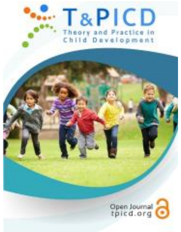

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Supporting the Use of Basic Scientific Process Skills with a Project Approach in Preschool Period: An Action Research

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ABSTRACT
The aim of this study is to examine in detail the project approach practices in preschool education and the state of supporting the use of basic scientific process skills on the water project sample. The research was modeled according to the action research design, which is one of the qualitative research methods. The study group was formed with the participation of 20 children attending the İzmir Foça Municipality Children's House 6 (60-72 months) age group, their parents, a classroom teacher, a teacher assistant and a project manager. In the water project implemented within the scope of the study, documents/products obtained from various activities of the s children such as forming a concept network through brainstorming, generating questions, producing materials, drawing graphics, making measurements and calculations, field visits, ensuring the active participation of families in the process, conducting experiments were considered as data collection tools. These documents were categorized in the context of basic scientific processes, "estimation, observation, measurement, communication, data recording/interpretation, trying/experimentation, drawing conclusions" skills and analyzed with content analysis. In the analysis of 57 activities carried out during the project, it can be said that students are looking for answers to their questions by using skills such as "estimation, observation, measurement, data recording, trying/experimentation, communication, drawing conclusions", and the project process carried out in this way greatly supports their use of basic scientific process skills and thus contributes to their scientific thinking.

KEYWORDS
Project approach; scientific process skills; preschool; education.

INTRODUCTION

The aim of contemporary education should be to raise individuals who research, question, try, produce solutions to problems, and can think scientifically while accessing information. At this point, preschool education, which is described as the golden years of human development, is of greater importance than the education given at all education levels. Children who open their eyes to the world with a great sense of curiosity observe and try with the desire to discover the environment they are in. In fact, children need to use scientific process skills in the process of discovering new information (Uludağ and Erkan, 2023). Scientific process skills are defined as the ways and methods scientists use to access and process information. Because scientists observe and classify, measure, try to draw conclusions, propose experiments and make experiments. In this context, the use of scientific process skills by students increases the permanence of learning (Lind, 1998; Lind, 2005). In other words, scientific process skills are explained as skills that constitute the roof of scientific research and support students to access information through various experiences and to expand the knowledge they have gained themselves (Kandır et al., 2012).

Therefore, it is important for preschool students to gain and develop scientific process skills with appropriate methods and techniques in order to find answers to their questions about the environment and the world they live in (Uludağ, 2019; Şahin et al., 2011). Because scientific process skills cover two processes that are continuation of each other and have a prerequisite relationship with each other. While basic skills can be acquired by students from the pre-school period, high-level integrated skills can be acquired from the second step of primary education (Doğan et al., 2009; Ergin et al., 2012). In the light of the literature, the basic scientific process skills deemed appropriate for early childhood can be listed as estimation, observation, measurement, communication, data recording/interpretation, trying/experiment and conclusion (Büyüktaşkapu, 2010; Büyüktaşkapu et al., 2012; Kefi and Uslu, 2015; Öztürk, 2016; Uludağ and Erkan, 2023; Yılmaz et al., 2018). Ministry of National Education (MEB, 2013) clearly states the necessity of acquiring basic scientific process skills in the preschool education program. Therefore, it is of great value to develop basic scientific process skills starting from preschool education (Akman 2003; Bağcı-Kılıç, 2003; Bozdoğan et al., 2006; Kefi and Uslu, 2015; Genç and Kumtepe, 2011; Pakombwele and Tsakeni, 2022).

As can be understood, preschool education includes various activities such as mathematics and science, on which the foundations of scientific process skills are laid for the primary education period (Akman et al., 2003; Kandır et al., 2013; Saçkes, 2013). In many of the early childhood approaches applied in the world today, the use of scientific process skills (Montessori, Reggio, High/Scope, Primary Years Program-PYP, Bank Street, Waldorf) is seen as one of the key features (Kefi, 2020) and the project approach is emphasized as one of them (Boz, 2017).

In this approach, in which an in-depth investigation of a subject selected according to the general interests and curiosities of the student group to which the project will be applied, students reveal a product using scientific methods and thus the foundations of future scientists are laid (Temel et al., 2003). During a qualitatively prepared project, students determine research questions by taking responsibility, taking initiative, collecting data, reporting and reaching a conclusion (Katz, 2010).

According to Helm and Katz (2001), the project approach encompasses a three-step research process that involves students seeking answers to questions they have generated on their own or with the support of their teacher or friends.

The stages of the project approach can be listed as planning and initiation, construction and implementation, presentation and termination (Katz and Chard, 2000; Helm and Katz, 2001; Katz, 1994; Roopnarine and Johnson, 2005).

The first stage is starting/planning/designing the project; at this stage, the subject is determined in line with the age, developmental characteristics, interests and curiosities of the students to whom the project will be applied. After the estimated operation plan of the project, the questions that will form the basis of the research on the project subject are determined by discussing with the students and the next stage is applied.

The second stage is the development/production/construction of the project; this stage is expressed as the heart of the project. At this stage, the process of developing the project with the students, conducting in-depth examinations on the subject and actively participating in the questions prepared in the first stage is followed.

The third stage is presentation/exhibition/termination; this stage covers the process in which students review what they have learned through documentation and end the project by sharing it with others (friends, families, other teachers) (Helm and Katz, 2001; Curtis, 2002; Temel et al., 2003; Tuğrul and Kefi, 2015).

