EFFECTS OF PROBLEM BASED LEARNING ON STUDENTS' ENVIRONMENTAL ATTITUDE THROUGH LOCAL VS. NON LOCAL ENVIRONMENTAL PROBLEMS

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ABSTRACT

EFFECTS OF PROBLEM BASED LEARNING
ON STUDENTS'
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THROUGH LOCAL vs. NON LOCAL ENVIRONMENTAL PROBLEMS

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The purpose of the study was to investigate the relative effect of problem based learning with a non local perspective (PBL1), problem based learning with a local perspective (PBL2) and traditionally designed environmental education (TRD) lectures on elementary school (7th grade) students' environmental attitude; specifically by the 3 dimensions as; general environmental awareness, general attitude toward solutions, and awareness of individual responsibility. The sample consisted of 95 7^{th} grade students from a public elementary school in Niğde. Three classes instructed by the same science teacher are randomly assigned as control group and experimental groups. All the groups were taught the topic "Why do ecosystems change?" for four weeks. On the other hand, the control group was taught through TRD, one of the experimental groups was taught through PBL with a non local perspective, and the other experimental group was taught through PBL with a local perspective. Students in TRD group received an instruction based on teacher explanations and textbooks. On the other hand, the experimental groups dealt with ill- structured real life problems working in small groups. The problem of PBL1 group was selected as "the declining environmental conditions of Manyas Lake" and the problem of PBL2 group was selected as "the declining

environmental conditions of Akkaya Dam in Niğde" to create a non local / local difference between the experimental groups. Environmental Attitude Questionnaire (EAQ) was administered to all groups as pre-test to determine the prior environmental attitude. The worksheets, on the other hand, used by experimental groups in their group work were examined to reveal the quality of the process. After the treatment, EAQ was administered to all groups as a post-test to compare the effectiveness of PBL1, PBL2 and TRD on students' environmental attitude. Analysis of covariance (ANCOVA) was performed to investigate the effect of traditionally designed EE, Problem Based designed EE, and Problem Based with a local perspective designed EE on students' general environmental awareness, awareness of individual responsibility and general attitude toward solutions when students' prior general environmental awareness, prior awareness of individual responsibility and prior general attitude toward solutions are controlled. The results of the study revealed that, students in PBL2 group had significantly more positive environmental attitudes in general environmental awareness and general attitude toward solutions dimensions than TRD group and in all three dimensions of the questionnaire than PBL1 group. Moreover, TRD group had significantly more positive attitude than PBL1 group in students' awareness of individual responsibility determined after the treatment.

Keywords: Environmental Education, Problem Based Learning, Traditional Education, Local Perspective, Environmental Attitude.

ÖZ

PROBLEME DAYALI ÖĞRENME MODELİNİN, YEREL VE GENEL ÇEVRESEL PROBLEMLER ARACILIĞI İLE, ÖĞRENCİLERİN ÇEVRESEL TUTUMUNA ETKİSİ

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Bu çalışmanın amacı, öğrencilerin ön çevresel tutumları kontrol altında iken probleme dayalı öğrenme modeli (PDÖ1), yerel bir problemin kullanıldığı probleme dayalı öğrenme modeli (PDÖ2) ve geleneksel eğitim (GE) yöntemlerinin öğrencilerin çevresel tutumlarına; özellikle genel çevre bilinci, genel çevresel çözümler konusundaki tutum, ve kişisel sorumluluk bilinci alt başlıklarına olan etkisini incelemektir. Çalışmanın örneklemini Niğde ilinde bir ilköğretim okulunda okuyan 95 yedinci sınıf öğrencisi oluşturmaktadır. Kontrol ve deney grupları aynı öğretmenle eğitim gören 3 sınıftan rasgele seçilmiştir. Tüm gruplarda 4 hafta süresince "Ekosistemler Neden Değişir?" konusu işlenmiştir. Konular iki deney grubunda probleme dayalı öğrenme modeli ile işlenirken, kontrol grubunda geleneksel yöntemle işlenmiştir. Kontrol grubundaki öğrenciler konuları öğretmen açıklamalarına ve ders kitaplarına dayalı olarak öğrenirken, deney grubundaki öğrenciler konuları iyi yapılandırılmamış, gerçek hayata dayalı problemler doğrultusunda grup çalışmaları ile öğrenmişlerdir. Deney grupları arasında yerel ve genel konular olmak üzere bir fark oluşturmak için, birinci probleme dayalı öğrenme grubunun problemi "Manyas gölünün bozulan çevre koşulları" olarak seçilirken ikinci probleme dayalı öğrenme grubunun problemi " Niğde ilindeki

Akkaya barajının bozulan çevre koşulları" olarak seçilmiştir. Öğrencilerin ön çevresel tutumlarının belirlenebilmesi için tüm gruplara Çevre Tutumu Testi uygulanmıştır. Bununla birlikte, uygulama sırasında deney grupları öğrencilerinin kullandığı grup çalışma kağıtları uygulamanın içeriği ve öğrencilerdeki gelişimi değerlendirmek amacı ile incelenmiştir. Uygulamalardan sonra PDÖ (1 ve 2) ve GÇE yöntemlerinin öğrencilerin çevre tutumlarına etkisini karşılaştırabilmek için tüm gruplara Çevre Tutumu Testi son test olarak tekrar uygulanmıştır. PDÖ (1 ve 2) ve GÇE yöntemlerinin öğrencilerin çevre tutumlarına etkisini incelemek için kovaryans analizi (ANCOVA) kullanılmıştır. Öğrencilerin ön tutumları analize ortak değişken olarak atanmıştır. Çalışmanın sonuçları, PDÖ2 grubu öğrencilerinin genel çevre bilinci ve genel çevresel çözümler konusundaki tutum alt başlıkları için GÇE öğrencilerinden, her üç alt başlık için de PDÖ öğrencilerinden daha yüksek bir ortalamaya sahip olduklarını, GÇE grubunun ise kişisel sorumluluk bilinci alt başlığında PDÖ öğrencilerinden daha yüksek bir ortalamaya sahip olduğunu göstermiştir.

Anahtar Sözcükler: Çevre Eğitimi, Probleme Dayalı Öğrenme Modeli, Geleneksel Öğrenme Modeli, Yerel Perspektif , Çevresel Tutum.

To all my family...

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF SYMBOLS

EE: Environmental Education

PBL: Problem Based Learning

TRD: Traditional Lecture

EAQ: Environmental Attitude Questionnaire

EG: Experimental Group

CG: Control Group

CHAPTER 1

INTRODUCTION

Biophysical environment, culture and man compose a system, and human being is an inseparable part of this system. In this system, human has the ability to affect the system's equilibrium; weaken, strengthen or maintain the relationships of the main components. Therefore, a whole understanding of the biophysical environment including natural sources is important, and the existence of any civilization depends on the results of this understanding. The problems of this biophysical environment, the solutions and the responsibilities in participating in the problem solving should be understood by the citizens. (Stapp, W. B., 1969)

This understanding explained by Stapp (1969), who is considered to be the founder of Environmental Education (EE), forms the basics of EE.
The widely accepted definition of Environmental Education was introduced in Tbilisi conference as:

> A process aimed at developing a world population that is aware of and concerned about the total environment and its associated problems, and which has knowledge, attitudes, motivations, commitments and skills to work individually and collectively towards solutions of current problems and the prevention of new ones. (UNESCO-UNEP, 1978)

In the same conference, three main goals of EE were determined. The three crucial aims of EE were to encourage awareness and concern; to provide every person opportunities to gain knowledge, values, attitudes, commitment, and skills necessary to environmental protection and to improve the behaviors of the people as a community towards the environment. (UNESCO-UNEP, 1978)

Environmental awareness, which is the first aim of EE, is one of the most important features of the community for the environment; in a state of lack of environmental awareness only laws are not enough to conserve environment. (Xu, 1999)

The second aim stated is also stressed in the 10th principle of Rio Declaration on Environment and Development. It is stated that the environmental protection can be accomplished best by the participation of each citizen. Therefore the access to essential knowledge and opportunity to be included in the decision making processes should be provided for each person. ("Rio Declaration", 1992)

On the basis of Tbilisi conference, Hungerford and Volk (1990) defined the third stated aim, environmentally responsible citizen as the person who has an awareness and sensitivity to the total environment and its related problems; a basic understanding of the environment and its related problems, feelings and concern for the environment and motivation for actively participating in environment and protection, skills for identifying and solving environmental problems and active involvement in working toward resolution of environmental problems.

Thus, the development of environmental awareness and attitudes, providing access to the related knowledge and opportunity to be included in the decision making processes and personal responsibility are the required yields of successful EE. On the other hand, Iozzi (1989) revealed that increasing the knowledge on the environmental problems without notable skills of addressing the problems results in negative feelings about the person's own ability to affect the environment in a positive way. Moreover, cognitive understanding is shown not to be adequate to foster environmental awareness; the affective domain is significant in encouraging positive attitudes (Moyer, 1975).

In recent years, many researches have been done to assess the efficiency of teaching methods, aims of which include cognitive understanding or affective domain, for successful EE. In these researches, Problem Based Learning is

generally shown to give positive results on increasing both knowledge and attitude. (Oliver & Herrington, 2000; Iangen & Walsh, 2006)

Problem Based Learning (PBL) is an approach to curriculum and teaching that the students are enrolled in the solution of a real life problem instead of conventional abstract exercises. PBL starts with a real problem which is connected to the student's real life experiences and stresses the core concept that is to be taught. The students study as a group, develop many possible means to find the most appropriate solution to present to the class. (Torp & Sage, 2002)

The origins of PBL constructed over the progressive movement, especially the idea of John Dewey that the students' ordinary lives and experiences should be used as a clue for the adaptation of school content. Dewey wrote: "careful inspection of methods which are permanently successful in formal education … will reveal that they depend for their efficiency upon the fact that they go back to the type of the situation which causes reflection out of school in ordinary life." (Dewey, J., 1966)

PBL originally constructed by Barrows to train doctors in adjusting theoretical knowledge to real patient problems. According to Barrows and Tamblyn's (1980) definition, PBL is the learning that results from the process of working toward the understanding or resolution of a problem. Instead of just giving the necessary knowledge, he used PBL to bring in an essential body of knowledge, the ability to use knowledge effectively, and the ability to extend or improve that knowledge and to provide appropriate care for future problems which they must face (Barrows, 1985).

The results of the related literature shows that PBL increases the critical thinking ability, motivation and understanding of the significant content (Oliver & Herrington, 2000). Studies also showed that students taught with PBL tend to have higher critical thinking disposition scores than students taught by lecturing and this dominance persists 2 years afterwards, yet a lesser degree (Tiwari, 2006).

In addition to its mentioned convenient results with the aims of EE, PBL was also shown to give significant positive results specifically in EE. It is effective in improving content knowledge, student interest and awareness about the environmental issues. (Iangen & Walsh, 2006)

Consistent with the Dewey's initiative belief to PBL that the learning is strongly related with ordinary life and experiences, Vaske and Kobrin (2001) found that a bridge with a given place enriches the students' environmental knowledge and concern. According to a study in China, people tend to perceive local issues more significant and tangible than the global issues. They pay more attention to the issues they can directly sense (Duan & Fortner, 2005). Moreover, it is stressed in Agenda 21 (1992) that there is not a global action plan for the solution of environmental problems. These problems only are successfully handled if the ecological, economic, and cultural differences of our local environment are considered (Eblen & Eblen, 1994). These findings highlight the possible positive effects of using local environmental problems, the results of which directly affect the students, as the problem of PBL in EE.

In Turkey, there is not an environmental education curriculum stressing the national/local environmental problems. According to the related research, the students seem to have a positive attitude toward the environment, believe the importance of personal responsibilities; yet not clear on the meaning of the concept of personal responsibility (Tuncer et al., 2005). This reveals the gap in EE research and applications in elementary grades in Turkey.

Thus, in line with the recent developments in the literature and the state of the EE application in Turkey, the current study is designed to apply PBL, with the use of a local problem, as an effective tool for developing environmental awareness, attitude and social responsibility among 7^{th} grade students. The purpose of this study is to compare the efficiency of PBL with traditional method in developing 7^{th} grade students' environmental awareness, attitude and social responsibility. Secondly, it is intended to compare the effects of using a local environmental problem, results of which directly affects the sample, with using a non-local

problem as the problem of PBL approach in EE, in developing 7th grade students' general environmental awareness, individual responsibility and general attitude toward solutions. Therefore, the uniqueness of the study comes from its feature that the problem used for PBL is a local one.

CHAPTER 2

THE MAIN PROBLEM AND SUB-PROBLEMS

This chapter of the study is comprised of one part as; description of the main research problem and sub-problems of the study.

2.1. The main Problem and Sub-problems

2.1.1. The main Problem

The main problem of the study is set out as; "What is the effect of traditionally designed instruction, problem based learning instruction with a non local perspective and problem based learning instruction with a local perspective on 7^{th} grade students' environmental attitude?"

2.1.2. Sub-problems:

The sub-problems of the study have been set out as follows:

1. Is there a significant mean difference among the control group, exposed to traditional instruction, first experimental group, exposed to PBL with a non local problem and second experimental group, exposed PBL with a local problem, with respect to students' general environmental awareness when students' prior environmental attitude is controlled?

2. Is there a significant mean difference among the control group, exposed to traditional instruction, first experimental group, exposed to PBL with a non local problem and second experimental group, exposed to PBL with a local problem, with respect to students' general attitude toward solutions when students' prior environmental attitude is controlled?

3. Is there a significant mean difference among the control group, exposed to traditional instruction, first experimental group, exposed to PBL with a non local problem and second experimental group, exposed to PBL with a local problem , with respect to students' awareness of individual responsibility when students' prior environmental attitude is controlled?

CHAPTER 3

REVIEW OF LITERATURE

This chapter includes the review of literature relevant to environmental education, problem based learning, and local problem based learning.

3.1. Environmental Education

The early influences of Environmental Education started with Jean-Jacques Rousseau, when he wrote his novel "Emile" in 1762, and mentioned that education should have a component of environment with the words; "call your pupil's attention to the phenomena of nature, and you will soon render him inquisitive. But, if you would keep his curiosity alive, do not haste to satisfy it. Ask questions that he can comprehend, and let him solve them" (Rousseau, 1762). In 1930s, John Dewey revealed his ideas on a student-centered education including approaches such as learning by doing, life-long learning, and integrated and interdisciplinary efforts which became major dimensions of environmental education later (McCrea, 2006). In 1969, Dr. Stapp and his students at the University of Michigan defined environmental education in their published work. The National Association for Environmental Education is found in 1971 (Wicks, 2001, p.8). The United Nation Conference on Human Environment was held in 1972 in Stockholm and the need for a common outlook and principles are considered for the protection and improvement of the human environment. In 1987, UN World Commission on Environment and Development published the report "Our common future" which placed the environmental issues on the political agenda and initiated many actions such as UN Earth Summits in 1992 and 2002. In 1992, United Nations Conference on Environment and Development (UNCED) was held

in Rio de Janeiro and Agenda 21 was released as the resulting document. The message of the Summit was “nothing less than a transformation of our attitudes and behavior would bring about the necessary changes” (UNESCO-UNEP, 1992). In 2002, the World Summit on Sustainable Development was held in Johannesburg and led the leaders to successfully implement the targets of agenda 21 which focuses on achieving a sustainable balance between consumption, population and the Earth’s life-supporting capacity (Agenda 21, 1992).

Stapp, who is considered to be the founder of Environmental Education, summarizes the basics of EE in his work in 1969. He states that man and culture compose a system and the human being, which is an inseparable part of this system, has the ability to change or maintain the balance of this system. Therefore, a whole understanding of this balance by the citizens is stressed as a crucial point for the existence of any civilization. This understanding forms the basics of EE.

Environmental education was defined in Tbilisi conference as a process aimed at developing a world population that is aware of and concerned about the total environment and its associated problems, and which has knowledge, attitudes, motivations, commitments and skills to work individually and collectively towards solutions of current problems and the prevention of new ones (UNESCO-UNEP, 1978). In the same conference, three main goals of EE were determined. The three crucial aims of EE were to encourage awareness and concern; to provide every person opportunities to gain knowledge, values, attitudes, commitment, and skills necessary to environmental protection and to improve the behaviors of the people as a community towards the environment (UNESCO-UNEP, 1978).

The first aim of EE which is environmental awareness is stressed by Xu in 1999, as being one of the essential features of the community for the environment. Xu states that in a state of lack of environmental awareness, only laws are not enough to conserve environment.

The second aim, that is to provide every person opportunities to gain knowledge, values, attitudes, commitment, and skills necessary to environmental protection, is

also stressed in the 10th principle of Rio Declaration on Environment and Development. It is stated that the environmental protection can be accomplished best by the participation of each citizen. Therefore the access to essential knowledge and opportunity to be included in the decision making processes should be provided for each person ("Rio Declaration", 1992).

On the basis of Tbilisi conference, Hungerford and Volk (1990) defined the third stated aim, that is to improve the behaviors of the people as a community towards the environment, as environmentally responsible citizen is the person who has an awareness and sensitivity to the total environment and its related problems; a basic understanding of the environment and its related problems, feelings and concern for the environment and motivation for actively participating in environment and protection, skills for identifying and solving environmental problems and active involvement in working toward resolution of environmental problems.

In addition to the stated aims, the concept of "environment" matured over time with the recognition of social, cultural and economic dimensions (Palmer, 1998).

As the stated definitions underline the importance of a successful environmental education, curriculum development and the most appropriate methods for environmental education became an essential research area.

