

Research Article

The effect of problem-based learning on problem-solving skills in English language teaching

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The purpose of this mixed-methods sequential explanatory study is two-fold. It is intended first, to determine the effect of problem-based learning (PBL) on problem-solving skills, and second, to reveal student opinions regarding PBL. A quasi-experimental design with a pre-test and post-test control group was preferred in the quantitative dimension, while in the qualitative dimension, a case study design was adopted. The study group of the quantitative dimension consists of 46 students who study at the School of Foreign Languages of a public university in T rkiye. 23 of these students participated in the experiment, while 23 of them were included in the control group. The study group of the qualitative dimension is eight students who were selected from the experimental group. Problem Solving Inventory (PSI) was used to collect quantitative data, whereas a standardized open-ended interview form was used to collect qualitative data. Quantitative data were analysed through SPSS 22 package program. The qualitative data were analysed descriptively. Where PBL was applied, there was a significant increase in the problem-solving skills of the experimental group compared to the control group in which PBL was not applied. Qualitative data have pointed out that PBL improves problem-solving skills, academic skills, social skills, and language skills. Nevertheless, the long-term application period had a demotivating effect.

Keywords: Problem-based learning; Problem-solving; ELT

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1. Introduction

One of the key issues for today's higher education is to develop and implement teaching practices that tend to develop students' ability to apply the knowledge efficiently (Dochy et al., 2003). Many universities include skills that can meet the demands of today's industries in their programs. Many high-performing institutions require decision-maker and solution-oriented employees to overcome complex workplace problems (Wan Mohamed et al., 2010). One of the approaches that improves such skills in learners is PBL. PBL is widely adopted and implemented in various fields and educational contexts to encourage critical thinking and problem-solving in the case of authentic learning (Dochy et al., 2003; Yew & Goh, 2016). According to Hung et al. (2008), PBL is perhaps the most innovative teaching method in the history of education. Wood (2003) claims that PBL is a method in which learners access and refine the information by conducting research themselves,

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synthesizing and presenting information after a learning goal that is triggered by a problem status or scenario. PBL is a pedagogical technique placing learning in complex problem-solving contexts. It provides students with opportunities to think about how the facts they have obtained relate to a particular problem. It forces them to ask what they need to know (Hmelo-Silver, 2004). PBL helps students to become thoughtful and flexible thinkers using knowledge to act (Hmelo-Silver, 2004). Kilroy (2004) defines PBL as a learning approach that contributes to both the goals of the program and to the critical thinking and problem-solving skills of students by taking problems from real life. On the other hand, Hung et al. (2008) state that PBL is 'an instructional method that initiates students' learning by creating a need to solve an authentic problem' (p. 486).

In PBL, since problems initiate the learning processes of students, the quality and scenario of the problems is very important for students' learning (Sockalingam & Schmidt, 2011). Scenario directs students who are in the learning process to a specific work area to achieve their goals (Wood, 2008). Therefore, design and format of problems that are used in PBL is an important variable (Barrows, 1986). Dolmans et al. (1997), sets principles of problem design as; problems simulate real life, provide elaboration, integration, encourage self-learning, are compatible with students' previous knowledge, attract students' attention and reflect their learning goals. Problems in PBL should be unstructured. Such problems are problems that are faced in everyday life, where there is not a single truth or a single solution. At this point, the goal is not only to solve the problem but also to develop skills to identify and solve the problem (Savery, 2006). Meanwhile, teachers help learners organize their thoughts with questions and problems such as "What do we know?", "What do we need to know?", "Where can we learn?" (Stepian & Gallagher, 1993, p. 27).

Six core characteristics of PBL are distinguished in the core model described by Barrows (1996). As Barrow puts forward, the first characteristic is that learning should be student-centered. Secondly, learning should be realized with a small group of students accompanied by a tutor. Thirdly, the tutor should be in the position of facilitator or guide. Fourthly, one can face authentic problems during the learning sequence before preparing or any research. Fifthly, problems faced can be benefited as a tool to succeed in the required knowledge and problem-solving skills, which are essential for solutions to problems. Finally, new information should be gained via self-directed learning. According to some, a seventh characteristic should also be highlighted: Necessary for problem-solving skills is that students learn around themselves through analysis and solutions to representative problems.

Improving problem-solving skills is one of the essential promises of PBL (Hung et al., 2008). Problem-solving is 'a process of understanding the discrepancy between current and goal states of a problem, generating and testing hypotheses for the causes of the problem, devising solutions to the problem, and executing the solution to satisfy the goal state of the problem.' (Hung et al., 2008, p. 486). To solve a problem, students are expected to know and use the scientific research process. Because the critical thing in PBL is not to solve the problem by any means, but to solve it by a systematic scientific research process and to teach students who have this consciousness and apply this process in their lives (Barrows & Tamblyn, 1980). Successful problem solvers have organized and flexible knowledge and transform this knowledge into practical skills to solve problems (Chi et al., 1982). In the problem-solving process, it can be asserted that students construct content knowledge and enhance their ability to learn problem-solving and self-directed learning skills during their studies when they try to find solutions to the problems. (Hung et al., 2008).