According to Gürkan (2010), the project approach is an approach that results in products or presentations in which children work in line with their interests and curiosities on questions related to daily life, including interdisciplinary work, and the teacher plays the role of a guide and provocateur. At this point, project approach applications are a valuable opportunity. Because it is stated that the applications of the project approach conducted at home and abroad on the project approach improve students' scientific thinking skills and are effective in their problem solving, concept development, cognitive development, creativity and multi-dimensional development areas (Aslan and Köksal-Akyol, 2006; Aral et al., 2013; Kogan, 2003; Kucharski, Rust and Ring, 2005; Güven et al., 2004; Tekbıyık and Yalçın, 2013; and Üstün and Çakar, 2006; Anlıak et al., 2008; Bıçakçı, 2009; Bıçakçı and Gürsoy, 2010; Chin and Kayalvishi, 2002; Dizman and Özasman, 2010; Danyi et al., 2002; Gallick, 2000; Helm and Beneke, 2003; Helm and Katz, 2001; Katz, 1994; Tuğrul and Kefi, 2015; Kefi, 2011; Kefi et al., 2012; Şahin, and Yıldırım, 2006; Şahin et al., 2011; Pehlivanlar and Şahin, 2006; Üstün and Çakar, 2006; Ho, 2001; Angın and Arı, 2014). Well-planned project studies allow children to explore the world around them by researching, predicting, measuring, communicating with real-life experiences, in short, using scientific process skills (Katz, 2010; Katz and Chard, 2000). In their study, Pakombwele and Tsakeni (2022) state that scientific process skills can be gained when students are actively involved with child-centered methods such as exploration, games, experiments, guided exploration and similar applications. The project approach also includes a process that supports the active participation of the student in the process.

As seen in the research studies mentioned above, students can be supported to use basic scientific process skills actively through project approach practices to be carried out inpreschool education. In this context, the study is important in terms of revealing the use of project approach practices and basic scientific process skills of preschool students with an action research. From this point of view, the aim of the study is to examine the project approach practices in preschool education in detail on the water project sample, and the situation of supporting the use of basic scientific process skills. In line with the determined purpose, the problem sentence of the study was determined as; how is the students' use of basic scientific process skills in the water project, which is planned and implemented in line with the basic philosophy of the project approach?

METHOD

Model of the study

The study was designed as action research. Action research is defined as a research approach that involves collecting and analyzing data directly by the practitioner or together with a researcher to reveal problems related to the application process or to understand and solve a problem that has already arisen (Yıldırım and Şimşek, 2018).

Study Group

Action research is carried out with people directly related to the problem. Therefore, the problem addressed, the suggestions developed for the solution of the problem (purpose, sub-problems), the findings and results obtained are always related to these people (stakeholders). Since it is carried out with a specially defined, intentional group, the population and sample are generally the same in action research (Büyüköztürk et al., 2012). In line with this criterion, the participant group of the project was determined from the institution kindergarten where the researcher worked as a manager. Accordingly, a study group was formed with the participation of 20 children who attended the Foça Municipality Children's House 6 age group, their parents, a classroom teacher, a teacher assistant and a project manager.

Demographic characteristics of the study group

20 children participating in the study consist of 11 girls and 9 boys. The parents of the children in the study group are in the 25-35 age range. Educational status of mothers; 11of them are undergraduate graduates, 7 of them are high school graduates and 2 of them are primary school graduates. The educational status of the fathers of the students is as follows; 13 of them are

undergraduate graduates, 6 of them are high school graduates and 1 of them is primary school graduates.

Ethical permission

Before the implementation process of the project started, a letter was sent to the families of the children who would participate in the study and detailed information was given. Necessary ethical permissions were obtained from the families to examine and publish the photos, videos, pictures made by the children, etc. to be taken during the project implementation process. Likewise, the children in the project group were discussed, informed about the process, and their permission was obtained.

Data collection tools

It is considered appropriate to use complementary data collection methods together, if possible, to reach more reliable and valid results in action research, and to provide diversification, also known as enrichment, in data collection (Büyüköztürk et al., 2012). Rust (2007) lists the data collection tools in action research as follows: "1. Class maps, 2. Anecdotal records, 3. Photos, 4. Examples of children's works, 5. Video and audio recordings, 6. Teacher diaries" In this direction, we paid attention to ensuring data diversity in the study. In the water project implemented within the scope of the study for five weeks, documents/products obtained from various activities of the students such as forming a concept network through brainstorming, generating questions, preparing and presenting posters, producing materials, watching videos, making animations through drama, drawing graphics, making measurements and calculations, performing art activities, field visits, calling source people to the classroom, preparing games, ensuring the active participation of families in the process, conducting experiments, and drawing in three stages of the project were categorized by being dated and numbered and considered as data collection tools. In addition, a "document review form" was developed by the researcher to codify the skills of "estimation, observation, measurement, trying/experiment, data recording/interpretation, communication and conclusion" as a data collection tool in the study. For the reliability of the form, opinions were taken from a different researcher who is an expert in the field and the "document review form" was finalized in line with the opinions.

Data analysis

In the study, content analysis design was used in order to determine the students' use of basic scientific process skills in detail in their "applications" during the project process (five weeks). Content analysis is defined as a qualitative data analysis method that includes the stages of organizing and classifying the findings and achieving theoretical results by comparison (Cohen et al., 2007). It is assumed that the results obtained by content analysis will guide future studies on the targeted subjects (Yıldırım and Şimşek, 2018). In addition, content analysis is not just a technique used on texts. It is also used in the examination of images such as student pictures (Büyüköztürk et al., 2011).