In an article of Hungerford et al., the goal for curriculum development in environmental education was explained as "to aid citizens in becoming environmentally knowledgeable and, above all, skilled and dedicated citizens who are willing to work, individually and collectively, toward achieving and/or maintaining a dynamic equilibrium between the quality of life and quality of the environment".

Many researchers examined the teaching methods for fully satisfying the goals of environmental education. Environmental attitudes of the students are especially in the focus of many research studies in this area.

Many studies done to examine the efficiency of education methods used in EE in changing attitude of elementary grade students in 1970's. Many of them assessed the efficiency of traditional instruction ranging from 2 hours to 2 years and most of the results were positive. On the other hand, most of these studies were suspected to have serious design, control group, and measurement errors (Leeming et al., 1993).

Recently, a study pointed out the lack of the understanding whose importance was previously stressed by Stapp (1969). Loughland et al. examined the responses to an open ended question as "I think the term/word environment means…", and found two typical responses that qualitatively differentiated. First one pointed an "object" perception of the environment and the other pointed a "relation" perception (Loughland et al., 2002). The authors published a following article one year later which analyzed the factors that channel students to the related conceptions. The study was conducted on 1734 students and students' own voices were used to plan their perceptions. The results of the study suggested that young people have an "object" perception of environment that is separate from themselves, rather than a "relation" perception in general. In the sample, the 'relation' perception was five or six times more frequent in primary school students than in high school students. Girls were one and a half times more likely to have a 'relation' perception than boys. The authors concluded that the current education system needs a reorientation (Loughland at al., 2003).

A similar study in 2005 examined 81 students' ideas about what defines an environment and how these ideas change. The sample was first asked to draw an environment and explain their drawings and later they were shown some photographs and asked if the photographs define an environment. The results of the study showed that the students understood an environment from a limited ecological perspective. The environment was defined as a location where animals live or an area that supports animal life. Human-managed areas are not categorized as environments by the students. They also did not include human as a part of the

environment. It is also revealed that cycling of matter and flow of energy were not identified by the students (Shepardson, 2005).

In a study in 2003, the authors examined the understanding of children about the needs of animals. During a zoo visit, 171 children, whose ages range between 4 and 14, were interviewed and did drawings about the needs of a favorite animal. The analyses showed three ways of children's thinking about the animal needs namely aesthetic, anthropomorphic, and psycho-social dimensions. The aesthetic was characterized with the concern about the bodily coherence and the completeness of its surroundings. The anthropomorphic was characterized with the awareness of the others similarity with the self and psycho-social dimension stressed the subjective experience of the animal and its' need for companions (Myers et al., 2003). In 2004, the authors published their second study about the same concept in which they examined the changes with age in how children think about the needs of animals, to reveal how they care about the animals and more generally about the environment. The results of the study showed that the concrete ecological connections children could discover around a favorite animal, increased steadily across ages. The authors found that the children construct their understanding of ecology around their first-hand interactions and concrete understanding of such animals and their needs. Therefore, these interactions are beneficial for constructing system-level understandings and values. The authors suggested that, development in solving dilemmas in human ecology requires the balancing of values they deducted from the individual animals, populations, ecosystems and the needs of people (Myers et al., 2004).

A case study in 2004, examined the primary children's understanding of and views on the issues related to the environment and science. Totally 138 children were interviewed in groups of four. It is revealed in the study that most of the younger children than older children had never heard of the term environment, or did not understand it. Most of the children who recognized the term identified it with the categories as, the world, living things in general, or with the living or non-living environments. Most of the children in the study mentioned concern related issues

such as animals, waste, transport and pollution. On the other hand, it is revealed that few showed extensive understanding and many of the children had misconceptions (Littledyke, 2004).

Another study examined the relationship between environment based education and the students' critical thinking skills and disposition toward critical thinking. The sample of the study comprised 404 students from 9^{th} and 12^{th} grades from Florida high schools. A two years environment-based education was given to the students as the treatment. Pre-testing was used for 9^{th} grade students, yet a post-test only design was used for 12^{th} grade students since they had started the environment-based education program before the study began. The results of the study showed a significant positive effect of environment-based education on students' critical thinking skills. The teachers' and students' perceptions are measured by interviews in the study. The examinations of these interviews showed that the success of the program was related to the characteristics; the interdisciplinary environmental context, project-based or issue-based instruction, and the learner-centered, constructivist approaches, according to the teachers and the students (Ernst & Monroe, 2004).

Another study stresses the effect of involvement on attitude. According to the results of the study conducted on 72 subjects, the level of environmental involvement is shown to be positively correlated with the ecologic attitude. Yet, it is revealed that the environmental programs should be focused on constructing factual and cognitive structures on the existing positive environmental attitudes of children (Eagles & Demare, 1999).

3.2. Problem Based Learning

The origin of PBL goes back to the progressive movement, particularly the ideas of John Dewey who advocated that the students should be presented with the real life problems and encouraged to find the information required to solve them

(Dewey, 1966). Discovering that Dewey's recommendations could be efficient in medical education, Barrows started to develop a method that could serve the doctors with both knowledge and the ability to use it (Barrows, 1985). According to Albanese and Mitchell (1993), medical students taught by this method are more successful than students taught by traditional method in terms of problem solving, self-evaluation and data gathering.

PBL is a constructivist approach that is driven by the students, with the teacher as a thinking coach (Greenwald, 2000). Savery and Duffy (1995) also suggest that PBL is in accordance with the principles of constructivist approach. The principles are; firstly the students should understand and accept the aim of the learning activities since the goals define what they learn; secondly students should be take part in the process used for the task.; thirdly, challenging tasks and environments should be produced for the learners; fourthly the teacher's role should be to support and encourage students' discussion and testing their ideas; and lastly, the assessment should be done taking into account both the knowledge learned and the learning process.

The unique characteristic of PBL approach that differentiates it from the other constructivist methods is the ill structured problems. The problems are related with real life, and have no unique solution; they require the students' personal opinions (Jonassen, 2000). Moreover, in most of the case-based studies the cases are used after the topic is covered to assess learning (Williams, 1992). In contrast, in PBL, learning is developed from the beginning in the context of the problem.

The steps of a typical PBL lesson are identified by Torp and Sage (2002) as, prepare the learners, meet the problem, identify what we know, what we need to know, define the problem statement, gather and share information, generate possible solutions, and finally debrief the problem. More specifically, Greenwald (2000) defined the following steps for implementing PBL; introduce an ill-structured problem to the students preferably in a larger, realistic scenario, ask open-ended questions to the students to guide them find out what is interesting or

important related to the problem, offer various problem-finding strategies to identify and clarify the problem, map problem finding activities and prioritize a problem, guide the students by inquiry oriented questions to plan their investigations, guide the students with questions to analyze their results, let students present what they have learned to their peers to reiterate learning, let students generate solutions and recommendations, communicate the results and conduct self- assessment. Moreover; Peterson, described the three major factors for success in implementing PBL as: orienting the students, picking the problem and forming the team (Peterson, 2004).

The most important yields of PBL are described by Watson, as the following foundational cognitive skills: researching and locating knowledge from a variety of sources, integrating the new and old information, organizing the new information through mental models, transmitting knowledge to others for validation (Watson, 2004).

PBL is an approach that contains the revealed factors which are found to foster critical thinking in Ernst and Monroe's study (2004), and it is shown to be effective in accomplishing most of the stated goals of EE in previous research.

A study, which analyzes the effects of PBL and lecturing on the development of students' critical thinking, suggests that the perceptions of PBL students and lecture students on their learning experience are considerably different. Lecture students reported passive listening while PBL students reported active participation during the lessons. Moreover, they differ in their feeling about the lessons; lecture students reported negative feelings about the lessons, while PBL students describe it as being enjoyable, inspiring and self-fulfilling. Lecture students did not mention thinking was encouraged in the lectures, while PBL students stated the encouragement to thinking as a characteristic of PBL lessons (Tiwari, Lai, So & Yuen, 2006).

In another study analyzing the effect of PBL on students' knowledge, control group was thought by traditional method and the experimental group thought by PBL by the same teacher. In the experimental group, students identified and defined the problem, and made their plan for searching the necessary information in the first week. Then, they discussed their findings in class and as a last step, they introduced their solution ideas to the class. According to the results of the questionnaire that is used as both pre and post test, the PBL group students scored higher than the traditional group students. In addition, they had more positive attitude and self confidence than the traditional group students (McBroom & McBroom, 2001).

Another study conducted on the prospective teachers in Gazi Education Faculty in Turkey, intended to explore the effects of PBL approach in developing problem solving skills and self- efficacy beliefs of the subjects towards science teaching. In the study, problem solving skills and self efficacy beliefs of the two groups that are thought with different methods as traditional and PBL were compared. The results of the study showed that PBL is more effective in developing students' different skills than traditional method (Yaman & Yalçın, 2005).

The results of another study done on the 10^{th} grade students revealed that, students taught with PBL more than students taught with lecturing tend to participate in a task for reasons such as challenge, curiosity and mastery and they perceive the content as interesting, important and useful. The study also suggests that PBL develops students' use of elaboration strategies, critical thinking, metacognitive self-regulation, effort regulation, and peer learning. Moreover, PBL students used paraphrasing, summarizing and generative note taking which are cognitive strategies, helped them in integration and connection of new knowledge. Integration of previous knowledge to new ones to solve problems was also higher in PBL students than lecture students. Students also stated that cooperation in group work helped them in revising their initial ideas (Sungur & Tekkaya, 2006).

A similar study showed that PBL students and lecture students had a similar ability on the items requiring simple recall. On the other hand, data showed that they considerably differ in the items that require organization and integration of knowledge. PBL students' 93.3% answered correctly to the items requiring organization and integration, while just 48% of lecture students answered correctly to these items. Moreover, it was found that the PBL students were better at interpreting knowledge, using related information for defining problems, and principles for objective judgment. The students also stated that they gained an understanding of the concepts and principles, an ability to integrate them to other topics, and the skills needed for proper research with the help of PBL lessons (Sungur, Tekkaya & Geban, 2006).

The results of another study done among pre-service educators who participated in a PBL scenario involving the developmental needs of a fictional child are consistent with the previous one suggesting that the perception of the pre-service educators in participating in a PBL scenario is positive. According to the results, participating in a PBL scenario supports pre-service educators in developing a sense of the possible issues and strategies related to the practice, helps them understanding of the relationship between theory and practice, developing key interpersonal and communication skills, and gaining awareness of the different perspectives a stakeholder held (Edwards & Hammer, 2006).

Another study in 2005, examined the question that "What effect does a problem-based instructional environment have on student achievement measured hierarchically?" 116 fourth grade students from five different classes in an elementary school that includes both problem-based/constructivist and directed pedagogies. The Paragon Learning Style Inventory was used for assessment. The results of the study revealed that the most constructivist class scored best in the questions related to remembering, being significantly higher than the most directed-teaching class (Overbaugh &Lin, 2005).

According to the results of Iangen and Walsh's study (2006), subjects of which are academically talented college upper-class students, PBL approach gives positive results in improving content knowledge, student interest and awareness about environmental issues. The students' opinions on the course are also investigated in the study and it is revealed that they found the course interesting and valuable.

Another study, conducted in 2006 among a class of 25 first year students for two semesters, investigated the strengths and limitations of PBL. Students in the study worked in groups of five on a given problem in each day of the week. After three sessions in which the students and the facilitator discuss how to achieve the best solutions, the teams are expected to present their solutions and defend it. Each day, the students kept a reflection journal including their own opinions on their learning process; these are used for assessment in the study. The examination of these logs revealed some strengths and limitations of PBL. The strengths include; self-regulated, independent learning, deep thinking and making meaning through knowledge construction, tapping the affective domain of learning, contextual learning, and collaborative-cooperative learning. The limitations that students stressed were structural-operational problems such as insufficient communication in groups and insufficient facilitators and assessment problems (Kumar & Kogut, 2006).

Lastly, another paper evaluated the implementation of PBL from teachers' perspective. Seven teachers were interviewed and the interviews are evaluated for this purpose. The teachers expressed two different perceptions of PBL namely, teaching and learning perspectives. The learning perspective focused on students' learning process. The teachers defined the advantages of PBL as the independence and freedom in the students' learning, deeper knowledge and comprehension focused learning and personal growth, and the disadvantages as the difficulties in balancing the syllabus and finding assessment criteria. The teaching perspective focused PBL as a way of creating variation in teaching methods or a strategy in problem-solving. The teachers defined the advantage of PBL as more varied and enjoyable methods of teaching and the disadvantages as the insufficient

exploitation of teacher competence and the arising difficulties in controlling the students' factual knowledge. Moreover, teachers expressed the perception of the role of the tutor as twofold; directive and supportive (Dahlgren, Castensson & Dahlgren, 1998).

3.3. Local Perspectives in EE

The recognition of the importance of local surroundings goes back to the phrase "think globally- act locally!" originated by Rene Dubos, an advisor to the United Nations Conference on the Human Environment in 1972. In 1980's, he held to his thoughts on acting locally, and felt that issues involving the environment must be dealt within their "unique physical, climatic, and cultural contexts." (Eblen & Eblen, 1994).

In 1992 Agenda 21, with this phrase as a parole, stated that countries and regions should specify their own priorities according to their specific needs and stresses that the adjustment to the local needs is crucial. In addition, being the sample of the study, students in Turkey is shown to be differentiated in their environmental attitudes according to their being from rural and urban areas (Tuncer et. al., 2004).

However, little research has been conducted on the effects of using local environmental issues instead of non-local ones in PBL in environmental education.

A study implemented on 108 college students, which investigates the students' perceptions about global versus local environmental issues suggests that the global and local environmental issues are perceived differently in the dimensions of certainty, complexity, tangibility, significance and danger. The local environmental issues were perceived as being more significant and tangible than the global issues by the subjects of the study. People tended to judge the issue as 'real' if they could directly sense it. The concern was on the issues which are directly related to their daily life than the issues far away from their life (Duan & Fortner, 2005).

Another study was aimed to assess the results of using a neighborhood EE program on children's awareness of their local biophysical environment,, the ecological patterns and processes, and the development of the understanding that human being is an inseparable part of the ecosystem. The sample of the study consisted of 49 third and fifth graders. The author used three different techniques for assessment; questionnaire, mapping and interviews. The students showed significant positive changes after the program. The results of the study revealed that a neighborhood EE program is efficient in increasing students' awareness (Fisman, 2005).

CHAPTER 4

METHOD

This chapter of the study is comprised of six parts as; research design, definition of variables, sample, problem setting, lecture design, and instrumentation.

4.1. Research Design

The current study has a quasi-experimental design. Three groups of subjects were used, with each group being measured twice.

Table 4.1. Research Design

Groups	**Pretest**	**Treatment**	**Worksheets used during treatment**	**Post test**
CG	EAQ	TRD		EAQ
EG1	EAQ	PBL with a non local problem	Worksheets 1&2	EAQ
EG2	EAQ	PBL with a local problem	Worksheets 1&2	EAQ

The main target of the design was to test the effect Problem Based Learning with local and non local perspectives environmental education on students' general awareness, attitude toward solutions and awareness of individual responsibility. Three groups of subjects were assigned for this purpose as;

1. Control Group (CG), subjected to traditional environmental education lectures (TRD),
2. Experimental Group (EG) subjected to problem based learning environmental education with a non local problem (PBL1),
3. Experimental Group (EG) subjected to problem based learning environmental education with a local problem (PBL2),

Before the instruction, EAQ was administered to all three groups to determine the attitude prior to the treatment. Worksheets are designed by the researcher for the usage in group work of experimental groups; to both enrich the PBL education and to examine the treatment process during application, especially the understanding of the students. After the treatment, EAQ was administered again to all groups to test the development.

4.2. Definition of Variables:

The definitions of the variables in the study are as follows:

Traditionally Designed Instruction: Instruction based on teacher explanations and textbooks.

Problem Based Learning: An approach to curriculum and teaching that the students are enrolled in the solution of a real life problem instead of conventional abstract exercises. Problem-based learning (PBL) is focused, experiential learning (minds-on, hands-on) organized around the investigation and resolution of messy, real-world problems. PBL curriculum provides authentic experiences that foster active learning, support knowledge construction, and naturally integrate school learning and real life. (Torp & Sage, 2002)

Ramsar Convension on wetlands: The Convention on Wetlands, signed in Ramsar, Iran, in 1971, is an intergovernmental treaty which provides the framework for national action and international cooperation for the conservation

and wise use of wetlands and their resources. There are presently 158 Contracting Parties to the Convention, with 1721 wetland sites, totaling 159 million hectares, designated for inclusion in the Ramsar List of Wetlands of International Importance.

Environmental awareness: A multidimensional concept including five dimensions: ecological knowledge, environmental values, environmental attitudes, willingness to act and actual behavior. (Zsóka, Á. N., 2006) It is measured by a 31-item Environmental Attitude Questionnaire (EAQ), with higher scores indicating high level of awareness, in this study.

Attitude: An enduring like or dislike (Koballa& Crawley, 1985). It is measured by a 31-item Environmental Attitude Questionnaire (EAQ), with higher scores indicating high level of awareness, in this study.

Social responsibility: Awareness and sensitivity to the total environment and its related problems; a basic understanding of the environment and its related problems, feelings and concern for the environment and motivation for actively participating in environment and protection, skills for identifying and solving environmental problems and active involvement in working toward resolution of environmental problems. (Hungerford & Volk, 1990) It is measured by a 31-item Environmental Attitude Questionnaire (EAQ), with higher scores indicating high level of social responsibility, in this study.

