The effect of project-based learning approach on student achievement in life science course in primary education

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ABSTRACT

Within the achievements of life science, a course in primary education; students are expected to have knowledge and skills about cultural heritage elements in their immediate surroundings, family cooperation and solidarity, the Turkish flag and the National Anthem, Atatürk's childhood, cooperation and participation in group activities, natural events and measures to be taken against natural disasters. In line with these achievements, it is aimed to quantitatively investigate the effect of a project-based learning (PJBL) approach on students' academic achievement (AA). This study was carried out with 41 students attending the 2nd grade and taking the life studies course in a primary school in Türkiye. First of all, the unit of “Life in Our Country” was briefly explained as preliminary information on the current curriculum and the AA test prepared by the researcher, which we called the pre-test, was applied to this group of students. Afterward, the project topics prepared by the researcher by the unit gains were given to the students and they were asked to complete these project assignments giving them a certain time. After completing and presenting the given project assignments, the AA test was applied again to the same student group as a post-test. In addition, feedback was received in this process to determine whether the students did their project assignments themselves and from whom they received help. With the help of the data obtained, the student’s AA was calculated according to their support status.

Keywords: Project-based learning approach, primary education, life science course, unit of life in our country, academic achievement.

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Note: This study was quoted from Melike Özmen Ulu's master's thesis under the supervision of İsmail KILIÇ.

INTRODUCTION

Primary school provides a pedagogical balance between controlled educational processes and children’s unique constructive processes. This provides learning opportunities that are individually directed and communicative. Thus, students are helped to socialize in the learning environment (Baysal and Dilber-Özer, 2021). Learning can be regarded as a permanent change by its nature. This change is important in developing certain skills, changing some attitudes, or creating a learning environment for a teacher (Munna and Kalam, 2021). Students first acquire values in their families, planned or unplanned. Students acquire values in schools in a planned way after their families. The primary school level is the first step in acquiring basic academic skills and values (Esenen, 2020; Yaşar et al., 2015).

Life science course is one of the courses where students gain skills such as realizing and transferring learning about their daily lives to their lives, becoming a good and responsible citizen, receiving skills training, adopting the society they live in and adapting to society (Batmaz et al., 2021, Yılmaz and Göçen, 2019). The effectiveness of the values gained by the students in the courses they encounter during the education and training process is longer than the effectiveness of the knowledge
they acquire in these courses. In other words, while the information learned by the students in the lessons is used by the students in the short term, the values gained by the students in these lessons turn into behaviors throughout their lives. In the first three years of education, it is expected that the values that students will acquire in Life Studies courses will be effective in their lifelong behaviors (Aydin and Gürler, 2014).

Considering that teaching is mostly done by transferring in our education system today, it is seen that social skills do not turn into behaviors at the application level, as in many other skills (Kaf, 1999). The understanding of education in the 21st century is no longer sufficient for the student to get information from someone else. Instead, a subjective learning approach has been adopted that reconstructs and produces knowledge according to the learning process. Thus, the student gets rid of memorizing information and provides meaningful and permanent learning (Kılıç and Özel, 2014). Learning through projects is considered one of the pedagogical strategies in student-centered learning where students are exposed to real-world skills such as problem-solving, critical thinking, experimental designs, data collection, analysis and interpretation of results, and collaborative learning (Rajan et al., 2019). In order for students to have continuous knowledge, there is a need to apply teaching methods, approaches and techniques that will allow them to learn by doing. It is necessary to apply the methods that will make student activities. PjBL is one of the approaches to be applied in the realization of this goal (Issa and Khataibeh, 2021).