In this research, the documents/products, drawings obtained from the application activities of the children during the project process were coded and categorized individually in the context of "estimation, observation, measurement, communication, data recording/interpretation, trying/experimentation, drawing conclusions" skills from the basic scientific processes and recorded in the document review form and analyzed with content analysis.

Development Process of Project Implementation

During the project implementation process, the researcher took part in the role of observer (keeping research diaries) and directing the classroom teacher. The classroom teacher implemented the project with the step-by-step guidance of the researcher during the project process. Class teacher was an associate degree graduate, has been working in the same institution for 25 years and voluntarily participated in the study. The assistant teacher took on the role of taking photos and videos. The project was carried out in the classroom and open space of Foça Municipality Children's House, where there are nine learning centers organized with rich materials with students in the range of 60-72 months.

In the development of the project to be applied in the study, first of all, the literature was reviewed and theoretical information was obtained. In line with the information obtained, the development of the project started. Throughout the project, various materials such as "various scale containers, pipes, funnels, bottles, transparent products, bags, glasses, seeds, kneading agents, pictures related to the project, photographs, papers of different types, cardboard, colored crayons, wax paints, etc." that support the sense of discovery of preschool children and support their meaningful and permanent learning were used. In addition, the activities carried out within the framework of the project approach were recorded on video using a digital camera and video camera.

In the water project implemented within the scope of the study, children were supported to perform various activities such as forming a concept network through brainstorming, generating questions, preparing and presenting posters, producing materials, watching videos, making animations through drama, drawing graphics, making measurements and calculations, performing art activities, field visits, calling source people to the classroom, preparing games, ensuring the active participation of families in the process, and conducting experiments by using basic scientific process skills such as "estimating, observing, measuring, communicating, recording/interpreting data, experimenting, drawing conclusions."

FINDINGS

In this section, the operation plan of the project, which is modeled as action research, the process of implementation of the project in three stages, the questions raised during the applications and the children' response seeking activities using basic scientific process skills such as "estimation, observation, measurement, communication, data recording/interpretation, trying/experimentation, drawing conclusions" were revealed by supporting these questions with visuals.

For the project process, children' documents/products, video recordings, drawings, photos taken during the activity were divided into seven categories and analyzed with content analysis. As a result of this analysis, it was seen that in the beginning/research, construction/development and finalization/presentation activities of the project, children were looking for answers to their questions using the skills of "estimation, observation, measurement, data recording, trying/experiment, communication, drawing conclusions" in a total of 57 activities. The project implementation process (photos 1-85) is described in detail below.

Estimated Operation Plan of the Project

The project team determined three different topics (water, air, onion) by taking into account the age groups, interests of the children in the class and the previously implemented projects. Then, a "subject network" was formed regarding these issues, and after reviewing the applicability of all three issues as projects, children were encouraged to choose one of these issues. When the teacher shared the topics with the children, it was observed that they asked more questions about "water", got excited, and some children wanted to be "scientists researching water" on earth. In this direction, the "water project" was decided with the Then, a "subject network" was formed regarding these issues, and after reviewing the applicability of all three issues as projects, children were encouraged to choose one of these issues. When the teacher shared the topics with the children, it was observed that they asked more questions about "water", got excited, and some children wanted to be "scientists researching water" on earth. In this direction, the "water project" was decided with the children. In this context, project executives first prepared a 5-week forecasted operational plan. After this stage, an exploratory active educational environment was prepared, which allowed the children participating in the project to research, examine, experiment, practice, and seek answers to their questions by using basic scientific process skills for 5 weeks. In this context, project executives first prepared a 5-week forecasted operational plan. After this stage, an exploratory active educational environment was prepared, which allowed the children participating in the project to research, examine, experiment, practice, and seek answers to their questions by using basic scientific process skills for 5 weeks.

Phase I: Project Beginning and Research Activities

At this stage, the findings regarding the documents/products of the children obtained within the scope of starting the water project and research activities were interpreted by supporting them with photographs.

On the first day of the project, the classroom is equipped with tips on how to start a new project by forming a different classroom environment that will attract children' interest and arouse their curiosity. Before starting the project work, the children were asked to wear badges with their names on them. A brainstorming was carried out to reveal the existing knowledge with the children to form the initial network. The teacher asked the children; "what do you think when you say water, and make them think about the subject then asked a second question "which liquid do we consume the most?" and tried to form a subject network by drawing attention to the subject of the project. In brainstorming, it is aimed to reveal both the existing knowledge of the children and the things they don't know. During the planning of activities throughout the project, children were supported to make discoveries on what they did not know about “water” and to seek answers to their questions (Photos 1 and 2). The teacher asked the children to describe what comes to their minds when they say "water" in order to evaluate their knowledge about the subject and to enable them to focus on the subject. The pictures made after the painting work were numbered and hung on the wall of the classroom (Photo 3).

Photo 1

Photo 2

Photo 3

Family participation

When the project implementations begin, an information letter has been sent to the families and it has been reported that within this scope, a "water project" will be carried out for 5 weeks, and they will be asked to participate in "review, research, experiment, model, water-related materials and costume preparation, painting, photography, magazine, CD, resource review etc." during the process.

The project information letter sent home was received with interest by the families and the parents of 20 children in the study group designed different posters and materials and sent them to school with their children (Photos 4 and 5).

Within the scope of the question "What did we prepare with our family?", the teacher gave the opportunity to the children to examine the materials from the families (dropper, funnel, transparent hose, water types, rain formation, water flow models) in detail, and then they were allowed to present what they brought and the work they did with their families to their friends. Children were supported to take notes with drawings for data recording while watching each other's presentations (Photo 6). The materials examined by the children were analyzed and arranged in the project center in the classroom.

