

A Study on Developing a Guide Material for Science Classes Supported by Out-of-School Learningⁱ

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Abstract The main purpose of this research was to develop a guide material in line with learning outcomes of the unit for the 5th Graders titled Solving the Puzzle: Our Body in order to be utilized during out-of-school learning activities by science teachers. There is no guide material developed in our country for science teachers to be used in out-of school learning activities. This research intended to contribute to the literature by developing such guide material. This research utilized the screening model. Prior to the development of a guide material, the literature has been reviewed to identify units and subjects for which guidance material is designed for. Moreover, the guide material is developed after completing the needs analysis, identifying the objectives and learning outcomes, organizing the content and learning activities and deciding on how to make assessment and evaluation. This research was designed to help develop guide materials that include other units related to out-of-school learning activities for different grade levels and for different classes.

Keywords Out-of-School, Learning Environment, Science Teacher, Guide Material

out-of-school learning environments have both formal and informal (out-of-school but unplanned) educational aspects [9]. In this regard, Maarschlak [10] and Tamir [11] classified learning environments into three groups as formal, non-formal and informal; and they regarded the out-of-school learning environments as non-formal (still based on a plan)- learning environment [12].

Out-of-school environments offer a rich variety of learning opportunities for students, as well as help them configure the information they have learned through concrete examples [4]. Additionally, it strengthens the social skills of the students and contributes to the development of their science skills [13]. On the contrary, out-of-school learning environments can be perceived only as entertaining, sightseeing activities by students and teachers [14]. In this regard, teachers, who would like to lecture in out-of-school environments, should be well informed about what needs to be done in such environments in order to have an effective and efficient class. Hence, guide materials about how to lecture a class in out-of-school learning environments are very much needed. According to Demircioğlu, guide materials are useful for teachers since they can read the content and method beforehand, and thus can facilitate the class more easily and use the time more efficiently throughout the course [15]. In order to increase the use of guide materials that are necessary for a well-planned learning process, teachers and pre-service teachers should benefit from various examples of guide materials and then make the implementation of content accordingly [16]. In the literature, it has been found that teachers expressed concerns about having insufficient knowledge and lacking self-sufficiency regarding trips to out-of-school environments; and they stated that they are not sufficient to guide students during these trips [17, 18, 19, 20, 21].

Curriculum for Science Classes, which is revised in 2013, was prepared based on the “research and questioning” approach. According to this curriculum, teachers are required to organize both in-class and out-of-school learning environments based on research and questioning strategy. Incorporate science, art and archeological museums, zoos

1. Introduction

Raising individuals who can make use of knowledge in their daily life, by being more productive and thus can contribute to the overall production process is thought to be possible in environments where the education is at the closest point to the reality because of the rapidly growing technology and easier access to the information [1]. This means that students cannot actualize their education and training if it is conducted only between school walls. Hence, today, out-of-school learning environments are very much needed.

Studies on out-of-school learning environments in Turkey have been attracting popular interest [2, 3, 4, 5, 6, 7, 8]. Although out-of-school learning is considered as informal, they are formally conducted processes. In other words,

and natural habitat can be used as informal learning environments, which may help students make sense of scientific knowledge and facilitate permanent learning [22]. As the Curriculum for Science suggests, science teachers should pedagogically benefit from out-of-school environments. When the related literature in Turkey was reviewed, it was found that science-arts centers, zoos, nature camps, and the museums are the focal points for out-of-school learning [9, 23, 24, 25]. In the respective literature there is no guide material for teachers to be used in out-of-school environments for the fifth grade unit to be used in Science classes [26]. In this regard, we have aimed to contribute to the literature by developing a guide material, named as *Solving the Puzzle: Our Body*, in line with the learning outcomes of the fifth grade units according to the Curriculum of Science classes revised in 2013.

2. Materials and Methods

2.1. Methods

The research was conducted through the document analysis method. Document analysis involves the analysis of materials like books, videos, photos etc. related to the research topic [27]. This method is used when it is not possible to have observation or interviews; however, it can also be used to support the observation and interview results [28]. Therefore, this study utilized the document analysis. Curricula of different countries were reviewed, and various other documents were examined to understand in which ways out-of-school learning is included in the curricula. Constitutive units and subjects for the guide material were determined after studying the Curricula for Science Classes in Turkey (revised in 2013). Then, the needs analysis was completed, the objectives and learning outcomes were identified, the content and learning activities were organized and assessment and evaluation methods were decided and lastly the guide material was developed.

