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Teachers' Opinions on Alternative Approaches in Social Studies Education: Poetry and Music Module

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Abstract

There are many methods and techniques used in social studies education. Some of them are good guides for students in the subjects which they want to learn, but others cannot. Therefore, alternative methods should be used in order to understand the social studies lesson better for students. Poetry and music are some of these alternative forms. In terms of applicability of this method, opinions of teachers of social studies working in various middle schools in Nevşehir province were taken. Qualitative data collection tools were used in the research and descriptive and content analysis methods were used in the analysis of qualitative data. A semi-structured interview form prepared by field experts was used as data collection tool. In addition, other field experts have been consulted for the validity of the form. The data were analyzed using descriptive and content analysis methods. Categorical analysis technique was used in content analysis. In addition, internal reliability of the questionnaire was increased by quantifying qualitative data by making direct citations from the interviews, and by giving examples from teacher opinions about the questions, it was aimed to explain the opinions of the teachers better. The opinions of the teachers, the applicability of poetry and music to social studies course has been put forward. Studies and findings show that teachers' opinions on the use of poetry and music in social studies are positive.

Keywords: teachers, social studies, module, music, poetry.

1. Introduction

Since poetry and music first appeared, it has always attracted people's attention. People tried to express their thoughts and feelings through music or poetry. In the Turkish poetry, religious issues were first covered. However, later on, poems related to different topics were written (Yardımcı, 1999: 16). Poetry is a branch of art that helps to understand and explain the world. Poetry is often seen as something central and necessary for human existence (Donaldson, 2001: 25; Arp, 1997). Poetry can show human reactions to historical or contemporary events, historical complexities and the common consciousness of an era (Meadows, 1999). Information about the world can offer unique information and explanations that increase our understanding and awareness in the world (Donaldson, 2001: 25). Poetry is a tool used rhythmically to stimulate people's emotions. With this feature, it is connected with music. Music is a tool that people use in every period from birth to death. Music has been seen as a major factor in the education and purification of the soul. Pythagoras, Plato, Aristotle and Boethius, who made important contributions to music during the period, found a place in the music with the written tragedies, metaphors in his works and experimental studies and argued that it was a fact that should be kept

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alive (Kutlu, 2019: 300). Music education that children will receive at a young age will provide them with convenience in developing and educating life perception, interpretation, creativity and thinking system. If children are fed with music that suits them psychologically and physiologically from a young age, they will be individuals who love, choose and know how to use it when they grow up (Şen, 2010: 342). Also, parents assume that music is essential for their children's healthy psychological development (Bağrıaçık, 2019). Therefore, it is an acceptable assumption that a rich music education to be given at a young age will help children develop their understanding of music and abilities, as well as facilitating the reason for the problems and events they will encounter. In addition, music is an expression of mental processes (Akkaş 1993: 11-12). Especially classical music has a relaxing effect on children. It is known that the works of W. A. Mozart, one of the known names of classical music, have an impact on children (Yöre, 2004: 38). In his book, Tanrıkorur (2003) stated that, according to the views of some ministers of the period, introducing Turkish music into schools would prevent our development and we could not be modernized. However, students can be given a very good education by using Turkish music in education. That is why alternative approaches exist. In addition, many poems contain at least one of the ten thematic areas of social sciences (McCall, 2004: 173). Since poetry is shorter than other literary texts, it can be read more quickly in the lesson and can be a more interesting material, far from boring of a textbook. With openness, focus, rich words, emotions, imagination and various perspectives, poetry is complementary rather than primary source for social studies (Vardell, 2003: 209). Poets are important because they can gain more understanding and awareness from the world. Therefore, it makes sense to expect poetry to create a window in which students can clarify their world views (Arp, 1997: 4). Poetry conveys the meaning more clearly when it is read and heard (Vardell, 2003). Songs are not just notes, poetry is not just text. Poetry helps students make correct pronunciation and gain correct words with their general listening understanding (Bagert, 1992). Many students love the link between music and poetry. Basically, poems are matched to song tunes that contain the same counter. This musical connection with poetry makes poems unforgettable (Vardell, 2003: 210). Adding sound effects and background music to the poems, reading the poems with the styles of music they like, encourages students to think and read the poems they love better (Chatton, 1993; Ada, 1995: 32). Music is essentially educational. Almost all functions of music in human life are formed, changed, developed and competent only through education (music education). In this respect, everyone who is related to music is more or less related to the educational dimension of music (Uçan, 1996: 30). Gardner states that every person who comes together with music can be successful with some skills he has in musical activities such as composing, singing and playing instruments. In addition, Gardner (2006) stated that music is an inspiration for people and that people find peace with music. Gardner (2006) especially emphasized Mozart's music and stated how important his compositions were in the education of people. Therefore, it is thought that the students will better understand the events described through the education that will be carried out using music in schools.

The module is a program unit that takes part in the curriculum of various professions and forms a whole within that program, has a transferable content and has the feature of having broader professional functions by integrating with other curriculums. Modules give individuals various competencies. The fact that the curriculum consists of various modules is also modular teaching. Each module helps the individual gain knowledge, skills and attitudes. In addition, modular programs are formed by following the modules in a certain order and grouping them as a whole (SVET, 2006: 79). Modular teaching, which is a student-centered learning and teaching approach within the framework of constructivist approach, constitutes a whole system within the framework of modular programs. This system is the integration of modules into training programs. The module consists of learning-teaching activities consisting of individual teachings that follow a certain order and teaching experiences that show systematic integrity (Karadeniz, 2008: 35; Alkan, 1997: 197).

Consequently, modular teaching is a teaching approach that gives opportunities to learn and improve itself in line with the individual's own life, by analyzing certain systematic ways in education and training (Külahçı & Taşpınar, 1993: 24). According to Alkan (1989), the modular teaching approach has the following basic characteristics:

- The content of the program can be arranged flexibly, which can be applied to different situations and needs of individuals.
- Individuals are given the chance to choose according to their interests and wishes.
- It is possible to switch between different programs.
- Enables individual education.
- There is an opportunity to switch between formal and non-formal education institutions.
- It brings a different understanding to educational practices.
- It is possible to apply modular instruction in pre-service and in-service training.
- It is possible to adapt the prepared learning modules to systems such as computer aided education and distance education.
- It can be used effectively in the evaluation of education in different times and in different situations in a degree or diploma program. Especially in the vocational and technical education system, it has an effective function such as accelerating workforce education, providing continuous education, on-the-job training and self-training opportunities, expanding the system, adapting technological developments, strengthening the relations between education and employment, raising quality and standards.

When the features of the modular teaching method are analyzed in general, it is seen that this teaching method has a contemporary structure like new teaching methods. It is an important teaching method both in terms of having a flexible program content and providing opportunity to switch between programs, as well as being applied to different education programs and enabling individual education (Kaykı, 2008: 14). In this study, by considering these features of the modular teaching method, an exemplary module with poetry and music was created. In addition, teachers' opinions about different teaching methods and modular teaching methods were determined.

1.1 *The importance and purpose of the research*

In this study, there are opinions of teachers about education that can be made to students by using poetry and music. As mentioned, poetry and music are part of human life. Therefore, every student will encounter these species throughout their life. For this reason, thanks to the education made by using music and poetry, what is wanted to be transferred to the student will be transferred more quickly and these gains will remain in the student's mind for a longer time. Music and poetry are a way of expressing thoughts, thoughts are a structure made of language and sounds. Musical and poetic expression can only be expressed in the language of music and poetry. Because the music is the common language of the human, the bases of universal culture are created by understanding the child's own country and the communities living in other countries and their cultures (Uçan, 1997: 133). When this universal quality of music is considered, the importance of education with music becomes clear once again.

In education with music, students will be more active than teachers. The student will be able to grasp the subject to be explained at the end of the lesson and make inferences about that subject. Therefore, it is thought that the Process Based Learning-Teaching Model is a suitable

method for this application. Because this model, the planned execution of teaching in the teaching-learning process improves the students' awareness and use of cognitive awareness or cognitive awareness strategies. It is known that the active participation of the student in the teaching processes increases the learning levels and the permanence of what is learned. Because activating the student more in the teaching-learning process leads to a more effective, meaningful, efficient and more permanent learning experience (Duman, 2007: 56-57).

The features of this model are as follows (Duman, 2007: 43-44):

- Suggests to concentrate in the process of meeting and thinking, transfer the process knowledge and regulate the process and the training and education of the awareness of the process awareness.

- It is a critical, creative, planning and problem-based thinking model that offers the student to plan how to learn independently, to make decisions, to solve problems, to learn by self-directed learning, and to develop their skills.

- Explain how the teacher facilitates teaching, how to plan, and systematically describes how to provide versatile, multi-dimensional and multi-interactive environments according to the planning process.

- CSO has a functional feature such that both the teacher and the student have methods and strategies.

- Process-based teaching is a process-based and interactive program model that embraces social and classroom democratic values and attitudes.

- It is student centered. Responsibility for learning, decision-making is the student, adopts cognitive and constructive learning theories, the teacher performs the coaching and guidance task that facilitates teaching, content teaching is about how, why and how to acquire and structure information rather than storing information.

- Admits that knowledge is structured by the student himself through conceptual framework and mental models through the best experiences and activities.

The aim of the research is to determine the views of social studies teachers about the use of poetry and music as a module in social studies education and to present an exemplary module. For the purpose of the research, answers to the following questions were sought:

(1) What are the opinions of social studies teachers about modular teaching?

(2) Do social studies teachers use different methods besides the methods known in their lessons? What are these methods if they are using?

(3) Do social studies teachers use poetry and music as modules in their lessons? If they do, how do they include these modules in their lessons?

(4) What are the opinions of social studies teachers regarding the use of poetry and music as a module?

2. Method

Qualitative data collection tools were used in the study and descriptive and content analysis method was used in the analysis of qualitative data. Analyzes were made according to the principles and rules of descriptive and content analysis method. In addition, the qualitative data were analyzed according to the data obtained from the interview form applied to the teachers. A framework was formed by examining the data obtained from the teachers and it was determined which themes were to be arranged according to the themes.

2.1 *Study group*

The research has been conducted to social studies teachers in the randomly selected secondary schools in the province of Nevşehir in the academic year 2016-2017. The information of these teachers is as in Table 1 below:

Table 1. Teachers in the research

Teacher	Gender	Age	Department	Professional Seniority
Teacher 1	Female	26	Social Studies	2
Teacher 2	Female	30	Social Studies	4
Teacher 3	Female	29	Social Studies	5
Teacher 4	Female	28	Social Studies	4
Teacher 5	Female	27	Social Studies	3
Teacher 6	Male	29	Social Studies	4
Teacher 7	Male	31	Social Studies	6
Teacher 8	Male	28	Social Studies	4
Teacher 9	Male	29	Social Studies	3
Teacher 10	Male	28	Social Studies	4

2.2 *Data collection tool and data analysis*

The data were collected by interview technique. In this study, semi-structured interview form was prepared by field experts and was used as data collection tool. In addition, other field experts were consulted for the validity of the form. Data were analyzed using descriptive and content analysis methods. Categorical analysis technique was used in content analysis. In addition, the qualitative data were quantified and the reliability was increased, internal credibility was increased by making direct quotations from the interviews and it was aimed to explain the views of the teachers by giving examples of the teachers' opinions on the questions. Descriptive analysis consists of the following four stages (Altunışık et al., 2010):

(1) Creating a framework for descriptive analysis,

(2) Processing of data according to the thematic framework,

(3) Identification of the findings,

(4) Interpretation of findings.

Categorical analysis technique was used in content analysis. The data were first coded in the content analysis. As a result of examinations on the data obtained, these were divided into meaningful sections. It was found out what each episode expresses conceptually. The stage of finding the categories and themes that emerged after the coding of the data was started. At this stage, the codes were categorized. Then the codes were explained in understandable language. In other words, the data was organized and defined according to the codes and themes in general. In addition, the qualitative data were digitized in the study and reliability was increased by direct quotations from the interviews, and internal reliability was increased, and it was aimed to explain the opinions of the teachers better by giving examples from the teachers' views on the questions. According to Yıldırım and Şimşek (2008), qualitative data can also be expressed with numerical values like quantitative data. For this reason, the qualitative data in this study also used numerical values.

3. Results

This section includes the views of social studies teachers on the use of poetry and music as a module in social studies education.

3.1 *Social studies teachers' opinions about alternative methods*

In order to determine the opinions of social studies teachers against alternative methods, the teachers first asked the questions: "What do you think are alternative methods? Can alternative methods be used in social studies lesson? What are these methods if they are using it?". When the answers given by the teachers regarding these questions are examined, it is seen that the teachers do not have information about alternative methods. When it comes to teachers as an alternative method, they first think of the school curriculum and the wrongness of the current education system. It is seen that teachers who think that the current education system is wrong do not know alternative methods. It was determined that what some teachers said as an alternative is not a method. As a matter of fact, it is seen that social studies teachers cannot go out of the existing system and cannot use / use alternative methods because the existing classes are not suitable for different methods. However, "Can alternative methods be used in the social studies course?", when the answers of the question were examined, most of the teachers stated that alternative methods were suitable for social studies lesson and different methods should be used in social studies lesson. In addition, it is seen that all of the teachers actively use the question-answer technique in their classrooms. Apart from this, it was determined that some teachers also made school trips to help their students understand the subjects better. Some of the answers given by some teachers to the questions are as follows:

> T3: *I don't know much about alternative methods. But existing systems can be changed. Apart from this, different methods can be used easily in the social studies course. However, these methods should be such that the student can understand the lesson more easily.*
>
> T7: *I do not think that the current curriculum of the social studies course is very suitable for different methods. If this curriculum and system are changed, lessons can be handled more easily if class sizes are reduced and teachers can use different methods more. Currently, even if teachers want, they cannot use different methods. Because the system does not allow this.*
>
> T10: *I do not think that the system we are currently using is suitable for different methods. Because there are serious problems about time and even the lesson we teach with students in the form of questions and answers is difficult to catch up. For different methods, either lesson hours should be increased or subjects should be spread more.*

3.2 *Social studies teachers' opinions on using poetry and music as a module*

In order to determine the opinions of social studies teachers about the use of poetry and music as a module, they said to teachers, and "Do you use poetry and music as modules? If you are, how do you include these modules in your lessons?", "Can poetry and music be used in social studies lessons as an alternative method? If used, how would you reflect this on the lesson?" questions were asked. When the answers received in line with these questions were examined, it was found that none of the teachers used poetry and music in their lessons. The reason for this is that teachers do not have enough time in the lesson. However, they stated that they could use poetry and music as an alternative method if they had enough time. Because they think that with poetry and music, students will be more interested in lessons and lessons will be more enjoyable for them. They also stated that the lessons taught in this way would be more permanent for the

student. Several of the teachers are worried that the lessons that will be taught in this way will take a long time and that the subjects cannot be trained. However, they also stated that this situation could be prevented thanks to a planned time management. Teachers presented different opinions on how poetry and music can be used as a module in social studies lesson. For example, S1: Poetry and music can be used in social studies. It would be even more beautiful if used. In this way, students' lessons are enjoyable and many students actively participate in the lesson. For example, we can turn the topics into songs with a certain melody and present them to the students. In this way, when a question about that subject comes up, the student immediately remembers that song and it becomes easier to remember, and stated that the subjects should be presented by integrating them with music. Again, some of the social studies teachers' views on the use of poetry and music as a module are as follows:

> T4: *Frankly, I am not actively using poetry and music in my classes. I only benefit from them if there is poetry in the books of national education. Apart from that, I have no idea how I can use these methods even if I want to use them. More precisely, we do not have any material for these. Also, there is a shortage of time in lessons and I am not sure if time is enough in lessons taught in this way. However, I think that if such methods are included in the lessons, the students will understand the topics better. Because I think that the lesson taught with music will attract the attention of every student.*

> T6: *I use not poetry but sometimes poetry in my classes. But they are not the poems I want. We read some of the poems in the curriculum (in the book) together with the students in the class and try to put forward their main idea. In the lessons, we usually teach with students in the form of questions and answers. In this way, I try to ensure students' participation in the class. However, teaching lessons with poetry and music can be more fun and permanent for students. Because music is something that most students love. I think that if we use the music in the lesson, the number of students attending the lesson increases. However, I do not have a clear idea about how the lessons will be transferred with poetry and music. If national education brings such activities to us, we apply it in our lessons.*

4. Discussion

The literature scans carried out also support the findings obtained. Plato (1963) emphasized that music can be a part of primary education and can be used to describe historical events. Çencen and Berk (2014) stated in their studies that the use of poetry in lessons can improve students' empathy, creativity and questioning skills. They also emphasized that poetry, a literary product, can be used as a teaching material in order to gain affective skills. Again, Ceylan (2008) emphasized the importance of using poetry in terms of providing a fun, interesting and student-centered educational environment in foreign language teaching. Önkaş (2013) emphasized the importance of using poetry in education and stated that the fluid and toned sounds in poetry are more than toneless sounds, and the connection between positive emotion and melodic voice will be made easier. In his studies, Şendurur and Barış (2002) emphasized that a proper and conscious music education should be given at every stage of the child's developmental stages and the importance of sensory education.

Again, considering the findings obtained in this study, there are some concerns about teachers' use of poetry and music in their lessons. Considering the findings obtained, teachers mostly use the question-answer technique in their lessons. Apart from this technique, it was determined that the student was more active and the methods and techniques that the student would make an inference in the taught lesson were not included in the lessons. The teachers stated that this was due to the current system of the Ministry of National Education and the low duration of the lessons.

5. Conclusions

Many alternative methods are recommended for use in social studies. These alternative methods include poetry and music. Because the individual has been involved with music since his childhood, and he has been acquainted with poetry from his earliest years. Therefore, students are not alien to these concepts. Therefore, poetry and music can be used as an alternative approach in social studies education. Surveys, researches, articles and book reviews support this view. Therefore, it is thought that poetry and music will be used as an alternative method in social studies course. This research reflects the opinions of teachers in some secondary schools in the province of Nevşehir in order to determine the views of social studies teachers about the use of poetry and music as a module in social studies education and to present a model module. Based on the opinions of the teachers, the applicability of poetry and music to the social studies course has been put forward. The studies and the findings show that the opinions of the teachers on the use of poetry and music in the social studies course are positive. Literature scans have also supported the findings. However, there are some concerns that teachers use in poetry and music classes. According to the findings, teachers use mostly question and answer technique in their lessons. Apart from this technique, it is determined that the students are more active and that the students do not place much in their lessons. The teachers stated that this was due to the current system of the ministry of education and the current duration of the courses.

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References

Ada, A. F. (1995). *A chorus of cultures: Developing literacy through multicultural poetry*. Carmel, Calif: Hampton-Brown Books.

Akkaş, S. (1993). *Okulöncesi eğitimde müzik* [Music in preschool education]. Ankara: Gazi Üniversitesi, Mesleki Eğitim Fakültesi.

Alkan, C. (1997). *Eğitim teknolojisi* [Education technology]. Ankara: Anı Yayıncılık.

Alkan, C. (1989). Modüler programlama ve Türkiye'de uygulama [Modular programming and its implementation in Turkey]. *Ankara Üniversitesi Eğitim Bilimleri Dergisi*, *22*(1), 13-22.

Altunışık, R., Çoşkun, R., Yıldırım, E., & Bayraktaroğlu, S. (2010). *Sosyal bilimlerde araştirma yöntemleri* [Research methods in social sciences]. 6. Baskı, Sakarya: Sakarya Kitabevi.

Arp, T. (1997). *Perrine's sound and sense: An introduction to poetry*, 9th Ed. Fort Worth, TX: Hardcourt Brace College Publishers.

Bagert, B. (1992). *Act it out: Making poetry come alive*. Bernice Cullinan, Ed., Invitation to Read: More Children's Literature in the Reading Program.

Bağrıaçık, Z. (2019). *Ortaöğretim öğrencilerine uygulanan müzik eğitimiyle ilgili olarak ebeveynlerin görüşlerinin değerlendirilmesi* [Evaluation of parents' views on music education applied to secondary school students]. Pamukkale Üniversitesi Eğitim Bilimleri Enstitüsü. Yayımlanmamış yüksek lisans tezi.

Ceylan, H. (2008). Yabancı dil olarak İngilizce'nin öğretiminde şiirin kullanimi. Trakya Üniversitesi [The use of poetry in teaching English as a foreign language]. *Sosyal Bilimler Dergisi, 10*(1), 116-121.

Chatton, B. (1993). *Using poetry across the curriculum*. Phoenix, Ariz: Oryx Press

Çencen, N., & Berk, N. (2014). Ortaöğretim T. C. inkilâp tarihi ve Atatürkçülük dersinde "şiir kullanimina" ilişkin öğretmen görüşleri [Teachers' opinions on "the use of poetry" in the Republic of Turkey, Turkish Revolution history and Kemalism course]. *Turkish History Education Journal*, *3*(1), 1-23. http://doi.org/10.17497/tuhed.185592

Donaldson, P. D. (2001). Teaching geography's four traditions with poetry. *Journal of Geography*, *100*(1), 24-31

Duman, B. (2007). Süreç temelli öğrenme öğretim modeli [Process-based teaching and learning model]. *Muğla Üniversitesi Sosyal Bilimler Enstitüsü Dergisi (İlke) Sayı: 19*. Muğla.

Gardner, H. (2006). *Eğitimli akıl* [Educated mind]. İstanbul: Morpa yayınları.

Karadeniz, O. (2008). *Endüstri meslek liseleri elektrik elektronik teknolojileri alanında uygulanmakta olan modüler öğretim yöntemi ile geleneksel öğretim yönteminin öğretmen görüşleri çerçevesinde karşılaştırılması* (Yeditepe Üniversitesi Sosyal Bilimler Enstitüsü Yüksek Lisans Tezi) [Comparison of the modular teaching method applied in the field of electrical and electronic technologies in the industrial vocational high schools with the traditional teaching method within the framework of teachers' opinions (Yeditepe University Institute of Social Sciences Master Thesis)]. İstanbul.

Kaykı, İ. E. (2008). *Modüler öğretim yöntemi ve uygulamalı dersler*. Yayımlanmamış Yüksek Lisans Tezi [Modular teaching method and practical lessons. Unpublished Master Thesis]. İstanbul: Beykent Üniversitesi Sosyal Bilimler Enstitüsü.

Kutlu, B. (2019). Antik Yunan kültüründe müziğin kullanım alanları ve 20. yüzyıldan günümüze etkileri [Usage areas of music in Ancient Greek culture and its effects from the 20th century to the present]. *Sosyal Bilimler ve Eğitim Dergisi*, *2*(2), 300-310.

Külahçı, Ş. G., & Taşpınar, M. (1993). Modüler öğretim yaklaşımı ve Fırat üniversitesinde yapılan çalışmalar [Modular teaching approach and studies at Fırat University]. *Eğitim ve Bilim*, *17*(90), 24-34. Ankara.

McCall, A. L. (2004). Using poetry in social studies classes to teach about cultural diversity and social justice. *The Social Studies*. July/August.

Meadows, D. M. (1999). African-American poetry and history: Making connections. *OAH Magazine of History*, *13*, 36-41.

MEGEP (2006). Öğretim Programları ve Modüler Öğretim Uygulama Kılavuzu [Curriculum and modular instruction practice guide].

Önkaş, N. (2013). Klâsik şiir örneklerinin Türkçe eğitiminde kullanilmasi üzerine bir çalişma [A study on the use of classical poetry samples in Turkish education]. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi, 28*(28-1), 1-14.

Plato (1963). *Republic, in The Collected Dialogues of Plato*. Princeton: Princeton University Press

Sidekli, S., Yangın, S., & Gökbulut Y. (2007). *5*. Sınıf sosyal bilgiler dersinde şiirle öğretim yöntemine örnek bir uygulama [An example of application to teaching method with poetry in classroom social studies course]. *VI. Sınıf Öğretmenliği Eğitimi Sempozyumu*. Anadolu Üniversitesi, Eskişehir

Şen, Y., (2010). Okulöncesi dönemde, çocuğun gelişiminde müziğin önemi [The importance of music for child's development in preschool period]. *Atatürk Üniversitesi Sosyal Bilimler Enstitüsü Dergisi*, *7*(1), 337-343.