Photo 4

Photo 5

Photo 6

Preparing a List of Questions

After the introductory web, the teacher asked “what do we want to know about water?” to the children and supported the preparation of a list of questions with them. After this stage of the project, children were supported in discovering the answers to all these questions using “estimation, observation, measurement, data recording, trial/experimentation, communication, drawing conclusion skills”. After this study, the children were asked to do a painting study again, and the 2nd pictures were given a sequence number and hung next to the 1st pictures.

Fieldwork

The inspection trip is planned as "environmental engineers at work" game. In this context, it was supported to search for answers to the questions "For whom is water needed? Do living things want water?" by "first guessing, then observing, experimenting, measuring, and recording data" (Photo 7). With what can we give water to the creatures in our garden, they were encouraged to guess and experiment to answer the question (Photos 8 and 9).

Photo 7

Photo 8

Photo 9

Examples of "prediction, observation, and outcome skills" for the question of "For whom is water needed?" are as follows:

- Prediction; it is necessary for birds, for ants, for flowers.
- Observation; water is needed for bird ants, snails, turtles, trees, flowers.
- The result; water is necessary for all the animals in the garden,
- They cannot live if they do not drink water, the ants work hard,
- They cannot walk if they do not drink water, the grass dries if not watered,
- The flowers die, they cannot grow, the trees cannot bear fruit,
- The daisies do not grow.

A second field study was carried out in the theater, where a play about water saving was exhibited. Before going to the theater, they were encouraged to guess what they could see in the theater, take notes of their predictions (with small symbol drawings), and take notes with their drawings of what they watched in the game about water saving at the end of the game. When they returned to school, their drawings were evaluated and the report of the trip was prepared, and what could be done at school and at home was discussed with water saving. In order to look for answers to the question "Are there types of water?", the teacher gave an opportunity for children to examine the resources coming from home (photos, magazines, etc.), and added them to the subject network by classifying the types of water (Photos 10 and 11).

Photo 10

Photo 11

Phase II: Project Development and Performance Activities

At this stage, the findings regarding the documents and products of the children obtained within the scope of water project development /performance activities were interpreted by supporting them with photographs.

At this stage of the project, children were supported to seek more detailed answers to their questions by examining, researching and applying basic scientific processes such as "estimating, observing, measuring, communicating, recording data, and drawing conclusions" skills. During the development phase of the project, the teacher supported the children to turn the classroom into an atmosphere related to the subject. The classroom was turned into a "research center for water explorers " and learning centers have taken the names of different types of water, and games in learning centers have been planned accordingly.

The performance activities phase of the project was started with the question "What are the dams for? Can we build a dam?" and it supported them to make predictions for the answer to the question first and then to make applications using observation, measurement, trying/experiment and drawing conclusion skills (Photos 12 and 13). In order to answer the question "How does water come to our home?", children were encouraged to conduct similar research at home with their families (Photo 14).

Photo 12

Photo 13

Photo 14

The examples of "prediction, observation, experimentation, drawing conclusion skills" for the question of "Can we build a dam?" are as follows.

- Guess; we can't save so much water,
- The dams are too big,
- How can we do it, we can do it if someone helps.

- Observation, trying; we have to close the middle of the dam,
- First, we put the water,
- First, we slide the water,
- How do we put the dam cover,
- Squeeze the bottom of the dam cover, glue, put sand.
- The result; you need to make the cover of the dam first and then accumulate water,
- Otherwise, the water leaks from the bottom, you need to tighten the cover thoroughly,
- It needs to rain a lot to fill the dam,
- You need a channel to send the rainwater to the dam.

Inviting Experts to the Class

Questions to be directed to the expert were determined, before the expert came, the children were divided into groups and it was determined who would ask which question. Children were supported to write down the answers (with a drawing) by giving small note papers to their hands. After the expert left, the notes were discussed and illustrated, and the children were supported to draw conclusions from the answers they received with their pictures.

Investigation Trip

It was aimed to plan more detailed trips during the development phase of the project. The teacher supported the children' guessing with the question "have you ever seen a water channel? What can we see in the water channel?" Then, the class was divided into groups and determined in advance who will to investigate what, take what with them, who wonder what, etc. The study trip was planned as a trip of "environmental scientists". In addition, during the trip, materials were provided to support each student to take notes and paint the answers according to him/her and a trip to a water channel was made. Children were encouraged to seek answers to their questions by taking notes of their observations. Can we all be as long as the water channel if we hold hands? The answer to the question was tried to be discovered by measuring together, at this point, attention was drawn to the fact that the water channels may be of different lengths, etc. (Photos 15 and 16).

Photo 15

Photo 16

Photo 17

The answer to the question " What did I see in the water channel?" was supported by preparing a trip report and discussing it in the classroom under the guidance of the notes kept during the trip (Photo 17). Children were allowed to plan trips to different water channels with their families and to present them in the classroom by preparing slides from the trip photos.

Examples of "prediction, observation, and drawing conclusion skills" for the question "What can we see in the water channel?" are as follows:

- Guess; We see fish, we see water, there are stones, there are ships.
- Observation; I see fish, there are small fish,
- There are two big fish,
- There are frogs,
- I saw greens, they threw garbage,
- Water flows into the sea,
- Result; there is no ship in the water channel, because the water in this water channel is not deep,
- The rainwater from the mountain flows into the sea from this channel, for him,
- There is a lot of water in the sea,
- The water in the sea is blue, the water in the channel is not blue,
- It is a little cloudy, there are algae, the frog is on the stone, if it does not rain,
- The water cannot flow into the sea,
- If the channel is not made,
- Water cannot accumulate and flow into the sea.