PjBL is a modern teaching approach for students that connects students' experiences with school life and encourages serious reflection as students acquire new knowledge. This PjBL helps students enrich their knowledge and develop various mental skills (Issa and Khataibeh, 2021; Kembara et al., 2019). PjBL is one of the constructivist teaching approaches (Mou, 2020) that has been accepted as an important classroom strategy in recent years (Frank and Barzilai, 2004). With this approach, students are expected to build and interpret what they have just learned instead of memorizing it (Kızkapan and Bektaş, 2017), and it refers to an inquiry-based teaching method that engages students in knowledge construction by enabling them to carry out meaningful projects and develop real-world products (Guo et al., 2020). The (PJB) approach teaches students to think, learn, question, access information sources, and establish a relationship between cause and effect. The aims of PBL are; to be able to solve complex mental problems, to work in cooperation, to look at problems with different solutions, to be rewarded for the effort, and to provide for a lifetime (Kılıç, 2021).

As a result of the literature review, it was found that the PjBL approach contributed positively to the academic achievement (AA) and attitude of the students towards the course. It is seen that these studies mostly focus on science education (Kılıç and Özel, 2014; Kılıç and Özel, 2015, Kılıç and Özel, 2022), social studies teaching in secondary education (Öteleş and Ezer, 2020), and social studies teacher candidates in higher education (Şeggin, 2020). In a study conducted by Kılıç and Özmen Ulu (2021) and Özmen Ulu (2019), the application of the PjBL approach to the opinions of students, teachers, and parents in the life science course in basic education was discussed. This study, it is aimed to investigate the effect of a PjBL approach on student achievement in life science courses in basic education to fill the gap in the literature. As it would be easy for both students and instructors to apply this method in Turkish, science, mathematics and life studies courses for project-based learning in primary education, one of these four courses was chosen. It is thought that it will contribute to the literature.

The general purpose of this study is to investigate the effect of applying the PjBL approach to student achievement in the life science course in basic education in Türkiye. Within the framework of this general purpose, the following sub-problems are included in the study:

1. Does the application of the PjBL approach increase the AA of the students?
2. What is the AA of those who do the given project assignments with their families?
3. What is the AA of those who do their project assignments with their teachers?

MATERIALS AND METHODS

This section contains information about the research method, working group, data collection tools and data analysis.

Research method

In this study, in which descriptive research type was applied from a quantitative research design, the effect of PjBL was tried to be determined. approach on the AA of the students to collect data on the main problem and sub-problems of the research. After the subject of “Life in Our Country” was briefly explained to the students according to the current curriculum, an achievement test was applied as a pre-test. Afterward, the project topics were determined according to the unit gains stated above, and the students were asked to choose a project topic (Table 1). The students who took the subject were given three weeks and asked to complete their projects. Projects were completed and exhibitions and presentations were made. After this process, the AA test was applied as a post-test. After the project presentations, the students were asked whether they were assisted while implementing the PjBL approach, either through one-to-
Table 1. Determining the project topics according to the gain of the unit Life in Our Country.

<table>
<thead>
<tr>
<th>Project assignment topics</th>
<th>Related gains</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Creating an Atatürk Album</td>
<td>Researches Atatürk's childhood.</td>
</tr>
<tr>
<td></td>
<td>- Understands the importance of national days and holidays.</td>
</tr>
<tr>
<td></td>
<td>- Understands the importance of religious days and holidays</td>
</tr>
<tr>
<td>2. Drama</td>
<td>- Observes the production activities in the immediate vicinity.</td>
</tr>
<tr>
<td>3. We Publish a Newspaper</td>
<td>- Shows country, capital, and place of residence on the map and Earth globe.</td>
</tr>
<tr>
<td>4. Doing puzzles from Türkiye and the World map</td>
<td></td>
</tr>
<tr>
<td>5. Preparation of presentations to promote the cultural heritage</td>
<td>- Searches for cultural heritage items in the immediate surroundings.</td>
</tr>
<tr>
<td></td>
<td>- Respects the lifestyles and habits of people from different cultures living in our country.</td>
</tr>
</tbody>
</table>

one interviews or as preliminary information in the achievement test.

Study group of the research

The study group of the research consists of 41 students who want to do a project assignment and take life science courses in the second grade of primary school in Turkey. The willingness to do project assignments is based on volunteering. In the study, this study was carried out in the classroom where the researcher conducted the life studies course. Because of this situation, the convenient sampling method, which is one of the selective sampling methods, was used in the study.