2.1.1. Development Process of the Guide Material

Development process of the guide material is presented in Table 1. The revised science curriculum was examined in terms of objectives and learning outcomes for the 5th grade unit titled *Solving the Puzzle: Our Body*. Additional required learning outcomes were included in this study by the researcher. An objective analysis was conducted for each outcome. The methods of lecturing the unit were examined in the existing course book parallel to these outcomes. The course book is the Elementary School Science Course Book for the 5th grade students, which is the same everywhere in the country.

The prepared unit consists of 13 learning outcomes in 2013 Curricula for Science Classes. It has 3 subtopics: *Nutrients and Their Characteristics*, *Digestion of Nutrients* and *Digestion in our Body* (MEB, 2013). The research adds 7 more learning outcomes that make 20 learning outcomes in total for this unit. These outcomes were examined, out-of-school environments for lectures were identified and related guide material was developed.

Visual materials were exclusively included in the all out-of class activities to make the subjects more comprehensive for students. Moreover, brochures, which provide information about the places to be visited, were distributed to students before the trip. Forms were prepared to be filled during the trip by students. Additionally, experiments and analogies were occasionally used during activities.

The first part of the unit covers the topic “*Nutrients and Their Characteristics*”. In the Curriculum for Science Classes, the recommended time to complete this section is 12 course hours. There are 6 learning outcomes for this section in the existing curriculum. In the guide material, there are 10 learning outcomes for this section, including 4 additional learning outcomes identified by the researcher. For the topic “*Nutrients and Their Characteristics*”, there are 3 out-of-school environments planned for lectures. Learning outcomes and respective out-of-school environments are presented below in Table 2.