Today, studies on both problem-solving skills (Han, 2021; Labe, 2015; Priyatni, 2020; Politis & Houtz, 2015; Sala et al., 2015) and PBL (Chen, 2016; Hendry et al., 2016; Kim, 2014; Stentoft, 2017; Wiggins et al., 2016) continue increasingly in different fields. On the other hand, various studies that have been conducted in recent years show the effects of PBL on problem-solving skills (Argaw et al., 2017; Choi, 2004; Choi et al., 2014; Dochy et al., 2003; Gurlen, 2011; Klegeris et al., 2013; Riswari et al., 2018; Rokhmawati et al., 2016; Sahyar, Sani, & Malau, 2017; Siagian, Saragih & Sinaga, 2019; Son & Song, 2012). In all of these studies, it has been found that PBL improves problem-solving skills. Contrary to these results, there are also studies indicating that PBL does

not affect the development of problem-solving skills (Oestreicher, 2019) or leads to negative situations (Rattanatumma & Vichian, 2016). It seems that all this research is concentrated on positive sciences such as mathematics, physics, chemistry, and medicine. Upon the examination of the studies that have focused on EFL (English as a foreign language) teaching, there are some studies examining the effect of PBL in teaching (Allen & Rooney, 1998; Azman & Shin, 2012; Bashith & Amin, 2017; Fard & Vakili, 2018; Ghaemi & Mirsaeed, 2017; Ghufon & Ermawati, 2018; Othman & Shah, 2013). However, research on the effect of PBL regarding problem-solving skills (Chen et al., 2021; Lee et al., 2016) is quite limited. However, not investigating the effect of such an important and effective approach related to problem-solving skills in EFL (English as a foreign language) teaching is regarded as a significant shortcoming. It can be said that EFL (English as a foreign language) learning within PBL contexts requires the active participation of students in realistic problem-solving processes and learning outcomes can be transferred to real-world environments more easily (Chen et al., 2021). Therefore, it is necessary to examine the effect of PBL on problem-solving skills and student opinions.

The research goal is to set the effect of PBL on problem-solving skills and opinions regarding PBL. In this framework, the answers to the following questions were sought:

RQ 1) Is there a significant difference between problem-solving skills pre-test results of the experimental and control groups?

RQ 2) Is there a significant difference between the problem-solving skills post-test results of the experimental and control groups?

RQ 3) Is there a significant difference between the problem-solving skills pre-test and the post-test results of the experimental group?

RQ 4) Is there a significant difference between the problem-solving skills pre-test and the post-test results of the control group?

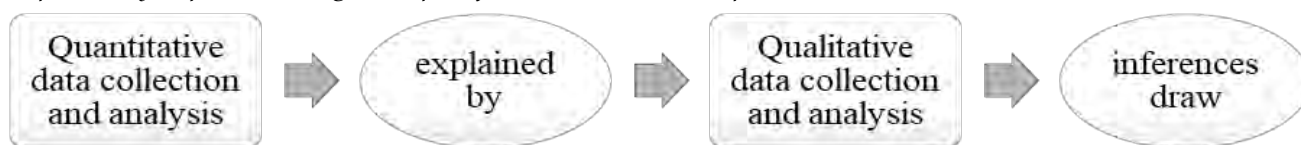
RQ 5) What are the opinions of the experimental group students regarding PBL?

2. Method

In this study, the explanatory sequential design was preferred from mixed-method research. The explanatory sequential design aims to start with the quantitative stage and conduct qualitative research to explain the quantitative results in the second stage (Creswell, 2015). The implementation stages of the explanatory sequential design are offered in Figure 1.

Figure 1

Explanatory sequential design (adopted from Creswell, 2015, p. 39)



In the quantitative stage of the study, a quasi-experimental design with a pre-test and post-test control group was employed. This design is one of the most common experimental designs in educational research. It covers experimental and control groups, where both the pre-test and the post-test are given. The control group and the experimental group do not have a pre-experimental equivalent sampling (Campbell & Stanley, 1963). At the qualitative stage of the research, the case study design was taken as the basis. *The case study is the study of the particular and complexity of a single case coming to understand its activity within critical circumstances* (Stake, 1995, p. xi). In the case study, the researcher wants to answer the questions *how* or *why* (Yin, 2003, p. 1). In this framework, it was tried to determine how the experimental group had experiences related to PBL.

2.1. The Study Group

The quantitative study group of the study is composed of Level B1 46 students studying at the School of Foreign Languages of a state university in Türkiye. While determining the experimental

and control groups, the PREP Smart program used by the current university was benefited. 456 students studying at the B1 level were gathered in a pool, and through PREP Smart program they were grouped on the basis of the four criteria: 1) Repeating the B1 level, 2) Moving from A2 level to B1 level, 3) Becoming a foreign national, and 4) Sex. Based on these criteria, the students were equally and homogenously distributed in random classes. According to this distribution, a total of 19 branches were formed, including 23 students in each class. One of these branches was randomly assigned as an experimental and one as a control group. As a result, the quantitative study group consisted of 23 experimental and 23 control group students.

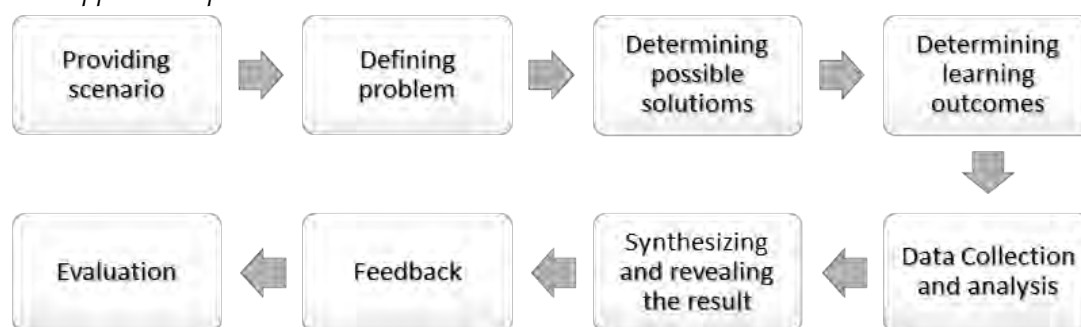
The study group was determined from 46 students selected for the quantitative dimension in the qualitative dimension. For this purpose, one of the purposive sampling methods, *typical case sampling*, was preferred. Purposive sampling is based on selecting cases that are rich in information clarifying the questions being studied. In the typical case sampling, mean cases are handled, and information is provided about the topic through those who have experience (Patton, 2002). With this understanding, eight students who have experience in PBL were selected from the experimental group to obtain the most healthy and reliable information.