4.3. Sample

The target population of this study is all 7th grade students in central Niğde which could possibly be affected by the environmental problems caused by Akkaya Dam and the accessible population is all 7th grade students (47 girls and 48 boys) in Niğde Atatürk Elementary School. Participants of the study are chosen to be the students from three classes of one teacher and the classes were randomly assigned to apply one of three modes of instruction for EE namely, traditional instruction,

PBL instruction with a non local problem and PBL instruction with a local problem.

Number of students for each group has been presented in the table below:

Table 4.2 Number of Students for Each Group

Mode of instruction	**Number of students**		
	Girls	**Boys**	**Total**
Traditional Learning (CG)	19	13	32
Problem Based Learning with a non local problem (EG1)	12	19	31
Problem Based Learning with a local problem (EG2)	16	16	32
		Total	95

Sample Characteristics

As was stated above, the sample of this study comprises 95 7th grade students (47 girls and 48 boys) of Niğde Atatürk Elementary School. The school is a typical public school. Almost half (53, 1 %) of the students stated that they had participated in an environmental activity before this research.

Parents' education level of the sample is not high. Approximately 46, 3 % of the mothers are elementary school graduates. Father education level is differentfrom mother education level, with the following percentages: 26,3% of the fathers is elementary school graduates, 23,2 % is middle school graduates, 22,1% are high school graduates and 20,2% are university graduates.

4.4. Problem Setting

4.4.1. Problem : Manyas Lake

The problem set for the Problem Based Learning with a non local problem Group (PBL1) is related with the declining environmental condition of Manyas Lake. The reason for choosing Manyas Lake is the fact that although it is not a local area, it has similar characteristics with the local problem area namely Akkaya Dam, Niğde.

Manyas Lake as a RAMSAR Site

Manyas Lake is located in Balıkesir, Turkey. The length of the lake is 20 km. and the width is 14 km. There are 239 bird species identified in the area. Of these species, 66 breed regularly every year in the area, and some years 21 more species join the population. The remaining 152 species visit the area during their migration. It is estimated that the number of birds visiting the area is approximately 2-3 million, and most of them are migratory species.

Manyas Lake was included in the RAMSAR list of wetlands of international importance in 1994. The meaning of defining an area as RAMSAR Site is that, the region is internationally important according to the criteria based on species or ecological communities, waterbirds or fish. The inclusion of a site in the RAMSAR list provides the international recognition and also forces the government to maintain the ecological characteristics of the site. (The criteria for identifying wetlands of international importance, 2007)

The reasons and the state of pollution in the area

Manyas Lake has been facing several pollution incidents in recent years. These can be summarized as follows:

1. High threats included agricultural, industrial and household pollution. Fish population decreased due to over-fishing, disease, and pollution. The dumped industrial wastes caused the death of the trees and the decrease of the fish population. As a result, the population of migratory birds decreased, too.

2. The level of water also decreased in Manyas Lake, causing some of the trees that are in the water previously left in the soil. This situation prevented some species from nesting in the area.

According to the research done by Onsekiz Mart University the environmental factors that affect Manyas Lake are; the damage of bird species' nutrients and rest places, the coverage of the forests with water due to floods, the insufficient refinement, the effect of over-hunting and human interaction with the water level. (Karafistan & Çolakoğlu, 2005)

4.4.2. Local Problem: Akkaya Dam

The local problem set for the Problem Based Learning with a local problem Group (PBL2) is related with the declining environmental condition of Akkaya Dam. The reason for choosing Akkaya Dam is the fact that the dam exists in the students' hometown, actually very close to the school. The area has crucial characteristics that make it one of the places proposed for the RAMSAR's list of wetlands of international importance. (Türkiye Çevre Atlası, 2004) Moreover, the dam is facing many environmental threats that could have possibly affected the sample of the study.

Akkaya Dam as a RAMSAR Site

Akkaya Dam is located within the provincial borders of Niğde in Turkey. It was constructed on Tabakhane stream between the years 1962- 1967 for the purpose of supplying irrigation water. The volume of the dam is 426000 m3 and it serves for the irrigation of 2000 hectares of land in Bor plain. Akkaya Dam is very well

known by its unique characteristics: There are 92 species identified in the dam area. The dam area which is a rest place for flamingoes, "angıt" (Tadorna ferruginea) and "dikkuyruk" (Oxyura leucocephala), an endemic species, was defined as one of the RAMSAR sites according to the above mentioned characteristic (Türkiye Çevre Atlası, 2004)

As stated by the experts, the dam meets the 2nd criteria of the Ramsar Convention on Wetlands and Criterion 2 states that, "A wetland should be considered internationally important if it supports vulnerable, endangered, or critically endangered species or threatened ecological communities." The meaning of defining an area as RAMSAR Site is that, the region is internationally important according to the criteria based on species or ecological communities, waterbirds or fish. The inclusion of a site in the RAMSAR list provides the international recognition and also forces the government to maintain the ecological characteristics of the site. (The criteria for identifying wetlands of international importance, 2007)

The reasons and the state of the pollution in the area

There are several environmental problems in the Akkaya Dam area. These are:

1. The dumped wastes caused a serious pollution and threatened the dam's ecological features. According to a report prepared by Governor of Niğde this condition of the dam threatened both the lives of plants and animals and also human health. It is also stated in the report that the accumulation of chemical wastes changed the flora and the chemical composition of the soil, and also transmitted the biological and chemical pollution to the ground water. Local people threatened with Typhoid, Cholera and Dysentery outbreaks in the region (Karakaya, 2004)

2. Another important aspect related with the pollution in the area is economical, in the region where there are many fish and bird deaths has been

detected in 2003, people get used to go fishing and get their income by selling them. Thus, pollution in the area impacts both the health and economical status of the people.

3. Moreover, there is a refinery in the area owned by the Municipality of Niğde that does not work properly and consistently due to technological problems and cause pollution in the area. (Bor, 2005)

4. Another problem of Akkaya dam is illegal hunting. Provincial Directorate of the Ministry of Environment and Forestry states that they consistently control the region and destruct the immobile bird traps yet local hunters develop mobile ones. In addition, people and children in the area destroy the eggs of the birds. (Gürer, 2005)

4. Furthermore, the level of water in the dam decreases constantly. This also disrupts the habitat of plants and animals. Yet, this is perceived as a natural prevention from the fatal disease, bird flu. (Demircioğlu, 2005)

There are several precautions have been taken by the governmental authorities in Niğde, to handle the above defined problem. According to a press release of a meeting held by the Governor of Niğde, Municipality of Niğde, Niğde University, Provincial directorate of the Ministry of Environment and Forestry, Provincial Directorate of the Ministry of Agriculture and that of the State Hydraulic Works, the precautions taken to protect the area are; to surround the dam with a wire fence, to control the region, to prevent illegal hunting and construct observation towers, to treat the wastes dumped into the dam, and to afforest the region to provide shelter. After this meeting, Ministry of environment and Forestry planted 500 saplings of willow, ash tree, locust tree and maple in the area. (IHA, 2005) However, these precautions are far from solving the increasing number of problems.

4.5. Lecture Design

This study was conducted with 95 7th grade students of Niğde Atatürk Elementary School for 4 weeks in the second semester of 2006- 2007 academic year. The classes consisted of 32, 31 and 32 subjects were assigned to three groups to form two experimental (PBL1 group, and PBL2 group), and one control group (TRD group). All of the subjects were administered the pretest before the treatment. Then, each group was treated with the related approach by the same teacher for 4 weeks. The general subject of the treatment has been set out to be "Why do ecosystems change?" and the lecturing duration were the same for each group. The 4 weeks treatment content and procedure for the three different groups are explained below.

4.5.1. Traditional Instruction (TRD Group)

The control group was taught by traditional instruction for four weeks. The general topic "Why do ecosystems change?" consisted of 2 sub-topics as "natural factors affecting ecosystem change" and "human effect on ecosystem change". The students of this group are also introduced with the RAMSAR Convention and wetlands. The techniques used during this session were lecturing and discussion (Table 4.3).

Table 4.3. Traditionally designed EE

	Subject	Content	Technique(s) used
1st week	Who broke the ecosystem equilibrium?	ecosystem equilibrium natural degradation and human based degradation	lecturing
2nd week	Population growth, production, industrialization	Population growth, production, industrialization	lecturing
3rd week	sustainable use of natural resources	definition of natural resources, sustainable use of natural resources	lecturing
4th week	What is RAMSAR, what is a wetland?	Definition of wetlands, Importance of wetlands, Ramsar Convention on wetlands Sustainable use of wetlands	lecturing

4.5.1.1. Treatment Procedure for TRD group:

1st week: who broke the ecosystem equilibrium?

In the first session, the teacher started with the definition of ecosystem equilibrium. It was stated that when the equilibrium is damaged the ecological problems arise. Then, the students are asked to give some examples that could damage an ecosystem's equilibrium. The given examples were tsunamis and fires. The teacher point out the difference between these examples and explained the two types of degradation namely; natural degradation and human based degradation. Volcanoes, earthquakes, drought and flood were given as examples for natural

degradation and population growth was given as an example for human based degradation. The teacher talked about population growth and its' possible effects. Most of the students stated urbanization as a harmful result of population growth, yet they seem unaware of the concept of sustainable development.

2nd week: population growth – production - industrialization

In the second week's session, the teacher asked the students to sum up the ideas discussed in the first lesson. Then, he linked the population growth to industrialization and stated that the population growth increases the consumption and therefore production. This causes a rapid industrialization in the world and since the required preventions are not provided, the factories cause pollution. The teacher talked about the declining ecological condition of Akkaya Dam, and he gave the example of the death of fish in the dam because of industrial pollutants as an example for the harmful effects of industrialization. The teacher discussed the effects of industrialization for the rest of the session and the students stated their opinions.

3rd week: sustainable use of natural resources

In the third week's session, one of the students summarized the last session's content first. Then, the teacher started with the definition of natural resources. He gave some examples and stated that natural resources are limited. He talked about the sustainable use of natural resources and gave some examples such as water shortage that points the results of exploiting the natural resources.

4th week: what is RAMSAR, what is a wetland?

In the last week's session, the teacher stated the topic as RAMSAR convention on wetlands. In this session, the definitions of Ramsar Convention on Wetlands which are conveyed via their internet site are used. The teacher stated that the convention on wetlands, signed in Ramsar, Iran, 1971, is an intergovernmental agreement which arranges national action and international cooperation for the conservation and wise use of wetlands. He defined wetlands as areas where water is the primary factor controlling the environment and the associated plant and animal life. The wetlands occur where the water table is at or near the surface of the land, or where the land is covered by shallow water. He asked to the students if they knew any places that could be a wetland in Turkey. The students mentioned Tuz Gölü and Manyas Kuş Cenneti. The teacher reminded Akkaya Dam and passed to the importance of wetlands. He gave some information on the fact that wetlands are among the world's most productive environments. They are important for biological diversity; they support high numbers of birds, mammals, reptiles, amphibians, fish and invertebrate species. Wetlands are also important for plant species. For instance, rice, which is a common nutrient for humanity, is a wetland plant. He also stated that the interactions of physical, biological and chemical components of a wetland, such as soils, water, plants, and animals, enable wetlands to perform many vital functions; for instance: water storage, storm protection and flood mitigation, shoreline stabilization and erosion control, and stabilization of local climate conditions, particularly rainfall and temperature. The teacher also pointed out the economic benefits of wetlands; such as water supply, fisheries, agriculture, energy resources, and transport and tourism opportunities. He also stated that these functions and values can only be maintained if the ecological features of wetlands are protected. On the other hand, in recent decades wetlands became the most threatened ecosystems in the world because of pollution and over- exploitation of their resources. He closed the session by mentioning the need for sustainable utilization of wetlands talking about the fact that humanity should use wetlands so that it may give the greatest continuous benefit to present generations without loosing its potential to meet the needs of future generations.

4.5.2. Problem Based Learning with a non local problem (PBL1 Group)

First experimental group was taught by problem based learning for four weeks. The general subject, as for the traditional lecture, was “Why do ecosystems change?” and the problem set for this group was the declining environmental conditions of Manyas Lake, which is known as one of the RAMSAR sites of wetlands of international importance. At the beginning of the implementation, the groups, representing an Environmental Conservation Council, are formed. A letter which includes the details of the problem and the expectations from the council was given to each group. The students were asked to analyze the problem and they were given problem and research plan sheets. They were expected to determine and write down the known parts of the problem and the parts to be searched to find the appropriate solution. The students were asked to search on the topics they determined in the lesson. Then, brainstorming sheets were delivered. They discussed the findings and agreed on the reasons and results of the problem and the most appropriate solution strategies. Each was written on the brainstorming sheets which were analyzed later for the research purposes. As a last step, each group presented their work to the class (Table 4.4).

Table 4.4 PBL1 lecture

	Subject	Content	Technique(s) used
1st week	RAMSAR Convention and wetlands	Definition of wetlands, Importance of wetlands, Ramsar Convention on wetlands, Sustainable use of wetlands	Group work
2nd week	Environmental Problems of Manyas Lake	Ecosystem equilibrium	Problem Based Learning
3rd week	Reasons of the problems and possible solutions	Industrialization, Population Growth, Human Based Degradation	Problem Based Learning
4th week	Presentation of the work and discussion	Sustainable use of natural resources	Problem Based Learning

4.5.2.1. Treatment Procedure for PBL1 Group:

Problem Based Learning was implemented for four sessions for four weeks. The details are presented below.

1st week: RAMSAR sites and wetlands

In the first session, groups were formed. Then, the brochure about RAMSAR (appendix 1) was given to each group. Students are asked to work on the brochure and determine the most important parts. After the students finished working, the class discussed the importance of wetlands as a whole.

2nd week: ***Let's ask to Environmental Conservation Council***

In the second session, the teacher explained that each group demonstrates an Environmental Conservation Council and will try to solve an environmental problem throughout the following 3 sessions. The teacher distributed the letter (appendix 3.1.1.) which contains the details of the problem and the expectations from the council to each group. The letter was starting with an opening paragraph addressing the council members and explaining that the members are expected to examine the given information on ecological condition of Manyas Lake taken from the newspapers and state their comments and suggestions on the possible solution strategies. The students seemed to like the idea of being a member of an Environmental Conservation Council. After all of the groups finished examining the letters, the teacher distributed the problem and research plan sheets (appendix 3.2.1). The sheets included the possible dimensions of a research such as; reasons of pollution, results of pollution, effects of pollution on biological diversity, effect of pollution on human health and responsibilities of local people and local government as a guide, and also a table that students are expected to write down known parts of the problem and the parts that should be searched to propose a solution. The groups worked on the sheets and determined what to search and shared the duties.

3rd week: ***Environmental Conservation Council at work***

At the beginning of the third session, the teacher distributed the brainstorming sheets (appendix 3.3.1) to the groups. The sheets included a chart that students could write down their opinions on the reasons of the problem, results of the problem and their solution suggestions. The teacher explained what is expected from the groups and stated that each group should choose a speaker to present their work briefly to the class next lesson. The students shared their individual work with the group members, discussed them and agreed on the most appropriate

solution strategies as a group. They wrote down their solution suggestions and chose their speaker.

4th week: ***Environmental Conservation Council brings solution***

In the last session, each group's speaker presented their work to the class mostly followed by a brief class discussion. At the end of the lesson, the teacher wrote down the most mentioned reasons, results and solution suggestions to the blackboard.

4.5.3. Problem Based Learning with a local problem (PBL2 Group)

In the experimental group, Problem Based Learning with the use of a local problem is implemented for four sessions for four weeks. The local problem is set out to be the declining ecological condition of Akkaya Dam, the results of which directly or indirectly affect the sample.

PBL2 group was taught by problem based learning with the use of a local environmental problem, results of which directly affect the sample, for four weeks. The general topic was "Why do ecosystems change?" and the problem of the PBL was the declining environmental conditions of Akkaya Dam which is defined as one of the RAMSAR list of wetlands of international importance. At the beginning of the implementation, groups each of which represents an Environmental Conservation Council were formed. A letter which includes the details of the problem and the expectations from the council was given to each group. The students analyzed the problem and the problem and research plan sheets were delivered. They were expected to determine and write down the known parts of the problem and the parts to be searched to raise an appropriate solution to the problem. The students were asked to search on the topics they determined in the lesson. Then, brainstorming sheets were delivered. They discussed the findings

and agreed on the reasons and results of the problem and the most appropriate solution strategies. Each was written to the brainstorming sheets which were analyzed later for the research purposes. As a last step, each group presented their work to the class (Table 4.5). The design of the lectures is the same with the PBL1 Group, yet the problem is chosen to be a local one.

Table 4.5 PBL2 lecture

	Subject	Content	Technique(s) used
1st week	RAMSAR Convention and wetlands	Definition of wetlands, Importance of wetlands, Ramsar Convention on wetlands, Sustainable use of wetlands	Group work
2nd week	Environmental Problems of Akkaya Dam	Ecosystem equilibrium	Problem Based Learning (local)
3rd week	Reasons of the problems and possible solutions	Industrialization, Population Growth, Human Based Degradation	Problem Based Learning (local)
4th week	Presentation of the work and discussion	Sustainable use of natural resources	Problem Based Learning (local)

4.5.3.1. Treatment Procedure for PBL2 Group:

Problem Based Learning with a local problem was implemented for four sessions for four weeks. The details are presented below.