Şendurur, Y., & Barış, D. A. (2002). Müzik eğitimi ve çocuklarda bilişsel başarı [Music education and cognitive success in children]. *Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi*, *22*(1).

Tanrıkorur, C. (2003). *Müzik kültür dil* [Music culture language]. İstanbul: Dergah Yayınları.

Uçan, A. (1997). *Müzik eğitimi temel kavramlar-ilkeler-yaklaşımlar* [Music education basic concepts-principles-approaches]. Ankara: Müzik Ansk. Yay. Adalet Matbaası.

Uçan, A. (1996). *İnsan ve müzik – insan ve sanat eğitimi* [Human and music – Human and art education]. Ankara: Müzik Ansk. Yay., Alf Matbaası.

Vardell, S. M. (2003). Poetry for social studies: Poems, standards, and strategies. *Social Education*, *67*(4), 206-211.

Yardımcı, M. (1999). *Başlangıcından günümüze halk şiiri aşık şiiri tekke şiiri* [Folk poetry, love poetry, and tekke poetry, from the beginning to the present]. Ankara: Ürün Yayınları.

Yıldırım, A., & Şimşek, H. (2008). *Sosyal bilimlerde nitel arastirma yontemleri* [Qualitative research methods in the social sciences]. Ankara: Seçkin Yayınları.

Yöre, S. (2004). Türkiye'de çocuk müziği [Children's music in Turkey]. *Çoluk Çocuk Dergisi* Sayı, 45.

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Prediction Level of the Fourth Grade Students' Scientific Attitudes on Reflective Thinking Skills for Problem Solving

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Abstract

In this study, the prediction level of the fourth-grade students' scientific attitudes on reflective thinking skills for problem solving was examined. The research was conducted using the correlational survey model and the sample of the study consisted of 468 students identified through simple random sampling. According to the findings the students had a low level of reflective thinking skills for problem solving and scientific attitudes. It can be said that there is a significant and positive correlation between the fourth-grade students' scientific attitudes with reflective thinking skills for problem solving. Besides, while the model established for the prediction of the reflective thinking of the fourth-grade students by the scientific attitude is significant, reflective thinking for problem solving of the fourth-grade students was strongly explained by scientific attitudes.

Keywords: attitude, scientific attitude, reflective thinking, problem solving, fourth grade students.

1. Introduction

Contemporary thoughts about learning have turned learning environments into a structure where the student is at the center and where individual differences about the student are considered. For this reason, the characteristics of students such as interest, need, attitude, expectation, and academic-self have a significant effect on both the theoretical and practical directions of the teaching process. Metacognition is one of the important concepts that emerges in learning environment and significantly predicts students' internal concepts such as attitudes and motivation to learn and their preferences towards learning strategies. According to Reeve and Brown (1985), metacognition is the ability of the individuals to control and direct their own cognitive activities. Metacognition is an important phenomenon that supports the purpose of creating independent learners that contemporary education systems care about (Kramarski, 2008; Mevarech & Amrany, 2008).

In this context, the individual should determine which way he/she learned best, and what aspects he/she should change or strengthen in the learning process and raise the level of learning through these regulations. At this point, reflective thinking skill, which is frequently emphasized in the current curriculum, appears. Unver (2003) defines reflective thinking as the thinking process to reveal the positive and negative situations related to the teaching or learning

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method and to solve the problems related to method or level of learning. In contemporary education systems it is very important to be aware of the problems and to engage in the thinking process to solve these problems. Reflective thinking in this regard appears as a thinking skill that supports problem solving.

- Students have a low level of reflective thinking skills for problem solving and sub-dimensions. Students have a low level of scientific attitudes, too.
- While students' reflective thinking skills for problem solving and scientific attitudes do not differ significantly in terms of gender, family income level and father education level, the students' reflective thinking skills for problem solving and scientific attitudes differ significantly in terms of mother education level, first semester grade and mathematics exam grade.
- There is a significant and positive correlation between the fourth-grade students' scientific attitudes with reflective thinking skills for problem solving and sub-dimensions.
- Compound effects of variables except family income level, mother education level and first semester grade with scientific attitude level were not significant.
- While the model established for the prediction of the reflective thinking of the fourth-grade students by the scientific attitude is significant, reflective thinking for problem solving of the fourth-grade students was strongly explained by scientific attitudes.

Problem solving skill is one of the important skills that education systems consider important in the light of current developments. According to Gagne (1980), it should be known that the teaching method of the 21st century is problem solving. According to Bingham (2004: 24), the problem is the obstacle that confronts the individual's existing skills used to achieve the desired goal. So, problem solving is to find new solutions by going beyond the simple application of the rules learned through previous experiences to solve a problem (Korkut, 2002). Problem solving skill is to develop the ability to limit and understand when a problem is encountered, to choose the appropriate method for its solution, to use this method, and to analyze the results. When this skill is acquired, the individual gets the habit of acting with a problem solving approach to explain the events around (Altun, 2002). At this point, the first and most important activity that an individual should do in order to show problem solving skills is "thinking".

The perception of the problem starts the thinking activity, the solution of the problem turns into a goal for the individual, and this purpose directs the thinking activity (Kalaycı, 2001). While some problems have the right answers or certain solutions, some other do not have. The solution of these problems requires interdisciplinary knowledge, multi-faceted thinking, and creativity (Senemoğlu, 1997). In this process, the individual needs to employ higher-order thinking activities and must be creative, reflective, critical, and analytical (Bilen, 1996).

Due to its nature, problem solving skills are both disciplinary and interdisciplinary. One of the areas where this skill has an important function due to its structure is science. When the Science Education curriculum published by the Ministry of Education (2018) is examined, particular emphasis is placed on creating students who produce knowledge, use it functionally in life, solve problems, think critically, have communication skills, empathize, and contribute to society and culture. Students' level of using problem solving skills or functioning within a field is closely related to their attitudes towards this field.

Attitudes are defined as a predisposition to respond positively or negatively to things, people, places, or ideas (Simpson et al., 1994). Attitude is best viewed as a set of affective reactions towards an object, derived from concepts of beliefs that the individual has, and predisposing the individual to behave in a certain manner towards that object. In science and science education, the major division has been in terms of scientific attitude which is directly related to someone's

disposition towards scientific research or activity. In other words, it is the inclination to value empirical evidence as the basis of belief on science (Gardner, 1975; Johnston, 1996; OECD, 2017). Munby (1983) defined scientific attitude as the thinking pattern and characteristic of scientists. To be scientific means that one has such attitudes as curiosity, rationality, open-mindedness, critical-mindedness, objectivity, honesty, humility, and willingness to suspend judgment.

Many researchers indicated that students' attitude and interests could play substantial role on their science achievement (Adodo & Gbore, 2012; Simpson & Oliver, 1990; Wilson, 1983). According to Osman, Iksan & Halim (2007), scientific attitude can support scientific learning and enhance the performance of scientific activity. Gokul and Malliga (2015) mentioned that scientific attitude is the most important outcome in science teaching, and it is equally important as the scientific knowledge. Similarly, Bloom (1976) reported that attitude accounted for up to 25% of the variability in students' achievement scores. Knowing students' scientific attitudes and attitudes towards science is important in structuring the learning environment. Well-structured learning environments both increase achievement and contribute to the positive change of attitudes (Olasehinde & Olatoye, 2014).

So, in this study, whether there was a significant correlation between these two concepts was investigated. Also, the fourth-grade students' scientific attitudes and reflective thinking skill levels of problem solving were determined. Whether the fourth-grade students' scientific attitudes and reflective thinking skill levels of problem solving showed a significant difference in terms of gender, family income level, mother education level, father education level, first semester average grade, and last mathematics exam grade was also examined.

2. Method

2.1 *Research design*

The research was conducted using the correlational survey model. The correlational survey model is important to reveal relationships between variables and to determine the levels of these relationships (Karasar, 2016: 114). Moreover, the correlational survey provides the necessary clues for conducting higher-level research on a relationship (Büyüköztürk, 2016: 185).

2.2 *Population and sample*

The population of the study consisted of the fourth-grade students studying in Afyonkarahisar city center. The sample of the study consisted of 468 students identified through simple random sampling. The distribution of the determined sample according to some variables is presented in Table 1.

Table 1. Distribution of the sample

Variable		**f**	**%**
Gender	Female	238	50.9
	Male	230	49.1
Family income level	Low (under 1500 TL)	112	23.9
	Average (1501-3000 TL)	242	51.7
	High (3001 TL and above)	114	24.4
Mother education level	Primary School	166	35.5
	Secondary School	124	26.5
	High School	101	21.6
	Undergraduate	77	16.5
Father education level	Primary School	79	16.9
	Secondary School	109	23.3

	High School	151	32.3
	Undergraduate	129	27.6
First semester grade	1	28	6.0
	2	13	2.8
	3	38	8.3
	4	90	19.7
	5	288	63.0
Last mathematics exam grade	1	18	3.8
	2	21	4.5
	3	52	11.1
	4	115	24.6
	5	254	54.3

Since the first semester grade and last math exam grade variables were not answered by all students, the total number of students in these two variables was slightly lower than the total sample number.

2.3 *Data collection tool*

In the data collection process, "Scientific Attitude Scale" developed by Moore and Foy (1997) and adapted by Demirbaş and Yağbasan (2006) was used. The scale is a five-point Likert-type scale which shows a six-factor structure with a total of 40 items. The degree of participation in items of scale is classified as "Strongly Agree", "Agree", "Undecided", "Disagree", and "Strongly Disagree". As a result of validity and reliability analyses, Cronbach Alpha reliability coefficient is .76 and Spearman Brown two-half test correlation is found .84. In the present study Cronbach Alpha reliability coefficient was .88.

Besides, "Reflective Thinking Skill for Problem Solving Scale" developed by Kızılkaya and Aşkar (2009) was used. The scale has a total of 14 items and three dimensions (questioning, reasoning and evaluation). Scoring has been designed according to the responses of the student considering the frequency of the performing of the action in those items. Action frequencies have been organized in the levels of "Always", "Often", "Sometimes", "Rarely", and "Never". According to the reliability analysis, Cronbach Alpha coefficient for the "questioning" dimension has been found as .73, for the "reasoning" dimension as .71, and for the "evaluation" dimension as .69. The value is .83 for the whole scale. In the present study, the Cronbach alpha coefficient for the whole scale was calculated as .92. The Cronbach alpha coefficients for dimensions were .72, .80 and .80, respectively. These values are considered to be highly reliable for the scale to be used in the present research (Tavsancıl, 2006: 29).

2.4 *Data analysis*

The data obtained from the evaluated scales were analyzed using a statistical program. In order to determine the level of the fourth-grade students' reflective thinking skills for problem solving (and sub-dimensions) and scientific attitudes, the mean of their answers was taken. Then it was determined that the data that related to scientific attitudes and reflective thinking skills for problem solving showed a normal distribution according to results of normality test. So, independent samples t-test, one way ANOVA test, Pearson correlation test, compound effect analyses and linear regression test was conducted for the purposes of the research.

3. Findings

In the study, first, the level of the fourth-grade students' scientific attitudes and reflective thinking skills for problem solving was examined. The results are shown in Table 2.

Table 2. Descriptive statistics of reflective thinking skills for problem solving and scientific attitudes

Dimension		**f**	**Minimum**	**Maximum**	$\overline{x}$	**Std. Dev.**
Scientific attitudes		468	10.00	173.00	100.65	22.09
Reflective thinking		468	14.00	70.00	31.87	12.20
Sub-Dimensions	Questioning	468	5.00	25.00	11.79	4.35
	Reasoning	468	4.00	20.00	8.57	4.08
	Evaluation	468	5.00	25.00	11.50	4.94

When the findings in Table 2 are examined, it can be stated that students have a low level of reflective thinking skills for problem solving and sub-dimensions. Students have a low level of scientific attitudes, too.

Second, independent samples t-test was applied to determine whether the reflective thinking skills for problem solving (and sub-dimensions) and scientific attitudes differed significantly in terms of gender. According to the test, it can be said that students' reflective thinking skills for problem solving (and sub-dimensions) and scientific attitudes do not differ significantly in terms of gender. Besides, it can be stated that the means determined in reflective thinking skills for problem solving and sub-dimensions are high in favor of male students. On the other hand, female students' scientific attitude levels are higher than male students according to means.

After that, one way ANOVA test was applied to determine whether the reflective thinking skills for problem solving (and sub-dimensions) and scientific attitudes differed significantly in terms of family income level, mother education level, father education level, first semester grade, and last mathematics exam grade variables. It can be said that students' reflective thinking skills for problem solving (and sub-dimensions) and scientific attitudes do not differ significantly in terms of family income level. Besides, it can be stated that the means determined in all dimensions are high in favor of students with high family income level except "questioning" sub-dimension. In "questioning" sub-dimension, students with low family income level have the highest mean.

When the data according to mother education level are examined, it can be said that students' reflective thinking skills for problem solving and sub-dimensions except "questioning" and scientific attitudes differ significantly in terms of mother education level. When the differences are examined, the attitudes towards science and reflective thinking skills towards problem solving of the students whose mother education level are high school and undergraduate are significantly high.

Besides, when the data according to father education level are examined, it can be said that students' reasoning skills differ significantly in terms of father education level. When it is analyzed from which groups the difference originates, it is seen that the students whose father education level are undergraduate and high school have a significantly higher level of reasoning skills than the students whose father education level are secondary school.

After that, when the data according to first semester grade are examined, it can be said that students' reflective thinking skills for problem solving (and sub-dimensions) and scientific attitudes differ significantly in terms of first semester grade variable. It is seen that the difference

is significantly in favor of the students with "excellent" and "good" grades. Also, when the averages are examined, the levels of skill and attitude increase as the grade increases.

When the data according to last mathematics exam grade are examined, it can be said that students' reflective thinking skills for problem solving and sub-dimensions differ significantly in terms of last mathematics exam grade. It is seen that the difference is significantly in favor of the students with "excellent" and "good" grades. Also, when the averages are examined, the levels of skill and attitude increase as the grade increases.

In the study, also, it was examined whether there was a significant correlation between reflective thinking skills for problem solving (and sub-dimensions) with scientific attitudes. The results are shown in Table 3.

Table 3. Correlation between reflective thinking skills for problem solving and sub-dimensions with scientific attitudes

		Reflective Thinking	**Questioning**	**Reasoning**	**Evaluation**
Scientific Attitudes	**Correlation coefficient**	.585**	.518**	.548**	.535**
	p	.00	.00	.00	.00

**Correlation is significant at the 0.01 level (2-tailed).

When the results in Table 3 are examined, it can be said that there is a significant and positive correlation between the fourth-grade students' scientific attitudes with reflective thinking skills for problem solving and sub-dimensions. All correlation coefficients are found to be significant.

In the study, compound effect analyses were conducted to determine whether the reflective thinking skills for problem solving of the fourth-grade students differed significantly according to the level of scientific attitude and the variables determined. Compound effects of variables except family income level, mother education level and first semester grade with scientific attitude level were not significant.

It is found that the compound effect of the level of scientific attitude and family income level is significant on the reflective thinking skills of students [F (104,259) =1.757; p<.05]. In addition to this, the scores obtained show a significant difference separately in terms of scientific attitude level [F (102,259) = 4.590; p<.05] in favor of higher level. According to the findings, in all single scientific attitude level, students who have higher family income level were more skillful at reflective thinking skill for problem solving.

Besides, it is found that the compound effect of the level of scientific attitude and mother education level is significant on the reflective thinking skills of students [F (9,451) =2.139; p<.05]. In addition to this, the scores obtained show a significant difference separately in terms of scientific attitude level [F (4,451) = 45.640; p<.05] in favor of higher level. According to the findings, in all single scientific attitude level, students who have higher mother education level were more skillful at reflective thinking skill for problem solving.

It is found that the compound effect of the level of reflective thinking for problem solving and first semester grade is significant on the scientific attitudes of students [F (13,435) =2.314; p<.05]. In addition to this, the scores obtained show a significant difference separately in terms of reflective thinking for problem solving level [F (4,435) =14,183; p<.05] and first semester grade [F (4,435) =4.223; p<.05] in favor of higher level. According to the findings, in all single reflective thinking for problem solving level, students who have higher first semester grade were better at scientific attitudes.

In the study, also, it was examined whether test to determine whether students' scientific attitudes significantly predicted their reflective thinking for problem solving. Before performing the regression analysis, it was checked whether the assumptions required for the analysis were met. Accordingly, it was first seen that the data had a normal distribution and normality assumption was provided. Then, as can be seen in Table 3, where the findings of the correlation analysis are presented, the presence of a linear relationship between the predictive variable and the predicted variable was determined. The results of the analysis of variance related to regression analysis are shown in Table 4.

Table 4. The results of the analysis of variance related to the prediction of reflective thinking for problem solving

Model	Sum of Squares	df	Mean Square	F	p
Regression	23838.528	1	23838.528	242.781	.00*
Residual	45756.284	466	98.189		

*p<.01

When the Table 4 is examined, it can be stated that the model established for the prediction of the reflective thinking of the fourth grade students by the scientific attitude is significant ($F_{(1,466)}$=242.781; p<.01). After that, the findings of linear regression analysis between the reflective thinking and scientific attitude concepts are given in Table 5.

Table 5. The results of regression analysis on the prediction of reflective thinking for problem solving by scientific attitude

Predictive Variables	B	Std. Error	β	t	p
(Constant)	-.667	2.138		-.312	.75
Scientific Attitude	.323	.021	.585	15.581	.00*
R=.585; R^2=.343; $F_{(1,466)}$=242.781; p<.01					

According to the analysis, while the model is significant as a whole [$F_{(1,466)}$=242.781; p<.01], reflective thinking for problem solving of the fourth grade students was strongly explained by scientific attitudes.

According to the findings, regression equation of reflective thinking for problem solving of the fourth-grade students was as follows:

Reflective Thinking = .323 x Scientific Attitude

4. Results and discussion

In the study, firstly, when the results related to the means were examined, it can be stated that the students had a low level of reflective thinking skills for problem solving (and sub-dimensions) and scientific attitudes. Accordingly, students use the reflective thinking skill very little in the problem solving process. In other words, they do not apply the questioning, reasoning and evaluation skills much in the problem solving process. However, it is seen that students' attitudes towards science were not high.

According to Demirel, Derman and Karagedik (2015) and Kızılkaya and Aşkar (2009) the level of reflective thinking skills for problem solving of secondary school students were not sufficient. Katrancı and Şengül (2020) also determined the questioning skills of secondary school

students at an intermediate level. In the research of Aydın and Diker Coşkun (2016), it was found that the eighth grade students' reflective thinking skills for problem solving were low. Based on these findings, it is seen that students do not use reflective thinking skills in their learning processes. However, it can be stated that the attitudes of the students determining their affective positions towards learning are low. In this context, it can be said that the revisions made in the curriculum and teaching processes towards constructivism have not yet had a positive effect.

When the results related to gender variable are examined it can be seen that students' reflective thinking skills for problem solving (and sub-dimensions) and scientific attitudes did not differ significantly. According to Corbett et al. (2008) gender differences between girls and boys have decreased and in some subjects no longer exist. But, the analyses typically do not present data on the academic achievement of male and female students in such a way as to show the effect of variables such as ethnicity or economic status. Fraser et al. (2011) pointed out that researchers do not give much detail about achievement differences between students according to gender. This situation has limited researchers' understandings of the issues that mediate students' achievement, attitudes, and participation in science.

Gender is characterized as the most significant variable towards students' attitude to science. When the literature is analyzed, men mostly show more positive attitudes towards science than women. Also, according to Aiken and Aiken (1969), it was a well-known cultural bias that science and mathematics were generally "masculine" occupations. But, Lowery (1966) said that fifth-grade girls had more positive attitudes than fifth-grade boys. Given the particular situation in Turkey, female students usually achieve high scores than male students in both national and international exams (MONE, 2019a; 2019b, ASPC, 2019). This shows that female students improve themselves academically better, identify their deficiencies better, take measures accordingly and arrange their learning processes in a way that reveals their potential.

According to Saygılı and Atahan (2014), reflective thinking skills of primary and secondary school students towards problem solving did not differ significantly according to gender variable. In the study of Kırnık (2010), it was obtained that the effect of the activities developing reflective thinking did not differ according to gender while Demirel, Derman, and Karagedik (2015) and Solakumur (2017) stated that reflective thinking skills for problem solving did not differ according to gender. In the study of Kaya (2009) in which primary school students' thinking styles and academic achievements in mathematics were examined, it was found that the scores obtained from the scale related to thinking styles did not change according to gender. In the study of Kızılkaya and Aşkar (2009), gender was not found to be effective on problem solving. There are studies supporting this finding in the literature (Aldan Karademir & Görgün, 2019; Dilci & Babacan, 2012; Erdoğan, 2019; Güneş, 2015; Köseoğlu, Demirci, Demir & Özyürek, 2017; Özkök, 2004; Tat, 2015).

When the results related to the family income level examined, it can be stated that students' reflective thinking skills for problem solving (and sub-dimensions) and scientific attitudes did not differ significantly in terms of family income level. Besides, it can be stated that the means determined in all dimensions are high in favor of students with high family income level except "questioning". Hacieminoglu (2016) found that family income had a significant effect on the students' attitude towards science. The mean scores of the students from a low income were significantly different from those students from a medium and from a high-income family. Also, Lowery (1966) determined that the students from an upper socioeconomic area had more positive attitudes toward science than those from middle and lower socioeconomic areas (Aiken & Aiken, 1969).

Uygun and Bilgiç (2018) determined that reflective thinking skills of middle school students towards problem solving did not differ significantly according to socio-economic level. There are studies supporting this finding in the literature (Aydın & Çelik, 2013, Ceyhan, 2014;

Gedik, Akhan & Kılıçoğlu, 2014; Güneş, 2015; Kırnık, 2010; Şen, 2013; Tat, 2015). Also, Bilgiç (2017) determined that students' reflective thinking skills for problem solving did not differ significantly according to the economic situation they perceived. In the light of this finding, it can be said that students' thinking skills and attitudes which constitute the cognitive and affective dimension of the learning context do not change according to the level of opportunities that students have.

When the results related to mother education level are examined it can be stated that reflective thinking skills for problem solving and sub-dimensions except "questioning" and scientific attitudes differed significantly in terms of mother education level. When the differences are examined, the attitude and skill of the students whose mother education level are high school and undergraduate were significantly high.

In his study, Rani (2006) found that the level of education of the mother had an effect on the attitude of the students to the utility of science, but this was not statistically significant. Hacieminoglu (2016) found that students with higher levels of mother education had higher attitudes towards science than those with lower mother education level. George and Kaplan (1998), in their research, determined that parental education was found to have significant total indirect effects on the extent of parental involvement. Higher parental education is associated with children's visits to libraries and museums and also participation in science activities such as science fairs and clubs. In general, all these activities have significant positive indirect effects on student science attitudes. Şen (2013) determined that there was a positive relationship between the education level of the parents and the reflective thinking skills of the students.

When the results related to father education level are examined, it can be stated that students' reasoning skills differed significantly in terms of father education level. When it is analyzed from which groups the difference originates, it is seen that the students whose father education level are undergraduate and high school had a significantly higher level of reasoning skills than the students whose father education level are secondary school. Hacieminoglu (2016) found that students with higher levels of father education had higher attitudes towards science than those with lower father education level.

According to Saygılı and Atahan (2014), reflective thinking skills of primary and secondary school students towards problem solving did not differ significantly according to their father's education level. Bilgiç (2017), in his study, determined that students' reflective thinking skills for problem solving did not differ significantly according to their educational status. According to Uygun and Bilgiç (2018), reflective thinking skills of middle school students towards problem solving did not differ significantly according to their father's education level. There are studies in the literature supporting this finding (Aydın & Çelik, 2013; Güneş, 2015; Tat, 2015)

When the results related to first semester grade examined, it can be stated that students' reflective thinking skills for problem solving (and sub-dimensions) and scientific attitudes differed significantly in terms of first semester grade. It is seen that the difference was significantly in favor of the students with "excellent" and "good" grades. Also, when the averages are examined, the level of skill and attitude increase as the grade increases.