2.2. Experimental Procedure

A month before the experimental application, a demo lesson was conducted with a similar study group within the scope of the feasibility study. Conditions such as duration, information, system functioning have been observed, and the most suitable conditions for the experimental application have been investigated. According to the results of the demo lesson, the experimental application was decided to be conducted with groups of three people for four-lesson hours per week. Besides, a PBL student information sheet was prepared for students on the functioning of the PBL. Then, the B1 level textbook was investigated, and the titles of topics were determined as follows: • *Success in business* • *Environmental problems* • *Stress and pressure* • *Phobias* • *Culture-specific social courtesy* • *Food and agriculture* • *Consumer society* • *Medication and diagnosis*. Later on, the learning outcome, learning-teaching process, and evaluation methods were determined (see Experimental Procedure table in Appendix 1). PBL sessions were decided to be implemented according to the stages specified by Gurlen (2020) (see Figure 2).

Figure 2

PBL application process



Pre-tests were applied to the experimental and control groups in the first week of experimental application. The experimental group was also provided with information about the lesson functioning process in the first week. For the next eight weeks, the lessons in the experimental group were taught according to the PBL approach while in the control group, it was taught according to the current curriculum without applying the PBL approach.

According to the stages in Figure 2, 32 hours of experimental application were carried out for eight weeks, four hours a week. A total of eight-lesson plans for PBL were prepared, one for each week (see Appendix 2: A lesson plan example). A scenario presentation was made at the first stage of each lesson plan (see Appendix 3: A scenario example), then the problem was identified, and the steps in Figure 2 were carried out, respectively. Post-tests were applied to both groups at the tenth

week. In the tenth week, eight students from the experimental group were interviewed about the application of PBL within the scope of the qualitative dimension. As a result, the research process was completed in ten weeks.

2.3. Data Collection Tools

2.3.1. Problem-solving inventory

The Problem-Solving Inventory was created by the joint work of Şahin et al. (1993) within the scope of adapting Heppner and Peterson's (1982) *personal problem-solving inventory scale* into Turkish. The inventory intends to measure the students' reactions to their everyday problems and their thoughts and skills regarding the solutions. The total Cronbach Alpha internal consistency coefficient of the scale was found to be .88. The scale consists of 35 items and three sub-dimensions in total. Sub-dimensions include *trust*, *approach-avoidance*, and *self-control*. All of the items are in negative sentence type. A high score from the scale indicates low problem-solving skills.

2.3.2. Standardized open-ended interview

As a qualitative data collection tool, the *standardized open-ended interview* was taken as a basis. This approach requires careful and thorough wording of each question before the interview (Patton, 2002). In the *standardized open-ended interview* form prepared within the scope of the research, *nine draft* questions were determined in which students could express their thoughts about PBL in a reflective and critical way. Opinions were obtained about these questions from academicians, one of whom is an expert in the field of education program and training and the other is an expert in the field of measurement and evaluation in education. Suggested corrections were carried out, and the standardized open-ended interview was put into final form with five questions finally agreed upon.

2.4. Data Analysis

In the analysis of quantitative data, SPSS22 package program was used. Non-parametric tests should be preferred in case the number of participants in the study groups is *less than 25* (Kitchen, 2009, p. 572). Therefore, in the comparison of pre-test and post-test scores of the experimental and control groups, the Mann-Whitney U test was used, while in comparison of the pre-test and post-test scores of the groups themselves, Wilcoxon Signed Rank test was used.

The qualitative data were analyzed descriptively. Descriptive analysis aims to organize the data systematically and to present them via interpretation. The descriptive analysis comprises four stages: Forming a conceptual framework for analysis, processing data according to this framework, identification, and interpretation of findings (Creswell, 2015).

3. Findings

3.1. Quantitative Findings

The results of the Mann-Whitney U Test, which was conducted to determine if there is a significant difference between the problem-solving skills pre-test scores of the experimental group and the control group, are presented in Table 1.

According to Table 1, there was no significant difference in both the sub-dimensions and the whole scale between the experimental and control group pre-test scores ($U=258.500$, $p>.05$). In this case, it can be said that the experimental and control groups are equivalent to each other in terms of problem-solving skills before the experimental application.

The results of the Mann-Whitney U test, which was conducted to determine if there is a significant difference between the problem-solving skills post-test scores of the experimental group and the control group, are given in Table 2.

Table 1

Comparison of pre-test scores for experimental and control groups

<i>Sub-Dimension / Group</i>	<i>n</i>	<i>Mean rank</i>	<i>Total rank</i>	<i>U</i>	<i>p</i>
Trust					
Experimental	23	25.26	581.00	224.000	.372
Control	23	21.74	500.00		
Approach-avoidance					
Experimental	23	22.83	525.00	249.000	.733
Control	23	24.17	556.00		
Self-control					
Experimental	23	23.91	550.00	255.000	.834
Control	23	23.09	531.00		
Overall scale					
Experimental	23	23.76	546.50	258.500	.895
Control	23	23.24	534.50		

Table 2

Comparison of the final test scores for the experimental and control groups

<i>Sub-Dimension / Group</i>	<i>n</i>	<i>Mean rank</i>	<i>Total rank</i>	<i>U</i>	<i>p</i>
Trust					
Experimental	23	13.72	315.50	39.500	.000
Control	23	33.28	765.50		
Approach-avoidance					
Experimental	23	15.22	350.00	74.000	.000
Control	23	31.78	731.00		
Self-control					
Experimental	23	16.04	369.00	93.000	.000
Control	23	30.96	712.00		
The whole scale					
Experimental	23	14.35	330.00	54.000	.000
Control	23	32.65	751.00		

According to Table 2, there is a significant difference between the post-test scores of the experimental group and the control group, in favor of the experimental group, between both sub-dimensions and post-test scores in the whole scale ($U = 54.000, p < .05$). According to this finding, the PBL approach enhances problem-solving skills.