1st week: ***RAMSAR sites and wetlands***

In the first session, groups of 6 people were formed. Then, each group was given a brochure about RAMSAR (appendix 1). Students are asked to work on the brochure and determine the most important parts. After the students finished working, the class discussed the importance of wetlands as a whole.

2nd week: ***Let's ask to Environmental Conservation Council***

In the second session, the teacher explained that each group demonstrates an Environmental Conservation Council and will try to solve an environmental problem throughout the following 3 sessions. Each group were supplied the letter (appendix 3.1.2) which contains the details of the problem and the expectations from the council to each group. The letter was starting with an opening paragraph addressing the council members and explaining that the members are expected to examine the given information on ecological condition of Akkaya Dam taken from the newspapers and state their comments and suggestions on the possible solution strategies. After all of the groups finished examining the letters, the teacher distributed the problem and research plan sheets (appendix 3.2.2.). The sheets included the possible dimensions of a research such as; reasons of pollution, results of pollution, effects of pollution on biological diversity, effect of pollution on human health and responsibilities of local people and local government as a guide, and also a table that students are expected to write down known parts of the problem and the parts that should be searched to propose a solution. The groups worked on the sheets and determined what to search and shared the duties.

3rd week: ***Environmental Conservation Council at work***

At the beginning of the third session, the teacher distributed the brainstorming sheets (appendix 3.3.2) to the groups. The sheets included a chart that students could write down their opinions on the reasons of the problem, results of the problem and their solution suggestions. The teacher explained what is expected from the groups and stated that each group should choose a speaker to present their work briefly to the class next lesson. The students shared their individual work with the group members, discussed them and agreed on the most appropriate ones as a group. They wrote down their solution suggestions and chose their speaker.

4th week: ***Environmental Conservation Council brings solution***

In the last session, each group's representative presented their work to the class mostly followed by a brief class discussion. At the end of the lesson, the teacher wrote down the most mentioned reasons, results and solution suggestions to the blackboard.

4.6. Instrumentation

The instruments used in the study are two fold. Environmental Attitude Questionnaire (EAQ) was used to test the students' environmental awareness, attitude and social responsibility and 2 worksheets were used to test the variability and quality of the students' answers.

4.6.1. Environmental Attitude Questionnaire (EAQ)

A 31 item 6-point likert type questionnaire (appendix 2) was used as pretest and posttest to determine the students' environmental awareness, attitude and social responsibility. The questionnaire was based on the one used by Tuncer, Ertepınar,

Tekkaya and Sungur (2005), which was originally developed from Herrera's (1992) Questionnaire of Environmental Beliefs.

Some of the items that are not related to the content of this study were eliminated from the questionnaire, and some new items pointing the targets of this research were added. The validity of the questionnaire was assured by taking the views of three professionals about the relevancy of each item. The internal consistency of the scale was assessed via a pilot study and Cronbach alpha internal consistency for the test was found to be $r = .72$.

The questionnaire consists of 3 basic dimensions namely general awareness (GAW), awareness of individual responsibility (AIR) and general attitudes toward solutions (GAS) (Table 4.6).

The target of the general awareness dimension is to determine the students' general awareness of the environmental problems and their opinions about the effects of these problems on their future.

The target of the general attitudes toward solutions dimension is to determine the students' opinions on the solutions.

Lastly, the target of the awareness of individual responsibility dimension is to determine the students' opinions on their responsibilities and the relation between the problems and lifestyles.

Following table summarizes the dimensions of the questionnaire:

Table 4.6 Dimensions of the questionnaire

Dimensions	Target	Example Questionnaire Item
Dimension 1: General Awareness (GAW)	Determine students' general awareness of the environmental problems and their opinions about the effects of these problems on their future.	Item no13: We are overloading the Earth's natural ability to support life on earth.
Dimension2: Awareness of Individual Responsibility (AIR)	Determine students' awareness on their responsibilities and the relation between the problems and lifestyles.	Item no 5: Environmental protection is a governmental responsibility.
Dimension3: General Attitudes toward Solutions (GAS)	Determine students' attitudes toward solutions for the environmental problems.	Item no 15: Science and technology are advancing so rapidly that it will always be in control of any environmental problems that arise.

4.6.2. Worksheets

The worksheets were designed by the researcher as a part of the PBL1 and PBL2 lecture designs for research planning, brainstorming and encouraging discussion. As a second target, they were used to assess the variability and quality of the students' answers and satisfaction of the process of PBL in the two experimental groups. The sheets include the opinions of students on the reasons and results of

the declining environmental conditions of the related area and their suggestions for possible solutions.

The first worksheet included the students' ideas about the known parts of the problem and the parts that should be searched to reach a solution.

The second worksheet included a chart that the students could write their opinions on the reasons, results and possible solutions of the related problem as a group.

Following table summarizes the primary and secondary targets of the worksheets.

Table 4.7 Targets of the worksheets

	Target as an instructional material	**Target as an instrument**
Worksheet 1	Helping students plan their research	Assessing the understanding of students Assessing the quality of PBL process,
Worksheet 2	Encouraging discussion and brainstorming in the group	Assessing the understanding of students Assessing the quality of PBL process

CHAPTER 5

RESULTS

In this chapter, results of the study will be presented in two sections comprised of; results of descriptive statistics of data, and results of inferential statistics followed by the sections; students' suggestions for the related environmental problem and summary of results.

5.1. Descriptive Statistics

Table 5.1 shows the descriptive information related to general environmental awareness, awareness of individual responsibility, general attitude toward solutions, for the control group and two experimental groups.

As presented in Table 5.1, in terms of prior general environmental awareness, prior awareness of individual responsibility and prior general attitude toward solutions are considered, PBL1 group students appeared to have lower mean scores than the other two groups.

Table 5.1. Descriptive Statistics

	N	Minimum	Maximum	Mean	Std.Deviation	Skewness		Kurtosis	
	Statistic	Statistic	Statistic	Statistic	Statistic	Statistic	Std.Error	Statistic	Std.Error
Prior General Environmental Awareness	95	1,36	4,82	3,46	,68	-,51	,24	,25	,49
Prior Awareness of Individual Responsibility	95	1,70	4,90	3,62	,72	-,49	,24	-,41	,49
Prior General Attitude Toward Solutions	95	1,20	4,50	3,26	,69	-,22	,24	-,23	,49
Post General Environmental Awareness	92	2,10	5,00	3,59	,73	-,18	,25	-,49	,49
Post Awareness of Individual Responsibility	92	1,50	4,90	3,57	,81	-,83	,25	-,10	,49
Post General Attitude Toward Solutions	92	1,90	4,60	3,36	,67	-,08	,25	-,96	,49

One-way between groups MANOVA was conducted to determine if the observed difference between groups with respect to prior general environmental awareness, prior awareness of individual responsibility and prior general attitude toward solutions are statistically significant. Analysis of results showed that there was a statistically significant difference between groups, on the combined dependent variables: $F(6, 180)=2.11$, $p=.054$; Wilks' Lambda=.87; partial eta squared=.07. When the results for the dependent variables were considered separately, the only difference to reach statistical significance using Bonferroni adjusted alpha level of .017, was prior awareness of individual responsibility: $F(2,92)=5.51$, $p=.006$, partial eta squared=.11. An inspection of the mean scores indicated that Traditional group reported slightly higher levels of prior awareness of individual responsibility. Represented by the partial eta squared value, magnitude of the difference was not large. In order to equalize the groups with respect to prior general environmental awareness, prior awareness of individual responsibility and prior general attitude toward solutions, and to reduce the error variance arising from them, these variables were used as covariates in the study.

5.2. Inferential Statistics

Multivariate Analysis of Covariance was performed to investigate the relative effect of traditionally designed EE, Problem Based Learning with a non local problem EE, and Problem Based Learning with a local problem EE on students' general environmental awareness, awareness of individual responsibility and general attitude toward solutions after controlling for students' prior general environmental awareness, prior awareness of individual responsibility and prior general attitude toward solutions. Before conducting MANCOVA, the assumptions were checked.

5.2.1. Assumptions of Multivariate Analysis of Covariance

5.2.1.1. Sample Size

Sample size of the study was adequate to conduct MANCOVA since the cases in each cell were greater than the number of dependent variables (Pallant, 2001).

5.2.1.2. Normality and Outliers

Univariate normality is tested by checking skewness and kurtosis values of dependent variables that are shown in table 5.1. It is shown that the values are within the range of -1 and +1, which is an acceptable range (Pallant, 2001).
Multivariate normality was tested by calculating the Mahalanobis distances with a maximum value of 11.47,being lower than the critical value of 16.27, multivariate normality assumption was not violated.

5.2.1.3. Linearity

The linearity assumption is tested by generating scatterplots between each pair of the dependent variables and each of the covariates. Although, the scatterplots do not show a perfect linear relationship, it can be assumed that the assumption is not seriously violated.

5.2.1.4. Multicollinearity and singularity

The strength of the correlations among the dependent variables are calculated to be; .66, .46 and .57. Since the variables are not strongly correlated, this assumption is not violated.

5.2.1.5. Homogeneity of variance-covariance matrices

The Box's M significant value of .016 of Box's test of equality of covariance matrices test shows that this assumption is not violated.

Moreover, Homogeneity of variance assumption was assessed by using Levene's test. Results showed that there was a violation of homogeneity of variance assumption for the dimension awareness of individual responsibility. On the other hand, a more conservative alpha level of .01 was used for determining significance for this variable.

5.2.1.6. Homogeneity of Regression Slopes

This assumption was tested by checking whether there is statistically significant interaction between the treatment and the covariate. The results showed that there was no interaction between the covariates and the treatment. The significance value for general environmental awareness found to be .78, for awareness of individual responsibility it is .81 and for general attitude toward solutions it is .48.

In summary, the assumptions of MANCOVA were checked and the results showed that there was no serious violation of the assumptions.

5.2.2. Multivariate Analysis of Covariance (MANCOVA)

Hypothesis: There is no statistically significant mean difference between students taught by traditional method, Problem Based Learning with a non local problem, and Problem Based Learning with a local problem after controlling for their prior environmental attitude.

A multivariate analysis of covariance was performed to investigate the effect of traditional method, Problem Based Learning with a non local problem, and Problem Based Learning with a local problem on students' general environmental awareness, awareness of individual responsibility and general attitude toward solutions when students' prior general environmental awareness, prior awareness of individual responsibility and prior general attitude toward solutions are controlled respectively.

Results of MANCOVA

A one way between groups multivariate analysis of covariance was performed to investigate group differences in environmental attitude. Three dependent variables were used: general environmental awareness, awareness of individual responsibility and general attitude toward solutions. The independent variable was the method used for each group. Participants' scores on the pre-intervention administration of general environmental awareness dimension of the Environmental Attitude Questionnaire were used as the covariate in this analysis. Preliminary assumption testing was conducted and no serious violation is noted.

There was a statistically significant difference between groups on the combination of dependent variables: $F(6,168)=5.84$, $p=.00$; Wilk's Lambda=.69; partial eta squared=.17. When the results for the dependent variables were considered separately, the differences reach statistical significance were general environmental awareness: $F(2,89)=8.30$; $p=.00$, partial eta squared=.16; awareness of individual responsibility: $F(2,89)=14.25$; $p=.00$, partial eta squared=.25; and general attitude toward solutions : $F(2,89)=4.20$; $p=.02$, partial eta squared=.09. An inspection of the pairwise comparisons indicated that for general environmental awareness, PBL2 group reported higher levels of general environmental awareness than both PBL1 group ($p=.00$) and TRD group ($p=.03$); for awareness of individual responsibility, PBL2 group reported higher levels of awareness of individual responsibility than PBL1 group ($p=.00$) and TRD group reported higher levels of awareness of individual responsibility than PBL1 group ($p=.00$); for general attitude toward solutions: PBL2 group reported higher levels of general attitude toward solutions than both PBL1 ($p=.01$) and TRD ($p=.02$) groups.

Estimated mean scores for each group for the variable post general environmental awareness is given in table 5.2. and figure 5.2.

Table 5.2. Estimated mean scores for each group for the variable post general environmental awareness

Group	N	Mean	Std. Deviation
TRD	29	3.60	.53
PBL1	31	3.25	.64
PBL2	32	3.95	.78

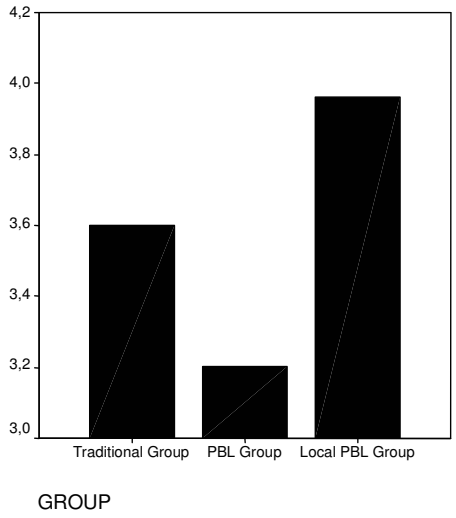


Figure 5.2. Estimated mean scores for each group for the variable post general environmental awareness

Estimated mean scores for each group for the variable post awareness of individual responsibility is given in table 5.3. and figure 5.3.

Table 5.3. Estimated mean scores for each group for the variable post awareness of individual responsibility

Group	N	Mean	Std. Deviation
TRD	29	3.71	.56
PBL1	31	3.02	.91
PBL2	32	3.97	.51

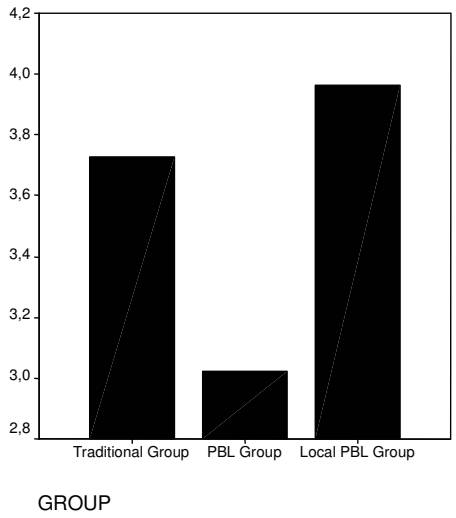


Figure 5.3. Estimated mean scores for each group for the variable post awareness of individual responsibility

Mean scores for each group for the variable general attitude toward solutions is given in table 5.4. and figure 5.4.

Table 5.4. Estimated mean scores for each group for the variable general attitude toward solutions

Group	N	Mean	Std. Deviation
TRD	29	3.22	.61
PBL1	31	3.20	.70
PBL2	32	3.62	.62

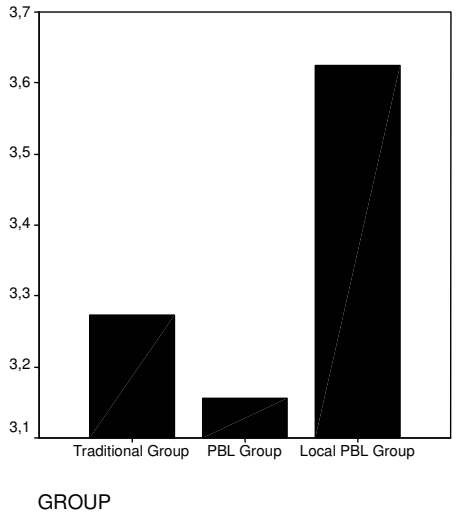


Figure 5.4. Estimated mean scores for each group for the variable general attitude toward solutions

To sum up, for each dimension of the questionnaire the order of the groups from highest mean scores to lowest mean scores was same, that is; PBL2, TRD, PBL1. On the other hand, the significant differences were between the PBL2 and PBL1 groups for each dimension in the favor of PBL2 group. Moreover, PBL2 group had more positive attitude than TRD group for the dimensions general environmental awareness and general attitude toward solutions. In addition, TRD group was significantly had more positive attitude than PBL1 group according to their awareness of individual responsibility.

5.3. Students' Suggestions for the Related Environmental Problem

Two worksheets were used to assess the process of experimental groups. These worksheets reveal the students' opinions on the possible solutions to the related environmental problem. There were 6 groups in PBL1 group and 5 groups in PBL2 group. All of the sheets are examined to reveal the given solutions and their percentages in each group. Following table shows the common proposed solutions and the percentages of each solution mentioned in the related instructional group (PBL1 and PBL2).

Table 5.5. Students' suggestions for solutions

Solutions	PBL1 Class %	PBL2 Class %
Preventing over irrigation	33.3	-
Forbidding hunting	100	100
Controlling refineries	66.7	100
Constructing observation towers	-	60
Afforestation	16.7	80
Constructing shelters for birds	-	40
Transfer of water from another source	83.3	-
Encouraging tourism	-	40
Reminding the local government about their responsibilities	16.7	100
Increasing the awareness of local people	16.7	80
Increasing the awareness of individual responsibilities	-	40

As it can be seen from Table 5.5, PBL2 group students' solutions are more variable and most of the proposed solutions are mentioned with a greater percentage than PBL1 group students. The original sheets are available in appendices 4 and 5.

5.4. Summary of Results

The purpose of the current study was to investigate relative effectiveness of traditionally designed environmental education (TRD), problem based learning with a non local problem (PBL1), and problem based learning with a local

problem (PBL2) on students' general environmental awareness, awareness of individual responsibility and general attitude toward environmental solutions.