Rani (2006) found in his research that achievement motivation was found to have statistically significant effects on science attitudes only in the eighth grade and the ninth grade. Katrancı and Şengül (2020) determined that the success levels of secondary school students positively affected their inquiry skills towards mathematics. In the study of İnel Ekici (2017), it was stated that students who have high scientific inquiry skills have higher level of participation, interest and attention in the learning process, and so their success increased because of the effect of these variables. Özsoy (2005); Wolf and Fraser, (2008); Taskoyan, (2008); Hacısalihoğlu, Mirasyedioğlu and Akpınar (2003); Kogan and Laursen (2014); Uygun and Bilgiç (2018) also reached similar findings.

In parallel with this result, students with high academic success think about the strategies they use in similar problems they have faced before and that they consider the suitability of these strategies to the problem (Polya, 1957; Yeşilova, 2013). It has been found that seventh grade students participating in the study conducted by Bilgiç (2017) differed significantly in their reflective thinking skills for problem solving in favor of those who received high grades from Social Studies course. In the study conducted by Altuntaş (2019), when the relationship between students' reflective thinking skills and academic achievement was examined, it was obtained that there was a positive and moderately significant relationship. When looking at the difference between the groups, it was determined that the groups with high academic success had more reflective thinking skills to solve more problems than the groups with lower academic success.

When the results related to last mathematics exam grade are examined, it can be stated that students' reflective thinking skills for problem solving and sub-dimensions differed significantly in terms of last mathematics exam grade. It is seen that the difference was significantly in favor of the students with "excellent" and "good" grades. Also, when the averages are examined, the level of skill and attitude increase as the grade increases.

While Baş and Kıvılcım (2013) determined that high school students' mathematics and geometry achievements made a significant difference on reflective thinking skills for problem solving, Tok (2008) concluded that reflective thinking activities increased academic achievement for primary school students' science course. Aldan Karademir, and Görgün (2019) determined that students who got a high grade in mathematics course had high reflective thinking skills for problem solving. Şen (2013), in his research on elementary school students, found significant relationships between students' reflective thinking skills based on problem solving and their academic achievements in mathematics. In addition, Özsoy (2002) found a significant relationship between the general success of mathematics lesson and problem solving. In his study, Leung (1993) stated that students with higher mathematics knowledge can produce problems that can be classified as reasonable and solvable problems. This result is consistent with the results of this study.

When the result related to the correlation analysis is examined it can be stated that there is a significant and positive correlation between the fourth grade students' scientific attitudes with reflective thinking skills for problem solving and sub-dimensions. According to Demirel, Derman, and Karagedik (2015), there was a moderately significant and positive relationship between students' reflective thinking skills and their attitudes towards mathematics. Besides, "evaluating" sub-dimension of the reflective thinking skills towards problem solving had a stronger relationship with the dimensions of the attitude towards mathematics compared to the other dimensions. Pimta, Tayruakham, and Nuangchalerm (2009) concluded in their study that problem solving skills directly affected the attitude towards mathematics in the positive way. Also, Bas and Beyhan (2012), Phan (2006; 2009), Tok (2008) pointed out a positive relationship in their study in which they have studied reflective thinking skills and attitudes towards different lessons.

Güneş (2015) found a statistically significant relationship between attitude towards mathematics lesson and reflective thinking towards problem solving in general. Aldan Karademir, and Görgün (2019) determined a positive, high-level and significant relationship between secondary school students' self-regulation and reflective thinking skills for problem solving. As a matter of fact, Francisco and Maher (2005), Hoffman and Spatariu (2011), and Yıldız (2010) also reached the conclusion that meta-cognition affects problem solving and it also improves learning.

Kesinkılıç (2010) concluded that activities based on reflective thinking applied in the seventh-grade science and technology lesson in primary education contributed to the development of scientific process skills. In their study, Kurtuluş and Eryılmaz (2017) determined that as the problem-based reflective thinking skills of students increased, their anxiety in mathematics lesson

also decreased. In the study conducted by Tat (2015), it was concluded that there was a relationship between weekly mathematics lesson working times and attitudes towards solving mathematics problem and dependent variable. According to Walle and John (1998), the time spent on problem solving is closely related to the pleasure of solving problems. An individual who enjoys problem solving tries to reach the result without getting tired or bored during the problem-solving process. The individual who has a negative attitude gets squeezed out of the problem after a maximum of one attempt.

Aydın and Diker Coşkun (2016) found a significant and positive relationship between seventh grade students' motivation towards mathematics course and reflective thinking skills based on problem solving. Erdoğan and Şengül (2019) aimed to investigate the effect of reflective thinking activities on mathematics attitude in sixth grade students. As a result of the research, it was concluded that the students' math attitudes in the experimental group were higher than the students in the control group. In the research of Pimta et. al. (2009), it was determined that reflective thinking skill towards problem solving had a positive effect on mathematics attitude. It has been determined that reflective thinking activities contribute to the positive attitude of the students towards the course (Bas & Beyhan, 2012). Aydın and Diker Coşkun (2016) stated that there was a positive relationship between eighth grade students' mathematics motivation and reflective thinking skills for problem solving.

When the result related to regression analysis is examined, it can be stated that reflective thinking for problem solving of the fourth grade students was strongly explained by scientific attitudes. No direct study was found in terms of the relationship between students' reflective thinking skills towards problem solving and attitude towards science. But, Demirel et al. (2015) pointed out that it is seen that the relationship between the students' reflective thinking skills towards problem solving and their attitude towards mathematics is significant on a moderate level in the positive sense. Kaur (2013) found that the relationship between the two variables of critical thinking and scientific attitude having the relationship of the magnitude .369 signified that there was positive and significant relationship between the two variables.

Baş and Kıvılcım (2013) thought that reflective thinking skills for problem solving are an important predictor of academic success in mathematics lessons ($R=.782$, $R^2=.611$, $p=.000$) and reflective thinking skills for problem solving predict approximately 62% of academic success in mathematics and 67% of the academic success in geometry. Albayrak, Şimşek and Yazıcı (2018) determined that reflective thinking skill for problem solving is a variable that predicts mathematics achievement significantly. On the other hand, in the study of Baş (2013), primary school students' reflective thinking skills for problem solving explained their academic achievements in science and technology. So, this finding supports the findings of this study.

5. Conclusion

Consequently, it is seen that there is a significant and positive correlation between the fourth-grade students' scientific attitudes with reflective thinking skills for problem solving. Also, reflective thinking for problem solving of the fourth-grade students was strongly explained by scientific attitudes. These findings should be taken into account when designing teaching and learning environments. Teaching and learning activities consist of sub-fields with different structures and that both cognitive and affective elements should be taken into account in order to teach effectively. Considering that reflective thinking skill is an important thinking skill, the importance of scientific attitude has been revealed in order to gain and develop this skill for students. In this way, it can be stated that thinking skills will become functional especially with the development of scientific attitude. This situation reveals once again the effect of affective elements in the learning process expressed in brain-related studies in recent years.

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References

Adodo, S. O., & Gbore, L. O. (2012). Prediction of attitude and interest of science students of different ability on their academic performance in basic science. *International Journal of Psychology and Counselling*, *4*(6), 68-72.

Aiken Jr, L. R., & Aiken, D. R. (1969). Recent research on attitudes concerning science. *Science Education*, *53*(4), 295-305.

Albayrak, M., Şimşek, M., & Yazıcı, N. (2018). The predictive power to mathematical success of belief and reflective thinking for problem solving. *International Journal of Human Sciences*, *15*(2), 807-815.

Aldan Karademir, Ç., & Görgün, S. (2019). Investigation of secondary school students' reflective thinking skills for problem solving and self-regulation skills. *International Journal of Euroasian Researches*, *7*(16), 292-313.

Altun, M. (2002). *Mathematics teaching in secondary education*. İstanbul: Alfa Printing and Publishing.

Altuntaş, L. (2019). *Examining the relationship between math achievement math attitudes and reflective thinking skills towards problem solving of the 7th grade students* (Unpublished Master Thesis). İstanbul: Yıldız Teknik University.

ASPC (2019). *Numerical information about 2019 YKS exam results*. https://www.osym.gov.tr/TR,16859/2019-yks-sinav-sonuclarina-iliskin-sayisal-bilgiler.html [Accessed 31 March 2020].

Aydın, B. B., & Diker Coşkun, Y. (2016). The relationship between math achievement motivation and reflective thinking skills towards problem solving. *Yeditepe University Journal of Education*, *5*(7), 12-28.

Aydın, M., & Çelik, T. (2013). The prospective teachers' opinions relating reflective thinking skills. *Pamukkale University Journal of Education*, *34*(34), 169-131.

Baş, G., & Beyhan, Ö. (2012). The effect of reflective thinking activities on students' academic achievement and attitudes towards the English course. *Amasya University Journal of Education*, *1*(2), 128-142.

Baş, G., & Kıvılcım, Z. S. (2013). The correlation between reflective thinking skills towards problem solving and academic success in mathematics and geometry courses of high school students. *Kırşehir University Journal of Education*, *14*(3), 1-6.

Baş, G. (2013). Investigating the correlation between elementary students' reflective thinking skills towards problem solving and academic success in science and technology course with structural equation modeling. *Hasan Ali Yücel Journal of Education*, *20*, 1-12.

Bilen, M. (1996). *Teaching from plan to practice*. Ankara: Aydan Web Facilities.

Bilgiç, C. (2017). *Reflective thinking skills of elementary school students to solve problems, social studies and academic achievements* (Unpublished Master Thesis). Uşak: Uşak University.

Bingham, A. (2004). *Developing problem solving skills in children*. A. Ferhan Oğuzkan (Trans.). İstanbul: Milli Eğitim Press.

Bloom, S. B. (1976). *Human characteristics of school learning*. New York: McCraw Hill.

Büyüköztürk, Ş. (2016). *Handbook of data analysis for the social sciences: Statistics, research pattern SPSS applications and interpretation* (Extended 22nd Edition). Ankara: Pegem Akademi Publishing.

Ceyhan, G. (2014). *Scrutinizing the university students' reflective thinking level and their anxieties towards research in terms of several variables by using CART analysis* (Unpublished Master Thesis). Van: Yüzüncü Yıl University.

Corbett, C., Hill, C., & St. Rose, A. (2008). *Where the girls are: The facts about gender equity in education*. American Association of University Women Educational Foundation. Washington, DC.

Demirbaş, M., & Yağbasan, R. (2006). The functional importance of scientific attitudes in science teaching and adoptation of scientific attitude scale into Turkish. *Uludağ University Journal of Education*, *XIX*(2), 271-299.

Demirel, M., Derman, İ., & Karagedik, E. (2015). A study on the relationship between reflective thinking skills towards problem solving and attitudes towards mathematics. *Procedia–Social and Behavioral Sciences*, *197*, 2086-2096.

Dilci, T., & Babacan, T. (2012). The views of the primary school teachers' depending on the fifth grade curriculum in development of reflective thinking skills. *CÜ Journal of Social Sciences*, *36*(1), 141-161.

Erdoğan, A. (2019). *The examination of secondary school students' reflective thinking skills towards problem solving in terms of certain variables* (Unpublished Master Thesis). Konya: Necmettin Erbakan University.

Erdoğan, F., & Şengül, S. (2019). *The effect of reflective thinking activities on sixth grade students' attitude towards mathematics*. *Kastamonu Journal of Education*, *27*(1), 247-260.

Francisco, J. M., & Maher, C. A. (2005). Conditions for promoting reasoning in problem solving: Insights from a longitudinal study. *Journal of Mathematical Behavior*, *24,* 361 372.

Fraser, B., Tobin, K., & McRobbie, C. J. (Eds.). (2011). *Second international handbook of science education* (Vol. 24). Springer Science & Business Media.

Gagne, R. M. (1980). Learnable aspects of problem solving. *Educational Psychologist*, *15*(2), 84-92. https://doi.org/10.1080/00461528009529218

Gardner, P. L. (1975). Attitudes to science. *Studies in Science Education*, *2,* 1-41.

Gedik, H., Akhan, N. E., & Kılıçoğlu, G. (2014). The reflective thinking tendency of social studies candidate teachers. *Mediterranean Journal of Humanities*, *4*(2), 113-130.

George, R., & Kaplan, D. (1998). A structural model of parent and teacher influences on science attitudes of eighth graders: Evidence from NELS: 88. *Science Education*, *82*(1), 93-109.

Gokul, R. R., & Malliga, T. (2015). A study on scientific attitude among pre-service teachers. *Research Journal of Recent Sciences*, *4*, 196-198.

Güneş, K. (2015). *Analysing the science and art students' reflective thinking skills aimed at solving problem, mathematics successes and attitudes to mathematics lesson* (Unpublished Master Thesis). Adana: Çukurova University.

Hacieminoglu, E. (2016). Elementary school students' attitude toward science and related variables. *International Journal of Environmental and Science Education*, *11*(2), 35-52.

Hacısalihoğlu, H., Mirasyedioğlu, S., & Akpınar, A. (2003). *Elementary mathematics teaching*. Ankara: Asil Publishing.

Hoffman, B., & Spatariu, A. (2011). Metacognitive prompts and mental multiplication: Analyzing strategies with a qualitative lens. *Journal of Interactive Learning Research*, *22*(4), 607-635.

İnel Ekici, D. (2017). An investigation on the factors affecting the scientific inquiry skills perceptions of secondary students. *Kastamonu Journal of Education*, *25*(2), 497-516.

Johnston, J. (1996). *Early explorations in science*. Buckingham: Open University Press.

Kalaycı, N. (2001). *Problem solving and applications in social sciences.* Ankara: Gazi Publishing.

Karasar, N. (2016). *Scientific research method: Concepts, principles, techniques* (30th Edition). Ankara: Nobel Publishing.

Katrancı, Y., & Şengül, S. (2020). The evaluation of inquiry learning skills towards math of middle school students in terms of inquiring, evaluating, reasoning, and reflective-thinking skills for problem-solving. *Education & Science*, *45*(201), 55-78.

Kaur, G. (2013). Scientific attitude in relation to critical thinking among teachers. *Educationia Confab*, *2*(8), 24-29.

Kaya, B. (2009). *A study on 6th, 7th and 8th grade students? thinking styles and mathematics achievement according to their school type, gender and grade level* (Unpublished Master Thesis). Yıldız Teknik University, İstanbul.

Keskinkılıç, G. (2010). *The affect of reflective thinking based learning activities in 7th class science and technology lesson on the students' achievements and their scientific process skills* (Unpublished Doctoral Dissertation). Konya: Selçuk University.

Kırnık, D. (2010). *Effect on student's success of activities improving reflective thinking in Turkish lesson of fifth class in primary school* (Unpublished Master Thesis). Elazığ: Fırat University.

Kızılkaya, G., & Aşkar, P. (2009). The development of a reflective thinking skill scale towards problem solving. *Education & Science*, *34*(154), 82-92.

Kogan, M., & Laursen, S. L. (2014). Assessing long-term effects of inquiry-based learning: A case study from college mathematics. *Innovative Higher Education*, *39*(3), 183-199.

Korkut, F. (2002). Problem solving skills of high school students. *Hacettepe University Journal of Education, 23,* 177-184.

Köseoğlu, E., Demirci, F., Demir, B., & Özyürek, C. (2017), The examination of 7th grade students' reflective thinking skills towards problem solving: A sample of Ordu city, *International e-Journal of Educational Studies, 1*(1), 60-68.

Kramarski, B. (2008). Promoting teachers' algebraic reasoning and self-regulation with metacognitive guidance. *Metacognition Learning*, *3*, 83-99.

Kurtuluş, A., & Eryılmaz, A. (2017). The relationship between reflective thinking skills based on problem solving and flow experiences in mathematics. *Journal of Theoretical Educational Science*, *10*(3), 349-365.

Leung, S. S. (1993). *The relation of mathematical knowledge and creative thinking to the mathematical problem posing of prospective elementary school teachers on tasks differing in numerical information content* (Unpublished Doctoral Dissertation). Pittsburg: Pittsburg University.

Lowery, L. (1966). Development of an attitude measuring instrument for science education. *School Science and Mathematics*, *64,* 494-502.

Mevarech, Z., R., & Amrany, C. (2008). Immediate and delayed effects of meta-cognitive instruction on regulation of cognition and mathematics achievement. *Metacognition and Learning*, *3*(2), 147-157.

Meyer, G. R. (1963). Factors related to scientific attitudes within the secondary schools of an Australian city. *Australian journal of education*, *7*(1), 21-40.

MONE (2019a). *PISA 2018 preliminary report of Turkey*. Ankara: MEB Publishing.

MONE (2019b). *Central exam report for secondary education institutions in 2019*. Ankara: MEB Publishing.

MONE (2018). *Curriculum of science course*. Ankara: MEB Publishing. Available online at http://mufredat.meb.gov.tr/ProgramDetay.aspx?PID=325 [Accessed 13 November 2019].

Moore, W. R., & Foy, R. (1997). The scientific attitude inventory: A revision (SAI II). *Journal of Research in Science Teaching*, 34(4), 327-336.

Munby, H. (1983). Thirty studies involving the "Scientific attitude inventory": What confidence can we have in this instrument? *Journal of Research in Science Teaching*, *20*, 141-162.

OECD (2017), *PISA 2015 assessment and analytical framework: Science, reading, mathematics, financial literacy and collaborative problem solving*. Paris: OECD Publishing. https://doi.org/10.1787/9789264281820

Olasehinde, K. J., & Olatoye, R. A. (2014). Scientific attitude, attitude to science and science achievement of senior secondary school students in Katsina State, Nigeria. *Journal of Educational and Social Research*, *4*(1), 445-452.

Osman, K., Iksan, Z. H., & Halim, L. (2007). Attitudes towards science and scientific attitudes among students in science. *Jurnal Pendidikan*, *32,* 39-60.

Özkök, A. (2004). *The effect of interdisciplinary art on creative problem solving skills and a model suggestion* (Unpublished Doctoral Dissertation). Ankara: Gazi University.

Özsoy, G. (2005). The relationship between problem solving skills and mathematical achievement. *Gazi University Gazi Journal of Education*, *25*(3), 179-190.

Phan, H. P. (2009). Exploring students' reflective thinking practice, deep processing strategies, effort, and achievement goal orientations. *Educational Psychology*, *29*(3), 297-313.

Phan, H. P. (2006). Examination of students learning approaches, reflective thinking, and epistemological beliefs: A latent variables approach. *Electronic Journal of Research in Educational Psychology*, *4*(3), 557-610.

Pimta, S., Tayruakham, S., & Nuangchalerm, P. (2009). Factors influencing mathematic problem-solving ability of sixth grade students. *Journal of Social Sciences*, *5*(4), 381-385.

Polya, G. (1997). *How to solve?* (F. Halatçı, Trans.). İstanbul: Sistem Publishing.

Rani, G. (2006). A Cross-domain analysis of change in students' attitudes toward science and attitudes about the utility of science. *International Journal of Science Education*, *28*(6), 571-589.

Reeve, R. A., & Brown, A. L. (1985). Metacognition reconsidered: Implications for intervention research. *Journal of Abnormal Child Psychology*, *13*, 343-356.

Saygılı, G., & Atahan, R. (2014). Investigation of gifted children's reflective thinking skills for problem solving in terms of various variables. *Süleyman Demirel University Faculty of Arts and Sciences Journal of Social Sciences*, *31*, 181-192.

Senemoğlu, N. (1997). *Development, learning and teaching*. Ankara: Ertem Press.

Simpson, R. D., & Oliver, J. S. (1990). A summary of major influence on attitude towards achievement in science among adolescent students. *Science Education*, *74*(1), 1-18.

Simpson, R. D., Koballa Jr, T. R., Oliver, J. S., & Cranley, F. E. (1994). Research on the effective dimension of science learning. In D. Gabel (Ed.), *Handbook of research on science teaching and learning*. New York: Macmillan.

Solakumur, A. (2017). *Relationship between physical education and sports teachers' reflective thinking tendencies and reflecting abilities* (Unpublished Master Thesis). Bartın: Bartın University.

Şen, H. Ş. (2013). Reflective thinking skills of primary school students based on problem solving ability. *International of Academic Research*, *5*(5), 41-48.

Taşkoyan, S. N. (2008). The effect of inquiry learning strategies on students? skills of inquiry learning, academic success and attitudes (Unpublished Master Thesis). İzmir: Dokuz Eylül University.

Tat, O. (2015). *Investigation of elementary school students' reflective thinking ability through problem solving by using hierarchical linear models* (Unpublished Master Thesis). Van: Yüzüncü Yıl University.

Tavsancıl, E. (2006). *Measurement of attitudes and data analysis with SPSS*. Ankara: Nobel Publishing.

Tok, Ş. (2008). The effects of reflective thinking activities in science course on academic achievements and attitudes toward science. *İlköğretim Online*, *7*(3), 557-568.

Unver, G. (2003). *Reflective thinking*. Ankara: Pegem A Publishing.

Uygun, K., & Bilgiç, C. (2018). Reflective thinking skills of elementary school students to solve problems, social studies and academic achievements. *Journal of the Human and Social Science Researches*, *7*(3), 1497-1515.

Walle, V., & John, A. (1998). *Elementary and middle school mathematics: Teaching developmentally*. New York: Addison Westley Longman.

Wilson, V. L. (1983). A meta-analysis of the relationship between science and achievement and science attitude kindergarten through college. *Journal of Research in Science Teaching*, *20*(9), 839-855.

Wolf, S. J., & Fraser, B. J. (2008). Learning environment, attitudes and achievement among middle-school science students using inquiry-based laboratory activities. *Research in Science Education*, *38*(3), 321-341.

Yeşilova, Ö. (2013). *The seventh-grade students' problem solving behaviors and problem solving achievement levels* (Unpublished Master Thesis). İstanbul: Marmara University.

Yıldız, G. (2010). *The relationships between middle school seventh grade students' mathematics achievement, metacognitive strategies, thinking styles and mathematics self-concept* (Unpublished Doctoral Dissertation). İstanbul: Yıldız Teknik University.

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Evaluation of the Educational Drama as an Innovative Method to be Adopted by Teachers in Order to Enhance Critical Thinking Skills of Students in Primary School

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Abstract

The aim of this study is to examine and determine the extent to which educational drama, as an innovative teaching approach, can cultivate critical thinking of students in primary school. Based on the principles of educational drama, 15 theatrical workshops were designed in relation with and corresponding to the culture and interests of the specific age group. The experimental method that was followed, was designed and implemented in three discrete stages including: the pre-research stage, the main research stage and the results extraction stage. The sample comprising 400 students aged 8-10 has been drawn from six different primary schools in Greece, the subjects of which were randomly selected. Five critical thinking skills were studied, including subtraction, induction, observation, reliability, detection and troubleshooting skills. The qualitative and quantitative data collected was next triangulated in order to lead to the desired result. The results confirmed the main research hypothesis, hence educational drama, as an innovative method, can enhance students' critical thinking in primary school.

Keywords: educational drama, critical thinking, skills, innovative method, primary school students.

1. Introduction

In the 21st century teachers are required to adapt to contemporary data of the times and modernize the teaching methods that they apply in the classroom. Huss (2019) suggests that it is important for teachers to work together in order to be able to acquire and develop the necessary skills. It is considered to be important to enrich their teaching approaches and evaluate their work so that they constantly become better through the experiences that they gain.

Children and young people are at the core of this need for change as in the future it will be they who will be called upon to judge what needs to be changed in society and one way to do that is to learn how to think efficiently and effectively. According to Facione and Facione (2013) if you teach people how to make the right decisions and equip themselves with the right skills, they will in turn improve their future and become active members of society. Teaching a student to think critically may not guarantee a life full of happiness, but it certainly offers them the foundations for better route of progress in all areas and is clearly better than burdening them with the heavy load of bad consequences of their poor decisions and choices.

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- Educational drama as an innovative method for teachers.
- An intervention program was designed and implemented based on the principles of educational drama with the aim of cultivating critical thinking.
- Five critical thinking skills were studied, including subtraction, induction, observation, reliability, detection and troubleshooting skills.
- Triangulation of qualitative and quantitative data to draw reliable conclusions.
- The results of the research revealed that educational drama can cultivate critical thinking in primary school students.