The results of the Wilcoxon Signed Rank test, which was conducted to determine if there is a significant difference between the pre-test post-test scores of the experimental group in terms of problem-solving skills, are offered in Table 3. According to Table 3, there were significant differences between the pre-test and post-test scores of the experimental group in favor of the post-test in both the sub-dimensions and the whole scale ($Z = -4.198, p < .05$). According to this finding, the PBL approach enhances problem-solving skills.

The Wilcoxon Signed-Rank test results, conducted to determine if there is a significant difference between the pre-test and post-test scores of the control group in terms of problem-solving skills, are presented in Table 4. According to Table 4, no significant difference is available between the pre-test and post-test scores of the control group ($Z = -198, p > .05$). Then, it is clear that the lessons conducted based on the current curriculum do not increase the problem-solving skills of the control group.

Table 3
Comparison of pre-test and post-test scores of the experimental group

Sub-Dimensions	Tests	Experimental group	N	Mean rank	Total rank	Wilcoxon (z)	p
Trust	Post-test-	Negative Order	23	12.00	276.00	-4.201	.00
	Pre-test	Positive Rank	0	0.00	0.00		
		Equal	0				
Self-control	Post-test-	Negative Order	23	12.00	276.00	-4.206	.00
	Pre-test	Positive Rank	0	0.00	0.00		
		Equal	0				
Approach avoidance	Post-test-	Negative Order	23	12.00	276.00	-4.200	.00
	Pre-test	Positive Rank	0	0.00	0.00		
		Equal	0				
General	Post-test-	Negative Order	23	12.00	276.00	-4.198	.00
	Pre-test	Positive Rank	0	0.00	0.00		
		Equal	0				

Table 4
Control group pre- and post-test score comparisons

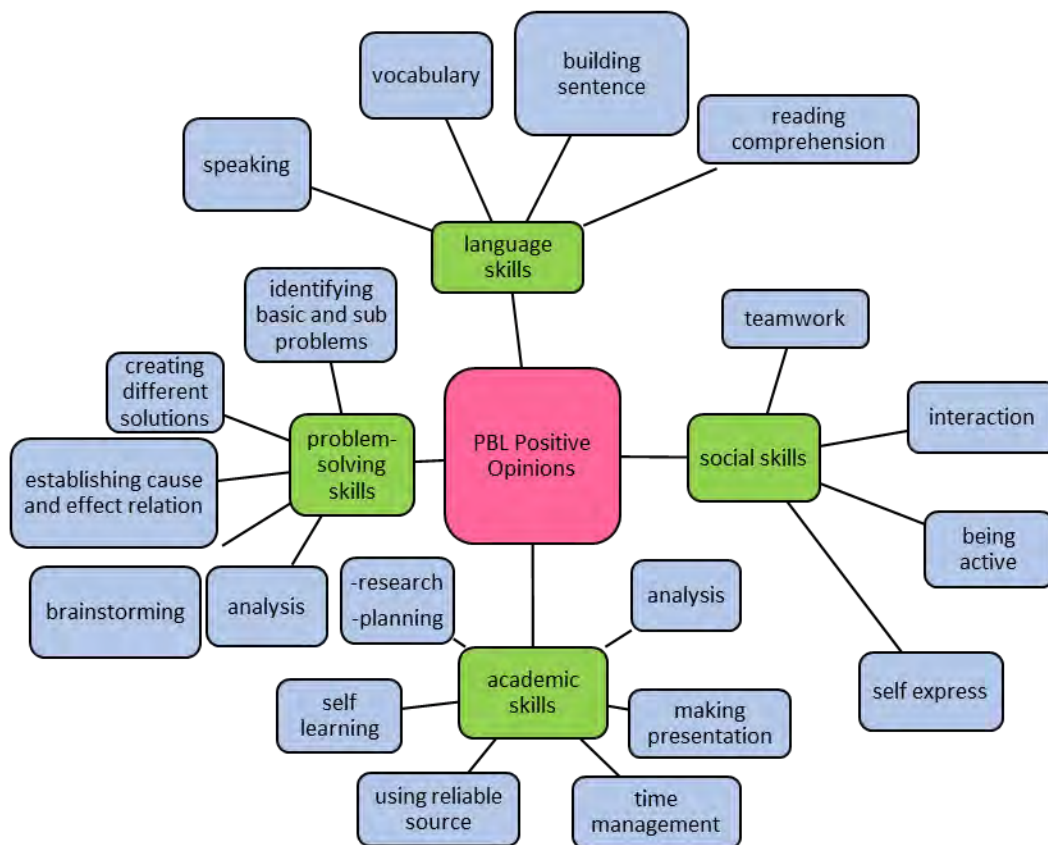
Sub-Dimensions	Tests	Control group	N	Mean rank	Total rank	Wilcoxon (z)	p
Trust	Post-test-	Negative Order	10	10.60	106.00	-0.667	.505
	Pre-test	Positive Rank	12	12.25	147.00		
		Equal	1				
Self-control	Post-test-	Negative Order	12	12.00	144.00	-0.183	.855
	Pre-test	Positive Rank	11	12.00	132.00		
		Equal	0				
Approach avoidance	Post-test-	Negative Order	15	10.63	159.50	-0.654	.513
	Pre-test	Positive Rank	8	14.56	116.50		
		Equal	0				
General	Post-test-	Negative Order	13	11.12	144.50	-0.198	.843
	Pre-test	Positive Rank	10	13.15	131.50		
		Equal	0				

3.2. Qualitative Findings

The qualitative findings were divided into two groups: Positive and negative opinions about PBL. Positive opinions about PBL are summarized in Figure 3.