Table 1. Development Process of the Guide Material

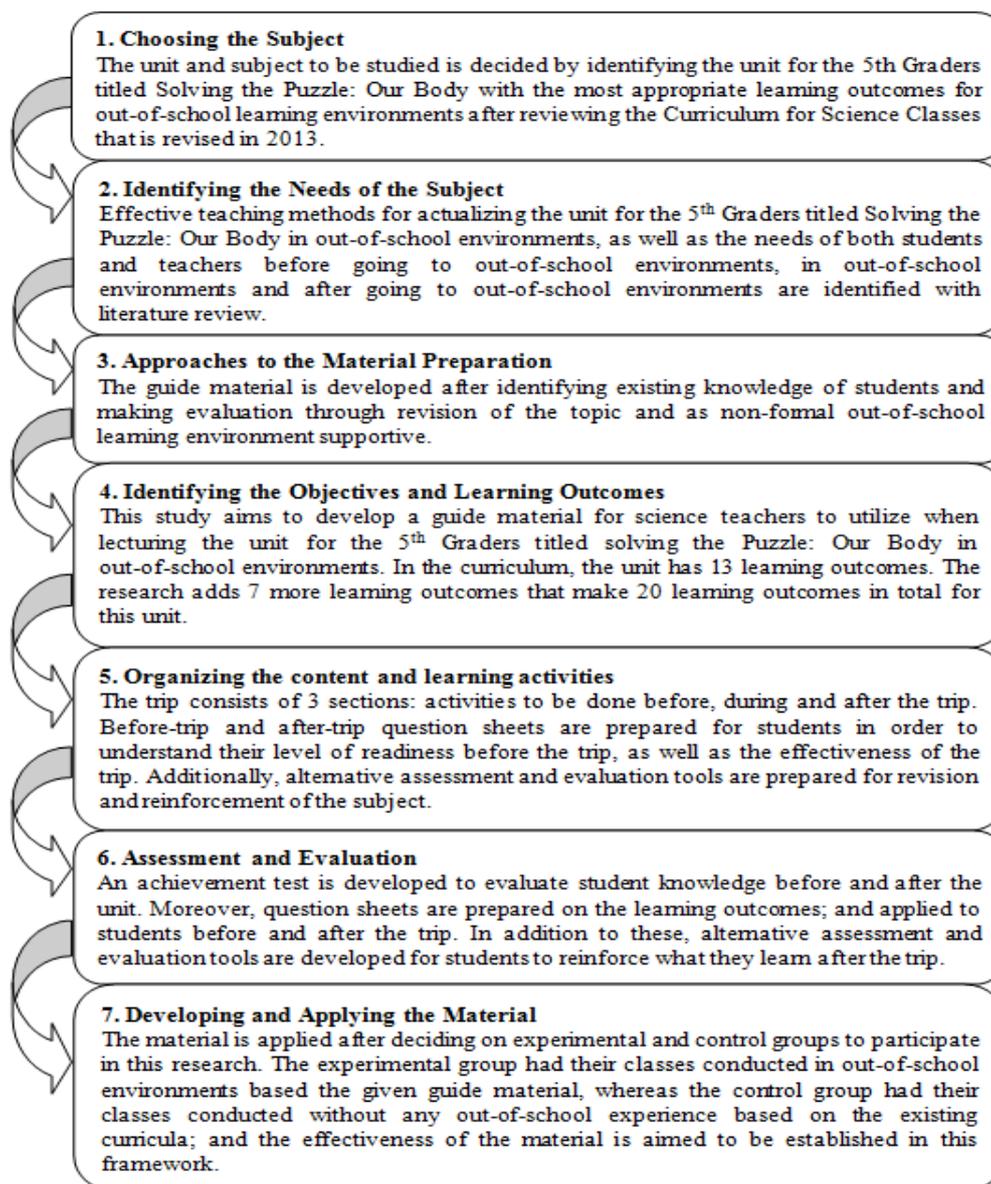


Table 2. Learning outcomes for the topic “Nutrients and Their Characteristics” and respective out-of-school environments

Learning Outcomes	Respective out-of-school environments
5.1.1.1. Recognizes that nutrient ingredients are necessary for vital activities of the living beings. 5.1.1.3. Infers that the water and minerals exist in all nutrients. 5.1.1.5. Discusses the importance of fresh and natural nutrients for a healthy life based on the data from the investigation.	<ul style="list-style-type: none"> • Picnic in the school garden
5.1.1.2. Investigates and presents which nutrients have the most vitamin varieties. 5.1.1.4. Investigates and presents the effects of a balanced nutrition on human health. 5.1.2.7. Recognizes the importance of balanced and regular diet for human health.* 5.1.1.7. Knows possible diseases that may develop in our body in vitamin deficiency.*	<ul style="list-style-type: none"> • Department of Nutrition and Dietetics (Dietitian)
5.1.1.6. Discusses the damages of cigarette and alcohol consumption on our body based on the data from the investigation. 5.1.1.7. Discusses the dangers of smoking and alcohol.* 5.1.1.8. Gives examples from the daily life about the dangers of smoking and alcohol.*	<ul style="list-style-type: none"> • Faculty of Medicine- Department of Pediatrics

*Learning outcomes that were added by the researcher

The second part of the unit covers the topic “Digestion of Nutrients”. In the Curriculum for Science Classes, the recommended time to complete this section is 12 course hours. There are 4 learning outcomes for this section in the existing curriculum. In the guide material, there are 6 learning outcomes for this section, including 2 additional learning outcomes identified by the researcher. For the topic “Digestion of Nutrients”, there are 2 out-of-school environments planned for lectures. Learning outcomes and respective out-of-school environments are presented below in Table 3.

The third part of the unit covers the topic “Digestion in Our Body”. In the Curriculum for Science Classes, the recommended time to complete this section is 12 course hours. There are 3 learning outcomes for this section in the existing curriculum. In the guide material, there are 4 learning outcomes for this section, including 1 additional learning outcome identified by the researcher. For the topic “Digestion in Our Body”, there is 1 out-of-school environment planned for lectures. Learning outcomes and respective out-of-school environments are presented below in Table 4.

The guide material was examined by 3 faculty members and 2 science teachers before its application. Then, the missing parts were completed and the material was finalized and made ready to use according to the feedbacks of faculty members and science teachers.