In addition, according to Bailin, Case, Coombs and Daniels's theory (1999) critical thinking in school may include teaching students the value of truth-telling, making students rational and open-minded towards new stimuli, respecting their interlocutors, and being willing to think and view things through a different prism. Therefore, it is necessary to cultivate critical thinking in students. It is reasonable to ask whether critical thinking can be measured, since it is not defined according to certain rules or in a particular context.

Mc Peck (1981) argues that critical thinking is a skill that can be taught like many others but is not included in any curriculum as a subject, therefore the teacher is called upon to incorporate it in the teaching of other subjects. Landy and Montgomery (2012) consider drama in education as a significantly useful tool for students' social reform. The experience of educational drama could shape attitudes and lead to pathways of critical thought.

Neelands (2011) suggests that drama in education can develop skills that are necessary for life in modern society and include: self-discipline, teamwork, critical thinking, problem-solving ability, self-esteem and self-confidence. Bailin (1998) explores critical thinking and drama in education and concludes that students through drama enter the process of developing their own critical challenges, answering questions, stimulating their thinking and developing healthy dialogue with peers, in an atmosphere of mutual trust and respect.

In this article we are called to investigate whether educational drama can bring about this change that the education system needs and how critical thinking can be integrated into it. Educational drama is called, as an innovative method, to function as the tool that will strengthen critical thinking in the context of primary school curricula.

2. Theoretical background

2.1 *Drama education*

The need for modernization of pedagogical methods and learning is increasing in an era dominated by the rapid pace of communication, information and technology. However, the need for an alternative form of learning began as early as the second half of the 19th century when the arts began to be introduced into European school curricula (Kamens & Cha, 1992). Art, therefore, is established as a means of cultivating spiritual, social, and moral values with the main goal of shaping children in depth, but the interesting thing is that it is not the value of the arts themselves that matters, but the artistic practices they use for the purpose sharpening their spirit and virtues of children (Jörissen et al., 2018). It should be noted at this point that of all the arts, the present article focuses on educational drama.

From a semantics point of view, the word "drama" means action and although as a term has been adopted by other European countries in a variety of forms such as "drame" (France) or "Schauspiel" (Germany), everywhere the term denotes theatrical or dramatic work (Pavis & Ubersfeld, 2006). The first signs of the beginning of drama being adopted in education and in the

classroom, appear in Plato's work "The Republic", referring to the contribution that play should have in classes (Bolton, 2007). In mid-1960s, actors, directors and writers in Britain encouraged teenagers to engage in theater, confirming that drama in education has its roots in theater (Sextou, 2004). However, it should be argued that the combination of theater and education appears earlier in Britain in the 1920s, where the term "dramatization" was coined by Finlay Johnson (1911).

Today, however, despite the passage of time and the need for technology within the school, educational drama remains almost unchanged (Anderson, 2012), that is, it uses techniques such as play through which students can express themselves freely and spontaneously (Boal et al., 2008). It can be realized that drama has offered many benefits to the education which will specified and discussed below. "*Drama is the paint that turns life into an art and builds the bridge between what this world is and what it might be*" (Prentki & Stinson, 2016: 4).

Additionally, the drama uses a symbolic language, through which the real world can be represented (Varriour, 1994). We find that drama in education, in addition to the entertaining character that it undoubtedly has, since it has a playful form at its base, also acquires a social character. It also motivates children and adults to use not only their body but their spirit and emotion (Kalidas, 2013) giving the drama a multi-layered role. However, drama in education not only offers aesthetic experience but also motivates students and drives them to learn in a different way, that is, to break away from the traditional methods they have learned so far by making it an educational phenomenon (Sextou, 2004). Cattanach (1996) also states that the most important thing offered through educational drama is the so called "aesthetic illusion", which means that educational drama and its tools, such as improvisation, games, etc., offer individual students the opportunity to simulate daily life activities in a "safe" environment created by the theatrical context without any restrictions and fears. Winship (1954) refers to the educational theater supporting that through it students have the opportunity to learn about the principles that govern, democracy and their interrelationship. In other words, through the resulting collaborations, students are trained through harmonious participation, in expressing their opinion freely and in cultivating a critical view of the world.

2.2 *Critical thinking skills*

On the basis of the above, a reasonable question that arises is related to the kind of benefit that educational drama can provide to school curricula and in the cultivation of critical thinking.

The search for the definition of critical thinking, both theoretically and empirically (through the investigation of appropriate tests), has been going on for decades without any clear definition found. Ennis, one of the theorists who has thoroughly researched critical thinking, defines it as *"a reasonable reflective process focusing on deciding what to believe or do"* (Ennis, 2018: 166). Nevertheless, this is apparently a definition that needs further investigation and clarification (Kuhn, 2019).

Another interesting definition that has been formulated, specifies critical thinking as an activity of the person evaluating or composing information using observation, experience, and/or communication as a guide for those who believe or act (Scriven, 1987). However, the author of this paper believes that a universally accepted definition may not exist or cannot be found since critical thinking is a conceptually complex entity involving a wide variety of skills, five basic and 35 subcategories, each one of which, according to the American Philosophical Association (APA) (Schmaltz, Jansen & Wenckowski, 2017), need a separate definition.

In the field of education, things are complicated since critical thinking concerns most if not all of the scientific disciplines and is tangible in many categories. What dominates and is

primarily cultivated at all levels of education primarily comprises the skills of understanding and evaluation, followed by analysis and synthesis (Kennedy, Fisher & Ennis, 1991).

Ennis (1989) considers it beneficial for elementary school students to be taught or rather guided through the pathways of critical thinking, especially starting from the early school years. Its teaching can be initiated through a "general approach", which can take for example the form of a simple disagreement in the classroom until students are trained to think critically and develop this ability to the wider external social environment. Therefore, the importance of cultivating critical thinking in primary school students' minds can be considered as of paramount significance since besides enhancing their academic performance, it can assist students' adaptability to society in their adulthood as well.

As Marin and Halpern (2011) also confirm through their research findings, critical thinking is composed of a series of vital skills. Cultivating these critical thinking skills in education is very important since we are going through an era where information is being transmitted at a very fast pace. Essential and effective education presupposes the promotion of all of the students' critical thinking-related skills (Facione & Facione, 1996). However, despite the unanimously acknowledged need for all school curricula to incorporate critical thinking, the literature on critical thinking cultivation and development is rather incomplete.

In the light of the above, it is deemed necessary to strengthen the critical thinking of primary school students. Skills that could be studied and measured according to Ennis (1989) include observation, reliability, induction, subtraction, problem identification and coping.

It was considered ideal in this case to use the experience of educational drama as the means that will cultivate critical thinking skills. Educational drama has the potential to turn learning into experience. Through role-playing games and theatrical improvisations, it has the potential to create a happy and creative atmosphere where students' interaction, collaborations and skills are enhanced.

3. Methodology

3.1 *Research objectives*

According to the theoretical framework, no one can dispute the fact that educational drama follows a dynamically evolutionary track, since it has been established as a fundamental process in human experience (Tsiaras, 2016a). As Heathcote (1984) argues, educational drama is a process in which students express themselves as they would in real life (Adıgüzel, 2009: 86). The relationship between educational drama and critical thinking is based on the fact that educational drama, as an innovative tool, can cultivate and contribute to the development of the five (5) main skills of critical thinking which, as mentioned above, include observation, inductive and subtraction, reliability, detection and troubleshooting.

Observation is one of the most important skills in critical thinking. Being an observant student means that all the data of the problem can be identified and thus a correct solution can be faster found and specified. Abstraction is the ability of the student to think logically, connect and interrelate data in the right sequence and make the right decision. Inductive thinking leads students from a given data to reasonable and sound generalization and consequently to the right solution. Identifying the student's problem is also important. Examining the data of the difficult situation will lead him to deal with it. Finally, self-confidence and therefore proper control of the data source has to do with the student's perception. When the student can evaluate and ensure the reliability of a specific data source, this in turn can lead to the correct solution of the problem.

In the light of the above, the research question examined of this paper can be specified as follows:

To what extent can educational drama, as an innovative tool, influence and enhance the critical thinking of primary school children?

In order to provide an answer to this question, an intervention program was designed and implemented based on the principles of educational drama that could cultivate these five critical thinking skills (observation, inductive and subtraction, reliability, detection and troubleshooting.)

3.2 *Pre-research preparation*

At the pre-research stage, the theoretical framework governing critical thinking and the theories around it were studied in depth. The principles of educational drama were also discussed and the steps required to be taken for the implementation of the present research were planned.

Scientific research is a continuous investigation of hypothetical propositions about the possible relationships between natural phenomena (Kerlinger, 1979). In that sense, for the selection of the methodological approach to be applied and in order for the goal and objectives of this paper to be satisfied, both the theoretical background of the research approaches and two basic criteria were taken into account. The first criterion implies that the approach to be chosen and applied has to be the one that provides the greatest possible certainty about the actual descriptive characteristics while according to the second criterion the greatest possible certainty about the true nature of the relationship between the variables has to be ensured.

It was therefore considered as vitally necessary by both the research supervisor and the members of the research team to design and implement the experimental method (Kolaczyk, 2009).

As dependent variables were identified the five critical thinking skills while as the independent variable has been decided to be the educational drama. Four hundred (400) students from six various primary schools in Greece, aged 8 to 10, were randomly selected. Two hundred students (200) were selected to compose the experimental group while the remaining two hundred (200) students compose the control group of the research. As far as the composition of the experimental group in terms of sex, 118 were girls and the remaining 82 were boys. This sample is considered to be representative of the population under examination since it was randomly chosen so as to cover the different educational and social criteria of the student population of the country's primary schools.

Then, after the theoretical framework through the review of domestic and international bibliography was established by the researchers, the fifteen (15) theatrical workshops that would be used as interventions in cultivating the critical thinking skills of primary school students were designed in detail.

The aim of these theatrical workshops was to achieve the development of students' critical thinking through playful activities and dilemmatic situations designed to lead them ultimately to the right decision. The design of each theatrical workshop was structured in such a way so that all of the six critical thinking skills could be progressively developed and enhanced.

Theatrical workshops had about the same structure. They began by telling a story in which the hero faced some obstacles and dilemmas and students were asked to help him overcoming them. This was followed by various theatrical techniques such as confidence games, role-playing games, icy images (Bolton, 2007) closed and completed with reflection. In the theatrical workshops, each student expressed their opinion after first identifying the problem, evaluating the data and the reliability of the sources, listening to everyone's opinions and leading to the correct treatment and solution of the problem.

At the stage of preparation to be led to the main research, the questionnaire that would be given to the students before the implementation of the theatrical workshops and after their completion was designed. The research team evaluated critical thinking as a complex function based on the Cornell Class-Reasoning Test scale (Form X), a series of Cornell Critical thinking tests by Ennis, Gardiner, Morrow, Paulus and Ringel (1964) and the Starkey's Questionnaire (2010).

The questions chosen to be used were translated with the reverse translation approach (translation- back translation), modified to match the age of the sample, as well as the culture and interests of the specific age group. After checking its validity, reliability and functionality, the skills of observation, reliability, detection, troubleshooting, induction and removal were investigated at the main research stage.

The questions in the final questionnaire were in the form of multiple choice and the correct answer was always one of the four choices provided (a, b, c, d). The questionnaire consists of twenty-four (24) questions that focus on the five axes of critical thinking skills. An indicative example from the questionnaire includes the following:

> You hear on TV that all buses, subways, trains, etc. will go on strike because employees are demanding an increase in their salaries. What conclusion do you draw?
>
> (a) They have made everything more expensive so they are asking for an increase.
>
> (b) If they are not given an increase, the ticket will be increased in the following days.
>
> (c) People who move with these means will have to find another way of commuting and reach their business.
>
> (d) Their bosses will not like this at all.

In addition to the questionnaire, each member of the research team was asked to keep a research diary (Burgess, 1981) to record all the important events and behaviors of the students during the implementation of the theatrical workshops.

Finally, after obtaining the required permits from the Ministry of Education and the consent of both the principals of the primary schools and the parents or the guardians of the students, the research team proceeded to the main research stage.

3.3 *The main research*

The main research phase began with the completion of the questionnaire from all 400 students. After completion the questionnaires were collected, the research team proceeded with the implementation of the 15 theatrical workshops. Each theatrical workshop for each class took place once a week and lasted 45 minutes, which is one teaching hour of the school. Theatrical workshops were held within the school schedule and during the Theatrical Education course. The 15 theatrical workshops were conducted on a sample of 200 students, which was our experimental group. This intervention lasted 4 months.

During the theatrical workshops, each researcher kept a diary, which would later be used to extract qualitative features of the research.

After the end of the 15 theatrical workshops, the research team gave for the second time the questionnaire that had been given before the intervention of the theatrical workshops. The same questionnaire was completed again by the 400 students, both in the experimental group and in the control group, to test whether the educational drama, as an innovative method, worked in cultivating critical thinking skills.

3.4 *Example of a theatrical lab*

The following is an example of a theatrical workshop conducted as part of the research.

The theatrical workshop began with kinetic exercises and were next followed by the narration of the story. This particular story deals with a historical event, the Battle of Thermopylae, which was in the textbooks of the History of the 4th grade of the students.

The story began somewhat like this: "The new king of Persia, Xerxes, began to prepare a new campaign against Greece. The Greeks held a meeting in the Isthmus of Corinth and decided that they should face the Persians together. The Spartans would be the leaders ..."

The children are divided into groups and are represented with an icy image, imagining the meeting at the Isthmus of Corinth.

The narration continued "... the great Persian army started in the spring of 489 BC. Never before have people seen so many armies. The Persians, after crossing the Hellespont, moved to Greece. The Greek army, led by the king of Sparta, Leonidas, headed for Thermopylae. In this narrow passage, 7,000 Greeks lined up to stop the Persians."

The children are divided into groups and each group writes on a piece of paper, two objects that the Greek soldiers may have had with them and express their psychological state.

The story continued: "... Xerxes, when he arrived at Thermopylae, asked the Greeks to surrender their weapons. Leonidas' answer was: "Molon lave" (come and get them). And the battle began ..."

The children sitting in a circle and taking turns express in one word how they would characterize Leonidas.

"The Persians could not fight together in the strait. Those who tried to cross fell dead. Xerxes was puzzled and believed that no one would have the courage to fight. He then called on his generals and a group of military representatives to listen to them and better assess the situation."

The children are divided into two groups. The 1st group, the generals, argue that they should not surrender their weapons and leave. The 2nd group, the representatives of the soldiers, claim that they must leave the Strait of Thermopylae. The views of each group are formulated with arguments in order to convince him and are announced to the researcher who is in the role of Xerxes.

The children sit in a circle again and each one playing the role of Xerxes announces her/his decision. What would they do in Xerxes' place?

"... Xerxes did not manage to decide what to do, but then a local from Trachina, Nightmare, who knew the surrounding mountainous area, came to him. So he approached Xerxes and promised to lead the Persians down a narrow and steep path behind Leonidas' army. Thus, those who would follow him could surround the Greeks and kill them with great ease. As soon as the king heard this, he jumped for joy and gave rich gifts to Nightmare."

The researcher selects a student who wishes to enter the role of the traitor called Nightmare and sit in the hot chair. The children below him ask questions to understand what a person he is, what he has experienced, how he feels now and what led him to this action of betrayal his Greek compatriots.

"... After that, Xerxes sent twenty thousand men with him against the Greeks at night. In the Persian army, however, there was also someone from Kimi, who was called Tyraskada, a good and right man. So at night he broke out of the Persian camp and went to Leonidas and told

him the news, he was not aware of. Leonidas realized that his army would be surrounded and trapped."

The children form "a corridor of consciousness" as it is called where they say out loudly their thoughts about what to do and the psychological state in which Leonidas finds himself. The researcher or a child in the role of Leonidas passes through.

The narration ends "… Leonidas then told those who wanted to leave. This left 700 Thespians and 300 Spartans. The Greeks were forced to fight on two fronts. And they were all killed. However, their death went down in history as proof of great patriotism."

Then the children themselves, regardless of what happened in the story, express their stating whether they would do the same or not, justifying each option.

4. Results

After collecting the completed questionnaires as well as the information written down in the research diary that were recorded during the 15 theatrical workshops, the evaluation of the research results followed. The research process was completed by triangulating the data.

The statistical processing of the values of the dependent variables in this study was observation, reliability, abstract and inductive thinking, problem identification and coping, using the SPSS statistical program. It was deemed necessary to study each dependent variable separately.

The averages of the dependent variables were measured on the same scale, at two different times, with the statistical criterion t-student. The statistical test for normal distribution was done with the Shapiro-Wilk test and the distribution of the population from which our sample comes is approximately normal.

The Cronbach's alpha reliability index was used to calculate the reliability of the measurement tool. Analyzing the results, based on the values observed before and after the intervention, Cronbach's alpha values for each of the five skills were calculated. The process was done for both the control and the experimental group.

Table 1 shows the mean estimate and standard deviation for all of the five factors as they evolved in the experimental group.

Table 1. Measurement values of the factors of variables subtraction-induction-reliability-observation-problem identification and troubleshooting of the experimental group

	Before		**After**		**Result**			
	Mean estimate	standard deviation	mean estimate	standard deviation	mean estimate	standard deviation	|z| value	P(>|z|)
Subtraction	1.96	0.20	1.60	0.50	0.36	0.49	3.674	<0.001
Induction	1.80	1.19	2.64	1.19	-0.84	1.46	2.871	0.002
Reliability	4.36	1.15	3.52	1.47	0.84	1.84	2.281	0.011
Observation	2.32	0.48	2.28	1.10	0.04	1.24	0.161	0.436
Identification Troubleshooting	0.92	0.64	2.24	1.23	-1.32	1.37	4.797	<0.001
experimental group	200 students							

The results for all five skills, subtraction, induction, reliability, observation, identification and troubleshooting, observed in Table 1, have a positive statistical significance. That is, after the intervention, all five students' critical thinking skills improved.

Table 2 reflects the mean estimate and standard deviation for all five skills in the control group.

Table 2. Measurement values of the factors of variables subtraction-induction-reliability-observation-problem identification and troubleshooting of the control group

	Before		**After**		**Result**			
	mean estimate	standard deviation	mean estimate	standard deviation	mean estimate	standard deviation	z value	P(>|z|)
Subtraction	1.24	0.66	1.04	1.04	0.20	1.08	0.926	0.177
Induction	2.52	1.32	2.28	2.28	0.24	1.54	0.782	0.217
Reliability	3.84	1.17	3.40	3.40	0.44	1.68	1.305	0.096
Observation	1.84	1.28	1.96	1.96	-0.12	1.81	-0.331	0.370
Identification Troubleshooting	1.76	1.23	1.96	1.96	-0.20	1.22	-0.816	0.207
control group	200 students							

The results in Table 2 of the control group do not show statistical significance.

Summing up, the statistical analysis of the data surveyed provided evidence that the research hypothesis can be confirmed. In the classes where the students attended the theatrical workshops which were based on the principles of educational drama, the five skills were enhanced in contrast to the findings of the control group. Therefore, our experimental research revealed that the answer to the main research question is affirmative. Educational drama, as an innovative tool, can influence and enhance the critical thinking of primary school children.

At the same time, the data collected from the research diaries of the members of the research team was also interesting. In the first weeks, some students did not actively participate as the more dynamic ones took responsibility and guided the rest. It was observed that most groups had "leaders". In the process, however, even the weakest characters slowly began to express their opinions. Students began to trust and cooperate with each other. Through theatrical workshops, students were encouraged to take initiatives, to examine all the data of the problem, to listen to the opinions of others, to evaluate them and to be led to draw their own conclusions.

In the beginning, what was noted in the research diaries was that decision making by the students was often trivial. The students were not used to observing all the data, listening to the opinions of the others, as a result of which they made wrong decisions. In the process, however, and as the theatrical workshops progressed, their observation became sharper and to the point.

We were impressed that almost all of the students did not evaluate the source of the information at all, as a result of which they perceived incorrect information as correct. The fact is, however, that most students could assess a difficult situation, which could be solved by the hero of our story.

As for inductive and abstract thinking, which are skills that students have difficulty acquiring, it was observed towards the end of theatrical workshops, a fact that was not initially observed, students at the reflection stage could generalize their thinking. Students' phrases such as "since the hero is lying, the rest will be never led to the truth" were heard, or they had the ability

to more easily formulate a series of interrelated sentences to prove the truth or not. They often recorded the details of the problem and drew their own conclusions.

Therefore, our experimental research revealed that educational drama, which is an innovative tool in the hands of teachers, can cultivate critical thinking skills.

4.1 *Discussion*

According to the results of the research, it turns out that educational drama, as an innovative method in educational practice, can cultivate the critical thinking skills of primary school students.

The educational drama approach focuses on experiencing and realizing reality. Through theatrical techniques, students experience and directly express their experiences, finding solutions to their problems (Adıgüzel, 2009). In students, pretending behavior, through role-playing games, evolves from a complex of recreating experiences from their daily lives, stimuli from what they read, hear and see on television. This fact reflects their life experiences (Tsiaras, 2016b).

The aim, therefore, of the 15 experiential, theatrical workshops was for the students to master the dilemmatic situations in which the heroes found themselves and try to find the most suitable solutions. In order to be led to them, they had to sharpen their critical skills.

Students had to enhance their observation. We could achieve this with icy images or sculpture-sculpture technique. Students had to observe all the details in order to be able to draw a correct conclusion. Judging which of all the data is reliable to take into account in order to make the right decision, theatrical improvisations helped a lot to make this possible.

Role-playing games helped students learn to identify details and lead to generalization of results and thus enhance their inductive thinking. The ability of students to use their abstract thinking, that is, to find in a logical sequence way that could lead them to the most appropriate decision-making, was greatly helped by theatrical improvisations and the corridor of consciousness. Finally, all theatrical workshops closed with reflection. At the stage of reflection, the students became aware of the experience they lived through the educational drama.

The targeted planning of theatrical workshops was the appropriate factor in cultivating the skills of critical thinking and highlighting educational drama as an innovative tool in the hands of teachers.

5. Conclusions

Educational drama is a different educational proposal that essentially separates its position from the principles of traditional teaching and turns learning into an interesting and creative “game”. Through this, students act independently, express their opinions freely, think critically, and act for the team. Educational drama, as an innovative tool for teachers, plays an important role in enhancing student’s critical thinking because it can link thinking ability to behavior (Fisher, 2008: 164).

We wanted to take advantage of this innovative proposal and prove in essence that primary school students, in a pleasant environment, can enhance their critical thinking skills. Specifically, the skills studied and measured were observation, subtraction, induction, reliability, detection and troubleshooting. The results of the research proved that educational drama has a positive effect on this advanced type of thinking.

Given the fact that the scope of research on critical thinking combined with educational drama is limited and the issues under consideration, we believe that the implementation and proof of the goals we set from the beginning, to cultivate critical thinking in primary school students, will re-position in a positive direction the important role of education in Greece, for the benefit of our society.

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References

Adıgüzel, H. O. (2009). The past and present in drama education in the Turkish Educational System: Issues and challenges. In N. Gkovas (Ed.), *Theater and education in the center of the stage* (pp. 83-93). Athens: PanHellenic Club for Theatre in Education.

Anderson, M. (2012). *Masterclass in drama education* (1st Ed.). London: Continuum International Pub. Group.

Bailin, S. (1998). Critical thinking and drama education. *Research in Drama Education: The Journal of Applied Theatre and Performance*, *3*(2), 145-153. https://doi.org/10.1080/1356978980030202

Bailin, S., Case, R., Coombs, J., & Daniels, L. (1999). Common misconceptions of critical thinking. *Journal of Curriculum Studies*, *31*(3), 269-283. https://doi.org/10.1080/002202799183124

Boal, A., Leal-McBride, M., Leal McBride, C., & Fryer, E. (2008). *Theatre of the oppressed*. London, UK: Pluto Press.

Bolton, G. (2007). A history of drama education: A search for substance. *International Handbook of Research in Arts Education*, *16*, 45-66. https://doi.org/10.1007/978-1-4020-3052-9_4

Burgess, D. (1981). A spectrum of achievements. *Nature*, *294*(5837), 111-112. https://doi.org/10.1038/294111a0

Cattanach, A. (1996): *Performance studies: An introduction*. London: Routledge.