Figure 3

Positive Opinions about PBL



Positive opinions about PBL are collected in four themes and 19 categories. In the topic of language skills, there are categories of speech, vocabulary, sentence building, and reading comprehension. In the theme of problem-solving skills, the categories of identifying main and sub-problems, creating different solutions, establishing a cause-effect relationship, brainstorming and analysis are available. The theme of academic skills includes the categories of research planning, self-learning, using reliable resources, time management, making presentations, and analysis. The theme of social skills, on the other hand, has the categories of teamwork, interaction, being active, and being able to express oneself.

Students stated that PBL improves their language skills. Some of their opinions on these skills are as follows:

In fact, it was like reading a reading piece because the problems in practice were described at length. We read the sentences, tried to understand them thoroughly, and understood the part-whole relationship more easily over time. I think we have gotten better at understanding what we are reading each week. [Reading comprehension]

First had to constantly check the vocabulary, but then I realized that I did not need it as much as I used to. Each time in problem scenarios, our vocabulary has become richer. This was reflected in our other lessons. For example, I used a word that I learned from practice one time. Our other instructor was surprised that I knew such a word. I have a feeling of self-confidence. [Vocabulary]

I think these problems have improved my English speaking more by speaking, discussing, etc. Sometimes we had to speak English all the time since there were foreign friends in the group, which of lesson improved my speech. [Talk]

Students have expressed that they get better in reading comprehension through the progress of implementation. Problem scenarios not only improve vocabulary, but also increase students' self-confidence and play a developing role. It is particularly emphasized that the common opinion of all students is that the effect of PBL improves speaking skills.

Some of the opinions of people that PBL positively affects social skills are presented below:

I cannot talk much in public, I feel embarrassed. At first, I was usually the one who kept silent in the group. However, I am not as shy anymore as I used to be, as we have to work together. And thanks to this, I got to know some of my friends better, and now I can express myself more easily. I am not standing on the sidelines as shy as I used to be. [Self-expression]

We do not do a lot of group work in other lessons, but since we work in groups in this application, we do our tasks and so on. I think this is something that will help us a lot in business life, as teamwork is critical in business life. We inevitably learn to work together in the group we are a member of and perform our duties. [Teamwork]

I think it's crucial to be active while learning languages. This PBL makes us more active than we are in other classes. We read it ourselves, conduct research, and make decisions with our group members. The teacher does not tell us what we will do, and we have to find it ourselves. That is why we can be more active. I think it is very important. [Be active]

Thanks to this application, interaction in the classroom has increased. Everyone helps each other and is in constant communication. Of course, we enjoy the lesson more when there is interaction. I think it is more useful than idly waiting on the sidelines. [Interaction]

PBL's collaborative approach has made socially introverted and shy students more active. On the other hand, the determination of student-centered understanding has also been an important factor in the activation of students. Students in study have developed a sense of responsibility and cooperation.

Some of the opinions of the students who stated that they improved their academic skills regarding PBL are as follows:

The time given to us when we started the application is certain, four hours. We have to do everything during this time. At first, we lingered a lot, we could not figure out what took much time, but we learned to use time more efficiently in respective applications. And this is definitely a feature that will be useful to us when we start working in a company or something. [Time management]

After we are given the problem, it is clear what we will do step by step, but of course, we still need to determine who will look at what, where to look at, what to write, and so on. Well, of course, that is where planning comes in. We have mastered planning now, and we are organizing immediately. [Planning]

When the teacher gives us the problem, we think it over, analyze the problem, try to solve it. Then we analyze the solutions as to which one would be the best solution, and so on. So that is why I think this application also improves our analysis ability. [Analysis]

...For example, I made presentations from our group. Nevertheless, the woman had to make a presentation on the problem, so we investigated how to make a good presentation. Thus, I used this information to prepare my presentation and researched to make a better presentation. I have learned how to make a better presentation, and I have learned that the presentation is not something to be afraid of. We overestimate, but in fact, after it is prepared beautifully, beautiful presentations appear. For my part, I feel that my presentation ability has improved more. [Making a presentation]

In fact, we have learned to learn on our own in this process. It does not happen like that when the teacher tells it, and we swallow it. We can also learn something on our own. [Self-learning]

According to these views, students believe that time management will benefit them especially in business life. Students who can be organized quickly in terms of planning can also overcome their fears about presentation.

Some opinions on problem-solving skills are presented below:

We have learned how to solve problems in this application most and determine the problems. There is a problem, but there are many other problems when you go deeper. Thanks to this, we have learned to determine the main big problem and the subproblems that lead to it. We see the cause-

effect relationship between these problems. As such, we can determine a lot of different solutions. [Determining the main and subproblems]

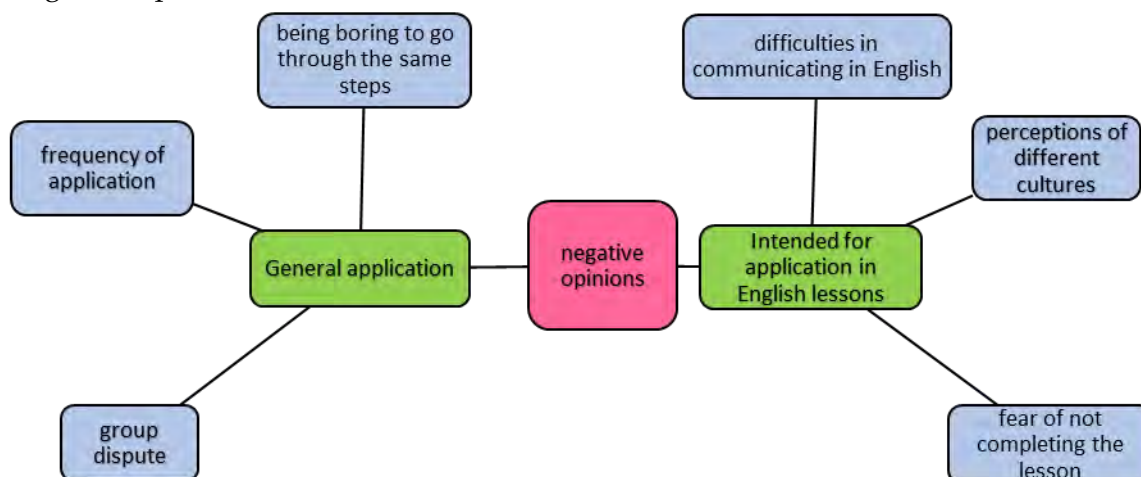
I have understood how the problems in this application are related to each other most. Over time, you come to see the big picture. Anyway, a problem does not have one solution, but it has a lot of different solutions. You analyze it with your group, thinking over which one would be best. I think this is something that will be of great use to us both in our normal lives and in business life. [Creating different solutions]

