pre-service teachers on different learnings. *Journal of Turkish Science Education*, *17*(4), 487-503.

Saraç, H. (2017). Researches related to outdoor learning environments in Turkey: content analysis study. *Journal of Education Theory and Practical Research*, *3*(2), 60-81.

Tan, M. & Temiz, B. K. (2003). The importance and role of the science process skills in science teaching. *Pamukkale University Journal of Education*, *13*(13), 89-101.

The World Health Organization [WHO]. (1997). *Life skills education in schools*. Programme on mental health. Dıvısıon Of Mental Health and Preventıon of Substance Abuse. World Health Organization.

Tseng, Y. W. (2008). *Effects of using the learning station model as a phonics remedial program in an elementary school*. [Master's Thesis]. National Pingtung University of Education, Pingtung.

Töman, U. (2018). The effect of peer teaching technique on 6th grade students' achievement levels towards the systems unit in our body. *Journal of Graduate School of Social Sciences*, *22*(3), 1727-1740.

Yalçın, M. (2013). Investigation of the effects of interdisciplinary studies in biology course on learning. *Journal of Research in Education and Teaching, 2*(3), 105-110.

Yaşar, M. (2018). Qualitative problem in qualitative research. *MSKU Journal of Education*, 5(2), 55-73. https://doi.org/10.21666 muefd.426318

Yazıcı, F., & Sözbilir, M. (2020). Teaching concepts on musculoskeletal system to 6th grade visually impaired students. *Journal of Theory and Practice in Education*, *16*(2), 231-250. https://doi.org/10.17244/eku.799303

Yetkin, Y. (2001). A contemporary approach to the biology science: The importance of understanding the logic and philosophy of the biology, *Anadolu University Journal of Science and Technology*, 2(2),231-243.

Yıldırım, A. & Şimşek, H. (2011). *Sosyal bilimlerde nitel araştırma yöntemleri* (Qualitative research methods in social sciences). Seçkin Yayıncılık.

Yılmaz, A. & Güven, Ö. (2015). The investigation of gifted students' perceptions about concepts like "physical education course and physical education teacher" through drawing-writing methodology. *Journal of Qualitative Research in Education*, *3*(3), 55-77. http://dx.doi.org/10.14689/issn.21482624.1.3c3s3m

Yüksel, Ö. (2017). *The effect of station technique on students' academic achievement and opinions in the teaching of household waste and recycling-chemical industry subjects.* [Unpublished master's thesis] Ordu University, Ordu.