Data collection tools

As there was no achievement test developed to measure the AA of students within the scope of the "Life in Our Country" unit, an "AA Test" (Appendix 1) was developed by the researchers on the unit gains (Table 2).

For this test, a multiple-choice test consisting of 24 questions was created by the gains of this unit. The prepared questions were taught to 6 primary school teachers and 4 unsuitable questions were removed. Misconceptions that may arise in the existing questions have been eliminated, and the questions have been made understandable. The content validity of the questions in the test was tried to be ensured by showing the relations of this achievement test with the subjects in a table of specifications. Before the prepared test was applied as a pre-test, it was administered to 41 primary 2nd-grade students. In the achievement test, 5 points were given to correct answers and 0 points to incorrect or blank answers. The reliability and validity test of the achievement test prepared in the study was not performed. The 'Life in Our Country' Unit gains and question numbers in the AA test developed for students are given in Table 2.

Table 2. Comparison of AA test questions prepared according to the life in our country unit gains.

<table>
<thead>
<tr>
<th>Gains of the unit of Life in Our Country</th>
<th>Question numbers</th>
</tr>
</thead>
<tbody>
<tr>
<td>He shows his country, capital, and residence on the map.</td>
<td>2, 9, 16, 20</td>
</tr>
<tr>
<td>He realizes the importance of the Turkish flag and the National Anthem for his country and nation.</td>
<td>10, 15</td>
</tr>
<tr>
<td>Researches Atatürk's childhood.</td>
<td>1, 3</td>
</tr>
<tr>
<td>Understands the importance of national days and holidays.</td>
<td>4, 17</td>
</tr>
<tr>
<td>Understands the importance of religious days and holidays.</td>
<td>11, 12</td>
</tr>
<tr>
<td>Researches the cultural heritage items in the immediate environment.</td>
<td>6, 7, 14, 18</td>
</tr>
<tr>
<td>It respects the lifestyles and habits of people from different cultures living in our country.</td>
<td>19</td>
</tr>
<tr>
<td>Observes the production activities in the immediate vicinity.</td>
<td>5, 8, 13</td>
</tr>
</tbody>
</table>

Data analysis

AA test evaluations were made for the data obtained from the pre-test results of the students before they started their project assignments. In the achievement test, each question was given 5 points and the AA of each student
was determined. Then, at the end of the completion of the project assignments, the final test was given. Evaluation of the post-test was done in the same way as the pre-test. Then, the arithmetic averages of the pre-test-post-test AAs of 41 students were calculated. These data were evaluated in line with the aims of the study.

FINDINGS

To find an answer to the first sub-problem, "Does the application of the PjBL approach increase the AA of the students?", the arithmetic averages of the students' AA pre-test and AA post-test results were taken and the percentage of change of these averages was found (Table 3).

When Table 3 was examined, it was determined that there was a significant success (27.46%) in favor of the students who made projects according to the arithmetic averages of the pre-test-post-test AA.

To find an answer to the second sub-problem, "What is the AA of those who do the given project assignments with their families?", the arithmetic averages of the students' AA pre-test and AA post-test results were taken and the percentage of change of these averages was found (Table 4).

As seen in Table 4, there was a significant difference between the change in the arithmetic average of the student's AA (33.36%) after the help of their parents for the given project assignments and the arithmetic averages of the AAs of the students (48.76%) who completed the project assignments by getting help from their families when necessary or difficult. However, since there was one student who did not receive any help, a comparison with the aid situation could not be made. According to Table 4, it is seen that most of the students (97.56%) in the study group received help.

To find an answer to the third sub-problem, "What is the AA of those who do their project assignments with their teachers?", the arithmetic averages of the students' AA pre-test and AA post-test results were taken and the percentage of change of these averages was found (Table 5).