2.1.2. Sections of the Guide Material

This guide material was developed for the teachers who want to lecture this unit (Solving the Puzzle: Our Body) in out-of-school environments as supportive material. In order to achieve the learning outcomes, six lectures and activities were designed to be conducted in out-of-class environments. The names of these out-of-school environments and activities are listed below:

- Picnic- I am having my breakfast
- Dietitian- I have balanced and regular diet nutrition
- Faculty of Medicine Department of Pediatrics- I learn about dangers of smoking and alcohol consumption.
- Faculty of Medicine Department of Gastroenterology- I learn about the digestive system in details
- Oral and Dental Health Clinics –I love my teeth
- Dialysis Center- My kidneys are precious

2.1.3. Use of the Guide Material

The guide material is consisted of 6 activities within the scope of the unit titled Solving the Puzzle: Our Body. As an example, the activity named “I am having my breakfast.” is presented in the Appendix-1.

The guide material for out-of-school learning consists of 3 parts: things to do before, during and after the trip.

Table 3. Learning outcomes for the topic “Digestion of Nutrients” and respective out-of-school environments

Learning Outcomes	Respective out-of-school environments
5.1.2.1. Shows where organs and structures responsible for digestion are placed on the model in respective order. 5.1.2.6. Explains the concept of digestion.* 5.1.2.4. Infers that nutrients are transported around the body through blood after digestion.	<ul style="list-style-type: none"> • Faculty of Medicine- Department of Gastroenterology
5.1.2.2. Shows tooth types on the model and explain their function. 5.1.2.3. Pays attention to nutrition, hygiene and regular dental control for dental health. 5.1.2.5. Uses the tooth brush appropriately.*	<ul style="list-style-type: none"> • Oral and Dental Health Clinics

*Learning outcomes that were added by the researcher

Table 4. Learning outcomes for the topic “Digestion in Our Body” and respective out-of-school environments

Learning Outcomes	Respective out-of-school environments
5.1.3.1. Recognizes structures and organs responsible for digestion. 5.1.3.2. Infers that there are different digestion processes in our body and toxic substances produced after digestions are required to thrown out of the body. 5.1.3.3. Investigates and presents what needs to be done to protect kidneys. 5.1.3.4. Recognizes that healthy kidneys require 1-1.5 liter daily water consumption on average.*	<ul style="list-style-type: none"> • Dialysis Center

*Learning outcomes that were added by the researcher

a. Things to do before the Trip

Things to do before the trip include necessary preparations for the out-of-school environment for this trip.

1. Brochures: They are prepared to provide information for students about the out-of-school learning environment, as well as the activities to be done during the trip. Brochures include sections of “What are we going to learn?”, “What are we going to do before going to the trip?”, “What are we going to do during the trip?” and “Rules”. These sections are prepared as to be a small plan of the trip. The purpose of preparing brochures is to help students get information about the place that they will visit. After teacher completes bureaucratic procedures (such as permissions of parents and school administration), S/he should distribute the brochure of the trip to students a couple of days prior to the trip.

2. Pre-and Post-Trip Question Sheet: Before-trip and after-trip question sheets includes open and closed ended questions about the information and skills that are expected to be acquired by students. These question sheets are developed to understand whether students efficiently benefit from the trip by distributing the question sheets both before and after the trip. Moreover, this helps to guide the trip on the basis of needs of students by measuring their prior knowledge.

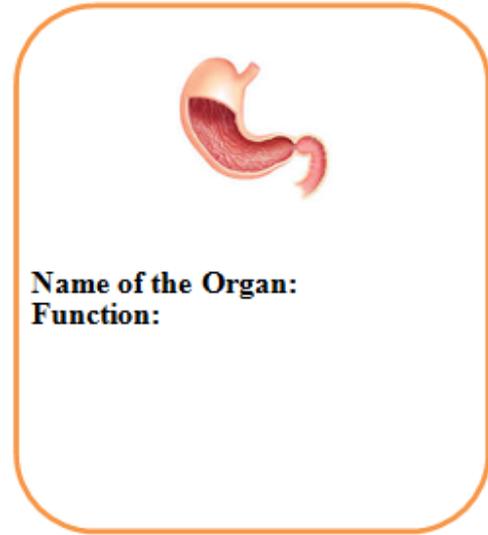
3. The Guide Material: It is prepared for teacher to have a well-organized and planned trip. It is a program including unit name, learning domain, subject, duration, method and technique, grade, critical skills to be achieved by students, materials, learning outcomes, application of activities, results, activities to do in classroom after the trip, and methods of assessment and evaluation. Teacher should examine the guide material before going to the trip. Necessary appointments with the institution to be visited should be made before the trip and the personnel that will accompany teacher during the trip should be informed about the flow of the class. Teacher should direct the flow of the class during the trip by using the guide material.

b. Things to do during the Trip

1. Forms about the trip: They are distributed to students before the trip to be filled during the trip and returned to the teacher after the trip. The question flows in question sheets are prepared by taking the guide material into account. The purpose of preparing forms about the trip is to keep students vigilant during the trip. Moreover, they can make notes of interesting things they encounter during the trip. Students are responsible for filling in these forms during the trip.