Problem solving skill was the subject that students expressed their opinions most. They stated that they experienced confusion in the beginning, but they were able to systematize the problem-solving task over time. Students who realize that more than one solution can be found, mention the importance of this awareness of academic career and business.

Considering the positive opinions about PBL in general, it can be asserted that students develop themselves in terms of social, academic, problem-solving, and language learning. In the findings, the skills that all students meet on a common ground are linked to problem-solving. This conclusion coincides with the quantitative findings. Qualitative findings point out that PBL is effective in improving problem-solving skills. Their negative opinions on PBL are presented in Figure 4.

Figure 4

Negative Opinions about PBL



Negative opinions about PBL have been gathered in two themes known as intended for general application and application in English lessons. In the theme of general application, categories of being boring to go through the same steps, the frequency of application, and group disputes are included. The theme of opinions based on application in the English lesson consists of the categories of difficulties in communicating in English, perceptions of different cultures, and fear of not completing the lesson topics. Some negative opinions about PBL are as follows:

I had the most difficulty reconciling with my group members. Some friends did not do their part while the majority in the group tried to do their part. This gets a little annoying. [Group dispute]

The application was too much. I think we could be more motivated if it was applied every two or three weeks instead of every week. [Frequency of application]

We were going through the same cycle every time we were given a problem. At first, it was fine, but after a while, it became monotony. This makes the application a little boring. [Boring to go through the same steps]

I do not know much Turkish, and my English is not very good either, so I had a hard time expressing my thoughts. [Difficulty communicating in English]

One of the biggest challenges I faced in practice was speaking English. While it is difficult to express ourselves even in Turkish, communicating in English made us tired and lost much time. It was beneficial for our 'speaking' in total, but we had a hard time. [Difficulty communicating in English]

Our friends from Chad came across our group several times. I am saying it is true. He/she is saying otherwise. It turns out that it is not so easy to solve a problem with someone from a different culture since our opinions are very different. [Different perceptions of culture]

In Saudi Arabia, women do not come to the forefront too much. That is what we experienced, so it was difficult for me to get along with the girlfriends in the group. I am telling the right solution for us. They think otherwise. [Different perceptions of culture]

The application was helpful for us. It will also be helpful to us after school but spending four hours for this despite our 'course map' intensity created some stress because it is something independent of the exam. It would be better if we spent that time doing other exercises. [Fear of not being able to complete the lesson topics]

Negative opinions about PBL are directed at the functioning of the process in general. It has been highlighted that studying in multinational groups is difficult to understand each other and meet on common ground. It has been stated that the necessity to speak English creates stress and reservations. It has also been stated that the frequency of applications further increases the intensity of the.

4. Discussion, Conclusion and Recommendations

This research intended to determine the effect of PBL on problem-solving skills and opinions about PBL was conducted by a mixed method. In the quantitative dimension, pre-tests were carried out in the first week of the experimental application, and it was found that no significant difference was available between the problem-solving skills of the experimental and control groups. This result pointed out that the groups were equivalent to each other in terms of problem-solving skills before the experimental application. The PBL approach was applied in the experimental group for eight weeks, whereas the lesson in the control group were carried out according to the current teaching plan. A total of 32 hours of experimental application were conducted over eight weeks, including four hours in a week. Lesson plans for PBL were used for each week. The post-tests were carried out in the last week of the experimental application. In addition, interviews were carried out with some students from the experimental group on PBL. These interviews constituted the qualitative dimension of the research.

Significant differences were found between the pretest-posttest results of the experimental group in terms of problem-solving skills in all sub-dimensions and in the whole scale in favor of the posttest. There were also significant differences in favor of the experimental group in all sub-dimensions and the whole scale between the post-test results of the experimental and control groups. No difference was found in the pre-test and post-test results of the control group. These results indicate that PBL effectively improves problem-solving skills in foreign language teaching, though the current curriculum is not effective. Qualitative results also show that the problem-solving skills of the PBL are improving. In the interviews, the students stated that their problem-solving skills have improved through activities such as identifying problems, creating solutions, analyzing, conducting research during the PBL process. Besides, they said that it would benefit them in solving problems they face both in their everyday lives and in their work lives. In this aspect, quantitative and qualitative results support each other. Findings of various research on how PBL improves problem-solving skills also have similarities to these results. In Turan's (2019) study, students stated that components of PBL such as research, examination, and solving problems from daily life increase their problem-solving skills. Likewise, according to the study by Rokhmawati et al. (2016), students stated that PBL makes them better problem solvers and that they will deal with the problem more confidently in the problems they face in daily life. In the experimental study conducted by Aslan (2021), it was found that the problem-solving skills of the online PBL approach were better than the teacher-based approach. In experimental research, Simone (2008) stated that the experimental group in which the PBL approach was applied was significantly better at creating problems, detailing the problem, associating solutions to the problem, and using multiple resources when compared to the control group. In a study by Sahyar et al. (2017), it was observed that the students' problem-solving skills increased, and the students

stated that the process improved the skills such as understanding the problem, reaching the solution, and planning. In Ülger's (2012) study, which used the same data collection tool as this research, it was concluded that the experimental group to which PBL was applied was more successful than the control group. Silviana & Miftakh (2021), concluded that PBL in foreign language teaching helps to overcome difficulties in the problem-solving process. Unlike these studies, in the experimental research of Chen, Hung & Yeh (2021), there was no significant difference in the problem-solving performances of the experimental group in which PBL was applied.