Ennis, R. (1989). Critical thinking and subject specificity: Clarification and needed research. *Educational Researcher*, *18*(3), 4-10. https://doi.org/10.3102/0013189x018003004 10.1007/s11245-016-9401-4

Ennis, R. (2018). Critical thinking across the curriculum: A vision. *Topoi*, 37(1), 165-184.

Ennis, R.H., Gardiner, W. L., Morrow, R., Paulus, D. & Ringel, L. (1964). *Cornell class reasoning test*. University of Illinois: Champaign, IL.

Facione, N., & Facione, P. (1996). Externalizing the critical thinking in knowledge development and clinical judgment. *Nursing Outlook*, *44*(3), 129-136. https://doi.org/10.1016/s0029-6554(06)80005-9

Facione, P., & Facione, N. (2013). Critical thinking for life. *Inquiry: Critical Thinking Across the Disciplines*, *28*(1), 5-25. https://doi.org/10.5840/inquiryct20132812

Finlay Johnson, H. (1911). *The dramatic method of teaching* (1st Ed.). London: James Nisbet and Co.

Fisher, A. (2008). *Critical thinking: An introduction*. Cambridge: Cambridge University Press.

Heathcote, D. (1984) The authentic teacher and the future. In L. Johnson & C. O' Neill (1984) (Eds.), *Dorothy Heathcote: Collected writings on drama and education* (pp. 170–199). London: Hutchinson.

Huss, R. (2019). Preparing teachers for the 21st century classroom. *Internet Learning*, *7*(1). https://doi.org/10.18278/il.7.1.3

Jörissen, B., Unterberg, L., Klepacki, L., Engel, J., Flasche, V., & Klepacki, T. (2018). *Spectra of Transformation* (1st Ed.). Munster-New York: Waxmann.

Kalidas, C. (2013). Drama: A tool for learning. *Procedia – Social and Behavioral Sciences*, *123*(123), 444-449. https://doi.org/10.1016/j.sbspro.2014.01.1443

Kamens, D., & Cha, Y. (1992). The legitimation of new subjects in mass schooling: 19th-century origins and 20th century diffusion of art and physical education. *Journal of Curriculum Studies*, *24*(1), 43-60. https://doi.org/10.1080/0022027920240103

Kennedy, M., Fisher, M. B., & Ennis, R. H. (1991). Critical thinking: Literature review and needed research. In L. Idol & B. F. Jones (Eds.), *Educational values and cognitive instruction: Implications for reform* (pp. 11-40). Hillsdale, New Jersey: Lawrence Erlbaum & Associates.

Kerlinger, F. (1979). *Foundations of behavioral research*. New York: Holt, Rinegart.

Kolaczyk, E. D. (2009). *Statistical analysis of network data: Methods and models*. New York: Springer.

Kuhn, D. (2019). Critical thinking as discourse. *Human Development*, *62*(3), 146-164. https://doi.org/10.1159/000500171

Landy, R., & Montgomery, D. (2012). *Theatre for change*. Basingstoke: Palgrave Macmillan.

Marin, L., & Halpern, D. (2011). Pedagogy for developing critical thinking in adolescents: Explicit instruction produces greatest gains. *Thinking Skills and Creativity*, *6*(1), 1-13. https://doi.org/10.1016/j.tsc.2010.08.002

Mc Peck, J. (1981). *Critical thinking and education*. New-York: St Martin's Press.

Neelands, J. (2011). Editorial. *English in Education*, *45*(1), 1-5. https://doi.org/10.1111/j.1754-8845.2010.01089.x

Pavis, P., & Ubersfeld, A. (2006). *Dictionnaire du théâtre* (1st Ed.). Paris: Dunod.

Prentki, T., & Stinson, M. (2016). Relational pedagogy and the drama curriculum. *Research in Drama Education: The Journal of Applied Theatre and Performance*, *21*(1), 1-12. https://doi.org/10.1080/13569783.2015.1127153

Schmaltz, R., Jansen, E., & Wenckowski, N. (2017). Redefining critical thinking: Teaching students to think like scientists. *Frontiers in Psychology*, *8,* 459. https://doi.org/10.3389/fpsyg.2017.00459

Scriven, M. (1987). Critical thinking and the concept of literacy. *Informal Logic*, *9*(2), 94-110. https://doi.org/10.22329/il.v9i2.2665

Sextou, P. (2004). *Drama and theatre education: a proposal for the establishment of Hellenic theatre in education (TiE); possibilities and problems in developing aspects of the British TiE expierence in Greece towards the provision of professional theatre with an educational purpose in pre-school and primary education.* Ph.D Thesis, Goldsmith College University of London.

Starkey, L. (2010). *Critical thinking skills success in 20 minutes a day*. New York: Learning Express.

Tsiaras, A. (2016a). Enhancing school-aged children's social competence through educational drama. *The Journal of Drama and Theatre Education in Asia, 6*(1), 65-90.

Tsiaras, A. (2016b). Improving peer relations through dramatic play in primary school pupils. *International Journal of Education & the Arts*, *17*(18), 1-21.

Varriour, P. (1994). *In role: Teaching and learning dramatically*. Ontario: Pippin Publishing.

Winship, F. (1954). Educational theatre: A definition. *The Southern Speech Journal*, *19*(4), 317-323. https://doi.org/10.1080/10417945409371327


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The Impact of Inquiry Based Learning Approach on Secondary School Students' Science Process Skills

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Abstract

The aim of this research was to investigate the effect of science course which is based on inquiry based learning approach on seventh grade students' scientific process skill levels. Both quantitative and qualitative data collection methods were used in the study. Considering that both quantitative and qualitative data collection methods were used, the study involved a mixed-method design. The research process was carried out according to the simultaneous transformational mixed research design. The study group consisted of 40 students at seventh grade who were studying in public schools in a district in the western part of Turkey in the 2016-2017 academic year. The data analysis was carried out with Scientific Process Skills Scale and Semi-Structured Interview Form. The obtained data were analyzed using statistical methods. As a result of the study, it was determined that the scientific process skill levels of the students in the experimental group increased statistically significantly compared to the students in the control group. Additionally, the results obtained in the analysis of qualitative data support the results obtained from the quantitative data.

Keywords: Science education, inquiry based learning approach, secondary school students, scientific process skills, student opinions.

1. Introduction

Nowadays, it is more important to teach students how to reach scientific knowledge instead of giving it directly. Students should be provided with opportunities to grow up as individuals who investigate, question, think critically, and manage their own learning process. In this regard, educators have been supporting students' learning through direct experiments for a long time. This issue was dealt by John Dewey in 1916 with the emphasis that understanding scientific method is more important than memorizing scientific knowledge (Lederman, 1992). It is stated that students learn better through direct experiments for a specific purpose, providing

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real-life content, methods and perspectives (Dewey, 1933, as cited in Dell'Olio & Donk, 2007). It is important to design strong learning environments based on constructivist approach-based learning processes for effective teaching (Sahranç, 2011).

- There is no statistically significant difference in the general science process skills (SPS) pre-test scores between the experimental group and control group, but there is a statistically significant difference in the SPS post-test scores between the groups. Considering the mean ranks of the groups in the table 2, this difference is in favor of the experimental group.
- It is found that there is a statistically significant difference between general SPS level the pre-test and post-test scores of the experimental group. Considering the means of the test scores, it is seen that this difference is in favor of the post-test scores. On the contrary, there is no statistically significant difference between the means of pre-test and the post-test scores of the control group (Table 3).
- The findings obtained from the quantitative data coincide with the findings obtained from the qualitative data in the research.

In our country, it is emphasized that, in 2013 and 2017 Science Curriculums, the Inquiry-based Learning (IBL) approach is preferred, in which the student is responsible for his/her own learning, and this approach enables the student to actively participate in the learning process and allows the student to construct information in his/her own mind (MoNE, 2013; MoNE, 2017). The IBL approach is based on the teaching-learning strategy developed by J. Dewey (Şahan, Uyangör & Işıtan, 2012). The inquiry-based method in science education has been a popular field of study for science literacy criteria since 1993 and for science education with the National Science Education Standards prepared by the National Research Council (NRC) since 1996 (Lederman, Abell & Akerson, 2008). The IBL approach is based on teaching science contents based on science, and it is a comprehensive approach where scientific inquiry and teaching strategies are used together in the teaching process (Bybee, 2006). In this approach, students use inquiry to reach ideas and theories that help them explain what they observe, such as scientists, to understand what is happening around them and the facts of nature (Duban, 2014). There is a learning cycle that follows the sequence of developing a question, constructing a hypothesis, developing an experimental design, collecting and recording data, analyzing data, reaching results, constructing and extending generalizations, and sharing results in an inquiry-based teaching process (Dell'Olio & Donk, 2007). In order for a student to succeed in the process of IBL, earn *learning outcomes*, understand the way scientists work, the student must have readiness to ask questions about the inquiry process, design research, and collect and analyze data. Moreover, they must have readiness to use evidences, establish connections with questions and answers. The ability of the student to produce scientific questions in the learning process is an essential feature (NRC, 2000; Jesus, Souza, Teixeira-Dias & Watts, 2005). In this regard, the teacher should guide the connection between scientific ideas and experimental data in the IBL process (Varelas, 1996; Metz, 2004). Students should be encouraged to formulate questions within the learning environment and to avoid subjectivity and to make predictions about the subject without being obsessed with objectivity, and thus new perspectives and possibilities will be considered (Zandvliet, 2013). It should be remembered that a rich learning process will be experienced with the emergence of different perspectives and practices in the process of IBL.

While IBL activities are used to improve students' inquiry skills, "real" is used to raise awareness of conducting a scientific study and prepare them to critically address scientific issues (Filippi & Agarwal, 2017). Moreover, the IBL approach is a powerful learning tool for the development of individuals as it supports understanding the nature of science, acquiring scientific knowledge and scientific process skills, and the establishment of scientific thinking (Fang, Lamme & Pringle, 2010). Through the inquiry method, students learn to use scientific knowledge and processes as well as use critical thinking and reasoning skills to identify and formulate their

problems. Furthermore, they earn a deeper understanding of the nature of science and scientific processes as a result of their active participation in discussing, explaining, and researching science-related events and issues, and develop their scientific thinking skills (Fang et al., 2010). The IBL approach makes it easier for students to perceive the real world and provides opportunities for them to use all kinds of science concepts, principles, and laws they have learned in the classroom to solve real-life problems (Duban, 2014).

Researches on IBL also supports the effectiveness of the IBL approach. In the study conducted by Wilson, Taylor, Kowalski and Carlson (2010) investigating the effectiveness of the IBL, it is stated that the students in the experimental group have showed significantly higher achievement in acquisition way such as knowledge, reasoning, discernment, and discussion than the students in the control group and that this difference has been maintained both immediately after the study and at the end of the four-week period. In the study carried out by Kuhn and Pease (2008) in which the IBL approach was applied, it is stated that in the development of the students followed up year by year, the students have made significant progress in understanding the inquiry objectives, identifying questions, expressing ideas, defining models, controlling comparisons, interpreting data that is becoming more complex, supporting claims and developing validated predictions overtime, and that they can apply the scientific method properly. In the study carried out by Bunterm, Lee, Ng Lan Kong, Srikoon, Vangpoomyai, Rattanavongsa and Rachahoon (2014), some learning outcomes were examined based on guided and structured inquiry-based learning. As a result of this research, it is stated that there is a significant positive difference on science knowledge and science process skills of both groups. In the study conducted by Van Uum, Verhoeff and Peeters (2017), the effect of teacher guidance on the learning process of the students is investigated, and it is concluded that the open IBL process could be initiated with the use of intensive guidance by the teachers, and it is detected that the use of lightened guidance in addition to the intensive guidance has improved the students' scientific understanding and contributed to the formation of a common guidance process between the teacher and the student during learning and that students could acquire scientific knowledge and skills to direct their own learning process over time.

Also, the studies carried out on the basis of the IBL approach within the scope of the research performed are considered important in terms of providing students the opportunity to improve their scientific process skills (SPS) levels by conducting scientific inquiry activities and providing the opportunity to conduct research and construct information using a scientific method. Based on this study, it is envisaged that the IBL approach may serve as an example of its applicability in science courses and that the IBL approach can provide an example of how it can be applied in science courses. It is thought that the prepared worksheets can be used in different academic studies and science courses in secondary schools and present ideas for new researches in the literature related to the research topic. In this context, in this study, it was aimed to investigate the effect of the IBL approach on the SPS level of seventh grade students. Moreover, it was aimed to determine the students' views on the applications of the IBL process. For this purpose, the following the sub-problems are examined:

- At the end of the application process, is there a statistically significant difference in basic SPS levels between the experimental group students to whom the IBL approach was applied in the science course and the control group students to whom the 2013 Science Education Program was applied in the science course?
- At the end of the application process, is there a statistically significant difference in high-level SPS levels between the experimental group students to whom the IBL approach was applied in the science course and the control group students to whom the 2013 Science Education Program was applied in the science course?

- What are the opinions of the experimental group students towards the application of the IBL process?

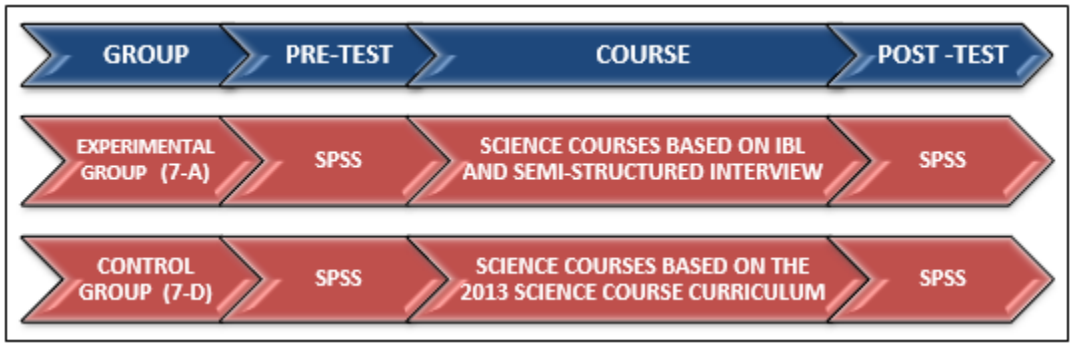
2. Method

2.1 *Research model*

The aim of scientific research in social sciences is to understand the complexity of human behavior and experiences. The task of the researcher is to understand, explain, and describe this complex structure within the limits of research methods (Morse, 2003). Although the techniques and methods used to reach scientific facts play an important role, one of them alone is not enough. In this respect, it is necessary to get closer to reality using more than one method (Türkdoğan, 2000). The use of quantitative and qualitative approaches in social research provides a better understanding of the research problem and a complex phenomenon, broadens the boundaries of the research, and provides answers to research questions from different perspectives (Morse, 2003; Creswell & Plano Clark, 2011). Research designs created by combining various qualitative and quantitative research methods are called mixed research (Morse, 2003).

In this research, since both quantitative and qualitative data collection methods were used together, the research involved a mixed method. The research process was carried out according to the simultaneous transformational mixed research design. In this design, quantitative and qualitative data are collected and analyzed at the same time. Priority is given to qualitative or quantitative data types, but in some cases equal importance can be given to both data types. Data analysis is performed separately, and combining usually occurs during the data interpretation stage or when data are transformed during data analysis. It is useful for providing a wide range of alternatives or perspectives, supporting the participants, and providing a better understanding of the phenomenon being studied (Creswell, 2003).

In this research, after the pre-test of the Science Process Skills Scale (SPSS), the science course was carried out in the experimental group according to the IBL approach while the control group was conducted based on the 2013 science course curriculum. Qualitative data were collected from experimental group with semi-structured interview form in order to support quantitative data during the IBL process. At the end of the process, SPSS was applied to both experimental and control groups as post-test. The steps applied in the research are detailed in Model 1.



Model 1. Research model

In the research, the quantitative data obtained from the pre-test and post-tests were examined by statistical methods and the qualitative data were examined by content analysis.

2.2 *Working group*

This research was conducted with 40 students at seventh grade level who were studying in a public school in a district western part of Turkey in 2016-2017 academic year. These students consisted of two classes of twenty individuals. With the random assignment, one of the classes was included in the study as the experimental group and the other as the control group. The science teacher, one of the authors of the article, provided the science courses of both groups. While a small number of students in the experimental and control groups lived in economic conditions at the upper or lower income level, the students of both groups generally had moderate economic opportunities. The experimental group consisted of 12 boy and eight girl students, and the control group consisted of 11 boy and nine girl students. The school where the research was carried out was that 450 students were studying, there is no conference hall, there is no indoor gymnasium, and there is no equipped science laboratory; however, it is a public school with moderate physical conditions with science course materials sent by MoNE in the science class, where there is a class that can be used as a science class.

2.3 *Data collection tools*

In the research, SPSS was used for the collection of quantitative data and a semi-structured interview form was used for the collection of qualitative data.

2.3.1 *Scientific process skills scale*

As a data collection tool, SPSS developed by Aydoğdu, Tatar, Yıldız and Buldur (2012) was used. SPSS consists of 27 multiple-choice items. Nine of the items are aimed at measuring basic skills and 18 of them measured high level skills. At the basic level, there are items for observing, classifying, using space/time relations, making predictions, making inferences; on the other hand, at the high level, there are items for problem solving, hypothesis building, determining and controlling variables, conducting experiments, and interpreting data. In order to determine the scientific process skills of all students in the second stage of primary education, the reliability coefficient (KR – 20) of the proposed measurement tool to be used in screening experimental studies is 0.84. Additionally, average difficulty is 0.54. The differences between the average scores of the students in the upper 27% and lower 27% of the measurement tool are statistically significant for each item ($p<0.05$). According to these results, it can be said that this measurement tool developed to measure the scientific process skills of elementary school students is valid and reliable (Aydoğdu, Tatar, Yıldız & Buldur, 2012).

2.3.2 *Semi-structured interview form*

In order to support the quantitative data collected in the study, qualitative data were collected from the experimental group students through a semi-structured interview form. The semi-structured interview form has developed by Yıldız (2008) and consists of eight questions.

2.4 *Preparation of worksheets*

The worksheets were prepared by the researcher, who was also the science teacher of the study group, in accordance with the seventh grade learning outcomes of the Science Education Program (MoNE, 2013), and by paying attention to the elements that might be of interest to the students and examining many studies about the IBL approach in the literature. Afterwards, the worksheets were re-submitted to the expert opinion by making necessary arrangements by the researcher in accordance with the expert opinion. The worksheets were used in the lessons after

finalizing the preparation process according to expert opinion. In line with the learning outcomes, a worksheet was created for each subject included in the course process. Each worksheet consisted of 4-6 pages. Students were not given ready-made problem situations on the worksheets; instead, scenarios were given to students on each worksheet. The scenarios were also prepared by the researcher who was the science teacher of the study group and prepared the worksheets. In the preparation of the scenarios, attention was paid to the development characteristics of the students, the content of the subject, and the quality of the students to reach the problem situations related to the subject. Considering the possibility that the students would see more than one problem situation that they could investigate in the scenarios, two sections in which the students should write their own sentences were presented on the worksheets. In both chapters, there were 10 parts: research problem, hypothesis, dependent variable, independent variable, control variables, tools and materials, trial plan, trial phase, observation-measurement and results, and evaluation. In both stages of the evaluation part, five or seven questions were given to the students to write their own sentences according to the subject characteristics.

2.5 *Inquiry-based learning process applied in the science class*

In order to collect quantitative data, SPSS was applied as a pre-test to the experimental and control group students before the application process and as a post-test at the end of the application process. Application process was carried out in both groups within the framework of "Force and Energy" unit learning outcomes. Within the scope of the Force and Energy Unit, five topics such a-as Pressure in Solids, Pressure in Liquids, Atmospheric Pressure, Gravitational Potential Energy and Kinetic Energy were discussed.

After the pre-tests, a small preparatory phase was applied to the experimental group students before starting the inquiry-based teaching process. In this preparatory phase, students were given the opportunity to make hypotheses, determine variables, and plan experiments by giving simple problem situations that should be investigated with short activities. Thus, it was aimed to facilitate the transition of students to open inquiry process. After the completion of the preparatory phase, the IBL process was carried out with five worksheets prepared for the subjects within the unit. Experimental group students carried out their studies in groups. In the formation of the groups, the students of the experimental group were divided into five groups of four persons, taking into consideration the volunteerism and wishes of the students. Each group carried out their studies and carried out in-group discussions, gathering on separate tables in the classroom layout where the large science-class desks of the school were placed according to the U-layout so that a large middle space could be used when needed.

The students were first given a working sheet on pressure in solids, and each student was asked to examine the sections in the worksheet, read and review the scenario given in the worksheet, and think about what ideas he had in mind before contacting each student's group friends. After the individual examinations were completed, the students were asked to discuss in groups for about 10 minutes to express their ideas about what they were thinking and to name their groups. In this process, it was stated that they should conduct their speeches within the framework of the following questions:

- Were there any situations that attracted your attention in the scenario, what was the situation that attracted your attention?
- What did you think about the situation that attracted your attention?
- After reading this scenario, was there any situation that you would like to investigate? If yes, what would be your research topic?
- What kind of problem statement did you express in your research?

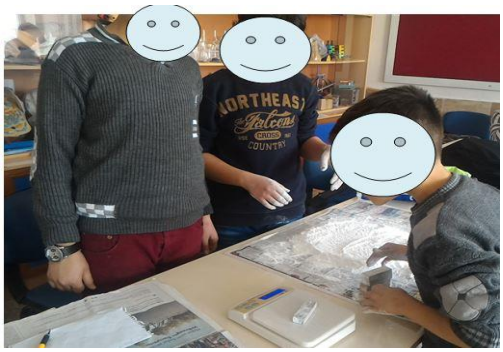
While the groups continued their discussions within the framework of the above-mentioned questions, each group was guided separately by a teacher who was one of the researchers of the study. In the meantime, it was seen that although all groups could determine which point they would investigate jointly, they had difficulty in expressing the research topics with an appropriate problem sentence. At this point, each group was guided by asking different questions according to the needs of each group. The groups reorganized their problem sentences based on the awareness they obtained under teacher guidance in group discussions and asked the teacher to check the problem sentences. This guidance was continued until the appropriate problem was reached. While some groups were able to express research topics with a searchable problem sentence in the second control, some groups needed third or fourth guidance. Afterwards, all groups were asked to establish a hypothesis about their own research and to determine dependent, independent, and control variables in their research depending on the hypothesis they established. Guidance was provided to the groups who needed help in writing the variables and all groups were provided to complete the phase. After that, in order to carry out their research, all groups were asked to plan an experiment with the participation of all students in the group and decide which materials to be used in this experiment. After a few minutes of group discussion about the students' experimental plans, the groups were guided for the last time for this phase. After all the groups decided on the experimental plans, they were given time to complete the trial plan and equipment-materials sections on their worksheets with their own sentences. While filling this section, it was stated that they could visualize their expressions by making use of pictures and schemes. In the last minutes of the course, the materials that would be used by all groups were reviewed for detecting which ones could be found in the laboratory and which ones should be provided and the students were asked to come prepared by bringing simple materials that they could supply themselves.

At the beginning of the next lesson, the students were asked to review their experiment plans in groups for two minutes. After the groups were ready to conduct their experiments, they were asked to conduct their experiments by reminding them that they should carefully record the data to be obtained from the experiments in the observation - measurement section. While conducting the experiments, the studies of all groups were observed one by one by the teacher, and guidance was provided to the groups where needed. After the groups completed their experiments, the students were asked to fill in the "trial phase" section on their worksheets with their own sentences and to indicate the results they obtained on the basis of the data based on their records. While the members of the group completed these sections of the worksheet, the students were also guided by the course teacher when necessary. Afterwards, all students were asked to formulate answers to the questions in the evaluation section. After that, a large group discussion environment was created and students were asked to express in which parts they had difficulty, how they offered solutions to these difficulties, and which stages they could easily handle. In this way, it was aimed to detect whether students developed awareness about their own learning and found the opportunity to compare their own learning processes with other students, and to reveal whether they could use learning ways of their friends in terms of social learning. In the ongoing section of the worksheet in the large group discussion, it was stated that the groups should be included in the discussion without sharing their hypotheses and experimental results because they would carry out a new research on the subject.