Before the treatment, Environmental Attitude Questionnaire was administered to all groups to determine students' prior environmental attitude. Pre-test results were used to examine the equality of the groups in their general environmental awareness, awareness of individual responsibility and general attitude toward environmental solutions. The analysis showed that the groups were similar in their general environmental awareness, and general attitude toward environmental solutions. On the other hand, a significant difference was found between groups in their awareness of individual responsibility. To equalize groups, these variables were chosen to be covariates. During the treatment, the topic "Why do ecosystems change?" was taught to the TRD group with traditionally designed instruction, to the PBL1 group with problem based learning by the use of declining environmental conditions of Manyas Lake as the problem and to the PBL2 group with problem based learning by the use of declining environmental conditions of Akkaya Dam, which is a local place, as the problem. During the treatment, two worksheets were used by the students of PBL1 and PBL2 groups in their group work. These worksheets were analyzed for research purposes later. After the treatment, Environmental Attitude Questionnaire was implemented to all groups to determine if the related treatments had changed students' scores. It is revealed that the order of the groups from highest mean scores to lowest mean scores was same for each dimension of the questionnaire, that is; PBL2, TRD, PBL1 On the other hand, the significant differences were between the PBL2 and PBL1 groups for each dimension in the favor of PBL2 group. Moreover, PBL2 group had more positive attitude than TRD group for the dimensions general environmental awareness and general attitude toward solutions. In addition, TRD group was significantly had more positive attitude than PBL1 group according to their awareness of individual responsibility.

Following tables summarize these results and show the related estimated mean scores for each group.

Table 6.1. Results for general environmental awareness

Mean	PBL1: 3.25	TRD: 3.60	PBL2: 3.95
Statistically significant difference	PBL2 > PBL1 PBL2> TRD		

Table 6.2. Results for awareness of individual responsibility

Mean	PBL1: 3.02	TRD: 3.71	PBL2 : 3.97
Statistically significant difference	PBL2 > PBL1 TRD > PBL1		

Table 6.3. Results for general attitude toward environmental solutions

Mean	PBL1: 3.20	TRD: 3.22	PBL2: 3.62
Statistically significant difference	PBL2 > PBL1 PBL2>TRD		

In summary, the results of the current study revealed that, students in PBL2 group had significantly more positive environmental attitudes in all three dimensions of the questionnaire, namely general environmental awareness, awareness of individual responsibility and general attitude toward solutions determined after the treatment than PBL1 group and in two dimensions of the questionnaire namely general environmental awareness and general attitude toward solutions than TRD group. Traditional group had significantly more positive attitude than PBL1 group in students' awareness of individual responsibility determined after the treatment. Moreover, PBL2 group students' solutions were more variable and most of the proposed solutions are mentioned with a greater percentage than PBL1 group students.

CHAPTER 6

DISCUSSION

This chapter includes the discussion of the results, significance of the study, implications, validity threats and limitations of the study and recommendations for further research.

6.1. Discussion

Environmental problems are one of the main problems of human being that needs to be solved for his own future and they are real life problems. Taking into account that environmental attitudes of the students from rural and urban areas differentiate in Turkey (Tuncer et. al., 2004) and owing to the belief that adding a local perspective to Problem Based Learning would enhance expected outcomes of Environmental Education, PBL2 group was formed at the beginning of the study, in parallel to the phrase stressed in Agenda 21 (1992), "think globally - act locally!". The phrase emphasizes the importance of the ecological, economic and cultural differences of our local surroundings for the solution of global environmental problems (Eblen & Eblen, 1994). The crucial need of local adjustments for countries and regions is also stressed in Agenda 21 (1992).

The results showed that PBL2 group differed positively from PBL1 significantly for all dimensions and from TRD for general environmental awareness and general attitude toward solutions dimensions, in the favor of PBL2 group. This result supports that PBL with a local problem is better in developing students' general environmental awareness, awareness of individual responsibility and general attitude toward environmental solutions than PBL with a non local problem.

Moreover, it shows that PBL with the use of a local problem is better in developing students' general environmental awareness and general attitude toward environmental solutions than the traditional method.

Although there is little research on the effects of using local problems in environmental education, the result of this study that PBL2 group had significantly more positive attitudes than PBL1 group for each dimension namely; general environmental awareness, awareness of individual responsibility and general attitude toward environmental solutions, is consistent with the previous research. Fisman in his study also showed that a neighborhood EE program is efficient in increasing students' awareness. (Fisman, 2005)

Moreover, PBL2 group students' proposed solutions in the worksheets are more variable and most of the proposed solutions are mentioned with a greater percentage than PBL1 group students. This result is consistent with the previous research which shows that a bond with a known place enriches the environmental knowledge and concern (Vaske & Kobrin, 2001). The core point of this result might be the bond between the theoretical knowledge and students' real life that is constructed by selecting local environmental problems for the problem of PBL lessons. In detail, most of the students in this study had encountered the given local problem prior to the lesson in their individual lives; heard about the problem from their parents, saw the condition of the dam, smell the stench, or probably even bought or sell some poisonous fish. Therefore, they might perceive the problem more concrete than any other one experienced away from them. In addition, another reason for the variability and frequency of the solutions mentioned by PBL2 group students could be the fact that people tend to perceive local issues as more significant and tangible than the global ones (Duan& Fortner, 2005). The dam stands opposite the school. Hence, it might be more convincing that they are the people who have a chance to change the condition. This might let them perceive the situation more significant and tangible.

Since the literature shows that PBL has positive effects on the expected results of EE, the method in this study was chosen to be Problem Based Learning. Problem Based Learning improves content knowledge, student interest and awareness about the environmental issues (Iangen & Walsh, 2006). Watson also showed in 2004 that PBL is effective in improving locating knowledge from a variety of sources, integrating the new and old information, organizing the new information through mental models, transmitting knowledge to others for validation. Moreover, Earnst and Monroe, in their article in 2004, stress the positive effect of PBL on students' critical thinking abilities.

In line with the literature, it was expected to see a positive effect of PBL of both local and non local perspectives on the three dimensions of the questionnaire namely general awareness, general attitudes toward solutions and awareness of individual responsibility than traditional education. Therefore, the results that PBL1 group and TRD group just differed significantly for the dimension of awareness of individual responsibility in the favor of TRD group and PBL2 group did not differed significantly from TRD group in awareness of individual responsibility are unexpected. The reason might be that the students are used to traditional method, yet not used to PBL method. The instruction process of four weeks might not be an effective time interval for students to get used to the new methods. This could be a factor that enhances the results in the favor of TRD group, and in this wise neutralizes the statistically significant differences. The advantage of PBL2 group that makes it better than PBL1 and TRD might be the characteristic that it stresses a local problem which may overcome the disadvantages of being a new method. Moreover, at the beginning of the study, the traditional group reported higher levels of awareness of individual responsibility than the other groups. Although the variable was used as a covariate to equalize the groups, the two unexpected results accumulated in the dimension of awareness of individual responsibility might be caused by this inequality.

In sum, this study added a local component to Problem Based Learning to create a bond with a known place, in other words to create a bridge between the theoretical

knowledge and real life. According to the results, Problem Based Learning, which is shown to be effective in fulfilling the most of the expected yields of Environmental Education in the literature, is experimentally found to be a more powerful tool when combined with a local perspective to meet the objectives of Environmental Education in 7th grade students in Niğde. Owing to the results of this study and the related literature that recommends Problem Based Learning and local action for effective Environmental Education and shows the differentiation of regions of Turkey, it appears that integrating Problem Based Learning with a local perspective in Environmental Education curriculum in Turkey would be successful. It is suggested that this research results supported with much more comprehensive and agelong further research to reveal the possible positive effect of this method in Turkey.

6.2. Conclusion

Environmental problems have been troubling human being for centuries and becoming more serious and urgent as time goes on. This is one of the main problems of human being that needs to be solved for his own future. Few issues are so crucial, yet troubling and time-consuming to solve. Moreover, it is one of the crucial issues whose solution is directly related with education. It is obvious that instantaneous solutions never worked with this issue. As stressed in Agenda 21 (1992), the actions taken should be sustainable. Based upon this idea, education should create a society with knowledge, awareness, positive attitudes, and responsibility whose yields would be much more action-based and permanent than the yields of an informed society. How should be Environmental Education formed to achieve these outcomes?

In parallel to the phrase stressed in Agenda 21 (1992), “Think globally- act locally!”, there is not a global action plan for the environmental problems around us. The phrase refers to the argument that global environmental problems could be successfully handled if the ecological, economic, and cultural differences of our local environment are considered (Eblen & Eblen, 1994) .Agenda 21 (1992), also

states that countries and regions should specify their own priorities according to their specific needs and stresses that the adjustment to the local needs is crucial.

Moreover, people generally do not perceive global issues as 'real' until they personally encounter it. Constructing a bond with a known place enriches the environmental knowledge and concern (Vaske & Kobrin, 2001).

In light of these ideas; an environmentally educated person could think globally, having the understanding of the relationship between the local and global perspectives, while having the characteristics that are needed to take action locally.

Therefore, environmental education might be formed to create a society which has knowledge, awareness and positive attitude to think globally, and has abilities of critical thinking, decision making and taking responsibility for taking action locally.

Turkey is a country where each region differentiates from the other. The country contains different geographical characteristics, climates, different lifestyles and cultures. In a study in Turkey, it is shown that environmental attitudes of the students from rural and urban areas differentiate (Tuncer et. al., 2004). These findings support the possible effectiveness of an environmental education with a local perspective. However, the curriculum in Turkey does not support a local perspective in environmental education.

Therefore, on the basis of the fact that this study shows Problem Based Learning with a local perspective is more effective in developing 7th grade students' general environmental awareness, awareness of individual responsibility and general attitude toward solutions than Problem Based Learning with a non local perspective; this study recommends the implementation of a combination of the method of Problem Based Learning, which is claimed to be effective in the literature in creating most of the mentioned outcomes, and a local perspective which brings a component of concrete reality, as an effective tool for successful

Environmental Education. However, more detailed and comprehensive research should be done to assess the effectiveness and implementation strategies of Problem Based Learning with a local perspective for Environmental Education in elementary grades.

6.3. Significance of the Study

In Turkey, the students seem to have positive attitudes toward environment, yet when it comes to the meaning of the concepts constitute this attitude; they are unclear (Tuncer et al., 2005).Moreover, environmental attitudes of the students from rural and urban areas differentiate (Tuncer et. al., 2004). These results stresses the need for serious EE research with a local perspective and applications in elementary grades in Turkey to construct an environmental education curriculum that could fill this gap between the abstract concepts and actual meaning for developing sound positive attitudes in children.

Thus, in line with the recent developments in the literature and the state of the EE application in Turkey, the current study is designed to apply PBL with a local perspective, as an effective tool for developing environmental awareness, attitude and social responsibility among 7^{th} grade students. It is found in this study that using a local environmental problem, results of which directly affects the sample, as the problem of PBL approach in EE, gives more positive results than a non local PBL approach in developing 7^{th} grade students' general environmental awareness, individual responsibility and general attitude toward solutions.

Therefore, the uniqueness of the study comes from its feature that the problem used for PBL is a local one.

6.4. Implications of the Study

One of the main goals of education is to raise people who are able to adopt knowledge and skills for handling real life problems to enhance their life which

requires meaningful learning. To achieve this goal, curriculums are becoming more student-oriented. The environmental problems are the very initial troubles of human being nowadays and environmental education is being stressed more in the curriculums. The core idea of the required education to achieve these goals might be to help students gain a sense of environment, specifically general awareness of the problems, awareness of individual responsibility and general attitudes toward solutions which are the dimensions measured in this study.

The literature shows that through handling ill-structured real life problems, generating and testing hypothesis, trying to produce solutions, students achieve a meaningful learning with Problem Based Learning. This study showed that PBL becomes more efficient with the use of a local problem since the bond between the knowledge and a known place enhances the concern coherent with the related literature.

In Turkey, the curriculum is newly designed to include many hands on activities. Moreover, it comprises more objectives for environmental education than the previous one. According to the results of this study and the related literature, it is recommended that environmental education be given through PBL with the use of local problems since it brings more general awareness of the problems, awareness of individual responsibility and general attitudes toward solutions. The students should be encouraged first to start thinking on the problems they encounter each day to reach a whole understanding of the global ones.

6.5. Validity Threats of the Study and Limitations

6.5.1. Internal Validity

In the study, intact classes were used which prevented random assignment of each student to the groups. Yet, the control and experimental groups were assigned randomly to the classes.

The questionnaire data was implemented by a single teacher to overcome instrumentation threat. Moreover, the purpose of the study was clearly stated to the teacher and the students.
Implementation threat was prevented by training the teacher.

Prior knowledge was a possible threat to this study. In an attempt to equalize the control and experimental groups, prior knowledge was used as covariate.

The last possible threat was history. Since environmental issues are frequently covered in the mass media, the subjects might encounter some sort of educative material. Yet, since the sample is random, the possibility of such a threat affecting each group differently is low.

6.5.2. External Validity of the Study

In the present study, 95 7^{th} grade students from one school were involved. This can be a potential threat to external validity. The findings can be generalized to the school settings that have the same conditions with the one in the study.

6.5.3. Limitations

The sample of the study, being 95 7^{th} grade students in Niğde Atatürk Elementary School, is a small sample. Only one grade level from one school attended the study. This limits the generalization of the study. The results of the study for other grade levels and especially for other schools from different regions should be checked for generalizability.

The teacher knew about PBL, yet had never implemented a PBL based lesson. He was educated by the researcher on how to implement PBL. The results of the study might have been affected by the different experience levels of the teacher on traditional and PBL methods, in the favor of traditional group. On the other hand, implementing the lessons with a teacher who has well experience in PBL would be

a limitation factor for the generalization and applicability of the study, in Turkey standards.

The implementation time interval was 4 weeks which may not be enough for children to get used to a new method. This might have affected the success of children in the favor of traditional group students.

The experimental group students' presentations of their work were not recorded in this study due to permission problems. Therefore, the written solutions of the students were examined. Recorded presentations would have been used for a qualitative analysis of the classroom culture created by the PBL activities.

6.6. Recommendations for Further Research

1. The same study can be repeated with a larger sample from different grade levels to assess the effectiveness of PBL with local problems in different grade levels.

2. The same study can be repeated with a larger sample from different schools and regions. Including schools from different regions in the study, with including different problems from each region might increase the generalizability of the study.

3. The same study can be repeated with a longer implementation time interval between pretest and posttest to eliminate the risk of effect that the students can not become accustomed to the new method.

4. The students can be video taped while they are working and presenting their ideas, to examine the communication and development of ideas in the groups.

5. PBL (with a local problem) can be compared to other teaching methods.

REFERENCES

Agenda 21 – Agenda for Change (1992). Retrieved February 12, 2008 from http://www.iisd.org/rio+5/agenda/agenda21.htm

İHA, Akkaya Barajı Korumaya Alınıyor (2005). Retrieved June 6, 2007 from http://www.kenthaber.com/Arsiv/Haberler/2005/Agustos/23/Haber_80227.aspx

Albanese, M., & Mitchell, S. (1993). Problem-Based Learning: A Review of the Literature on Its Outcomes and Implementation Issues. *Academic Medicine. 68(1),* 52-81.

Baptiste, A. K., (2006). *Environmental Awareness and Concern of rural wetland communities, Trinidad*. Retrieved April 12, 2007 from http://www.einaudi.cornell.edu/LatinAmerica/student/pdf/Baptiste.pdf

Barrows, H. S. (1985). *How to design a problem-based curriculum for the preclinical years*. NY: Springer, p.3.

Barrows, H.S., Tamblyn R.M. (1980). *Problem-based learning: An approach to medical education.* New York: Springer Publishing Company, p.1.

Bor, Ö. F., (2005). Kuşlar Kaçtı. Hürriyet. Retrieved June, 17 2007 from http://hurarsiv.hurriyet.com.tr/goster/haber.aspx?id=335182&yazarid=42

RAMSAR convention on Wetlands (1971). *The Criteria for Identifying Wetlands of International Importance.* Retrieved April 12, 2007 from http://www.ramsar.org/about/info2007-05-e.pdf.

Dahlgren, M. A., Castensson, R., Dahlgren, L. O. (1998). PBL from the Teachers' Perspective. *Higher Education,* 36, 437-447.

Demircioğlu, G. (2005). Niğde'de Kuş Gribine Karşı Önlem. Ntvmsnbc. Retrieved June, 12 2007 from http://www.ntvmsnbc.com/news/345053.asp?cp1=1

Dewey, J. (1966). *Democracy and education*. New York: Free Press. p.229.

Duan, D., Fortner, R.W. (2005). Chinese College Students' Perceptions About Global Versus Local Environmental Issues. *Journal of Environmental Education, 36*(4), 23-58.

Eagles, P., Demare, R. (1999). Factors Influencing Children's Environmental Attitudes. *Journal of Environmental Education, .30*(4), 33-37.

Edwards, S., Hammer, M. (2005). Laura's Story: Using Problem Based Learning in Early Childhood and Primary Teacher Education. *Teaching and Teacher Education, 22*, 465–477

Ernst, J.A., Monroe, M. (2004).The Effects of Environment Based Education on Students' Critical Thinking Skills and Disposition toward Critical Thinking. *Environmental Education Research, (10)* 4, 507-522.

Gürer, Ö. F. (2005). Cennete Veda Etmeyelim. Kenthaber. Retrieved June, 12 2007 fromhttp://www.kenthaber.com/Arsiv/Haberler/2005/Haziran/15/Haber_68567.aspx

Hungerford, H., Peyton, R.B., Wilke, R. J. (1980). Goals for Curriculum Development in Environmental Education. *Journal of Environmental Education*, 11(3), 42-47.