Considering that problem-solving skill is 21st-century skill, the effect of PBL gains special attention. As a matter of fact, the results of research on this issue are noteworthy. Research by Motlhale and Dudu (2021) shows that PBL improves 21st-century skills, especially communication and critical thinking skills. According to Suwastini et al. (2021), PBL is a teaching approach that must be applied to meet the needs of the 21st century (Cosgun & Atay, 2021). PBL was applied in ELT classes, and as a result, there was a statistically significant increase in students' critical thinking and creativity levels. According to Doch et al. (2003), it is seen that PBL has a strong positive effect on students' skills. It has been found that with PBL, students learn less but remember more of the information obtained. In other words, *the positive effect of PBL on students' skills seems immediate and lasting*. All these results can be interpreted as the fact that it might be useful for English teachers to integrate PBL into their classrooms for the purpose of improving their students' language skills, as well as various high-level skills such as critical thinking and creativity.

Upon the evaluation of the qualitative findings of the research, it was found out that PBL supports the development of language skills, academic skills, social skills, and problem-solving skills. The students stated that their ability to be active, self-research, and learn increased during the lesson. These results are similar to different research results. Ansarian and Mohammadi (2018) examined the studies regarding problem-based language learning in countries where English is taught as a foreign language, and it was seen that the effect of PBL on speaking and writing skills was mainly studied. Particular attention was paid to the need to conduct qualitative studies. In the study of Chen et al. (2021) titled *Virtual reality in problem-based learning contexts: Effects on the problem-solving performance, vocabulary acquisition, and motivation of English language learner*, students in the experimental group showed significantly better performance than the students in the control group in terms of vocabulary acquisition. Silviana and Miftakh (2021) asserted that PBL improves speech skills in teaching foreign languages. Montafej et al. (2021) in their experimental studies showed that PBL has improved speech skills. Lin (2018) asserted that PBL improves reading comprehension skills in into a web-based English reading course. Yuliani and Lengkanawati (2017) confirmed with PBL that Indonesian English learners become more independent information seekers by planning, monitoring, and evaluating their second language learning processes. A study by Cosgun and Atay (2021) has pointed out that PBL improves language scores in ELT classes. Lin (2018) asserted that PBL improves speech skills in teaching foreign languages.

On the other hand, qualitative findings have revealed some negative opinions about PBL. Some of these opinions are directed at the general use of PBL application, while some are directed at the use of PBL in English teaching. Among the opinions attracting attention are the time-consuming nature, the fear of not keeping the other lessons, the frequency of application and being boring of going through the same steps. It can be said that these factors sometimes reduce the motivation of students. It can be interpreted that the length of the application period lies at the heart of negative opinions about PBL. An issue that can be considered positive and is expressed together with these negative opinions, is the opinion that the outcomes obtained with PBL will be beneficial in terms of career in the long term, despite the negativities. A similar result is encountered in Huang and Shan (2012) study investigating the effect of PBL in an English classroom of a university. Huang and Shan (2012) showed that most students regard PBL as interesting but time-consuming. They also found out that although students are satisfied with PBL, they have mixed feelings about their

motivation for PBL. Unlike this result, a study by Chen et al. (2021) showed that students are more motivated to learn English for their future careers with PBL.

When the quantitative and qualitative results are compared, the following evaluations can be done; both quantitative and qualitative data has been shown that PBL improves problem solving skills. In this respect, quantitative and qualitative results are interrelated. On the other hand, qualitative data has also identified some situations that were not seen in the quantitative results and has made a difference. The most obvious of these differences is to present some negative perceptions regarding the PBL approach by its reasons. In this respect, it can be said that qualitative data can be more enlightening contributions to the research in addition to quantitative data.

In summary, according to the quantitative results of this study, the PBL approach to teaching English has improved students' problem-solving skills. The qualitative results showed that the PBL approach contributes to the development of language skills, academic skills, social skills, and problem-solving skills. Based on the results of the research, the following recommendations can be offered: Long and repeated PBL applications can be tedious and demotivating. Therefore, higher efficiency can be achieved as a result of keeping the application time reasonable and using PBL by mixing it with different learner-centered teaching approaches. Different study groups can investigate the effect of PBL on problem-solving skills.

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Appendix 1. Experimental Application Table