2. Have Fun and Learn Cards: They are prepared for objects found during the trip. The empty spaces on cards are filled by students. These cards are only used during the trip to the Faculty of Medicine Department of Gastroenterology. There are pictures of organs of the digestive system. Students are asked to write the name and their function on these cards after finding them during the trip. These cards can be used for the purpose of repetition at the last step of the

trip. An example of Have Fun and Learn Cards is provided in Picture 1.



Picture 1. An Example of Have Fun and Learn Card

c. Things to do after the Trip

They include alternative assessment and evaluation tools to reinforce knowledge and skills gained during the trip.

1. Concept maps: They are maps prepared to revise, summarize or assess and evaluate the knowledge gained during the trip. The purpose of using concept maps changes on the will of the teacher. When coming all together in classroom after the trip, concept maps presented in the guide material can be filled in all together for the purpose of repeating or summary. If the teacher wants to use concept maps for assessment and evaluation, s/he can give points to answers.

2. Knowledge maps: They are maps prepared to revise, summarize or assess and evaluate the knowledge gained during the trip. Like concept maps, knowledge maps can also be filled in all together after coming in the classroom after the trip for the purpose of repeating or summary. If the teacher wants to use knowledge maps for assessment and evaluation, s/he can give points to answers.

3. Structured Grids: They are questions prepared to revise or assess and evaluate the knowledge gained during the trip. Structural grips can also be graded by making each student fill them in, as well as for repeating or assessment and evaluation after coming in the class.

4. Diagnostic Trees: They are questions prepared to assess and evaluate the knowledge gained during the trip. Grading can be completed by distributing diagnostic trees to students one by one.

3. Results and Suggestions

Recently interests in out-of-school learning environments

Find the correct pathway to exit in the diagnostic tree pathway given above. Write down true and false expressions of questions from the diagnostic tree below.

TRUE EXPRESSIONS

FALSE EXPRESSIONS

.....

.....

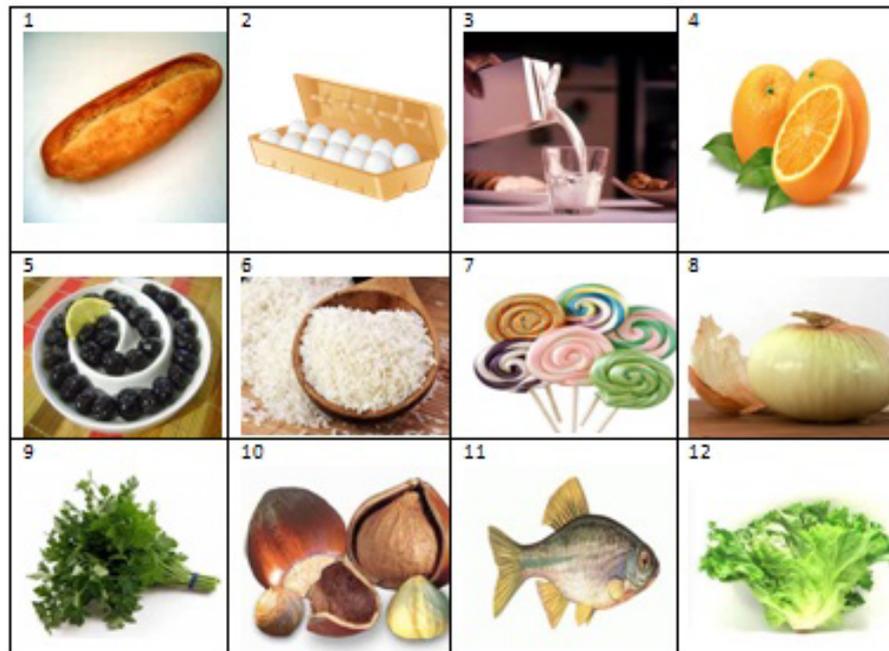
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A Structured Grid



Please answer the following questions using the table below.