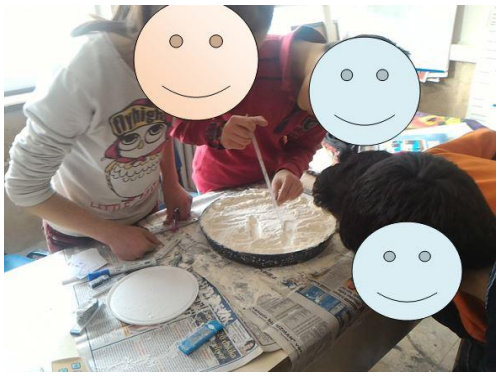
In the second part of the issue of pressure in solids, the groups were given the opportunity to work on another problem situation they wanted to investigate. At this stage, the students continued the IBL process in the sequence indicated in the first stage using the second part of the worksheet on the issue of pressure in solids. In the second part of the research, the students used the second part of the worksheets. After the completion of the second part of the worksheets and when there was no new research that all groups wanted to carry out on the subject, a final large group discussion was held for the whole subject. In the big group discussion, the students were asked what research question they started, what they thought in their hypothesis,

how they designed a group experiment, what materials they used, which results they obtained from the data that they obtained, and what answers were written in the evaluation section of the worksheets. In the meantime, all students were asked to pay attention to the ideas, experiments, hypotheses, materials created by other groups, which were interested in, and to consider the work of other groups in comparison with their own work. Additionally, they were asked to compare the experiment they proposed and the one they applied as a result of the group decision.

Picture 1. Sample image from the moment of the students experimenting with fruits about pressure in solids.



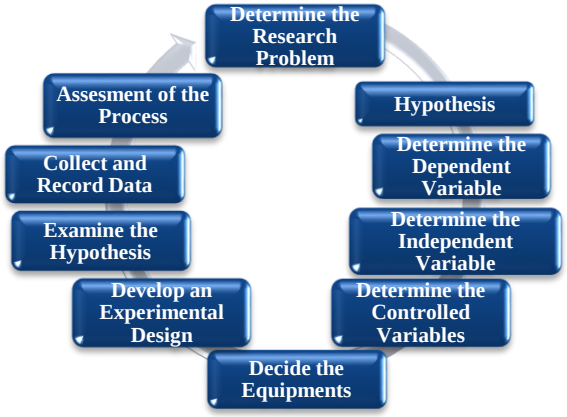
Picture 2. Sample image from the moment that the students repeated their measurements on pressure in solids.



Picture 3. Sample image from the moment that the students measured the depth of the traces on the flour ground.

Picture 4. Sample image from the students' experiments on kinetic energy.

Following the completion of the first activity, the other four activities were dealt in the stages specified in Model 2 in accordance with the IBL approach. At the end of each topic in the large group discussion, upon the request of the students, it was allowed that some groups repeat their experiments so that all students could see.



Model 2. The Stages of IBL in experimental group

In the control group, after the pre-test application in the same week with the experimental group, the learning outcomes were handled by adhering to the current curriculum without the IBL process. At the end of the process, as in the experimental group, the post-test application was performed.

3. The results

The quantitative data obtained from the pre-test and post-test using SPSS were analyzed using statistical methods. In the statistical analysis, before the application process of the experimental and control groups, the SPS level of the students before the application was examined in terms of the dependent variable of the study. Then, the levels of the groups at the end of the application process were examined, and the findings were formed. Furthermore, the data obtained from the groups were examined separately by single sample analysis within the group, and the findings were supported.

The Shapiro-Wilks test was used to determine whether the data obtained from the groups showed a normal distribution in order to examine the effect on general SPS levels of secondary school seventh grade students of the science course processed within the framework of the IBL approach. The Shapiro-Wilks test is used to examine the normality of the data if the group size is less than 50 (Büyüköztürk, 2015). The results of the Shapiro-Wilks test analysis are presented in Table 1.

Table 1. The Shapiro-Wilks test findings for general SPS scores

Test	Group	n	Z	p
General SPS in Pre-test	Experimental Group	20	0.949	0.355
	Control Group	20	0.908	0.059
General SPS in Post-test	Experimental Group	20	0.873	0.013*
	Control Group	20	0.929	0.148
General SPS Pre-test and Post-test Difference Scores	Experimental Group	20	0.944	0.289
	Control Group	20	0.966	0.678

*p<0.05

When Table 1 is examined, it is observed that general SPS scores show a normal distribution (p>0.05) in both groups in pre-test. On the other hand, in the last tests, while the general SPS score shows a normal distribution (p>0.05) in the control group, the general SPS score doesn't show a normal distribution (p<0.05) in the experimental group. In this respect, the independent samples t-test, a parametric method, was used to compare the general SPS pre-test

scores of the groups. Additionally, the Mann Whitney U-test, a non-parametric method, was used to compare the last-test scores statistically. The results of the analysis are presented in Table 2.

Table 2. Unrelated measurements T and U-test results for general SPS Pre-Test and Post-Test scores of the experimental and control group students

Unrelated Measurements T-Test Results						
TEST	GROUP	N	$\overline{X}$	SS	t	p
Pre-test	Experimental Group	20	1.77	0.73	0.689	0.495
	Control Group	20	1.92	0.65		
Unrelated Measurements U-Test Results						
TEST	GROUP	N	Mean Rank	Sum of Rank	U	p
Post-test	Experimental Group	20	29.00	580.00	30.000	0.000*
	Control Group	20	12.00	240.00		

*p<0.05

When Table 2 is examined, it is found that there is no statistically significant difference between the general SPS pre-test scores of the groups (t=0.689; p>0.05), but there is a statistically significant difference between the post-test scores (U=30.000; p<0.05). Considering the mean ranks of the groups in the table, this difference is in favor of the experimental group.

The normality of pre-test and post-test difference scores was examined to determine the statistical method to be used to compare general SPS levels within the group before and after the application process. When Table 1 is examined, it is seen that the difference scores of both groups show normal distribution (p>0.05). In this respect, paired samples t-test, a parametric method, was used to compare the general SPS levels of both groups statistically. The results of the analysis are presented in Table 3.

Table 3. Related measures of T-test results for general SPS Pre-Test and Post-Test scores of the experimental and control group students

GROUP	TEST	N	$\overline{X}$	SS	sd	t	P
Experimental Group	Pre-test	20	1.68	0.85	19	11.077	0.000*
	Post-test	20	3.08	0.78			
Control Group	Pre-test	20	1.92	0.65	19	0.829	0.417
	Post-test	20	1.79	0.58			

*p<0.05

When Table 3 is examined, it is found that there is a statistically significant difference between general SPS level the pre-test and post-test scores of the experimental group (t=11.077; p<0.05). Considering the means of the test scores, it is seen that this difference is in favor of the post-test scores. On the contrary, there is no statistically significant difference between the means of pre-test and the post-test scores of the control group (t=0.829; p>0.05).

Table 4. The Shapiro-Wilks Test findings for basic SPS scores

Test	Group	n	Z	p
Basic SPS in Pre-test	Experimental Group	20	0.934	0.184
	Control Group	20	0.943	0.270
Basic SPS in Post-test	Experimental Group	20	0.873	0.013*
	Control Group	20	0.929	0.148
Basic SPS Pre-test and Post-test Difference Scores	Experimental Group	20	0.798	0.001*
	Control Group	20	0.888	0.025*

*p<0.05

The research also examined the effect of Science course, which was processed within the framework of IBL approach, on basic SPS levels of middle school seventh grade students. For this purpose, firstly, the Shapiro-Wilks test was used to determine whether the data showed a normal distribution in order to determine the statistical methods to be used in the analysis of the data related to the basic SPS level obtained from the groups. The results of the Shapiro-Wilks test analysis are presented in Table 4.

When Table 4 is examined, it is observed that the basic SPS scores of both groups show a normal distribution ($p>0.05$) whereas, in the post-tests, the basic SPS score of experimental group doesn't show a normal distribution ($p<0.05$). In this respect, independent samples t-test, a parametric method, was used to compare the basic SPS pre-test scores of the groups statistically. Moreover, the Mann Whitney U-test, a non-parametric method, was applied to compare the post-test scores of the groups statistically. The results of the analysis are presented in Table 5.

Table 5. Unrelated measurements T and U-test Results for basic SPS Pre-Test and Post-Test scores of the experimental and control group students

Unrelated Measurements T-Test Results						
TEST	GROUP	N	$\overline{X}$	SS	t	p
Pre-test	Experimental Group	20	1.95	0.78	0.290	0.773
	Control Group	20	2.02	0.55		
Unrelated Measurements U-Test Results						
TEST	GROUP	N	Mean Rank	Sum of Rank	U	p
Post-test	Experimental Group	20	28.75	575.00	35.000	0.000*
	Control Group	20	12.25	245.00		

$p<0.05$

When Table 5 is examined, it is seen that there is no statistically significant difference between the groups' basic SPS pre-test scores ($t=0.29$; $p>0.05$). On the other hand, there is a statistically significant difference between the basic SPS post-test scores of the groups ($U=35.000$; $p<0.05$). Considering the means of the groups in the table, this difference is in favor of the experimental group.

The normality of pre-test and post-test difference scores was examined to determine the statistical method to be used to compare the basic SPS levels within the group before and after the application process. When Table 4 is examined, it is seen that the difference scores of both groups do not show a normal distribution ($p<0.05$). In this respect, the Wilcoxon signed rank test, a non-parametric method, was used to compare the basic SPS levels of both groups statistically. The results of the analysis are presented in Table 6.

Table 6. Related measurements Wilcoxon signed rank test results for basic SPS Pre-Test and Post-Test scores of the experimental and control group students

GROUP	Pre- Post-test	N	Mean Rank	Sum of Rank	Z	p
Experimental Group	Negative Rank	0	0.00	0.00	3.87	0.000*
	Positive Rank	19	10.00	190.00		
	Equality	1				
Control Group	Negative Rank	9	8.78	79.00	0.119	0.906
	Positive Rank	8	9.25	74.00		
	Equality	3				

*$p<0.05$

When Table 6 is examined, it is found that there is a statistically significant difference between basic SPS level the pre-test and post-test scores of the experimental group ($Z=3.87$; $p<0.05$). Considering the mean ranks and sum of ranks, it is seen that this difference is in favor of

post-test scores. On the contrary, there is no statistically significant difference between the pre-test and post-test scores of basic SPS levels in the control group (Z=0.119; p>0.05).

The research also examined the effect of Science course, which was processed within the framework of IBL approach, on high level SPS levels of middle school seventh grade students. For this purpose, firstly, the Shapiro-Wilks test was used to determine whether the data showed a normal distribution in order to determine the statistical methods to be used in the analysis of the data related to the high level SPS level obtained from the groups. The results of the Shapiro-Wilks test analysis are presented in Table 7.

Table 7. The Shapiro-Wilks Test findings for high level SPS scores

Test	Group	n	Z	p
High Level SPS in Pre-test	Experimental Group	20	0.899	0.039
	Control Group	20	0.916	0.081
High Level SPS in Post-test	Experimental Group	20	0.796	0.001*
	Control Group	20	0.887	0.023*
High Level SPS Pre-test and Post-test Difference Scores	Experimental Group	20	0.905	0.051
	Control Group	20	0.973	0.816

*p<0.05

When Table 7 is examined, it is seen that the high level SPS pre-test scores show a normal distribution in the control group (p>0.05). However, it is seen that the high level SPS pre-test scores do not show a normal distribution in the experimental group (p<0.05). In the post-tests, it was observed that the high level SPS scores of both groups do not show a normal distribution (p<0.05). In this respect, the Mann Whitney U-test, a non-parametric method, was applied to compare the high level SPS pre-test and post-test scores of the groups. The results of the analysis are presented in Table 8.

Table 8. Unrelated measurements U-test results for high level SPS Pre-Test and Post-Test scores of the experimental and control group students

Unrelated Measurements U-Test Results						
TEST	GROUP	N	Mean Rank	Sum of Rank	U	p
Pre-test	Experimental Group	20	18.65	373.00	163.000	0.313
	Control Group	20	22.35	447.00		
Unrelated Measurements U-Test Results						
TEST	GROUP	N	Mean Rank	Sum of Rank	U	p
Post-test	Experimental Group	20	28.48	569.50	40.500	0.000*
	Control Group	20	12.53	250.50		

*p<0.05

When Table 8 is examined, it is seen that there is no statistically significant difference between the high level SPS pre-test scores of the groups (U=163.000; p>0.05). Additionally, there is a statistically significant difference between the groups' high level SPS post-test scores (U=40.500; p<0.05). Considering the mean ranks of the groups in the table, this difference is in favor of the experimental group.

The normality of pre-test and post-test difference scores was examined to determine the statistical method to be used to compare the high level SPS levels in the group before and after

the application process. When Table 7 is examined, it is seen that the difference scores of both groups show a normal distribution (p>0.05). In this respect, paired samples t-test, a parametric method, was used to compare the high level SPS levels of both groups statistically. The results of the analysis are presented in Table 9.

Table 9. Related measurements T-test results for High Level SPS Pre-Test and Post-Test scores of the experimental and control group students

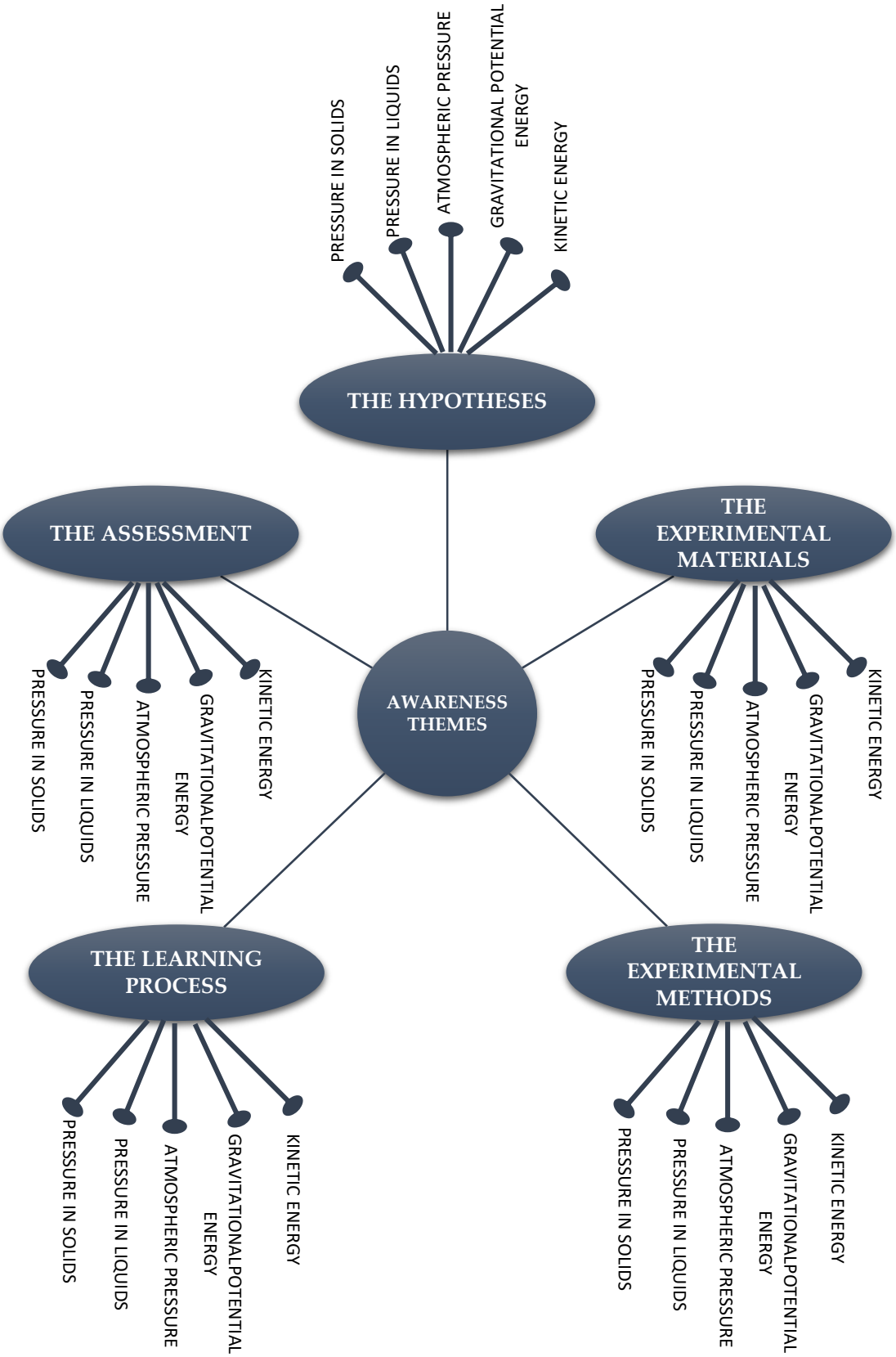
GROUP	TEST	N	$\overline{X}$	SS	sd	T	p
Experimental Group	Pre-test	20	1.95	0.78	19	11.332*	0.000*
	Post-test	20	3.11	0.47			
Control Group	Pre-test	20	1.87	0.75	19	1.146	0.266
	Post-test	20	1.66	0.63			

*p<0.05

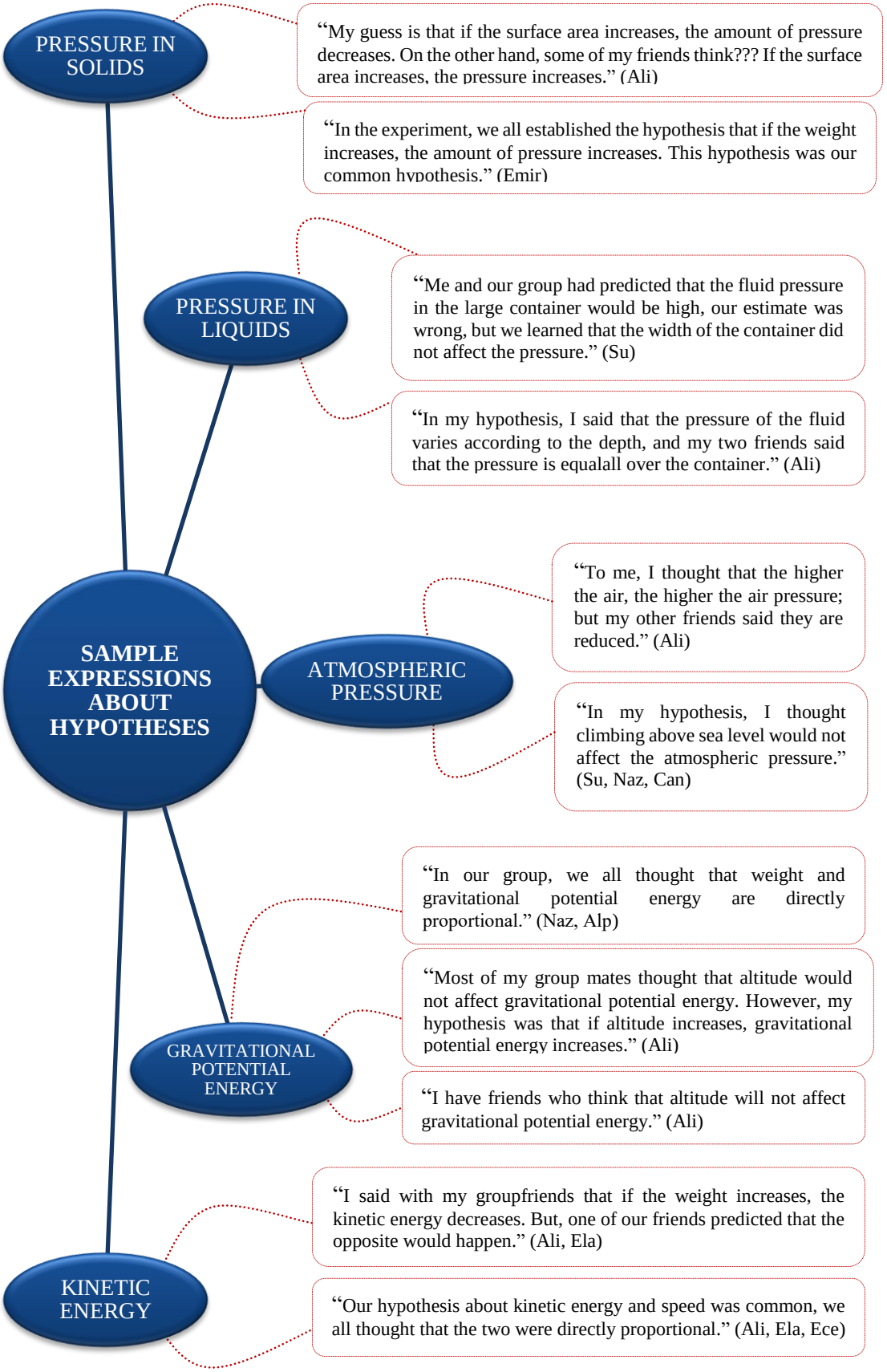
When Table 9 is examined, it is seen that there is a statistically significant difference between the high level SPS pre-test and post-test scores in the experimental group (T=11.332; p<0.05). Considering the means of the test scores, it is seen that this difference is in favor of the post-test scores. On the other hand, there is no statistically significant difference between the high level SPS pre-test and post-test scores in the control group (T=1.146; p>0.05).

In order to support the quantitative data obtained from the research, a semi-structured interview form was used. The interviews were conducted with 20 students in the experimental group regarding the inquiry-based teaching process. Instead of a single interview for the whole unit, the answers were collected separately for all subjects because of the possibility that the students could answer a different question for each subject in the unit. Content analysis was applied to the data obtained. In the analysis of the data, the opinions of three experts were consulted. As a result, the findings were presented with six models. In the models, the themes that emerged as a result of content analysis and the students' expressions were included. Students' expressions are not based on their real names; instead, a separate code name is provided for each student.

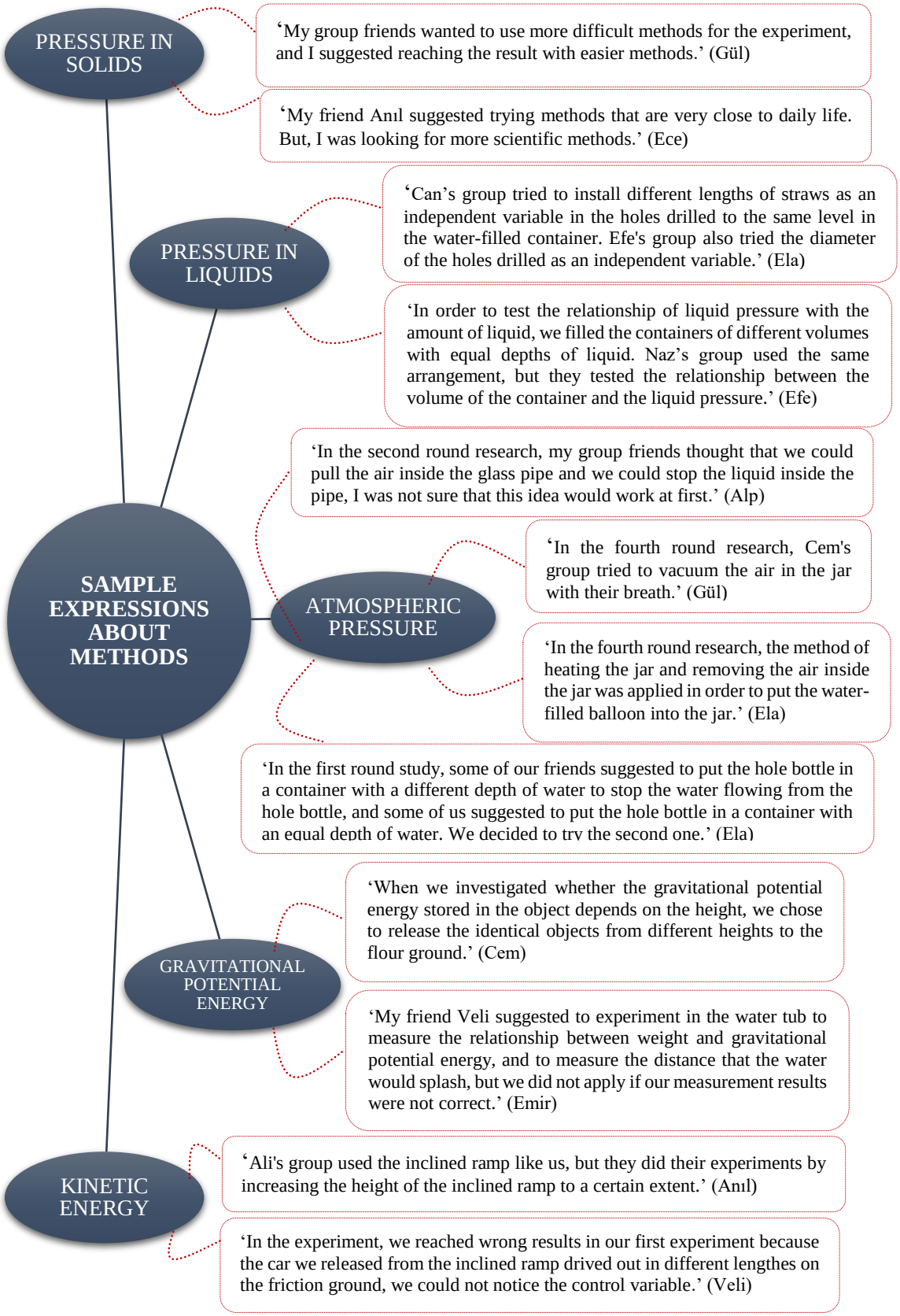
In the content analysis of the semi-structured interviews, it was seen that the students' expressions consisted of five themes. These themes are related to the hypotheses established during the IBL process, the materials used by the groups, the experimental methods applied by the groups, the learning process, and the assessment of the learning process. In each theme, it was noticed that the students expressed their opinions about all the subjects in the unit. Themes formed in the analysis of the data are presented in Model 3.