Examples of "prediction, observation, and experiment, measurement, drawing conclusion skills" for the question "What can we see in the water channel?" are as follows.

- Guess; we'll be too crowded,
- We can't be a canal it is too long,
- Maybe we'll end up here.
- Observation, measurement; We held hands, but we could not be as long as the canal,
- We became taller when we opened our arms a little,
- Maybe if the children from the other class came,
- Then we would be as long as the canal.
- Result; the water channel is too long if the other children at school come too,
- If we hold hands maybe then we can be as long as the canal,
- If our parents come too,
- We will be very long, but still we cannot be that long,
- Because the water channels are too long,
- Because they are long to collect the water,
- If it is not long, the water cannot reach the sea.

Polling

With the role of water researchers, an environment was prepared for students to survey. First of all, "To whom can we do the survey? What questions should be in the survey?" questions were asked and discussed together, a short survey consisting of "Do you have a broken fountain in your house? Do you consume fruits and vegetables without washing? Do you put a container of water outside for street animals on very cold or very hot days?" was prepared. Children were encouraged to ask their parents the survey questions at home and to register their answers. The following day, the survey studies of the children were read one by one in the classroom environment, their answers were noted, and common results were discussed.

Game Preparation

At this stage of the project, the teacher supported the children to seek answers to their questions by preparing various games with them. For example, the game "With what can I transfer the water from the bowl to the bowl?" was planned and the students were supported to make guesses first, then make observations, make measurements and draw conclusions by making different experiments (Photos 18-20). The plays performed by the children by taking different roles are given below.

Photo 18

Photo 19

Photo 20

Game 1: How can I make a balloon from foam? (Photos 21 and 22)

Photo 21

Photo 22

Photo 23

Game 2: Water, does it move? Can I move the ball in the water with water? (Photo 23)

Game 3: How does water pass through pipes? (Photos 24 and 25)

Photo 24

Photo 25

Game 4: Can we prepare games where we can use our sensory organs about water? what happens when we throw sugar into the water? Does its color change? Does its taste change? Does its smell change? (Photos 26 and 27).

Photo 26

Photo 27

Experimentation

During the project process, the science center was expanded further and enriched so that children could work in detail. In order to seek answers to the questions, students were supported to participate in the process in a playful way with the role of "the experiments of scientists conducting research on water". In the implementation of the experiments listed below (experiment; 28-73), the playful process was applied under the guidance of the basic scientific processes; "estimating, observing, measuring, experimenting, communicating, recording data, drawing conclusions" skills. Observations of experiments conducted to look for answers to each question were reported by the students on small papers (symbol drawings).

Experiment 1: "What does the same amount of water look like in different containers?"

The photos below 28-31, shows the predictions made by the children to look for the answer to this question, the observation records during the application and the result notes.

Examples of children quoting "estimation, observation, experimentation, measurement, drawing conclusion skills" for the question "How does the same amount of water look in different containers?" are as follows.

- A glass of water looks different in each container,
- It spreads in the container,
- In this blue container the water appeared very little,
- Because this blue is very large,
- In the pink container it also appeared little, because in pink it is large, but not as much as blue.

Photo 28

Photo 29

Photo 30

Photo 31

Experiment 2: "Where does ice melt faster?" (Photos 32-36). How can we draw conclusions from our observations?"

The answer to their questions in photo 34, the self-expressive drawings of each of the children, their estimates 1st and 2nd observations, the conclusion drawings and the report of the experiment are detailed.

Examples of children quoting "prediction, observation, and experiment, measurement, drawing conclusion skills" for the question "where does ice melt faster?" are as follows.

- Guess; it melts faster on the cabinet, in the cabinet,
- In front of the window,
- On the heater, on the table.
- Observation and measurement: First observation; The ice on the heater melted a little bit,
- The ice in the fridge melted a little bit,
- The ice exposed to sun melted a little bit,
- The ice on the table melted a little bit too.
- The second observation is that it completely melted on the heater,
- The ice exposed to sun became too small,
- It still hasn't melted in the cabinet.
- The result; it melts most quickly on the heater,
- Because the heater gives off heat, so it melts.
- The sun is warming,

- The ice has melted quickly, the inside of the closet is not very hot,
- There is nothing to heat there,
- So, it has melted a little.

Photo 32

Photo 33

Photo 34

Photo 35

Photo 36

Experiment 3: "What happens to the objects I put in the water in the freezer?" (Photo 37).

Photo 37

Experiment 4: "Can I paint the ice?" (Photos 38 and 39)

Photo 38

Photo 39

Experiment 5

The answer to the question "Can I carry the water of the melting ice drop by drop?" was also sought by using basic scientific process skills. At first, it was difficult for the children to carry the melted ice drop by drop, but as a result, they saw that the water accumulated in the container by carrying it drop by drop (Photo 40). In this case, it was observed that they deduced that it can reach large amounts when it accumulates in the water flowing drop by drop from the fountains (Photos 41 and 42).

Photo 40

Photo 41

Photo 42

Examples of children quoting "estimation, observation, experimentation, measurement, result skills" for the question "Can I carry the water of my children's melting ice drop by drop?" are as follows.