<p>| Table 3. Comparison of the pre-test and post-test AA of the students who applied the PjBL approach. |</p>
<table>
<thead>
<tr>
<th>N</th>
<th>Pre-test AA X</th>
<th>Post-test AA X</th>
<th>AA Change (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>56.95</td>
<td>78.51</td>
<td>27.46</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 4. AA of students according to their parents' help status after the PjBL approach was applied.</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
</tr>
<tr>
<td>---</td>
</tr>
<tr>
<td>Those who do their project homework with their families.</td>
</tr>
<tr>
<td>Those who do not do their project homework with their families</td>
</tr>
<tr>
<td>Those who get help from their families when necessary or have difficulty in project assignments.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 5. The AA of students with the help of teachers after the PjBL approach was applied.</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
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<tr>
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</tr>
<tr>
<td>Those who want to do the whole process are under the control of their teachers.</td>
</tr>
<tr>
<td>Those who do not want to do the whole process under the control of their teachers.</td>
</tr>
<tr>
<td>Those who do not want to do the whole process under the control of their teachers and want to ask questions when necessary.</td>
</tr>
</tbody>
</table>
According to Table 5, it is striking that the number of students who want to complete the project assignment completion process under the control of the teacher is remarkable. The arithmetic average of the AA of the students who want to complete the process under the control of their teacher is high and the pre-test and post-test favor the students who do the project. When the data of the two groups were compared, no significant difference was found between the two groups, since the number of students who wanted to get help when necessary and those who did not want to receive any help was low.

**DISCUSSION**

The PjBL approach, which puts the student at the center of the teaching-learning process and incorporates a real-life problem or any application into the education system, make students not passive learners as in traditional learning, but individuals who interact with their environment. Instead of giving information to students and dragging them to learn by rote, they expect them to reach information, understand, interpret, produce and make them sustainable in daily life (Karaer and Soytürk, 2021).

Discussions were made and inferences were made according to each research sub-question created under the main question of the study:

**Does the application of the PjBL approach increase the AA of the students?**

In this study, when the PjBL approach was applied to the 2nd-grade students in primary education, there was a significant increase in the AA of the students. Due to this increase, it is possible to say that the PjBL approach can be applied to primary school students. When the relevant literature is examined, Güneş (2014) emphasized in his study that students who are given homework contribute positively to their AA when they take responsibility. When the studies of Ergül and Kargın (2014), Korkmaz and Kaptan (2002), Türkmen (2019) and Yıldırım (2011) are examined, it is stated that the project-based learning approach increases the AA of the students.

**What is the AA of those who do their project assignments with their families?**

It is seen that 73% of the families of the students who prepared the project homework helped their children and there was a remarkable increase in the AA of these students. The number of students who get help when they have difficulties is 24.3%. There is also a significant increase in the AA of students who receive help when they have difficulties. The conclusion to be drawn from these data may be as follows. Family aids increase student achievement. Looking at the literature, Güneş (2014) sees parents accompanying students’ homework as an opportunity for his study. According to the researcher, students emphasized that when they take responsibility for their homework and get help from their parents, there are positive reflections on their AA. In the study of Kılıç and Özel (2015) on the PjBL approach in science education, they emphasized that the parents help their students and that is why the students deliver successful projects to their teachers. Turanlı (2007) emphasized in the study that whether the students have the tools and equipment needed for doing the homework or whether the student can do the homework on her own determines the level of usefulness of the homework.

The number of students who want to complete the project completion process with the help of their teacher is quite high (85.36%). For students in the 2nd year of primary school, it seems meaningful that the completion of this process requires help from their teacher. In addition, the AA of the students who received help from their teachers in the project completion process is in the direction of the post-test AA in terms of pre-test and post-test evaluation. The low number of people who want to get help with the process alone or when necessary is also interesting. In the study conducted by Kılıç and Özel (2014) on the PjBL approach in science education to secondary school 6th-grade students, it is stated that the teachers help and the students are satisfied with this situation and the delivered projects are successful.