1. Which foods contain which vitamins?

.....

2. Which foods are rich in carbohydrates?

.....

3. Which foods are rich in Proteins?

.....

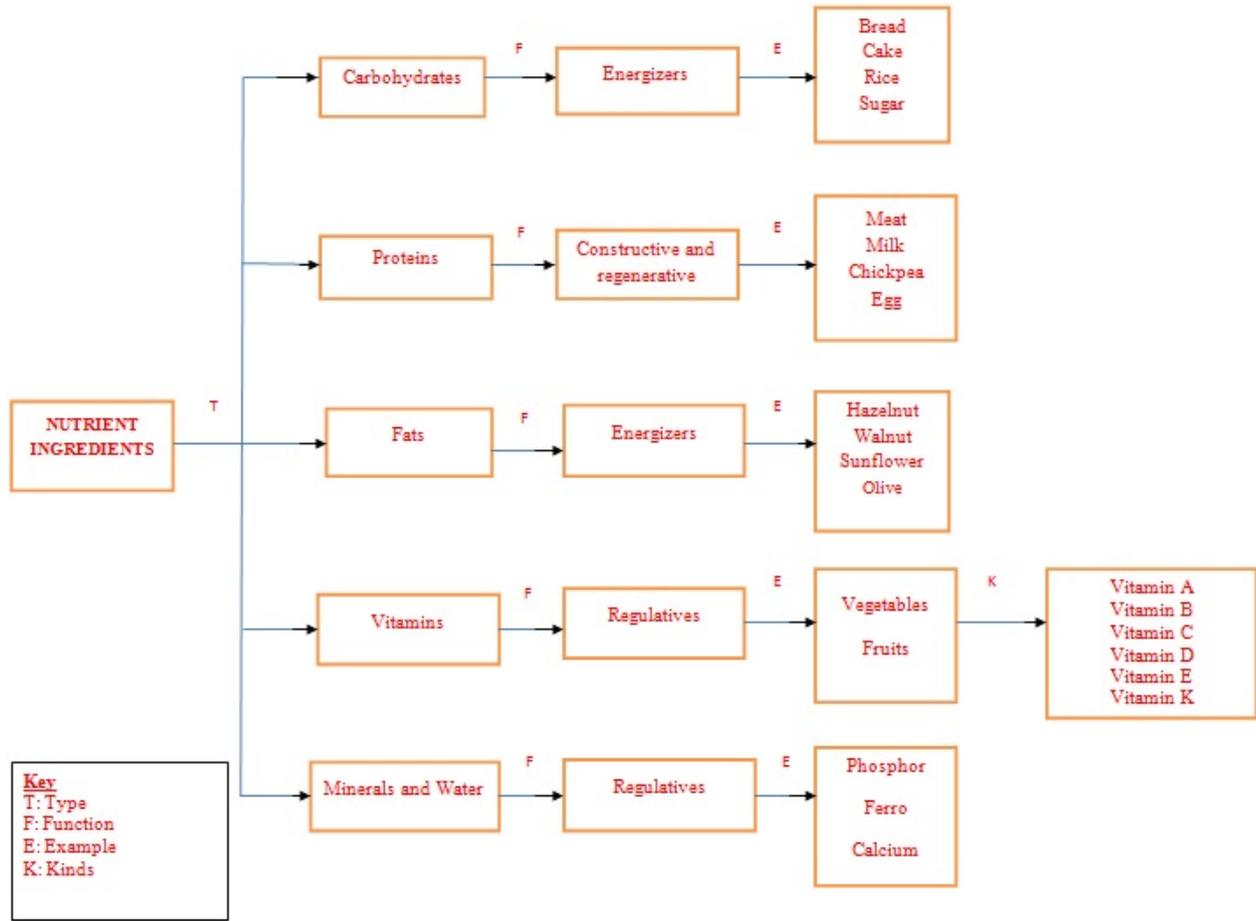
4. Which foods are rich in fat?

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5. Which foods contain water and minerals?