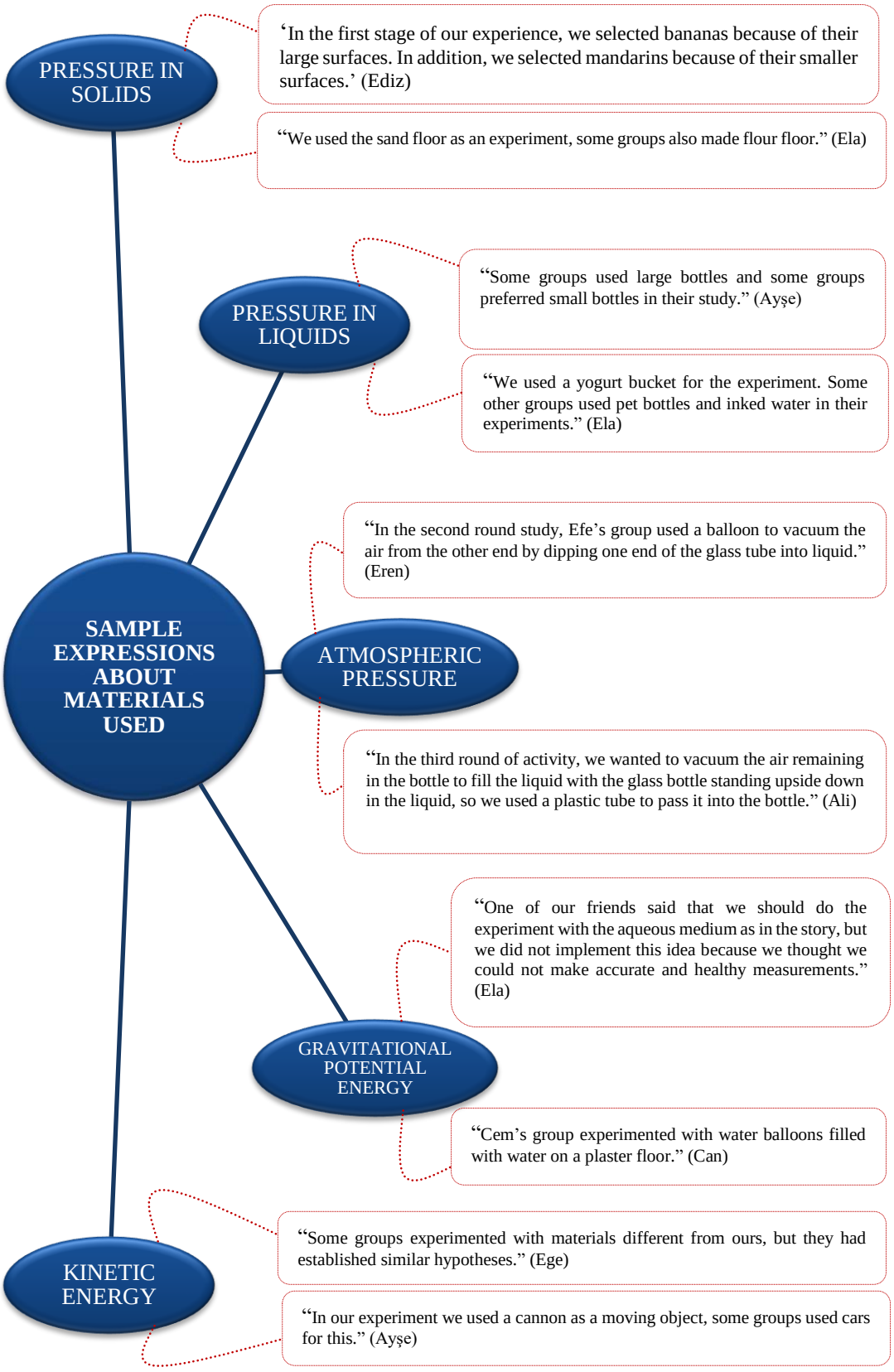
Model 3. Awareness themes related to the IBL process



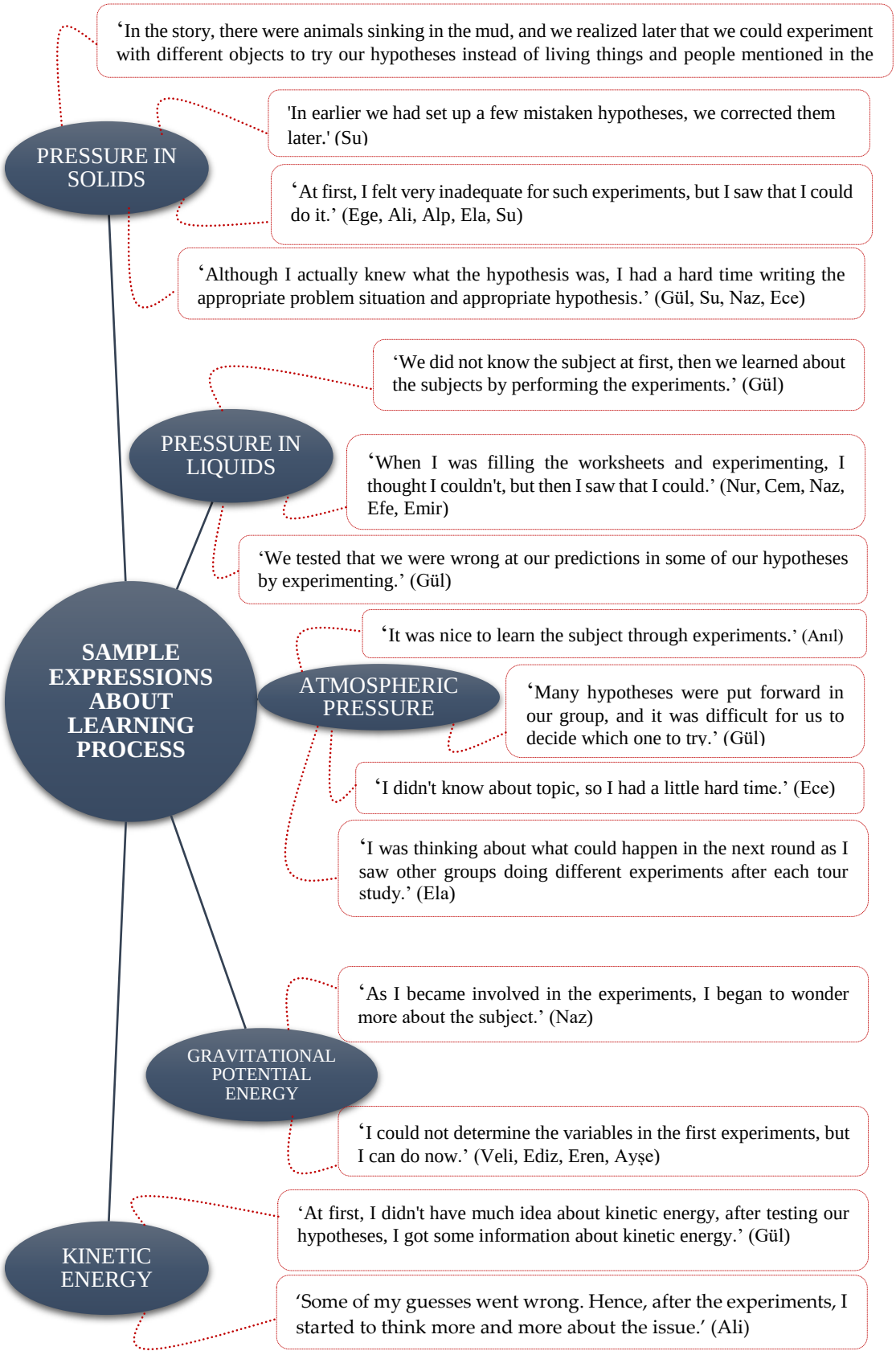
Model 4. Students' awareness about hypotheses



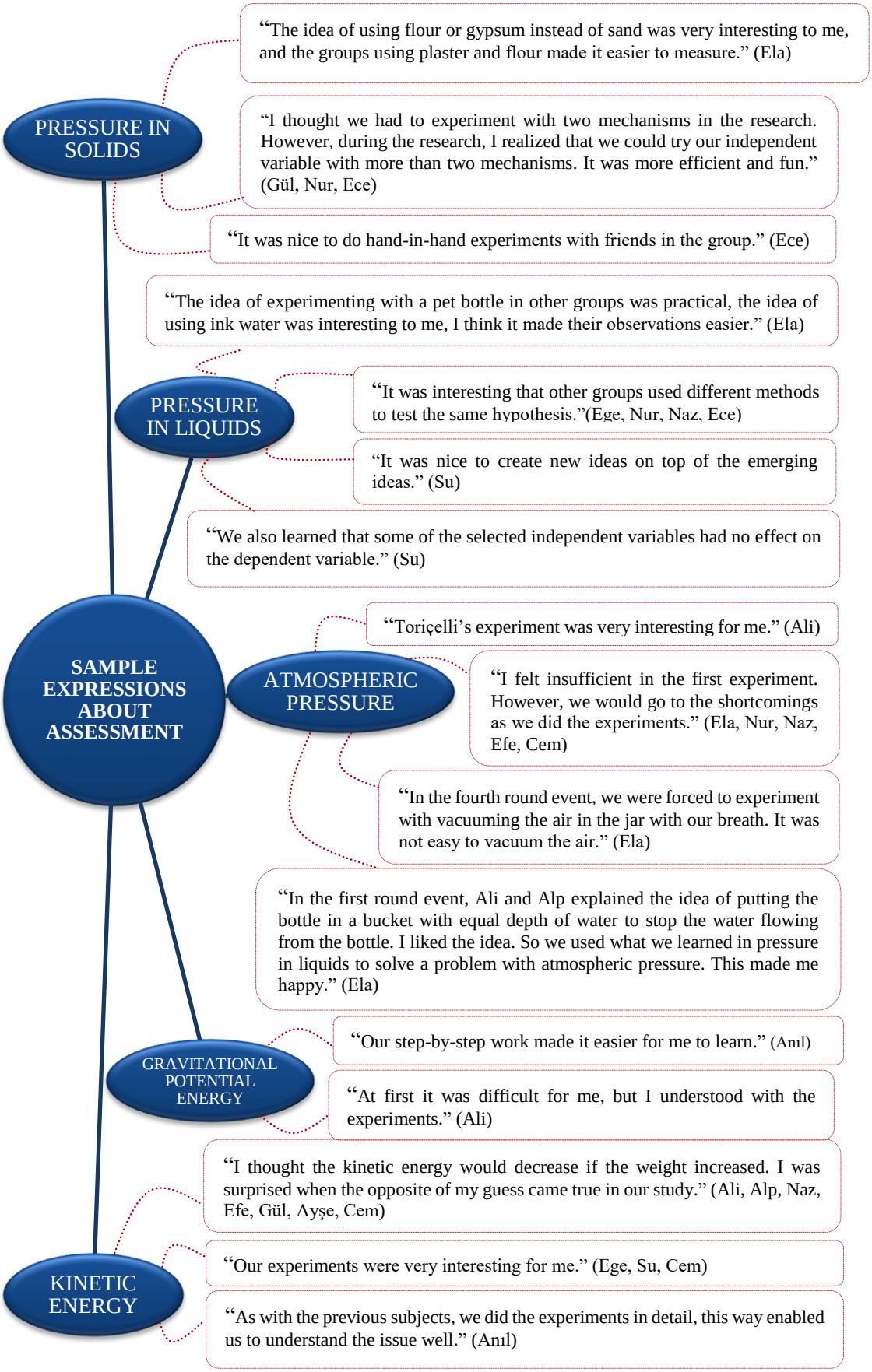
Model 5. Students' awareness about applied methods



Model 6. Students' awareness of materials used



Model 7. Students' awareness about learning process



Model 8. Students' awareness of assessment

In the content analysis of the qualitative data, despite the fact that students' expressions were mostly gathered in the beginning of the IBL process to make students feel inadequate, the expressions of feeling inadequate as the learning process progressed were left, and they were replaced by expressions about not feeling inadequate. At the beginning of the IBL process, students' expressions of feeling inadequacy generally included the following statements: "I was unfamiliar with constructing a controlled experiment", "I was upset when my hypotheses were wrong" and "I was forced at first".

It was discovered that students mostly formed directional hypotheses during the IBL process and that in the first experiments of the IBL process, they were surprised and upset when the experiments carried out by the students resulted in a different direction from the hypothesis they established. The students expressed these feelings during the semi-structured interviews with the following words: "It upset me when my hypotheses were wrong". This situation means that the students who use this voice expect to see that the hypothesis established at the beginning of the IBL process should be supported as a result of their experiments. However, in the later weeks of the IBL process, it was seen that the students accepted this situation when the results of the experiment were different from their hypotheses. The students expressed this as follows: "The fact that our hypothesis results in a mistake and that the hypothesis we have established turns out to be in the opposite direction also enable us to learn".

The student's voices "I was forced at first because I did not know the issue", used at the beginning of the IBL process, could be interpreted as follows: "Students were unaware that information can be accessed using scientific inquiry". Over time, this idea gave way to the following statement presented in content analysis models: "I learned the subject by doing scientific inquiries".

It was discovered that the students' voices "I thought we had to experiment with two mechanisms in research. However, during the research, I realized that we could try our independent variable with more than two mechanisms. It was more efficient and fun", used at the beginning of the IBL process, shows that the students had a misconception about the statement "In order to conduct scientific inquiry, it is necessary to establish two different mechanisms in terms of independent variables". Also, it has seen that students develop an idea suitable for scientific inquiry by applying in the process.

4. Discussion and conclusion

Although there is no statistically significant difference between the basic SPS, high level SPS, and general SPS levels before the application process of the experimental and control groups, there has been a significant difference between basic SPS, high level SPS, and general SPS levels of the experimental and control groups in favor of the experimental group after the IBL process. Additionally, a statistically significant difference has been found between the pre-test and post-test scores of the basic SPS, high level SPS, and general SPS levels of the experimental group students in favor of the post-tests. This shows that the IBL approach has an effect on the basic SPS, high level SPS, and general SPS levels. However, it should be noted that there is no statistically significant difference between the pre-test and post-test scores of the control group of the basic SPS, high level SPS, and general SPS levels. Therefore, it has been seen that the teaching process in the control group could not improve the students' basic SPS, high level SPS, and general SPS levels at a level that would make a statistically significant difference. The results obtained in the literature are similar to the various studies on the effects of the IBL approach on different variables. In the studies conducted by Tatar (2006), Kuhn and Pease (2008), Wilson et al. (2010), Çeliksöz (2012), Büyükdokumacı (2012), Duran (2014), Bunterm et al. (2014), Kaya and Yılmaz (2016), Yıldırım and Altan (2017), and van Uum et al. (2017) with different age groups, the effect of the IBL approach on SPS is revealed. It is stated that students have made significant progress

in understanding the goals of questioning over time, defining questions, explaining their ideas, making controlled comparisons, interpreting the increasingly complex data, supporting claims and making validated predictions, and using the scientific method as necessary to manage their own learning processes. In this respect, the findings and results obtained from the analysis of quantitative and qualitative data in this study are similar to those mentioned in this study.

According to the results obtained in the analysis of the qualitative data of the research, the students' thoughts regarding the teaching process carried out in line with the IBL approach are as follows:

- They think that they have realized a more detailed learning by scientific inquiry,
- They think that they will be able to learn topics they do not know by performing similar scientific inquiry activities,
- They have seen that they can easily learn the subjects they think are too difficult,
- As a result of the experiment, they have realized that the correct and incorrect results of their hypotheses provide learning,
- They think that the use of more than two mechanism in experiments to test a hypothesis provides better results,
- They have realized that there are many different mechanisms that can be established to test the same hypothesis, and they find it interesting,
- They have realized that they can use different materials in similar experimental mechanism to test the same hypothesis,
- They have realized that non-affective variables can be detected such as independent variables that affect a dependent variable by using scientific inquiry,
- They have realized that in order to solve any problem on another topic, they can use the information that they have learned on a previous subject,
- They have been happy to see what they can achieve during the IBL process,
- They have realized that they can compare multiple methods used for the same research subject and draw conclusions,
- They have been disposed to use the scientific inquiry method again so as to do new researches in daily life,
- Initially they had difficulty in identifying the problem, establishing hypothesis, determining and controlling variables, planning experiments in accordance with the variables and hypotheses, and even they could not; however, they have realized that they have accomplished them easily in the following process, that is, they are aware of the progress they have made in the IBL process,
- They found the lesson activities funny and interesting,
- They have been happy when their stages in experiments result in learning,
- Although they thought "I cannot carry out the experiments about scientific inquiry" and then they were surprised and glad when they saw what they could achieve,
- They are aware that the feeling of fear of taking responsibility for learning is replaced by the desire to learn,
- In each new experiment they had the following excitement: "I wonder what other groups will try, how to do the experiment",
- They have realized that more than one method can be applied to solve a problem and that more than one can be correct.

In addition to the student expressions, based on student worksheets completed by students during the process, and the teacher observations, the students carried out the following points:

- They performed in IBL process gladly,
- All group members, even including academically disadvantaged students, performed the experiments eagerly, took part in group works with interest, curiosity, and enthusiasm,

- When they saw that the predictions in their hypotheses were wrong as a result of experiments, they learned with surprise,
- Although they were content with just two mechanisms at the beginning to try their hypotheses, they started to use more and more as the process progressed,
- Although they used simple tables or data logging methods to save the initial data, they have used more qualified data logging methods in the forthcoming days,
- Although they never or rarely use graphical representation of the data they recorded at the beginning, they have used different graphical forms more consciously in the forthcoming days.

In the literature, in the research conducted by Chang and Moa (1999), Duran (2014), Yaşar and Duban (2009), it is emphasized that in the process of IBL, the students found the lessons more enjoyable, they are more interested in the course and they have learned more easily and that the effect of the IBL approach on the attitude and motivation towards learning the science course. In this respect, the findings and the results obtained from the analysis of the qualitative data of this research are similar to the researches mentioned. In the current study, it is found that students had less difficulty in expressing research topics with problem sentence in the second part of pressure in solids and that the students no longer have difficulty in creating a problem statement about pressure in liquids. Similarly, it is observed that in the IBL process, students have been able to detect and correct faulty practices that could affect their results without the need of teacher guidance during the scientific inquiry experiments. Moreover, over time, it is observed that students could direct their own learning process and apply the scientific method properly. This may have been due to the students becoming familiar with such scientific inquiry over time. In this regard, the IBL process was carried out with an in-depth teacher guidance in the first days; however, teacher guidance was gradually reduced by considering the progress of the students. Alleviating the level of teacher guidance that students need in the process is similar to the research conducted by van Uum et al. (2017).

5. Suggestions

In line with the results obtained in the study, the following suggestions were created:

- In order to develop the students' scientific process skills in all sub-dimensions, students should be provided with learning environments in which the IBL approach can be used actively by applying these skills as a scientist. Providing these skills, especially during the process of the development of abstract thinking skills, will enable them to acquire skills that they can use throughout their lives.
- At the application stage of the research, it was observed that the students with relatively low skills in the experimental group were closely interested in learning activities, they made efforts to participate in the studies and they participated in the learning process with interest and curiosity. In this regard, the contribution of the IBL approach to collaborative learning environments should be considered not only to academically successful students, but also to students with relatively lower skills.

As presented in the review of the literature, new studies can be conducted in order to increase the quantity of research on the application of the IBL approach in science classes and especially in secondary school students.

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References

Aydoğdu, B., Tatar, N., Yıldız, E., & Buldur, S. (2012). The science process skills scale development for elementary school students. *Journal of Theoretical Educational Science*, *5*(3), 292-311.

Bernal, J. D. (2011). *The social function of science.* (T. Ok, Int.) İstanbul: Evrensel Publishing. (Published in the original study: 1939)

Bunterm, T., Lee, K., Ng Lan Kong, J., Srikoon, S., Vangpoomyai, P., Rattanavongsa, J., & Rachahoon, G. (2014). Do different levels of ınquiry lead to different learning outcomes? A comparison between guided and structured inquiry. *International Journal of Science Education*, *36*(12), 1937-1959. https://doi.org/10.1080/09500693.2014.886347

Büyükdokumacı, H. (2012). *Effects of problem based learning on learning products in science and technology lesson for elementary 8th grade*. Master's Thesis, Pamukkale University.

Büyüköztürk, Ş. (2015). *Data analysis handbook for social sciences*. Ankara: Pegem Academy Publishing, 21 st edition.

Bybee, R. W. (2006). Scientific inquiry and science teaching. In L. B. Flick & N. G. Lederman (Eds.), *Scientific inquiry and nature of science: Implications for teaching, learning, and teacher education* (pp. 1-15). Netherlands: Springer Publications.

Chang, C. Y., & Mao, S. L. (1999). Comparison of Taiwan science students' outcomes with inquiry-group versus traditional instruction. *Journal of Educational Research*, *92*(6), 340-349. https://doi.org/10.1080/00220679909597617

Creswell, J. W. (2003). *Research design: Qualitative, quantitative, and mixed methods approaches* (2nd Ed.). Thousand Oaks, CA: Sage.

Creswell, J. W., & Plano Clark, V. L. (2011). *Designing and conducting mixed methods research* (p. 1-19). Thousand Oaks, CA: Sage Publications, 2nd edition.

Çeliksöz, M. (2012). *Effects of different levels of inquisitive-research-based teaching methods on the success, attitude, scientific process skills and knowledge permanence of primary school students*. Master's Thesis, Trakya University.

Dell'Olio, J. M., & Donk, T. (2007). *Models of teaching*. Thousand Oaks, CA: Sage Publications.

Duban, N. (2014). Inquiry-based learning. In Ş. S. Anagün & N. Duban (Ed.), *Teaching science* (pp. 221-240). Ankara: Anı Publishing.

Duran, M. (2014). *The effect of research-based learning approach on the level of conceptual understanding of the unit of granular structure of matter and some learning outcomes*. Phd Thesis, Gazi University.

Filippi, A., & Agarwal, D. (2017). Teachers from instructors to designers of inquiry-based science, technology, engineering and mathematics education: How effective inquiry-based science education implementation can result in innovative teachers and students. *Science Education International*, *28*(4), 258-270.