Hungerford, H., Volk, T. (1990). Changing Learner Behavior through Environmental Education. *Journal of Environmental Education, 21(3),* 153-166.

Iozzi, L.A. (1989). What a Research Says to the Educator Part One: Environmental Education and the Affective Domain. *Journal of Environmental Education, 20*(3)*,* 3-9.

Jonassen, D. H. (2000). Toward a design theory of problem solving. *Educational technology research & Development*, *48*(4), 63-85.

Karafistan, A., Çolakoğlu A. F. (2005). Physical, Chemical and Microbiological Water Quality of the Manyas Lake, Turkey, *Mitigation and Adaptation Strategies for Global Change*, 10, 127-143

Karakaya, K. (2004). Akkaya Baraj Gölü Atık Deposu Oldu. Akşam. Retrieved July, 20 2007 from http://www.arkitera.com/v1/haberler/2004/06/14/akkaya.htm

Koballa, T. R., Jr., & Crawley, F. E. (1985). The Influence of Attitude on Science Teaching and Learning. *School Science and Mathematics, 85(3)*, 222-232.

Kumar, M., Kogut, G. (2006). Students' Perceptions of Problem Based Learning. *Teacher Development. 10*(1), 105-116.

Leeming, F. C., Dwyer, W.O., Porter, B. E., Cobern, M. K. (1993). Outcome Research in Environmental Education: A Critical Review. *Journal of Environmental Education, .24(* 4), 8-21

Littledyke, M. (2004). Primary Children's views on Science and Environmental Issues: Examples of Environmental Cognitive and Moral Development. *Environmental Education Research*, *10*(2), 217-235

Loughland, A., Reid, A., Walker, K. & Petocz, P. (2003). Factors Related to Young People's Conceptions of Environment. *Environmental Education Research 9*(1), 3-20.

McCrea, E. J., The Roots of Environmental Education: How the Past Supports the Future. Retrieved February, 02 2007 from http://www.naaee.org/about-naaee/history-final-3-15-06.pdf/

Moyer, R.H. (1975). An Investigation of Factors Influencing Environmental Attitudes. *School Science and Mathematics,* .3, 266-269.

Myers, Jr. O. E., Saunders, C. D. & Garrett, E. (2003). What do children think animals need? Aesthetic and psycho-social conceptions. *Environmental Education Research 9*(3), 305-325.

Oliver, R., Herrington, J. (2000). Using Situated Learning as a Design Strategy for Web-based learning. *Instructional and Cognitive Impacts of Web-based Education*, (pp.178- 191) Hershey, PA: Idea Group Publishing.

Overbaugh, R. C., Lin S. Y. (2005). Problem Based Learning and Fourth Grade: Who Really Benefits? *The Constructivist. 16(*1)

Pallant, J. (2001) *SPSS Survival Manual*. Buckingham, Philadelphia. Open University Press.

Peterson, T. O. (2004). So You're Thinking of Trying Problem Based Learning?: Three Critical Success Factors for Implementation. *Journal of Management Education. 28(* 5), 630-647.

Shepardson, D. P. (2005). Student Ideas: What is an Environment? *Journal of Environmental Education,* 36(4), 49-58.

Stapp, W. B. (1969). The Concept of Environmental Education. *Journal of Environmental Education, 1(*1), 30-31.

Stevens, J. (1996) Applied Multivariate Statistics for the Social Sciences (3rd edition). Mahway, NJ: Lawrence Erlbaum.

Sungur, S., Tekkaya, C. (2006). Effects of Problem-Based Learning and Traditional Instruction on Self-Regulated Learning. *Journal of Educational Research*, *99(*5), 307-318.

Sungur, S., Tekkaya, C., Geban, Ö. (2006). Improving Achievement through Problem-Based Learning. *Journal of Biological Education*, *.40(* 4), 155-160.

Tiwari, A., Lai, P, So, M., Yuen, K. (2006). A Comparison of the Effects of Problem-Based Learning and Lecturing on the Development of Students' Critical Thinking. *Medical Education*, *40(*6), 547-554(8).

Torp L. & Sage S. (2002). *Problem-based learning for K–16 education*. VA: Association of Supervision and Curriculum Development. 15-16

Tuncer, G., Ertepinar, T., Tekkaya, C., Sungur, S. (2005). Environmental Attitudes of Young People in Turkey: Effects of School Type and Gender. *Environmental Education Research*, *11(* 2), 215–233.

UNESCO-UNEP, 1978. *The Belgrade Charter: A Global Framework for Environmental Education* Retrieved April, 12 2007 from http://portal.unesco.org/education/en/file_download.php/47f146a292d047189d9b3 ea7651a2b98The+Belgrade+Charter.pdf

UNESCO-UNEP, 1992. *Rio Declaration on Environment and Development* Retrieved April 12, 2007 from http://www.unep.org/Documents.Multilingual/Default.asp?DocumentID=78&ArticleID=1163

Vaske, J. J., Kobrin, K. C. (2001). Place Attachment and Environmentally Responsible Behavior. *Journal of Environmental Education*, 32*,* 16-21.

Watson, G. (2004). Integrating problem-based learning and technology in education, Enhancing thinking through problem-based learning approaches (Singapore, Thomson Learning).

Wicks, D. (2001) NAAEE, Thirty years of History 1971 to 2001. Retrieved April 12, 2007 from http://naaee.org/aboutnaaee/naaeehistory2001.pdf

Xue, X., Hong, H., Zhang, L., Xu, X., Shen, S.S. (2006). Developing Public Environmental Education: Improving Community-Based Environmental Management. *Aquatic Ecosystem Health and Management, 9,* 105–110.

Zsóka, Á. N., (2006) Dimensions of corporate environmental awareness – gaps and factors behind. Retrieved April 12, 2007from http://www.vito.be/erscp2005/documents/papers/PAPER058.PDF

APPENDICES

Appendix A.Worksheet: Ramsar Sözleşmesi ve Sulak Alanlar

RAMSAR SÖZLEŞMESİ VE SULAK ALANLAR

Ramsar Sözleşmesi Nedir?

1971 yılında birçok ülke tarafından İran'da imzalanan Ramsar Sözleşmesi, tüm sulak alanların korunmasına birincil öncelik sağlanması, sulak alan ekosistemlerindeki biyolojik çeşitliliğin sürdürülmesi yönünde gerekli önlemlerin alınması yönünde imzalanmış önemli bir sözleşmedir. Ramsar Sözleşmesi'ne Türkiye 1993 yılında imza attı. Türkiye'de 19'u önemli olmak üzere 250'yi aşkın sulak alan sözleşme kapsamına alındı.

Ramsar Sözleşmesi neleri gerektirir?

- İnsan ve çevresinin karşılıklı bağımlılıklarını tanımak;
- Sulak alanların temel ekolojik fonksiyonlarının, su rejimlerini düzenlemek ve karakteristik bitki ve hayvan topluluklarının,

özellikle su kuşlarının yaşama ortamlarını desteklemek olduğunu göz önüne almak;

- Sulak alanların ekonomik, kültürel ve bilimsel olarak büyük bir kaynak teşkil ettiğine ve kaybedilmeleri halinde bir daha geri getirilemeyeceğine inanmak;
- Sulak alanların giderek artan şekilde kaybına sebep olacak hareketleri şimdi ve gelecekte durdurmayı istemek;
- Su kuşlarının mevsimsel göçleri sırasında sınırlar aşabildiğini ve bu yüzden uluslararası bir kaynak olduğunu tanımak;
- Sulak alanların ve onlara bağlı bitki ve hayvan topluluklarının korunmasının, ileri görüşlü ulusal politikalarla, koordineli uluslararası faaliyetlerin birleştirilmesi yoluyla sağlanacağından emin olarak hareket etmek.

Sulak Alan nedir? Neden önemlidir?

Su kaynaklarımızın başında sulak alanlar gelir. Bataklıklar, turbalıklar, taşkın düzlükler, nehirler, göller, tuzlalar, mangrovlar, deniz çayırı yatakları,mercanlar, gelgit anında altı metreden derin olmayan deniz kıyısı alanları gibi kıyı sulak alanları, atık su arıtım gölcükleri ve rezervuarlar gibi insan yapımı sulak alanlar da sulak alan tanımına dahildir.

Sulak alanlar biyolojik çeşitlilik açısından önemli olmalarının yanında, içme suyu sağlama, taşkın kontrolü, yeraltı sularının beslenmesi, sediman ve besin depolama; iklim değişikliğinin kontrolü; balıkçılık, tarım, ve turizm olanakları sağlar.

Sulak alanlar, doğal servetimizin bir parçasıdır.

Türkiye'deki Sulak Alanların Durumu

Tatlı su ekosistemleri, yeryüzündeki toplam su varlığının %1'inden azını kaplamasına karşın, dünyadaki tüm canlı türlerinin %40'ını barındırır. Sulak alanlarımız;

• Yeni tarım, yerleşim ve eğlence alanları açmak için kurutulmakta ya da zarar görmekte,

• Gereğinden fazla yapılan tarımsal sulamalar ya da sulak alanları dikkate almadan tasarlanan su yönetim projeleri sebebiyle kurumakta,

• Evsel ve endüstriyel atıklarla kirletilmekte ve doldurulmakta,

• Üreme dönemlerinde ve yasaklanmış usullerle yapılan avcılık ve balıkçılık nedeniyle bozulmaktadır.

Türkiye`de son 40 yıl içerisinde yaklaşık 1.300 bin hektar sulak alan; kurutma, doldurma ve su sistemlerine müdahaleler nedeniyle ekolojik ve ekonomik özelliğini yitirmiştir. Türkiye'deki toplam sulak alanların 2,5 milyon hektar olduğu düşünüldüğünde, son 40 yılda sulak alanlarımızın yarısını kaybettiğimizi söyleyebiliriz.

Tuz gölü, Beyşehir gölü, Meke gölü, Sultansazlığı ve Manyas gölü, Türkiye'deki önemli sulak alanlardandır.

Bu broşürdeki bilgiler Türkiye Doğal Hayatı Koruma Vakfı Türkiye Sulak Alan Raporu (2006)'dan alınmıştır.

Appendix B. *Questionnairre:*

Sevgili Öğrenciler,

Bu anket sizin çevre sorunları ile ilgili düşünce ve davranış biçimlerinizi ölçmek amacı ile hazırlanmıştır. Bu sorulara vereceğiniz yanıtlar, araştırma amacıyla kullanılacak ve gizli tutulacaktır.
Yardımlarınız için teşekkür ederiz.

Selcen İşeri

1. Bölüm: Kişisel Bilgiler

1. Cinsiyetiniz: ❑ Kız ❑ Erkek

2. Doğum tarihiniz (yıl): _____

3. Sınıfınız ve şubeniz: _____

4. Not ortalamanız : _____

5. Annenizin eğitim durumu: ❑İlkokul ❑Ortaokul ❑Lise ❑Üniversite ❑Yüksek Lisans ❑Doktora

6. Babanızın eğitim durumu: ❑İlkokul ❑Ortaokul ❑Lise ❑Üniversite ❑Yüksek Lisans ❑Doktora

7. Daha önce çevre ile ilgili bir çalışmaya katıldınız mı? ❑Evet ❑Hayır

Aşağıda çevre sorunlarına yönelik düşünceler göreceksiniz. Belirtilen ifadelere ne derecede katıldığınızı ya da katılmadığınızı ilgili seçeneği işaretleyerek belirtiniz.

1= Kesinlikle Katılmıyorum, 2= Katılmıyorum, 3= Kararsızım, 4= Katılıyorum, 5=Kesinlikle Katılıyorum, 6 = Bilmiyorum

2. Bölüm: Anket

	Kesinlikle Katılmıyorum	Katılmıyorum	Kararsızım	Katılıyorum	Kesinlikle Katılıyorum	Bilmiyorum
1. Dünyada çevre kirliliği tehlikeli düzeyde değildir.	1❑	2❑	3❑	4❑	5❑	6❑
2. Çevre sorunlarının çözülmesi, yaşama alışkanlıklarımızda önemli değişiklikler yapmamızı gerektirir.	1❑	2❑	3❑	4❑	5❑	6❑
3. İnsanoğlu yaşamını sürdürebilmek için doğa ile uyum içinde yaşamak zorundadır.	1❑	2❑	3❑	4❑	5❑	6❑
4. Çevre kirliliği geçici bir problemdir.	1❑	2❑	3❑	4❑	5❑	6❑
5. Çevre kirliliğini önlemek devletin sorumluluğudur.	1❑	2❑	3❑	4❑	5❑	6❑
6. Ülkelerin kendi doğal kaynaklarını istedikleri gibi kullanmalarına Birleşmiş Milletler dahil, hiçbir kurum ya da kuruluş karışmamalıdır.	1❑	2❑	3❑	4❑	5❑	6❑
7. İnsanlar adaptasyona yatkındır, bu nedenle kirlenmiş bir çevrede yaşamaları problem olmaz.	1❑	2❑	3❑	4❑	5❑	6❑

8. Çevre kirliliğinin önlenmesinde bireysel sorumluluk çok önemlidir.	1❑	2❑	3❑	4❑	5❑	6❑
9. Çevrenin korunması ekonomik büyümeden daha önemlidir.	1❑	2❑	3❑	4❑	5❑	6❑
10. Ormanların azalması ve bitkilerin yok edilmesi sadece ağaçları değil, orada yaşayan hayvanları ve tüm çevreyi yok etmektir.	1❑	2❑	3❑	4❑	5❑	6❑
11. Yaşam tarzımızda değişiklik yapmayı doğal kaynakların yok olmaması için kabul edebiliriz.	1❑	2❑	3❑	4❑	5❑	6❑
12. Çevre sorunları her zaman vardır ve çözülmektedir, bu nedenle gelecekle ilgili kaygı duymaya gerek yoktur.	1❑	2❑	3❑	4❑	5❑	6❑
13. Dünya'nın canlı yaşamını desteklemekle ilgili doğal yeteneğini aşmak üzereyiz.	1❑	2❑	3❑	4❑	5❑	6❑
14. Toplum, doğa korumacı davranışları desteklemelidir.	1❑	2❑	3❑	4❑	5❑	6❑
15. Bilim ve teknoloji, herhangi bir çevre sorununu kontrol edebilecek hızla gelişmektedir.	1❑	2❑	3❑	4❑	5❑	6❑
16. Erozyon ve çölleşme bir çevre sorunudur.	1❑	2❑	3❑	4❑	5❑	6❑
17. Çevre kirlenmesinde yaşam tarzına bağlı olarak az ya da çok herkesin sorumluluğu vardır.	1❑	2❑	3❑	4❑	5❑	6❑
18. Bilim ve teknoloji, çevre ile ilgili problemleri belirler ve çözer; bu yüzden bu konuların gelecekte önemi kalmayacaktır.	1❑	2❑	3❑	4❑	5❑	6❑

19. İnsanlık çevreyi sömürmektedir.	1❑	2❑	3❑	4❑	5❑	6❑
20. Yaşadığım ildeki çevre sorunları yerel yönetimin sorumluluğundadır.	1❑	2❑	3❑	4❑	5❑	6❑
21. Herhangi bir aktiviteyi değerlendirirken, herşeyden önce çevreye etkisini göz önünde bulundurmalıyız.	1❑	2❑	3❑	4❑	5❑	6❑
22. Dinozorlar doğal nedenler yüzünden yok oldu ama, deniz kaplumbağalarının sayılarının azalmasının nedeni insanlardır.	1❑	2❑	3❑	4❑	5❑	6❑
23. Çevreci grupların koruma çalışmalarına katılmayı gerekli buluyorum.	1❑	2❑	3❑	4❑	5❑	6❑
24. Önümüzdeki birkaç yıl içinde çevre sorunları sona erecektir.	1❑	2❑	3❑	4❑	5❑	6❑
25. Ülkemizde nesli tükenmekte olan birçok bitki ve hayvan türü bulunmaktadır.	1❑	2❑	3❑	4❑	5❑	6❑
26. Çevre sorunlarının büyük bir bölümü halkın çevre konusunda yeterli bilince sahip olmamasından kaynaklanmaktadır.	1❑	2❑	3❑	4❑	5❑	6❑
27. Türkiye'nin endüstrileşmeye gereksinimi vardır, bu durumda endüstrileşmenin neden olduğu çevre kirliliği göz ardı edilebilir.	1❑	2❑	3❑	4❑	5❑	6❑
28. Denizler insan etkisi olmasa da içinde yüzülemeyecek kadar kirli hale gelebilirdi.	1❑	2❑	3❑	4❑	5❑	6❑
29. Yaşadığım ildeki çevre sorunlarının çözümüne katkıda bulunabileceğimi düşünüyorum.	1❑	2❑	3❑	4❑	5❑	6❑

30. Avcılık yasaklanması gereken bir uğraştır.	1❑	2❑	3❑	4❑	5❑	6❑
31. Türlerin yok olmasının en önemli nedenlerinden biri yaşam alanlarının yok edilmesidir.	1❑	2❑	3❑	4❑	5❑	6❑

Appendix C. Sheets:

C. 1. Letters used in PBL1 and PBL2 groups

C. 1. 1. Letter for PBL1 group:

Sayın Çevre Koruma Konseyi üyeleri,

Ekteki belgeler Balıkesir'de bulunan Manyas Gölü' nün önemini ve gölde ciddi bir kirlenme olduğunu açıkça ortaya koymaktadır. Bu kirlenmenin önlenebilmesi ve gölün eski haline kavuşması için araştırma ve önerilerinize ihtiyaç duymaktayız.
Manyas Gölü'nün ekolojik durumu ve göldeki kirlenmenin önlenmesi için neler yapılması gerektiği konusundaki düşüncelerinizi içeren raporunuzu Sayın Can Aşır'a teslim etmenizi rica ederiz.
Saygılarımızla.