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A Knowledge Map



REFERENCES

- [1] Cantürk Günhan, B. & Başer, N. Probleme Dayalı Öğrenme Yönteminin Öğrencilerin Matematiğe Yönelik Tutumlarına ve Başarılarına Etkisi. Abant İzzet Baysal Üniversitesi Eğitim Fakültesi Dergisi, 8 (1), 119- 134, 2008.
- [2] Armağan, B. İlkokul Dördüncü Sınıf Fen Öğretiminde Okul Dışı Öğrenme Ortamları: Bir Eylem Araştırması. Yayınlanmamış Yüksek Lisans Tezi, Dokuz Eylül Üniversitesi, İzmir, 2015.
- [3] Bakioğlu, B. & Karamustafaoğlu, O. Okul Dışı Ortamlarda Fen Eğitimi: Diyaliz Merkezine Teknik Bir Gezi. Turkish Journal of Education, 3 (2), 15- 26, 2014.
- [4] Balkan Kıyıcı, F. & Atabek Yiğit, E. Sınıf Duvarlarının Ötesinde Fen Eğitimi: Rüzgâr Santraline Teknik Gezi. International Online Journal of Educational Sciences. 2 (1), 225- 243, 2010.
- [5] Bodur, Z. Sınıf Dışı Etkinliklerin Güneş Sistemi ve Ötesi Ünitesinde Ortaokul Yedinci Sınıf Öğrencilerinin Akademik Başarıları, Bilimsel Süreç Becerileri ve Motivasyonları Üzerine Etkisi. Yayınlanmamış Yüksek Lisans Tezi, Marmara Üniversitesi, İstanbul, 2015.
- [6] Bozdoğan, A.E. Bilim ve Teknoloji Müzelerinin Fen Öğretimindeki Yeri ve Önemi. Yayınlanmamış Doktora Tezi, Gazi Üniversitesi, Ankara, 2007.
- [7] Ertaş, H., Şen, A.İ. & Parmaksızoğlu A. The Effects of Out-of-School Scientific Activities on 9th Grade Students 'Relating the Unit of Energy of Daily Life. Necatibey Faculty of Education Electronic Journal of Science and Mathematics Education, 5 (2), 178-198, 2011.
- [8] Yorulmaz, E. Sosyal Bilgiler Dersi Kapsamında Okul Dışı Çevrelerin Kullanımı: Çorum Yatılı Arkeoloji Müzesinde Bir Gün. Yayınlanmamış Yüksek Lisans Tezi, Cumhuriyet Üniversitesi, Sivas, 2016.
- [9] Bozdoğan, A.E. Planning and Evaluation of Field Trips to Informal Learning Environments: Case of the Energy Park. Journal of Theory and Practice in Education, 4 (2), 282-290, 2008.
- [10] Maarschalk, J. Scientific Literacy and Informal Science Teaching. Journal of Research in Science Teaching 25(2), 135– 146, 1988.
- [11] Tamir, P. Factors Associated with the Relationship Between Formal, Informal, and Non formal Science Learning. Journal