- *Guess; we cannot carry it drop by drop, it will be very difficult, maybe it can be carried a little.*
- *Observation, experimentation, measurement: it is difficult, but I carried 10 drops,*
- *look, it has accumulated a little, my droplet is big,*
- *I carry more,*
- *I carried it very fast,*
- *if you pull too much water into the dropper,*
- *it carries too much water.*
- *The result; it is very difficult to carry water drop by drop,*
- *but still water accumulates,*
- *there is a lot of water that flows from the fountain,*
- *let's put a container under the dripping fountain,*
- *let's accumulate water, repair the fountain,*
- *let's not let the water flow drop by drop.*

Experiment 6: "What pollutes the sea?", (Photos 43 and 44).

Photo 43

Photo 44

Experiment 7: Which objects we put in the bottle will remain on the water? (Photo 45).

Photo 45

Experiment 8: "Can we make a rainbow?" (Photos 46 and 47).

Photo 46

Photo 47

Experiment 9: "Why is water important for plants?"

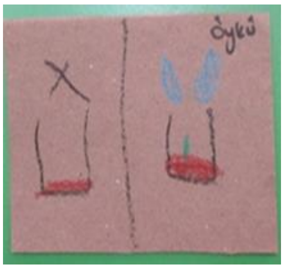
Photos below 48-51, shows that water is necessary for plants to grow, in their first, second and third observations, they express with their drawings. In their three-week observation, they observed that the grass seeds they irrigated were greening, and the grass seed they did not irrigate as a control observation was not greening. As a result, they inferred the necessity of water for the growth of plants, and it is seen that they transfer these inferences to their conclusion drawings.

Photo 48

Photo 49

Photo 50

Photo 51



Experiment 10: "Does water disappear?" (Photos 52 and 53).

Photo 52

Photo 53

Experiment 11: "What object will sink when I throw it into water?" (Photos 54 and 55).

Photo 54

Photo 55

Experiment 12: "How does rain form?"

The answer to the question "How does rain form?" was supported by the students' search for the role of "Scientists are investigating the formation of rain" (Photos 56 and 57).

Photo 56

Photo 57

Experiment 13: "How much can I collect rainwater in my jar for one hour?"

The answer to the question "How much can I collect rainwater in my jar for one hour?" was performed by marking the jars by predicting how much water they can collect in an hour, then making observations by measuring time, recording their observations and comparing them with their estimates of how much rainwater they can collect in their jars at the end of the determined period. Children' discussions on the outcome were supported (Photos 58-60).

Photo 58

Photo 59

Photo 60

"Estimation, observation, experimentation, measurement, drawing conclusion skills" are the examples for the question “How much can I collect the rainwater in my jar for an hour?" are as follows.

- Guess; rainwater is collected in my jar so far, (the children have marked their jar with a pen to estimate how much rainwater they can collect).
- Observation; (the children observed from the window how much water was filled in the jars they left under the rain for an hour)
- My jar is not filled with rain water much, mine crossed my mark,
- I marked it too high,
- It is not filled with water until there,
- The rain started to rain slowly.
- Result; (the children compared the estimation drawings with the result drawings)
- If the rain had rained faster,
- More rainwater would have collected in my jar,
- I guessed that it would have collected a lot,
- But little rainwater was collected,
- It could not pass my mark,

- My jar's mouth was small and could not get into the rain much,
- If the jar's mouth was large, more rain would have entered in jars,
- While doing it again,
- Let's put a large jar with a mouth,
- The water channels are open, rainwater is collected for him.

Experiment 14: "How long have the grass seeds I planted grown? With what can I measure?"

Measurements and calculations were made for the answer to the question "How long have the grass seeds I planted grown? With what can I measure?" Children were supported to measure on different days with non-standard measurement units.

Photo 61

Photo 62

Experiment 15: "Does water have weight? How can I measure it?" (Photos 63-65).

Photo 63

Photo 64

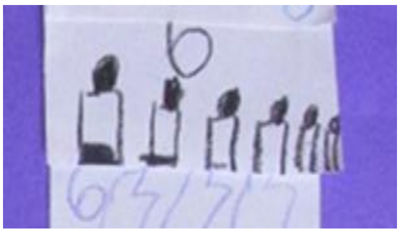
Photo 65

Experiment 16: "How many cans of water can we consume in a week in our school?" (Photos 66-68).

Photo 66

Photo 67

Photo 68



"Estimation, observation, trial, measurement, drawing conclusion skills" are the examples for the question "How many cans of water can we be consuming in our school in a week?" are as follows.

- *Guess; we consume one can,*
- *Five cans,*
- *Ten cans,*
- *Observation; (every morning the lid of the water can was opened with the children and the cook brought the empty can to the classroom as the water can was empty, the children were supported to draw the observation papers for each can).*
- *Today we drank two cans of water,*
- *Today we drank three cans of water because there was lemonade today,*
- *Today there was children's tea,*
- *Today we drank three cans,*
- *The result is; I drew six cans of water,*
- *I marked six cans,*
- *I understood that we consume so much water,*
- *I will count at the house,*
- *I counted at the house,*
- *We could not even finish one can,*
- *Because there are few of us at home.*

Art activities

In this context, an environment was prepared for children to search for answers to the question "Can we make warning cards to avoid unnecessary use of water? Can we do puzzles about water? Can we make albums about water?" (Photos 69 and70).

Photo 69

Photo 70

In addition, various scamper questions were included to support innovative thinking in children at appropriate times during the project process. For example; if you were a drop of water, where would you like to fall? They were encouraged to answer the question individually first and then to illustrate these answers: "Can we write the story of the development of water on earth?" (Photos 71 and 72) by drawing.

Photo 71

Photo 72

Photo 73

For the answer to the question "Can we portray the story of water with drama?", it was concluded by supporting the children to play the story they created and illustrated with drama (Photo 73).