Jesus, H. P., Souza, F. N., Teixeira-Dias, J. J., & Watts, M. (2005). Organising the chemistry of question-based learning: A case study. *Research in Science & Technological Education*, *23*(2), 179-193. https://doi.org/10.1080/02635140500266419

Kaya, G., & Yılmaz, S. (2016). Impact of open interrogation-based learning on students' success and development of scientific process skills. *Journal of Hacettepe University Faculty of Education, 31*(2), 300-318. https://doi.org/10.16986/HUJE.2016016811

Kuhn, D. & Pease, M. (2008) What needs to develop in the development of inquiry skills? *Cognition and Instruction, 26*(4), 512-559. https://doi.org/10.1080/07370000802391745

Lederman, N. G. (1992). Students' and teachers' conceptions of the nature of science: A review of the research. *Journal of Research in Science Teaching, 29*(4)*,* 331-359.

Lederman, N. G., Abell, S. K., & Akerson, V. (2008). Student's knowledge and skill with inquiry. In E. Abrams, S. A. Southerland & P. Silva (Eds.), *Inquiry in the classroom: Realities and opportunities* (pp. 3-35). USA: IAP–Information Age Publishing.

Metz, K. E. (2004). Children's understanding of scientific inquiry: Their conceptualization of uncertainty in investigations of their own design. *Cognition and Instruction*, *22*(2), 219-290. https://doi.org/10.1207/s1532690xci2202_3

MoNE (2013). *Science course curriculum of primary schools*. Ankara: MoNE Publishing.

MoNE (2017). *Science curriculum (3, 4, 5, 6, 7 and 8. Classes)*. Taken from https://ttkb.meb.gov.tr/www/ogretim-programlari/icerik/72.

Morse, J. M. (2003). Principles of mixed methods and multimethod research design. In A. Tashakkori & C. Teddlie (Eds.), *Handbook of mixed methods in social & behavioral research* (pp. 189-208). Thousand Oaks, CA: Sage Publications.

National Research Council (1996). *National science education standards*. Washington, DC: National Academy Press.

National Research Council (2000). *How people learn. Brain, mind, experience, and school*. Washington, DC: National Academy Press.

Sahranç, Ü. (2011). Basic learning environments: Family-school-class. In İ. Yıldırım (Ed.), *Educational psychology* (pp. 323-348). Ankara: Anı Publishing, 3rd edition.

Şahan, H. H., Uyangör, N., & Işıtan, S. (2012). Learning-teaching strategies and models. In B. Oral (Ed.), *Learning-teaching theories and approaches* (pp. 283-408). Ankara: Pegem Academy Publishing, 2 nd edition.

Tatar, N. (2006). *The impact of research-based learning approach in primary science education on scientific process skills, academic success and attitude*. PhD Thesis, Gazi University.

Türkdoğan, O. (2000). *Bilimsel araştırma metodolojisi* [Scientific research methodology]. İstanbul: Timaş Yayınları, 3. baskı.

Yaşar, Ş., & Duban, N. (2009). Student opinions on questioning-based learning approach. *Primary Online, 8*(2), 457-475. [Online]: http://ilkogretim-online.org.tr.

Yıldırım, M., & Türker Altan, S. (2017). The impact of research and inquiry-based learning approach on the scientific process skills of primary school students. *Journal of the Institute of Social Sciences of Mustafa Kemal University, 14*(38), 71-89.

Yıldız, E. (2008). *Effects of mastery in teaching based on conceptual change using the 5E model: an application for 7th-class force and movement unit*. Phd Thesis, Dokuz Eylül University.

van Uum, M. S. J., Verhoeff, R. P., & Peeters, M. (2017). Inquirybased science education: Scaffolding pupils' self-directed learning in open inquiry. *International Journal of Science Education*, *39*(18), 2461-2481. https://doi.org/10.1080/09500693.2017.1388940

Varelas, M. (1996). Between theory and data in a seventh-grade science class. *Journal of Research in Science Teaching*, *33*(3), 229-263.

Ward, H. (2007). *Using their brains in science: ideas for children aged 5 to 14*. London: Paul Chapman Publishing.

Wilson, C. D., Taylor, J. A., Kowalski, S. M., & Carlson, J. (2010). The relative effects and equity of inquiry-based and commonplace science teaching on students' knowledge, reasoning, and argumentation. *Journal of Research in Science Teaching*, *47*(3), 276-301.

Zandvliet, D. B. (2013). Environmental learning. In D. B. Zandvlient (Ed.), *The ecology of school* (s. 1-18). The Netherlands: Sense Publishers.


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The Effect of Blended Learning on Academic Achievement and Attitudes at Social Studies Courses

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Abstract

As a result of scientific and technological developments reflection, improvements on education science moved from teacher centered to student and learning centered system. Learning concept is not only seen a at schools and some learning centers but in all areas and places of life. The aim of this study is to search the achievement and persistency of blended learning method at social studies lesson. With the empirical method used at research, the impact of independent variable examined on experimental group is blended learning method. The independent variable used at control group is face to face learning method. The impact of same dependent variable has been searched on experimental and control group. As a dependent variable the results of social studies academic success test has been searched. For the determined dependent variables, between groups assessment has been applied according to pre-test and post-test scores. The experimental application of the research has been applied to 52 students at 7th grade. 26 students take place from experimental group and 26 students take place from control group. According to the findings, no difference has been found between pre-test scores. According to post test and persistency test a significant difference has been appeared in favor of experimental group which is blended learning method. According to repeated measures analyses results between pre-test and post-test, and between post-test and persistency test; comparison of pre-test and post-test, both effect the student achievement. But according to impact results; the effect of blended learning is larger. According to post-test and persistency score results; it came out that for the persistency of knowledge blended learning is more effective than face to face learning. According to the results of persistency test and final application which is a comparison of blended learning and face to face learning, blended learning group is more effective than face to face learning group. While face to face learning group final application score lessen 12 points, blended learning group score lessen 8 points. It can be confessed that according to the persistency of student achievement, blended learning method is more effective than face to face learning method.

Keywords: blended learning, academic achievement, social studies.

1. Introduction

Due to reflections of science and technological developments upon the field of education, developments in the field of education have started to be student- and learning-centered than teacher-centered. Learning is seen as a concept that can occur not only in schools and special institutions, but also in every second of life (Reigeluth, 1999).

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Blended learning is a method of distance education that uses technology (high technology such as television, Internet and low technology such as e-mails by voice and conferences) with traditional teaching and learning (Smiths, 2001).

On the other hand, Horton (2009) defined blended learning as a combination of advantaged aspects of both web-based learning and in-class learning. By blended learning, it is usually meant a use of two or more methods for a need of learning. To define blended learning, it is a use of the most effective ways of learning for achieving learning outcomes for certain purposes (Wilson & Smilanch, 2004).

Electronic media such as the Internet and web will not take place of face-to-face learning and approaches to teaching as claimed by advocators of e-learning a few years ago. Electronic media have not questioned the existence of a teacher or an educational institution. This media will take place with face-to-face learning approaches (Kerres & Witt, 2003). In web-based learning, teacher's role cannot be underestimated. As learning has not been possible without teachers for centuries, the role of teachers will be of great significance in further learning processes as well. Drucker (2006) said that teachers who are inspectors and mentors will explore strength of learners and guide them to the success, developing their abilities. Gates (1999) claimed that teachers who create synergy in the classroom, are creative, and who have strong relationships with students will be successful. Moreover, the author argued that the worth and salaries of teachers will get higher thanks to technology.

1.1 *Problem statement*

What is the effect of blended learning in social studies on student performance and retention?

1.2 *Sub-problems*

(1) Is there any difference among students' academic achievement pre-test scores based on group variable?

(2) Is there any difference among students' academic achievement post-test scores based on group variable?

(3) Is there any difference among students' academic achievement retention-test scores based on group variable?

(4) Is there any difference between social studies achievement pre-test and post-test scores of students both in experimental and control groups?

(5) Is there any difference between social studies achievement post-test and retention-test scores of students both in experimental and control groups?

2. Material and method

In this study aimed to explore the effect of blended learning on student performance in social studies, experimental design was used. Common characteristics of experimental designs are as follows: (1) More than one group is used and (2) groups are formed through random sampling. That is why there is a need for the existence of one experimental and one control group.

It can be said that pre-test – post-test control group design is a design frequently used in behavioral sciences that gives statistical power to the study, testing the effect of the

experimental process on the dependent variable, giving an opportunity of interpreting findings regarding cause-effect relationships (Buyukozturk, 2001).

The independent variable whose effect on the experimental group was blended learning. However, face-to-face learning was initiated in the control group. In both experimental and control groups, effects on the same dependent variable were investigated. As a dependent variable, social studies achievement test results were used. Using pre- and post-test scores regarding the dependent variable, comparisons between groups were made.

The first group of study consisted of 57 seventh graders from Ataturk Elementary School, Afyonkarahisar, Turkey. There were 34 students in the experimental group and 33 students in the control group. However, students who could not take pre-test, post-test and retention-test were excluded from the study. As a result, the experimental group consisted of 26, and the control group comprised 26 students. Students were randomly assigned to both experimental and control groups. Students were not informed of to which group they were belonged to and studies were conducted in both classrooms by usual teachers.

Two hours a week were devoted for this study which lasted in four weeks. Hence, a total of 8 hours were devoted for the whole study. In the experimental group, students were exposed to blended learning. But, they were exposed to face-to-face instruction in the control group. Beforehand, a social studies pre-achievement test was administered to students. Then, post-achievement test was administered. Six weeks after the intervention, achievement test was administered again for retention.

While developing an achievement test, measurement begins with a plan called test plan (Özçelik, 1991; İşman & Eskicumalı, 2001). The first step to do is to determine the content and then, the items according to the content (Tavşancıl, 2006). The content is about a unit or a theme that also highlights objectives and behaviors (Demirel, 2007). The achievement test consisted of 20 multiple-choice, five true-false, five fill–in-the-blank, and two open-ended questions. Each of the two open-ended questions was five points while all the remaining was three points.

To check reliability, there are different techniques and formulas. The ones most frequently used are Kuder-Richardson 20 (KR-20), Kuder-Richardson 21 (KR-21) and Cronbach alpha techniques (Erkuş, 2006). KR-20 is used when item scores are not discrete (1–0) (Atılgan et al., 2006). Correct responses of multiple-choice, true-false and fill-in-the-blank questions were given three points while wrong ones were given zero point. It was found that KR-20 reliability coefficient the achievement test produced was .89, average difficulty .52, and average discriminatory power .40.

3. Results

The results of the study were presented and interpreted according to each sub-problem below.

Table 1. Results of experiment and control groups' pre-practice of academic success test

Group	N	Rank average	Rank total	U	p
Experiment	26	25.40	660.50	309,500	,597
Control	26	27.60	717.50		

In Table 1, Mann-Whitney U pre-achievement test results of students exposed to blended learning and face-to-face instruction were presented. According to this, there were

nonsignificant differences between pre-achievement test scores of students in both groups (U=309,500, p>.05). The rank averages showed that there are not any significant differences between the experimental and the control group. That is, both groups were similar in terms of achievement in social studies at the outset of the study. This result was useful for the purpose of this study.

Table 2. Results of experiment and control groups' post-practice of academic success test

Group	N	Rank average	Rank total	U	p
Experiment	26	38.46	1000	27	,000
Control	26	14.54	378		

In Table 2, Mann-Whitney U post-achievement test results of students exposed to blended learning and face-to-face instruction were presented. According to this, there were significant differences between pre-achievement test scores of students in both groups (U=27, p<.05). The rank averages showed that there are significant differences between the experimental and the control group, in favor of the experimental group exposed to blended learning. That is, blended learning was more effective that face-to-face instruction. A reason for this might be a use of maps, pictures, and videos more than the other ways of learning.

Table 3. Academic success permanency test results of experiment and control groups

Group	N	Rank average	Rank total	U	p
Experiment	26	38.87	1010.50	16,500	.000
Control	26	14.13	367.50		

In Table 3, Mann-Whitney U retention test results of students exposed to blended learning and face-to-face instruction were presented. Results indicated that there are significant differences between the experimental group and the control group (U=16,500, p<.05). To the rank averages, there was a gap between both groups. That is, blended learning was more retentive than face-to-face instruction.

Table 4. Academic success test averages and standard deviation values

	Pre-test			Post-test		
	N	$\overline{X}$	S	N	$\overline{X}$	S
Experiment	26	19.00	3.48	26	86.96	4.82
Control	26	20.03	1.28	26	75.76	3.98

As can be seen, students in the experimental group exposed to blended learning earned a mean score of 19.00 before the intervention while 86.96 after the intervention. Besides, students in the control group exposed to face-to-face instruction earned a mean score of 20.03 before the intervention. Also, they earned a mean score of 75.76 after the intervention. Accordingly, both groups earned higher mean scores after the intervention.

Table 5. Academic success test pre-practice and post practice points' ANOVA results

Variance Resource	**Square total**	**Sd**	**Square average**	**F**	**P**
Among subjects	1326,652	51			
Group Experiment/Control	670,153	1	670,153	51,040	.000

Error	656,499	50	13,130		
In subjects	101088,999	52			
Calculation pre-test – post-test	99448,615	1	99448,615	7443,330	,000
Group* calculation	972,346	1	972,346	72,776	,000
Error	668,038	50	13,661		
Total	102415,6511	103			

Repeated-measures factors had a significant interaction effect both on achievement and retention in both groups. In light of this, blended learning and face-to-face instruction had also main effects on student performance in social studies. The experimental group exposed to blended learning, gaining more from the achievement test before the intervention, has achieved more than the control group exposed to face-to-face instruction.

Table 6. Academic success test average and standard deviation values

	Pre-test			Post-test		
	N	$\overline{X}$	S	N	$\overline{X}$	S
Experiment	26	86.96	4.82	26	77.69	4.64
Control	26	75.76	3.98	26	63.07	4.69

As can be seen, mean scores of students exposed to blended learning have changed from 86,98 to 77,69 after the practice. Also, mean scores of those exposed to traditional teaching and learning have changed from 75,76 to 63,07. In both groups, it can be mentioned about a decline in mean scores of students they obtained from the achievement test.

Table 7. Academic success test post-practice and permanency points ANOVA results

Variance resource	**Square total**	**Sd**	**Square averages**	**F**	**P**
Among subjects		51			
Group Exp./Control	4329,240	1	4329,240	119,749	.000
Error	1807,635	50	36,153		
In subjects		52			
Calculation pre/post test	3135,010	1	3135,010	595,269	.000
Group* calculation	76,163	1	76,163	14,462	.000
Error	263,327	50	5,267		
Total		103			

Accordingly, two different types of learning have caused significant differences from post-intervention to retention. In other words, both blended learning and face-to-face instruction had an interaction effect on retention which was positively affected by both. However, blended learning was found more retentive than face-to-face instruction when post-test and retention-test scores compared.

4. Discussion and conclusions

Nonsignificant differences were found between pre-achievement test scores of students both in the experimental and the control group. According to this, it can be concluded that both groups were similar in terms of achievement in social studies. This can be regarded as important to understand the effectiveness of an intervention. Results that are in parallel to this study's findings have also been concluded by Akbaba (2009), Yapıcı (2011), and Ünsal (2007).

Post-achievement test scores of students in both groups were found in favor of those exposed to blended learning. Blended learning, compared to face-to-face instruction, is more effective with improving student performance. The reason might be that blended learning is enriched with lots of visuals and supported more with visual content. There have also been studies in parallel to this one. According to Usta (2007), Akyol (2009), and Arıkan (2007), blended learning has significant effect on student performance. A study conducted by Garrison and Kanuka (2004) also supports this finding. Doo, Mitchel, and Virginia (2006) found that blended learning affects student performance positively. This result has also been supported by the related literature (She & Fisher, 2003; Navarro & Shoemaker, 2000; Frederickson et al., 2005; Aladejana, 2009; Tuckman, 2002; Boyle et al., 2003; Godfrey & Gyles, 2003; Cüez, 2006; Pereira et al., 2007). El-Deghaidy and Nouby (2008) found significant differences in favor of pre-service teachers exposed to blended learning according to their post-test achievement scores. However, in the literature, there have also been contradictory studies. Ünsal (2007), Deliağaoğlu (2004), Lesh (2000), and Olapiryakul and Scher (2006) did not found significant differences between experimental and control groups according to post-test scores. Moreover, Matches and Asher (2000), and Demirli (2002) concluded that there were not any significant differences between groups. Achievement levels of groups exposed both to web-based learning and face-to-face learning were found close to each other. Colesca, Dobrica and Alpopi (2009) did also not found any significant difference between experimental and control groups in studies they conducted in 2005 and 2008. Nevertheless, in most of the studies, blended working has been found to be more useful to student performance. It can also be thought that blended learning will contribute student performance in social studies.

Comparing mean retention-test scores of both groups, significant differences were detected in favor of the experimental group. According to students' retention-test results, students in the control group showed a decline in their performance more than those in the experimental group. It has been represented in many studies that students do not forget what they learn by sight and hearing.

The results of repeated-measures analysis of variance showed that methods had a significant interaction effect on student performance in social studies when pre- and post-test scores considered. Yet, blended learning was found more effective than face-to-face instruction. Besides, differences were found significant in favor of the experimental group exposed to blended learning. These findings are also supported by the studies of Şahin (2000) and Gültekin (2006). According to Kert and Tekdal (2004), Taşçı (2006), Demirel (2006), Tutaysalgır (2006), Yekta (2004) and Çelik (2007)'s studies, the experimental group has been more successful in light of post-test results. Altınışık and Orhan's (2002) study showed no significant differences according to analysis of covariance of pre- and post-test results.

According to the results of post-achievement test and retention-test, blended learning was found more effective than face-to-face instruction. While means scores of students exposed to face-to-face instruction had a decline of 12, means scores of those exposed to blended learning had a decrease of 8. It can be said that blended learning method is more retentive than face-to-face instruction.

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References

Akyol, Z. (2009). *Examining teaching presence, social presence, cognitive presence, satisfaction and learning in online and blended course contexts*. Unpublished Doctoral Thesis. Ankara: Ortadoğu Teknik Üniversitesi.

Aladejena, F. (2009). Blended learning and technology-assisted teaching of biology in Nigerian secondary schools. *Special Edition of the World Congress on Engineering and Computer Science* (pp. 133-140). San Francisco, USA.

Altinişik, S., & Orhan, F. (2002). Sosyal bilgiler dersinde çoklu ortamin öğrencilerin akademik başarilari ve derse karşi tutumlari üzerindeki etkisi [The effect of multimedia in social studies course on students' academic achievement and attitudes towards the course]. *Hacettepe Üniversitesi Eğitim Fakültesi Dergisi*, *23*, 41-49.

Boyle, T., Bradley, C., Chalk, P., Jones, R., & Pickard, P. (2003). Using blended learning to improve student success rates in learning to program. *Journal of Educational Media*, *28*(2-3), 165-178.

Colesca, S. E., Dobrica, L., & Alpopi, C. (2009). Students outcomes and perceptions in a blended learning format. *Metalurgia International*, *14*(8), 222-229.

Cüez, T. (2006). *İlköğretim 8. siniflarda fen bilgisi dersinde web tabanli öğretim desteğinin öğrenci başarisina etkisi* [The effect of web-based instruction support on student achievement in primary education 8th grade science lesson], Master Thesis. İzmir: Dokuz Eylül Üniversitesi Eğitim Bilimleri Enstitüsü.

Çelik, E. (2007). *Ortaöğretim coğrafya derslerinde bilgisayar destekli animasyon kullaniminin öğrenci başarisina etkisi* [The effect of using computer-assisted animation in secondary school geography lessons on student achievement], Unpublished Master's Thesis. Marmara Üniversitesi, Eğitim Bilimleri Enstitüsü.

Delialioğlu, Ö. (2004). *Effectiveness of hybrid instruction on certain cognitive and affective learning outcomes in a computer networks course*, Doctoral Thesis. Ankara: ODTÜ Sosyal Bilimler Enstitüsü.

Demirel, A. (2006). *Sanat eğitiminde bilgisayar ve çoklu ortam uygulamalari* [Computer and multimedia applications in art education], Unpublished Master's Thesis. Selçuk Üniversitesi, Sosyal Bilimler Enstitüsü.

Demirli, C. (2002). *Web tabanlı ögretimin ögretim teknolojileri ve materyal gelistirme dersinde ögrenci basarısına etkisi (f.ü. teknik egitim fakültesi örnegi)* [The effect of web-based instruction on student success in instructional technologies and material development course (technical education faculty example)], Unpublished Master's Thesis. Elazıg: Fırat Üniversitesi Sosyal Bilimler Enstitüsü.

Doo, L, Michael, M., & Virginia, K. (2006). *Online vs. blended learning: Differences in instructional outcomes and learner satisfaction*. http://robinwofford.wiki.westga.edu/file/view/EJ842695.pdf.

El-Deghaidy, H., & Nouby, A. (2008). Effectiveness of a blended e-learning cooperative approach in an egyptian teacher education programme. *Computers & Education*, *51*, 988-1006.

Frederickson, N., Reed, P., & Clifford, V. (2005). Evaluating web-supported learning versus lecture-based teaching: Quantitative and qualitative perspectives. *Higher Education*, *50*, 645-664.

Garrison, D. R., & Kanuka, H. (2004). Blended learning: Uncovering its transformative potential in higher education. *Internet & Higher Education*, 7.

Gültekin, K. (2006). *Çoklu ortamin bilgisayar programlama başarisi üzerine etkisi* [The effect of multimedia on computer programming success], Unpublished Master's Thesis. Hacettepe Üniversitesi, Fen Bilimleri Enstitüsü.

Kert, S. B., & Tekdal, M. (2004). Literatürdeki tasarim ilkelerine uygun olarak hazirlanmiş multimedya ders yaziliminin lise düzeyi fizik öğretiminde akademik başariya ve kaliciliğa etkisi [The effect of multimedia course software prepared in accordance with the design principles in the literature on academic achievement and retention in high school physics education]. *XIII National Educational Sciences Congress*, 6-9 July 2004. İnönü Üniversitesi, Malatya.

Lesh, S. G. (2000). *Web-based learning: A Kirkpatrick's multilevel evaluation of effectiveness* (Dissertation abstracts online). 1 August 2003, OCLC, http://FirstSearch.oclc.org (taken from database).

Olapiriyakul, K., & Scher, J. M. (2006). A guide to establishing hybrid learning courses: Employing information technology to create a new learning experience and a case study. *Internet and Higher Education*, 9, 287-301.

Pereira, J.A., Pleguezuelos, E., Merı', A., Ros, A. M., Carmen, M., Toma's, M., & Masdeu, C. (2007). Effectiveness of using blended learning strategies for teaching and learning human anatomy. *Medical Education*, 41, 189-195.

She, H. S., & Fisher, D. (2003). Web-based e-learning environments in Taiwan: The impact of the online science flash program on students' learning. In M. Swe (Ed.), *Technology-rich learning environments* (pp. 343-364). Singapore: World Scientific Publishing Company, Incorporated.

Şahin, T. Y. (2000). İlköğretim sosyal bilgiler dersinde çoklu ortamlarin etkililiği [Effectiveness of multimedia in primary education social studies lesson]. *Eğitim Araştırmaları*, *1*(1), 68-73.

Taşçi, G. (2006). *Biyoloji öğretiminde çoklu ortam uygulamalarinin öğrenme başarisina etkisi [The effect of multimedia applications on learning achievement in biology teaching*], Unpublished Master's Thesis. Hacettepe Üniversitesi, Fen Bilimleri Enstitüsü.

Tuckman, B. W. (2002). Evaluating ADAPT: A hybrid instructional model combining web-based and classroom components. *Computers and Education*, *39*, 261-269.

Tutaysalgir, H. (2006). *Powerpoint sunu programiyla hazirlanan sosyal bilgiler dersi öğretim materyalinin öğrenci tutum ve performanslarina etkisi* [The effect of the social studies lesson teaching material prepared with powerpoint presentation program on student attitudes and performance], Unpublished Master's Thesis. Afyon: Afyon Kocatepe Üniversitesi Sosyal Bilimler Enstitüsü.

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