Kuş zenginliği M.Ö 500'lü yıllara dayandığı bilinen, Ramsar'ın uluslararası önem taşıyan sulak alanlar listesinde bulunan Manyas Kuş Cenneti, dünyada kuşların göç yolları üzerinde konaklama ve beslenme alanı olarak önemli bir konumda bulunuyor. Halen Avrupa'da nesli tükenmiş sekiz tür ile birlikte yaklaşık 266 kuş türüne ev sahipliği yapan Kuş Cenneti'nde, 66 tür kuş da kuluçkaya yatıyor. Kuş Cenneti'nde barınan türler arasında, karabatak, gri balıkçıl, kaşıkçı, su tavuğu, tepeli pelikan, beyaz balıkçıl, gece balıkçılı, çeltikçi, su bülbülü ve üveylim önde geliyor. Manyas Kuş Cenneti, kuşlar tarafından emniyet, barınma, gıda ve iklim şartlarının elverişli olması nedeniyle tercih ediliyor.

Manyas Kuş Cenneti çöle döndü (3 Nisan 2007)

Küresel ısınmaya bir kanıt da Manyas Kuş Cenneti'nden geldi. Manyas'ta sular ilk defa kuşların göç etmeye başladığı mart ayında çekildi. Göçten gelen binlerce pelikan toprak alanda kuluçkaya yatmak zorunda kaldı. En az iki metre su yüksekliğinin bulunması gereken tepeli pelikanların yuvalarının bulunduğu bölgede hiç su kalmazken karabatak kuşları da, geçen yıl su içinde olan ve içinde yuvalarının bulunduğu söğüt ağaçlarının karada olması nedeniyle henüz kuluçkaya yatmadı. Kuş Cenneti Muhtarı Mehmet Ekin, göldeki seviyenin geçen yılın temmuz ve ağustos ayındaki düzeyde bile olmadığını belirterek "Maalesef küresel ısınma bu yıl Türkiye'yi de etkiledi" dedi.

Avrupa Konseyi tarafından tabiatın en iyi korunduğu yerlere verilen "A sınıfı" Avrupa diploması ile ödüllendirildi uzun yıllar boyunca. Ama Bandırma'da birbiri ardına kurulan fabrikalar, sadece Bandırma Körfezi'ni değil, Manyas Kuş Cenneti'ni de mahvetti. Körfezde yaşayan balık tabiatı yok oldukça, ağaçlar kurumaya başlayınca, göç eden kuşlar vazgeçtiler Manyas'a gelmekten. Birkaç kuş sürüsünün dışında uğrayan kalmadı. (2004)

Balıkesir'deki Manyas Kuş Cenneti sakinleri, yağışsız geçen kışın mağduru oldu.

Su seviyesi düşen kuş cennetinde, birçok kuş türü kuluçkalama sürecinde sorun yaşıyor. Önceki yıllarda su içindeki ağaçlara ve sazlıklara yuva yapan kuşlardan bazıları bu kez toprak üstünde kuluçkaya yattı.

Yetersiz yağış nedeniyle Manyas Gölü'nde su seviyesi bir buçuk metreye yakın düştü. Bu da kıyılarda su çekilmesi demek. Su çekilmesinden en çok etkilenen de kuş cenneti sakinleri oldu.

Manyas Kuş Cenneti, her mart ayında uzun yolculuklarından dönen göçmen kuşlara kuluçkaya yatmaları için en uygun ortamı sunuyordu. Kuşlar, su içindeki ağaç ve sazlıklarda rahatlıkla kuluçkaya yatıyordu. Ancak durum bu yıl farklı.

Yağışsız geçen kış göçmen kuşları hayal kırıklığına uğrattı. Kuş cennetinde alışılan ortam yoktu. Normalde su içindeki çardaklara yuva yapan göç pelikanları bu kez toprak alanlarda kuluçkaya yattı.

Karabatak kuşları da geçen yıl yuva yaptıkları söğüt ağaçlarının artık su içinde olmaması nedeniyle hala kuluçkaya yatamadı. Gri balıkçıl ve kaşıkçı kuşlarının yuva yapacakları ağaçlar da karada kaldı.

Kuş cennetinin bu durumu yeni yavrular için tehlike yaratıyor. Yırtıcı hayvanlar su içinde olmadığı için kuşları öldürebiliyor.

Manyas Kuş Gölü'nde Sığırcı Deresi ile kuzeyden, yani Bandırma tarafından gelen kirlilik baskısı devam ediyor. Kuşların önemli barınma, kışlama ve üreme alanı olan bu deltada, geçmişte DSİ'nin gölün güney bölüme etki eden baraj çalışması sonucu su seviyesi yükselmişti ve Avrupa Konseyi tarafından iyi korunan milli parklara verilen "A sınıfı diplomanın geri alınması söz konusu olmuştu. Bu süreçte, gölün kuzeyindeki söğütlük kurumuş, yeniden dikilen söğütler yeni yeni büyümeye başlamıştır. Manyas Gölü, alana yapılan su müdahalelerinin geri dönülmesi çok zor, pahalı ya da imkansız sorunlara yol açabildiğini gösteriyor.

Doğal dengeyi korumak için göllere su pompalanacak

Türkiye'de sulak alan ve göletlerin küresel ısınmaya da bağlı olarak yavaş yavaş kuruması Devlet Su İşleri Genel Müdürlüğü'nü (DSİ) harekete geçirdi. Su seviyesi azalan göller ve kuruyan sulak alanlarda doğal denge dışarıdan su pompalanarak korunacak. Küresel ısınma ve mevcut kaynakların verimli kullanılmaması nedeniyle sulak alanların kurumaya başlayarak göllerde su seviyesinin azalması, DSİ' yi yeni projeler geliştirmeye zorluyor. Söz konusu alanlarda doğal dengenin korunmasını isteyen DSİ, hazırladığı projeleri tek tek hayata geçiriyor. Balıkesir'de halen inşaatı süren Manyas Barajı'nın tamamlanmasının ardından Manyas Gölü'ndeki ekolojik dengenin korunması için su takviyesi yapılacak. DSİ' den yapılan açıklamada, suya muhtaç diğer sulak alanlar için de 2007'de çeşitli projeler hazırlanacağı ifade edildi.

C.1.2. Letter for PBL2 Group:

Sayın Çevre Koruma Konseyi üyeleri,

Ekteki belgeler ilimizde bulunan Akkaya Barajı' nın önemini ve barajda ciddi bir kirlenme olduğunu açıkça ortaya koymaktadır. Bu kirlenmenin önlenebilmesi ve barajın eski haline kavuşması için araştırma ve önerilerinize ihtiyaç duymaktayız. "Akkaya Barajı'nın ekolojik durumu" ve "barajdaki kirlenmenin önlenmesi için neler yapılması gerektiği" konusundaki düşüncelerinizi içeren raporunuzu Sayın Can Aşır'a teslim etmenizi rica ederiz.

Saygılarımızla.

Uluslar arası sulak alan ilan edilen Akkaya Barajı çevresinde ağaçlandırma çalışması hazırlığı içinde olduklarını belirten yetkililer, 2 kilometrelik göl kenarının kuşların konaklamaları ve yuva yapmaları için ağaçlandırılacağını söyledi.Ayrıca, kuşların korunması ve yaşam alanlarının bozulmaması için baraj çevresinin tel örgüyle çevrilmesi, bölgenin kontrol altında tutulması, kaçak avcılığın önlenmesi ve baraja gelen kuşların izlenebilmesi için gözlem kulelerinin oluşturulması,ve baraja akan evsel ve sanayi atıklarının tamamının arındırılması çalışmalarının yapılandırılması kararları alındı.

Balık katliamına miniklerden protesto

Niğde'nin Akkaya Baraj Gölü'nde binlerce balık cansız halde su yüzüne vurdu. Göldeki balık katliamını öğrenen Vali Refik Arslan Öztürk, İl Sağlık Müdürlüğü'ne talimat vererek bölgede derhal inceleme yapılmasını istedi.

Bazı atıklarının bırakıldığı Bor İlçesi'ndeki Akkaya Baraj Gölü'nde binlerce irili ufaklı balık cansız olarak su yüzüne ve kıyıya vurdu. Niğde Valiliği balık ölümleriyle ilgili inceleme başlattı.

Balıkların yanı sıra, göl üzerindeki çeşitli cinslerdeki kuşların da öldüğü görüldü. Atıkların yaydığı kimyasal maddelerden zehirlenmiş olabileceği öne sürülen balıkların durumuna dikkat çekmek isteyen Gazi ile Behzat Ecemiş İlköğretim Okulu öğrencileri, göle giderek önlem alınmasını istedi.

AKKAYA BARAJI'NDA SU SEVİYESİ DÜŞTÜ

Kısa bir süre önce "Uluslararası Sulak Alan" ilan edilen ve göçmen kuşlarının göç yolu üzerinde bulunan Akkaya Barajı'ndaki su seviyesinin düşmesi, yetkilileri sevindirdi. Tarımsal sulamada kullanılan baraj suyunun yüzde 80 oranında azalması yetkilileri endişelendirse de, Kuş Gribi tehlikesinin önlenebilmesi için doğal bir tedbir olarak değerlendiriliyor.

Barajdaki su seviyesinin normallerin altında kalmasının en önemli doğal tedbir olduğunu belirten yetkililer, bu aylarda Türkiye'ye Artvin üzerinden girmesi beklenen leylek, pelikan, flamingo, karabatak, balaban, alaca, ördek, Sibirya kazı ve dikkuyruk kuşlarının barajdaki su seviyesinin düşmesi nedeniyle konaklama imkanlarını azaltacağını ve olası tehlikenin Niğde'yi pas geçeceğini düşündüklerini kaydetti.

Niğde Valiliği'nin hazırladığı rapora göre, atık suların akıtıldığı Akkaya Barajı, insan sağlığını tehdit ediyor. Bölgede tifo, kolera, dizanteri hatta kanser vakalarına rastlanabileceği, barajdaki kirliliğin, hayvan ve bitki varlığını da tehlikeye attığı açıklandı.

Niğde Kongresi Çevre ve Orman çalışma grubundaki komisyon üyelerinin hazırladığı raporda, baraj göletinin, evsel, sanayi ve endüstriyel atık deposu haline geldiği belirtilen raporda şu görüşlere yer verildi:

'Kimyasal madde birikimi, bitki örtüsüyle birlikte toprağın kimyasal yapısını değiştirmekte, biyolojik ve kimyasal kirliliği yeraltı sularına bulaştırmaktadır. Tehlikenin kaynağı, gölete atık sularını boşaltan işletme ya da kurumlardır. Önlem alınmazsa tifo, kolera, dizanteri, hepatit ve kanser salgını başlayabilir. Hayvan ve bitki varlığı da tehlike altında.'

Kuşlarkaçtı

AKKAYA Barajı'na bu yıl ilk kez göç eden kuşlar bölgeyi terk ediyorlar. Çünkü baraj sulama ve buharlaşmayla suyunu çekti. Çayır, çimen ortaya çıkınca kuşların konakladığı alanlara biçerdöverler, traktörler girdi. Atıkların Akkaya'ya boşaltılmasından vazgeçilmesine rağmen, arıtma tesisi düzenli olarak faaliyet göstermediği için değişen bir şey olmadı. Şu an baraj çevresinde 54 tane flamingo, 4 tane dikkuyruk ve 2 adet kırlangıç kaldı. Su kaynağına ek olarak yeni su girdisi sağlanamazsa Niğde'nin bir kuş cenneti olamayacak.

Akkaya Barajı Uluslararası Sulak Alan ilan edildi

Niğde-Bor karayolu üzerinde bulunan ve göçmen kuşlardan flamingo ile endemik kuş türlerinden dikkuyruk kuşlarının konaklama yeri olan Akkaya Barajı, Çevre ve Orman Bakanlığı uzmanlarının baraj ve çevresinde yaptıkları incelemeler sonrası hazırladıkları raporlara göre, Ramsar Sözleşmesi'nin 2. kriterine karşılık gelen Endemik Kuş Türü ve Popülasyonu Barındırma maddesi gereği Uluslararası Sulak Alan ilan edildi ve uluslararası anlaşmalar ile koruma altına alındı.

Karar üzerine Niğde Vali Yardımcısı Metin Borazan başkanlığında toplanan Niğde Belediyesi, Niğde Üniversitesi, İl Çevre ve Orman Müdürlüğü, İl Tarım Müdürlüğü ve Devlet Su İşleri Müdürlüğü yetkililerden oluşan komisyon baraj ve çevresinin korunması için alınması gereken tedbirleri görüştü.

Toplantı sonunda Akkaya Barajı'nın korunmasıyla ilgili olarak kuşların korunması ve yaşam alanlarının bozulmaması için baraj çevresinin tel örgüyle çevrilmesi, bölgenin kontrol altında tutulması, kaçak avcılığın önlenmesi ve baraja gelen kuşların izlenebilmesi için gözlem kulelerinin oluşturulması, baraja akan evsel ve sanayi atıklarının tamamının arındırılması ve kuşların barınması için ağaçlandırma çalışmalarının yapılandırılması kararları alındı.

NİĞDE'nin, Bor İlçesi'ndeki Akkaya Barajı'nda son aylarda farklı bir değişim yaşanıyor. İlk kez baraj çevresinde değişik tür kuşların göçü var. Kayseri Sultan Sazlığı ve Tuz Gölü bölgesine giden kuşlar bu kez Akkaya'ya göç ettiler.

Baraj 2003'te, kirlenme sonucu balıkların ölmesiyle gündeme gelmişti. Bu kez kuşlar bölgede dokuyu değiştirdi. Dik Kuyruk, Flamingo, Deniz Kırlangıcı, Angıt gibi 100'e yakın kuş göç ettiği baraj çevresinde hiçbir önlem alınmayınca sapanı ile ava meraklı çocuklar, çoban köpeğini yanına katıp baraj kenarına giden vatandaşlar kuşlara zarar vermeye başladı. Kuşların bıraktıkları yumurtalar tahrip edildi. Acil önlem alınıp bölgenin korunması gerekiyor. Yoksa yuvaları, yumurtaları tahrip olan ve bazıları da avlanan hayvanlarla önemli bir doğa dengesinin ışıkları daha sönecek. Kuş cenneti olmaya aday bölge için yetkilileri konuya duyarlı olmaya çağırıyorum

C.2. Problem and Research plan Sheets:

C.2.1. Problem and Research plan Sheet for PBL1 Group:

Problem:

Aşağıdaki konuları esas alarak, Manyas Gölü'ndeki kirlenme düzeyini ve önlenmesi için neler yapılması gerektiğini nasıl belirleyebiliriz?

- Manyas Gölü'ndeki kirlenmenin nedenleri
- Manyas Gölü'ndeki kirlenmenin sonuçları
- Manyas Gölü'ndeki kirlenmenin biyolojik çeşitliliğe etkisi
- Manyas Gölü'ndeki kirlenmenin insan sağlığına etkisi
- Yerel yönetim ve halkın sorumlulukları

Bilinenler:	Araştırılması gerekenler:
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

C.2.2. Problem and Research plan Sheet for PBL2 Group:

Problem:

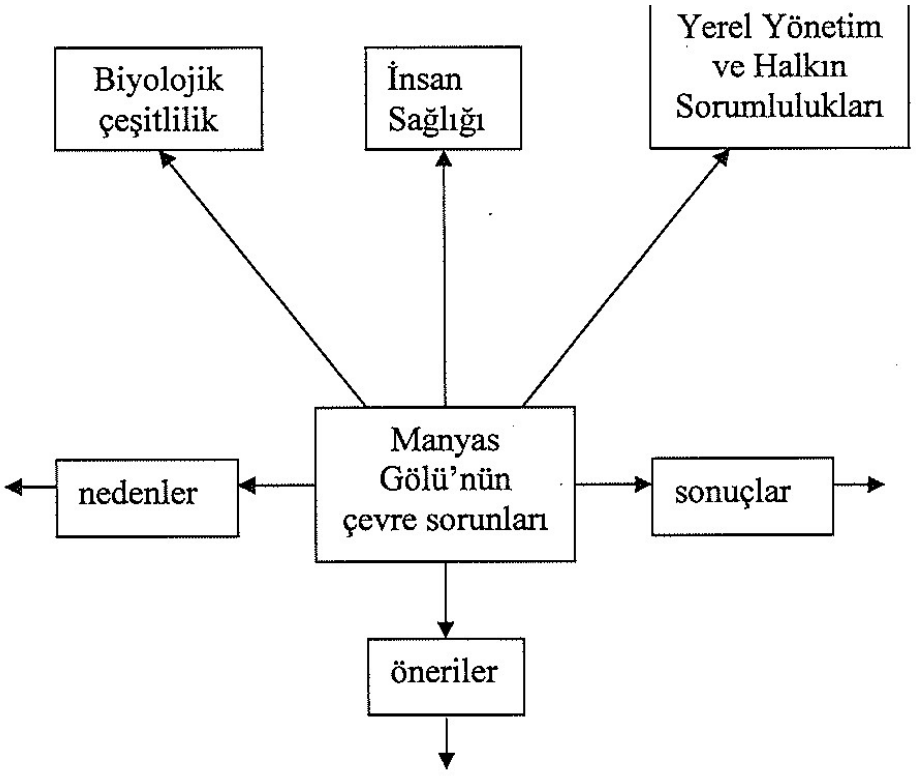
Aşağıdaki konuları esas alarak, Akkaya Barajı'ndaki kirlenme düzeyini ve önlenmesi için neler yapılması gerektiğini nasıl belirleyebiliriz?