Phase III: Project Completion and Presentation Activities

At this stage, the findings regarding the documents and products of the children obtained within the scope of the water project termination and presentation activities were interpreted by supporting them with photographs. In the presentation phase of the project, first of all, the questions of "Can we prepare water-related costumes? Who can we get help from to prepare costumes? Can we wear costumes on the day of presentation?" were sought for answers and they were supported to share. An information letter was sent to the families and they were encouraged to prepare innovative costumes. When the costumes arrived, children were encouraged to introduce themselves separately (Photos 74-75).

Photo 74

Photo 75

Documentation and Evaluation

The studies carried out to evaluate the effectiveness of the water project and to reinforce and evaluate what has been learned so far are presented below.

Slide show

In order for the children to see the experiences and discoveries in a concrete way during the 5-week period from the beginning to the end of the project, the photographs of all the studies were turned into a slide presentation by the classroom teacher and watched gradually on the cinema screen with the children (Photo 76).

Photo 76

Termination Network

At this stage, the concept network and question list prepared in the initial stage were focused in order to transfer what was discovered during the project. The children were asked "What did the water researchers discover during the project?" and they were supported to sort the things they discovered during the project and their answers were written on the white board by the teacher (Photos 77 and 78).

Then the termination network was formed. The termination network was formed by writing the answers to the questions of the children during the project, the answers of the children at the beginning of the project were written in black pencil, and the answers at the end of the project were written in blue pencil (Photo 79).

Photo 77

Photo 78

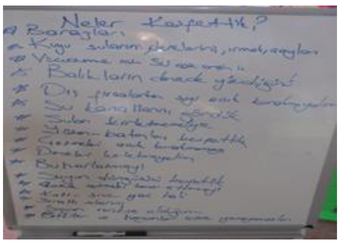


Photo 79

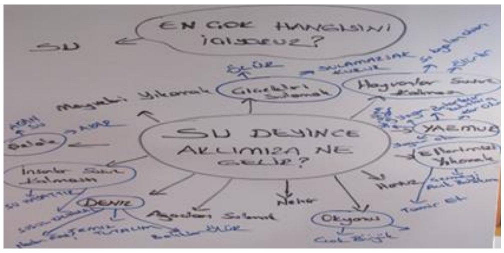


Illustration of the final form of the project; by adding the pictures made at the beginning and in the middle of the project to the pictures made in the third stage (Photos 80-82), children were supported to interpret both their own picture and the pictures of their other friends in the class by comparing them. Thus, it was ensured that the development they achieved was seen concretely by the children.

Photo 80

Photo 81

Photo 82

Presentation Day and Project Exhibition

The project team held a meeting with the children with the view that presenting the activities and products in the learning process spent with the students in an exhibition environment could make the students feel how valuable their work is. In this meeting, it was suggested to make an exhibition for the students covering all the studies they have done for 5 weeks. It was announced that this exhibition will be an exhibition covering the process of the project, it was emphasized that those who come to the exhibition should be able to see the project from beginning to end, and how an arrangement can be made for this with children were discussed with the questions "How can we present our project? How can we exhibit what we do for 5 weeks? Where should we put it? Who can we invite to our project exhibition, who will tell what we do to those who come? Who will wear what on the day of the exhibition?" Together, it was decided to sort the ones made in the process according to the order of starting the tables. In addition, it was decided that the project should be explained to the guests who came to the exhibition, and the children who would stand at the tables were determined and a division of labor was made by focusing on what would be explained. The invitations prepared by the children within the scope of these labor divisions were delivered to the 4-5 age group in the school, other adults in the school and the people who received support in the project. Then, all the works carried out during the project process were arranged by placing them on the tables in the classroom according to the "order of starting". Experiments, prepared albums, puzzles, various classifications, measurements and calculations, various art activities, seeds planted, reports kept, various charts, scamper studies and surveys were put on the tables. During the exhibition, the children stood at the tables where they were assigned with water costumes and explained to the guests what they were doing during the project process. In the photos 83-85, "water project" exhibition was included as the final stage of documentation.

Photo 83

Photo 84

Photo 85

The families were informed in advance for the day of the exhibition, and it was announced that they would explain what was done for the project process of their children when they came to the exhibition. Under the guidance of the classroom teacher, the families listened to and examined what was done by the children in the project. The families, who saw that all the products in the project exhibition were original products made by children using scientific process skills, were both surprised and admired that their children spent the process playing in an exploratory environment by using simple daily materials and scientific process skills, even though they were small. At the end of the project, families were asked to express their thoughts on the process and the exhibition in writing. Below are examples of quotations from families for the project and the project exhibition:

- Everywhere I looked during the project process, I integrated with my child by trying to discover something about water.
- We did in-depth research on water with our child and had a lot of fun. At first we thought very superficially. As the weeks progressed, the topic deepened. In every activity we did, we noticed that the subject of water was involved in every aspect of our lives.
- My child started to examine and research his/her surroundings more carefully during the project process. He used to cry when she couldn't do anything. Now he uses expressions like "I guess I haven't tried, I'll try again." He started to think scientifically.
- We were very happy that my child's observation skills increased and he started to examine and explore his environment more consciously. Trying to measure the water we fill in the glass or trying to collect rainwater, I was very proud to see this.
- I observed that the water project aroused curiosity in my child to research and explore. We think that the project is important for my child to think scientifically and allows children to look at the environment and objects from a different perspective.
- After our research, we discussed the materials we collected with the family and combined what we wanted to use. We rehearsed the presentation of the poster we prepared at home with Cenk and sent it to the school.
- We saw the excitement in his eyes that he made his presentation to his teachers and friends in the classroom.
- We think that this project contributed to my child being a questioning individual.
- My child was very careful when my wife made a channel through the water pipes, he asked us questions, I was happy to observe that my child was developing.
- You made me tell my friends about the model we made about the project in the classroom, my child talked about it happily when he came home in the evening, my wife and I were both very emotional and observed that our child started to think scientifically, this is very valuable.
- It was nice to see that there was a full project that would support them to make their own discoveries throughout the entire project process. It was very impressive that it contributed to scientific awareness with student-teacher-family participation.
- It was very nice to have the models and posters made by us as a family in the exhibition. I was surprised to see the different innovative ideas of each family. When we were asked to prepare a costume about water, we felt anxious, we thought, we asked our friends, then we prepared a very nice costume.
- We made a water skirt out of a blue garbage bag. At the exhibition, I saw that all the families designed very innovative costumes. It was very valuable for you to ensure that what we did as families was used as a learning tool by children.

- Children’s studies and narratives within the scope of the water project, to see how they observed the importance of water in our natural life, how they observed it through their eyes, how they predicted, observed, measured, tried and drew conclusions in every activity.
- It was very impressive that children drew their observations and predictions in every study, although they did not know how to read and write. Now he tries to draw his observations at home and shows them to me.

CONCLUSION AND RECOMMENDATIONS

This study, which was conducted as action research, was carried out to examine in detail the status of project approach applications in preschool education to support the use of basic scientific process skills on the water project sample. At the end of the project, in the analysis of all the process-oriented (photography, 1-85), documents/products and researcher diaries; it was observed that the children were looking for answers to the questions they were curious about by having fun, exploring, and having an interest in the "water theme" for 5 weeks; that they contributed to thinking about the subjects they wanted to learn, being productive in cooperation by making innovative and collaborative studies and learning effectively; and that a innovative and scientific learning process was experienced. In addition, in the analysis of 57 activities carried out during the project, it can be said that children are looking for answers to their questions by using skills such as "estimation, observation, measurement, data recording, trying/experimentation, communication, drawing conclusions", and the project process carried out in this way greatly supports their use of basic scientific process skills and thus contributes to their scientific thinking.

Considering the studies on project approach practices and scientific process skills in preschool education in the literature, it is seen that there are studies with similar results in the current study. Diffily (1996) has emphasized that project-oriented education motivates students and supports their inclusion in all studies related to fields such as art, language, social, mathematics and science. In another study, it is stated that students make connections between mathematics, social studies, literature and especially "science" in order to find answers to open-ended questions during project approach applications (Curtis, 2002). In another study, it is stated that during the projects, students focus on science and conduct collaborative inquiry-based research to answer repulsive questions (Marx, et al., 1997). Haris and Grounlund (2000) carried out a "turtle project" to determine how preschool children gain scientific thinking. During the project process, they guided children to make observations and draw pictures, talk about the project and learn by questioning. In the study, it was concluded that project implementation was effective in developing scientific processes such as making inquiries, conducting research, making observations and examinations on students. In a similar study, İnan, Trundle and Kantor (2010) observed how natural sciences were presented to students and how students' basic scientific process skills developed during the project process carried out by Reggio Emilia-inspired class with the aim of enabling students to gain experience in natural sciences. The findings of the research showed that students made progress in basic scientific process skills.

Şahin et al., (2011) aimed to improve the level of use of scientific processes by preschool children with project-based educational practices. As a result of the study, a significant difference was found in the ability of preschool children to use scientific processes at the end of the projects. In addition, it was observed that children successfully carried out these processes during project implementation and presentation. İnan (2009) examined the development process of the plant with the students in the "plants project" he implemented with preschool students. In the Plants project, children observed the effect of different factors on plants and tested their development in different environments according to the reactions of the plant during the application process. At the end of the project, it was seen that the students established cause-effect relationships and used scientific process skills such as hypothesis formation during the applications.

Kefi and Tuğrul (2015), at the end of their project on universal and developmental gains from cultural games and toys, observed that all 55 students who participated in the study knew and learned about cultural games and materials, played these games with fun, participated in educational games prepared in this direction willingly and effectively, and frequently learned the relevant concepts and basic scientific process skills. In another study, Kayır (2015) determined that carrying out project studies inspired by the Reggio Emilia Approach, basically, when it is examined within the framework of pre-school education achievements and pre-school education activities, various achievements and activities in each project occur naturally and integratedly. Arıkan and Kimzan (2016) conducted a study with preschool students on "tree scientists' research project". According to the results of the study, it was observed that the students gained new knowledge with the experiences they gained during the project process, reduced their misconceptions and corrected the mistakes they knew to be true. In this context, it was stated that they mostly realized cognitive gains such as associating, predicting, and remembering what they perceived. Anlıak (2008), at the end of the milk project they carried out; Kefi (2012), at the end of the root project they carried out, emphasized that the project approach should be implemented by sticking to its basic philosophy in order to be effective. In this context, the careful implementation of the project approach stages gains great importance in terms of supporting students to use their scientific process skills.

As can be seen, in research conducted at home and abroad, similar to the findings of the current research, it is observed that project approach practices in preschool education support students' use of scientific process skills. In this context MEB (2013) recommends that project approach practices that will cover each of the basic scientific process skills be frequently utilized in order to achieve the achievements of the preschool education program and to support the development of students' basic scientific process skills from the early period. The limitation of this study is that it was conducted with a group of 20 children and a single project topic. In future research, it may be recommended to carry out projects on various subjects with larger children's groups.

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