- of Environmental Education, 2(2), 34–42, 1990.
- [12] Erten, Z. Fen Bilgisi Dersine Yönelik Okul Dışı Öğrenme Ortamları Etkinliklerinin Geliştirilmesi ve Öğrencilerin Bilimsel Süreç Becerilerine Etkisinin Değerlendirilmesi. Yayımlanmamış Yüksek Lisans Tezi. Erzincan Üniversitesi, Erzincan, 2016.
- [13] Panizzon, D. & Gordon, M. Mission Possible: A Day of Science, Fun and Collaboration. Australian Primary Junior Science Journal, 19 (2), 9-14, 2003.
- [14] Laçın Şimşek, C. Okul Dışı Öğrenme Ortamları ve Fen Eğitimi. C. Laçın-Şimşek (Editör), Fen öğretiminde okul dışı öğrenme ortamları (1.Baskı.), s. 1-23. Ankara: PegemA, 2011.
- [15] Demircioğlu, G. Lise II Asitler ve Bazlar Ünitesi ile İlgili Rehber Materyal Geliştirilmesi ve Uygulanması. Yayımlanmamış Doktora Tezi, Karadeniz Teknik Üniversitesi, Trabzon, 2003.
- [16] Devocioğlu, Y. Fizik Öğretmen Adaylarına Rehber Materyal Geliştirme ve Uygulama Becerilerinin Kazandırılmasına Yönelik Bir Yaklaşım. Yayımlanmamış Yüksek Lisans Tezi, Karadeniz Teknik Üniversitesi Fen Bilimleri Enstitüsü, Trabzon, 2004.
- [17] Bozdoğan, A.E. Eğitim Amaçlı Gezilerin Planlanmasına İlişkin Fen Bilgisi Öğretmen Adaylarının Uygulamaları: Altı Farklı Alan Gezisinin Değerlendirilmesi. Kuram ve Uygulamada Eğitim Bilimleri, 12(2), 1049-1072, 2012.
- [18] Griffin, J., & Symington, D. Moving from Task-Oriented to Learning Oriented Strategies on School Excursions to Museums. Science Education, 8 (1), 763–779, 1997.
- [19] Orion, N., & Hofstein, A. Factors That Influence Learning During a Scientific Field Trip in a Natural Environment. Journal of Research in Science Teaching, 31(10), 1097–1119, 1994.
- [20] Kisiel, J. Understanding Elementary Teacher Motivations for Science Fieldtrips. Science Education, 89(6), 936–955, 2005.
- [21] Thomas, G. Facilitator, Teacher, or Leader? Managing Conflicting Roles in Outdoor Education. Journal of Experiential Education, 32(3), 239–254, 2010.
- [22] MEB (Milli Eğitim Bakanlığı). İlköğretim Kurumları (İlkokullar ve Ortaokullar) Fen Bilimleri Dersi Öğretim Programı. T.C. Milli Eğitim Bakanlığı Talim ve Terbiye Kurulu Başkanlığı, Ankara, 2013.
- [23] Tekkumru Kısa, M. Development and Implementation of a “Science Center Learning Kit” Designed to Improve Student Outcomes from an Informal Science Setting, Unpublished Master Dissertation, Boğaziçi University, İstanbul, 2005.
- [24] Yardımcı, E. Yaz Bilim Kampında Yapılan Etkinlik Temelli Doğa Eğitiminin İlköğretim 4 ve 5. Sınıftaki Çocukların Doğa Algılarına Etkisi. Yayımlanmamış Yüksek Lisans Tezi, Abant İzzet Baysal Üniversitesi, Bolu, 2009.
- [25] Yavuz, M. Fen Eğitiminde Hayvanat Bahçelerinin Kullanımının Akademik Başarı ve Kaygıya Etkisi ve Öğretmen- Öğrenci Görüşleri. Yayımlanmamış Yüksek Lisans Tezi, Sakarya Üniversitesi, Sakarya, 2012.
- [26] Özsevgeç, T. Kuvvet ve Hareket Ünitesine Yönelik 5E Modeline Göre Geliştirilen Öğrenci Rehber Materyalinin Etkililiğinin Değerlendirilmesi, Türk Fen Eğitimi Dergisi, 3(2), 36-48, 2006.
- [27] Metin, M. Eğitimde Bilimsel Araştırma Yöntemleri. 2. Baskı, Pegem Akademi Yayınları, 2015.
- [28] Yıldırım, A. & Şimşek, H. Sosyal Bilimlerde Nitel Araştırma Yöntemleri. Seçkin Yayıncılık, Ankara, 2011.
- [29] Bozdoğan, A. E., & Kavcı, A. Sınıf Dışı Öğretim Etkinliklerinin Ortaokul Öğrencilerinin Fen Bilimleri Dersindeki Akademik Başarılarına Etkisi. Gazi Eğitim Bilimleri Dergisi, 2 (1), 13- 30, 2016.
- [30] Morag, O., & Tal, T. Assessing Learning in the Outdoors with the Field Trip in Natural Environments (FINE) Framework. International Journal of Science Education, 34(5), 745 - 777, 2012.
- [31] Tatar, N., & Bağrıyanık, K.E. Fen ve Teknoloji Dersi Öğretmenlerinin Okul Dışı Eğitime Yönelik Görüşleri. İlköğretim Online, 11(4), 883 - 896, 2012.
- [32] DeWitt, J., & Storksdieck, M. A Short Review of School Field Trips: Key Findings from the Past and Implications for the Future. Visitor Studies, 11(2), 181 - 197, 2008.