- Akkaya Barajındaki kirlenmenin nedenleri
- Akkaya Barajındaki kirlenmenin sonuçları
- Akkaya Barajındaki kirlenmenin biyolojik çeşitliliğe etkisi
- Akkaya Barajındaki kirlenmenin insan sağlığına etkisi
- Yerel yönetim ve halkın sorumlulukları

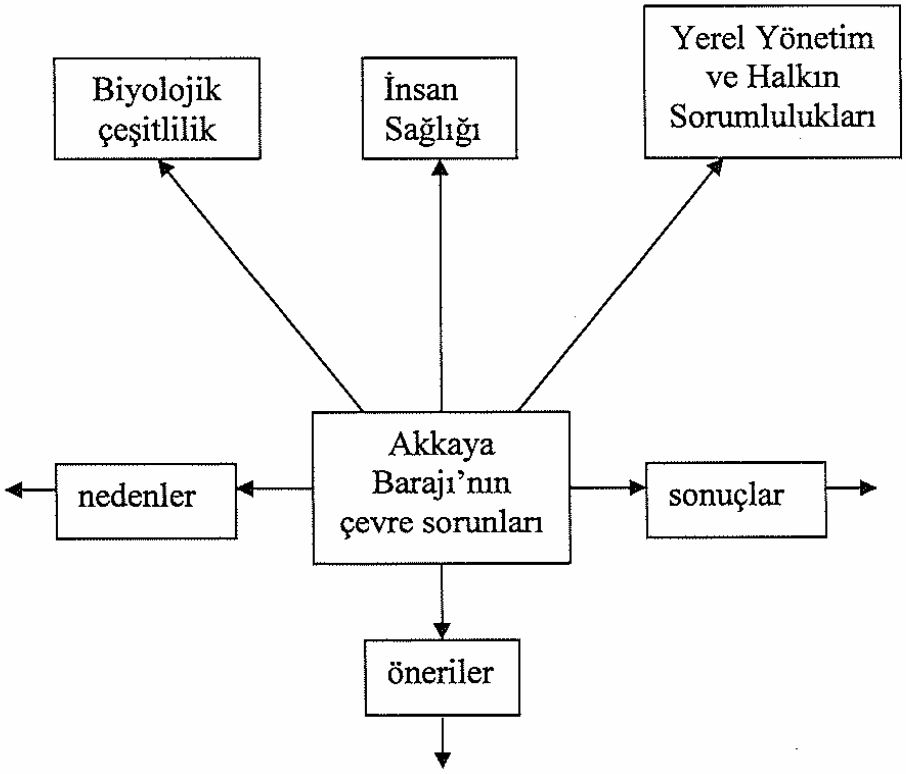
Bilinenler:	Araştırılması gerekenler:
1.	1.
2.	2.
3.	3.
4.	4.
5.	5.
6.	6.
7.	7.
8.	8.
9.	9.
10.	10.

C.3. Brainstorming Sheets

C.3.1. Brainstorming Sheet for PBL1 Group



C.3.2. Brainstorming Sheet for PBL2 Group



Appendix D. Examples of Sheets

D.1. Examples of Problem and Research Plan Sheets for PBL1 Group

Problem:
Aşağıdaki konuları esas alarak, Manyas Gölü'ndeki kirlenme düzeyini ve önlenmesi için neler yapılması gerektiğini nasıl belirleyebiliriz?

- Manyas Gölü'ndeki kirlenmenin nedenleri
- Manyas Gölü'ndeki kirlenmenin sonuçları
- Manyas Gölü'ndeki kirlenmenin biyolojik çeşitliliğe etkisi
- Manyas Gölü'ndeki kirlenmenin insan sağlığına etkisi
- Yerel yönetim ve halkın sorumlulukları
- Neler yapılması gerektiği

Bilinenler:	Araştırılması gerekenler:
1. Küresel ısınma ve az yağış almaması	1. Kuş cennetine başka yerden su aktarılması.
2. Kuşların gelmemesi. Atıkların oluşması.	2. Atıkların arındırılması ve temiz tutulması
3. Tarıma önemsizliği, suların çok kullanılması	3. Suların yeterli kadar kullanılması, tarıma önem verilmeli
4. Pislikten dolayı hastalıkların çok fazla olması. Balıkların yok olması.	4. Pisliklerin temizlenmesi hastalıkların önlenmesi.
5. Piknik alanlarında pislikleri oralarda bırakmamalıyız.	5. Piknik alanlarında bıraktığımız pislikler toplamalı ve çöpe atmalıyız
6. Temiz tutulmalı. Çöpleri oralarda bırakmamalıyız.	6. Bıraktığımız takdirde hastalıkların daha fazla olması.
7.	7.
8.	8.
9.	9.
10.	10.
11.	11.
12.	12.
13.	13.
14.	14.

Problem:
Aşağıdaki konuları esas alarak, Manyas Gölü'ndeki kirlenme düzeyini ve önlenmesi için neler yapılması gerektiğini nasıl belirleyebiliriz?

- Manyas Gölü'ndeki kirlenmenin nedenleri
- Manyas Gölü'ndeki kirlenmenin sonuçları
- Manyas Gölü'ndeki kirlenmenin biyolojik çeşitliliğe etkisi
- Manyas Gölü'ndeki kirlenmenin insan sağlığına etkisi
- Yerel yönetim ve halkın sorumlulukları
- Neler yapılması gerektiği

Bilinenler:	Araştırılması gerekenler:
1. Ekolojik dengenin bozulması nedeniyle yağışın yetersiz olması	1. Başka bölgelerden su aktarımı
2. Çevrelerine fabrika kurulması yani arıtmasız kimyesel yükler olması	2. Fabrikalara arıtma tesisleri kurulması
3. Aşırı avlanma ve su seviyesine müdahalelerin su ürünlerini etkilemesi	3. Av yasağı
4. Küresel ısınma ve mevcut kaynakların verimli kullanılmaması	4. Halka verimli kullanımla ilgili bilgi verilmesi
5. Taşkınlarla orman ve koruların sular altında kalması	5. Suların başka tarafa aktarılıp aktarılmayacağı araştırılması
6. Hayvan çiftliği, ev atıklarının getirdiği mikrobiyolojik kirlilik	6. Kirliliğin önlenmesi için çiftçilerin uyarılması
7. Hayvanların kuluçkaya yattıkları alanların bozulması	7. Neden gelemedikleri hakkında araştırma bulunması
8.	8.
9.	9.
10.	10.
11.	11.
12.	12.
13.	13.
14.	14.

D.2. Examples of Problem and Research Plan Sheets for LPBL 2 Group

Problem:
Aşağıdaki konuları esas alarak, Akkaya Barajı'ndaki kirlenme düzeyini ve önlenmesi için neler yapılması gerektiğini nasıl belirleyebiliriz?

- Akkaya Barajındaki kirlenmenin nedenleri
- Akkaya Barajındaki kirlenmenin sonuçları
- Akkaya Barajındaki kirlenmenin biyolojik çeşitliliğe etkisi
- Akkaya Barajındaki kirlenmenin insan sağlığına etkisi
- Yerel yönetim ve halkın sorumlulukları
- Neler yapılması gerektiği

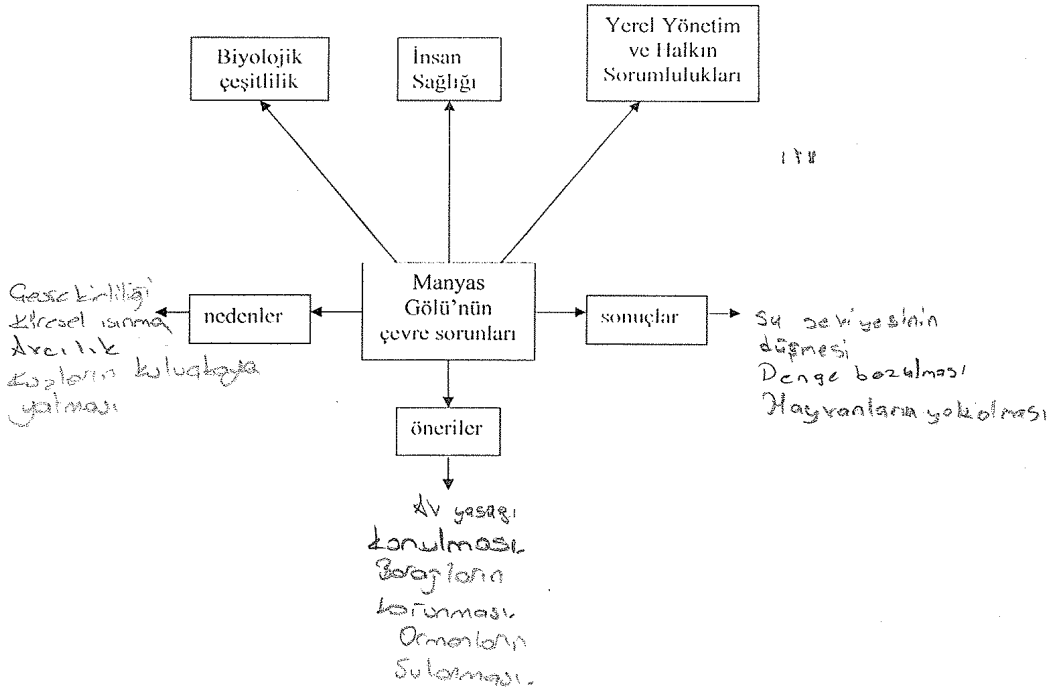
Bilinenler:	Araştırılması gerekenler:
1. Baraja akan suların kaynakları.	1. Suların içine karışan yabancı maddeler.
2. Baraj suyunda yaşayan balıkların azalması.	2. Canlıların azalmasının nedenleri.
3. Balık ve diğer ürünlerde bilinçsiz avcılık.	3. Yanlış avlanma sonucu biyolojik yok olma.
4. Baraj gölü ve çevresinin korunması gerektiği	4. Nasıl ve hangi önlemler alınabilmesi
5. Barajın su seviyesi yüksek mi düşük mü	5. Nedenlerin ayrıntıları
6. Baraj ve çevresindeki bitki örtüsü	6. Azlığının nedenleri ve yeni bitki örtüsü nasıl geliştirilebilir.
7. Baraj gölü ve çevresinde yaşayan hayvanlar	7. Kuşların ve diğer hayvanların azalma nedenleri
8. Barajların sulamada yararlanıp yararlanılmadığı	8. Sulama ve kirlenmenin insan sağlığına zararları
9. Yerel yönetimlerin baraj ve çevresi için ne yaptığı	9. Neler yapılabileceği hakkında planlama yapılması
10. Baraj ve çevresinin kuş cenneti olabilmesi.	10. Turizim açısından kuş cenneti için nasıl bir planlama gerektiği.
11. Herkes bireysel sorumluluğu üstüne almalıdır	11.
12.	12.
13.	13.
14.	14.

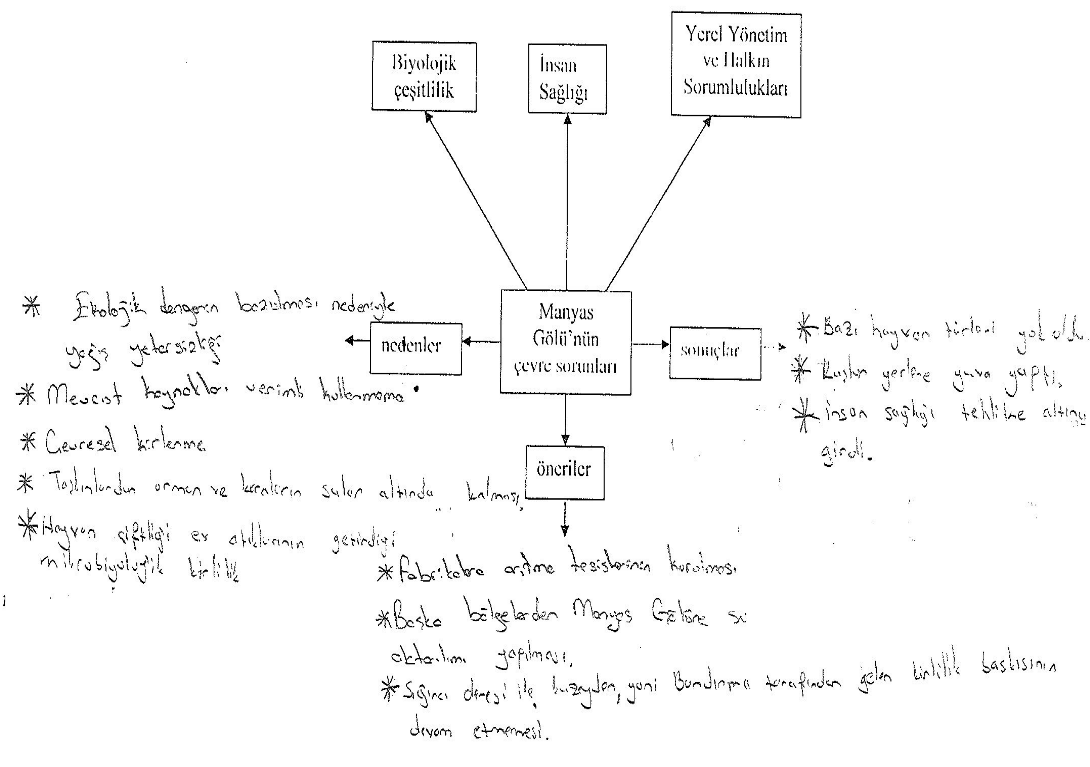
Problem:
Aşağıdaki konuları esas alarak, Akkaya Barajı'ndaki kirlenme düzeyini ve önlenmesi için neler yapılması gerektiğini nasıl belirleyebiliriz?

- Akkaya Barajındaki kirlenmenin nedenleri
- Akkaya Barajındaki kirlenmenin sonuçları
- Akkaya Barajındaki kirlenmenin biyolojik çeşitliliğe etkisi
- Akkaya Barajındaki kirlenmenin insan sağlığına etkisi
- Yerel yönetim ve halkın sorumlulukları
- Neler yapılması gerektiği

Bilinenler:	Araştırılması gerekenler:
1. Atık suların Akkaya barajına akıtılmasını engellemek.	1. Kirlenmenin biyolojik çeşitliliğe etkisi?
2. Niğde bir kuş cenneti olamayacak.	2. Endüstriyel kirliliğin toprağı ne kadar kirlettiği?
3. Hayvan ve bitki varlığı tehlikede.	3. Kimyasal attığın yeraltı sularına bulaşıp bulaşmadığı?
4. Tifo, kolera, dizanteri, hepatit ve kanser riski.	4. Atıkların nasıl temizleneceği?
5. Kuşların ve yaşam alanlarının korunması için baraj çevresi tel örgülenmeli.	5. Toprağın yeniden nasıl temizleneceği?
6. Bölgenin kontrol altında tutulması için gözlem kuleleri kurulmalı	6. Ağaçlandırma süresince kuşların nasıl konaklayacağı?
7. Baraj atıklardan temizlenip. Kuşlar için çevresi ağaçlandırılmalı	7. Hayvan ve bitki sağlığı yeniden nasıl sağlanacak?
8. Baraj çevresinde avyapılmamalı.	8. Evsel ve kimyasal atıklar nereye boşaltılacak?
9. Barajа evsel atıklar atılmamalı.	9. Kimyasal atıkları boşaltan fabrikalar cezalandırıldımı?
10. Kuş yumurtalarına zarar verilmemeli.	10. 2003 yılındaki balık ölümlerine neden olan kirlenme yaşanabilirmi
11. Acilen Akkaya barajına temiz su girişi yapılmalı.	11. Korkan ve kaçan kuşlar dönecek mi?
12. Baraj tamamen arındırılmalı.	12. Salgın hastalıklar nasıl engelenecek?
13. Kuşların konakladığı yerlere traktörler girmemeli.	13. Gerekli kurumlar işini yapıyomu?
14. Kimyasal kirlilik yer altı sularına bulaştırmamalı.	14. Kuş cenneti olan bu bölge düzeltilecek mi?

D.3. Examples of Brainstorming Sheets for PBL1 Group




Biyolojik çeşitlilik
İnsan Sağlığı
Yerel Yönetim ve Halkın Sorumlulukları
Manyas Gölü'nün çevre sorunları
nedenler
sonuçlar
öneriler
* Ekolojik dengenin bozulması nedeniyle yağış yetersizliği
* Mevcut kaynakları verimli kullanmama
* Çevresel kirlenme
* Taşkınlardan orman ve karaların sular altında kalması
* Hayvan çiftliği ev atıklarının getirdiği mikrobiyolojik kirlilik
* Bazı hayvan türleri yok oldu.
* Kuşlar yerlere yuva yaptı.
* İnsan sağlığı tehlike altına girdi.
* Fabrikalara arıtma tesislerinin kurulması
* Başka bölgelerden Manyas Gölüne su aktarılımı yapılması.
* Sığırcı deresi ile kuzeyden, yani Bandırma tarafından gelen kirlilik baskısının devam etmemesi.

D.4. Examples of Brainstorming Sheets for LPBL2 Group