**CONCLUSION AND RECOMMENDATIONS**

Project-based learning is one of the tools used to understand the learning abilities of students in various educational processes. Traditional educational methods have ceased to be useful with the development of technology, and recently many active learning methodologies have been proposed to alleviate the difficulties of teaching and learning. A project-based learning approach should be applied to students in primary education in order to overcome the difficulties experienced in education and training. The PjBL approach can be applied to elementary school students in the teaching of life sciences, as well as in other courses in the curriculum. The PjBL approach can enable students to acquire technical knowledge and skills as well as non-technical skills such as project management, communication, collaborative working and presentation skills in primary education, which is considered the first
REFERENCES


APPENDIX 1

Demographic Information

1. Have you prepared a project assignment?
   A) Yes   B) No
2. Do you get help from your parents while doing your project assignment?
   A) I get help from my family.
   B) I'm not getting help
   C) I get help when needed or when I'm struggling
3. Do you get help from your teacher while doing the project homework?
   A) Yes   B) No
4. If you're getting help, would you like to do the entire project completion process?
   A) I would like to do it all under the control of their teachers.
   B) I don't want to do the whole process under the control of their teachers.
   C) I want to do the whole process under the control of my teachers when necessary.

Academic Achievement Test

1. Which of the following information about Mustafa Kemal Atatürk is false?
   A) He was born in Thessaloniki.
   B) He lost his mother at an early age.
   C) He was given the name Kemal by the mathematics teacher in secondary school.
2. Which of the following seas does not have a coastline in our country?
   A) Mediterranean   B) Black Sea   C) Red Sea
3. Which country is the city where Atatürk was born now?
   A) Italy   B) Türkiye   C) Greece
4. Which of the following is considered the beginning of Our War of Independence?
   A) Atatürk’s going to Samsun
   B) Occupation of Izmir
   C) Opening of the Turkish Grand National Assembly
5. Which of the following production activities are common in big cities?
   A) Agriculture   B) Livestock   C) Industry
6. Which of the following dishes does not belong to our culture?
   A) Ravioli   B) Hamburger   C) Lahmacun
7. On which of the following days in our country, local clothes are worn?
   A) Birthday celebration
   B) Wedding anniversary celebration
   C) Henna night celebration
8. Which one can be said to be developed in a region where egg production is high?
   A) Poultry farming   B) Fishing   C) Small cattle breeding
9. Which of the following countries is not our border neighbor?
   A) France   B) Syria   C) Bulgaria
10. Which of the following is not true about our flag?
    A) There is a white crescent and star on a red background.
    B) It has the sun on it.
    C) It gets its color from the blood of our martyrs.
11. Which of the following about Religious Holidays is incorrect?
    A) We visit our relatives and neighbors.
    B) We offer sweets to our guests.
    C) We decorate our classrooms.
12. Which of the following options includes religious holidays together?
    A) Eid-al-Fitr - Eid-al-Adha
    B) Republic Day - Victory Day
    C) Eid-al-Adha - Children's Day
13. Which of the following is related to agricultural activities?
    A) Greenhouse   B) Beekeeping   C) Ceramics
14. Which of the following is not one of our traditional theatrical plays?
A) Middle game  B) Karagöz- Hacivat  C) Opera

15. “The poet of ................................, which is our national anthem, is ..........................” Which of the following should be filled in the blank space in the statement?
A) İzmir Anthem – Arif Nihat ASYA
B) National Anthem – Mehmet Akif ERSOY
C) Youth Anthem – Osman Zeki ÜNGÖR

16. Which of the following is the map of Türkiye?
A)  
B)  
C)  

17. Which of the following matches is wrong with the names of the national holidays and the dates they are celebrated?
A) National Sovereignty and Children’s Day – 23 April
B) Victory Day – 19 May
C) Republic Day – 29 October

18. Which of the following is not one of our cultural heritage?
A) Ballet  B) Horon  C) Harmandalı

19. Which of the following statements is false?
A) Poems are read in schools on Eid al-Adha.
B) We should be respectful towards people who immigrated to our country from foreign countries.
C) We must protect our cultural heritage.

20. In which of the following options, Türkiye’s continents are given together?
A) Asia – Europe  B) Africa – Asia  C) America – Europe

The correct answer to each question is 5 points.