Week	Lesson period	Outcome	Topic	Learning-Teaching Process (Application)	Assessment
1.	4	Information - Application of pre-tests			
2.	4	<ol style="list-style-type: none"> The student correctly pronounces words related to professions and work. The student collects information about the criteria that employers want. The student builds sentences using "must, have to" modals. The student prepares a CV The student works on the questions asked in interviews. The student distributes tasks within the group. The student collects information from different sources. The student distinguishes reliable sources from unreliable ones. The student prepares a concept map of problems and solutions that may prevent success in business life. 	Success in business	Problem Situation-Scenario 1: Success in business <ol style="list-style-type: none"> Presentation of the problem Defining the problem Identifying possible solutions Setting learning goals Data collection and analysis Synthesizing and revealing the result Giving feedback Evaluation 	Group observation form Reflective diary Flowchart
3.	4	<ol style="list-style-type: none"> The student correctly pronounces words related to nature and the environment he uses it. The student builds the sentence using "must, have to, may, might" modals The student learns about the biodiversity of the Great Barrier Reef. The student distributes duties within the group. The student collects information from different sources. The student distinguishes reliable sources from unreliable ones. The student offers solutions to environmental problems. 	Environmental problems	Problem Situation-Scenario 2: Environmental Problems <ol style="list-style-type: none"> Presentation of the problem Defining the problem Identifying possible solutions Setting learning goals Data collection and analysis Synthesizing and revealing the result Giving feedback Evaluation 	Group observation form Reflective diary Poster preparation
4.	4	<ol style="list-style-type: none"> The student correctly uses words related to stress. The student collects information on how to make a good presentation. The student gives advice using the "should" modal. The student distributes tasks within the group. The student collects information from different sources. The student distinguishes reliable sources from unreliable ones. The student offers solutions to problems for transportation and life in a big city. 	Stress	Problem Situation-Scenario 3: Stress <ol style="list-style-type: none"> Presentation of the problem Defining the problem Identifying possible solutions Setting learning goals Data collection and analysis Synthesizing and revealing the result Giving feedback Evaluation 	Group observation form Reflective diaries Presentation evaluation
5.	4	<ol style="list-style-type: none"> The student correctly uses words related to phobias. The student builds sentences with Past Simple Tense and Perfect modes. The student learns to express his/her feelings properly. The student distributes tasks within the group. The student collects information from different sources. The student distinguishes reliable sources from unreliable ones. The student provides solutions that can overcome 	Phobias	Problem Situation-Scenario 4: Phobias <ol style="list-style-type: none"> Presentation of the problem Defining the problem Identifying possible solutions Setting learning goals Data collection and analysis Synthesizing and revealing the result Giving feedback Evaluation 	Group observation form Reflective diaries Roleplay

Appendix 1 continued

Week	Lesson period	Outcome	Topic	Learning-Teaching Process (Application)	Assessment
6.	4	<ol style="list-style-type: none"> 1. The student correctly uses words related to courtesy. 2. The student uses expressions such as "In my opinion, I strongly believe" to express his/her feelings. 2. The student learns the rules of social courtesy. 3. The student distributes duties within the group. 4. The student collects information from different sources. 5. The student distinguishes reliable sources from unreliable ones. <p>The student offers solutions to situations related to etiquette in society.</p>	Specific to the culture public courtesy	<p>Problem Situation-Scenario 5: Culture-specific social courtesy</p> <ol style="list-style-type: none"> 1. Presentation of the problem 2. Defining the problem 3. Identifying possible solutions 4. Setting learning goals 5. Data collection and analysis 6. Synthesizing and revealing the result 7. Giving feedback 8. Evaluation 	<p>Group observation form</p> <p>Reflecting logs</p> <p>Report preparation</p>
7.	4	<ol style="list-style-type: none"> 1. The student correctly uses words related to food and agriculture. 2. The student learns the relative clause and adjectives used in the definition of food. 3. The student conducts research in agricultural activities based on extreme and favorable conditions. 4. The student collects information from different sources. 5. The student distinguishes reliable sources from unreliable ones. 6. The student provides solutions to problems that may prevent agricultural activities and prepares the concept map. 	Food and agriculture	<p>Problem Situation-Scenario 6: Food and agriculture</p> <ol style="list-style-type: none"> 1. Presentation of the problem 2. Defining the problem 3. Identifying possible solutions 4. Setting learning goals 5. Data collection and analysis 6. Synthesizing and revealing the result 7. Giving feedback 8. Evaluation 	<p>Group observation form</p> <p>Reflective diaries</p> <p>Concept map</p>
8.	4	<ol style="list-style-type: none"> 1. The student correctly pronounces the words related to shopping and consumption. 2. The student investigates the English phrases that can be used when purchasing a product, which sites are reliable, and product exchange and cancellation procedures. 3. The student collects information from different sources. 4. The student distinguishes reliable sources from unreliable ones. <p>The student provides solutions to problems related to consumption.</p>	Consumer society	<p>Problem Situation-Scenario 7: The consumer society</p> <ol style="list-style-type: none"> 1. Presentation of the problem 2. Defining the problem 3. Identifying possible solutions 4. Setting learning goals 5. Data collection and analysis 6. Synthesizing and revealing the result 7. Giving feedback 8. Evaluation 	<p>Group observation form</p> <p>Reflective diaries</p> <p>Presentation evaluation</p>
9.	4	<ol style="list-style-type: none"> 1. The student correctly uses simple medical terms. 2. The student learns phone applications to help to establish the diagnosis. 3. The student collects information from different sources. 4. The student distinguishes reliable sources from unreliable ones. 5. The student follows a scientific way to identify medical symptoms. <p>The student prepares a cause-effect diagram.</p>	Medication and diagnosis	<p>Problem Situation-Scenario 7: Medication and diagnosis</p> <ol style="list-style-type: none"> 1. Presentation of the problem 2. Defining the problem 3. Identifying possible solutions 4. Setting learning goals 5. Data collection and analysis 6. Synthesizing and revealing the result 7. Giving feedback 8. Evaluation 	<p>Group observation form</p> <p>Logs</p> <p>Cause-effect diagram</p>
10	4	Implementation of the post-tests – Implementation of the quasi-structured interview form			

Appendix 2. Lesson Plan

I. Section

Lesson: Main Course

Topic: Environmental Problems

Level: B1

Time: 180 minutes

II. Section

Student Achievements

1. The student correctly uses words related to nature and the environment.
2. The student builds sentences using the " must, have to, may, might" modals.
3. The student learns about the biodiversity of the Great Barrier Reef.
4. The student distributes tasks within the group.
5. The student collects information from different sources.
6. The student distinguishes reliable sources from unreliable ones.
7. The student offers solutions to environmental problems.

Learning- Teaching Strategies, Methods and Techniques

Problem-Based Learning, Research-review, Problem Solving, Question-answer, Discussion, Brainstorming

Tools and Equipment Used

Smart Board, PPT Slide towards Problem Status, Mobile Phones, Macmillan Skillful Textbook, Problem Chart

Learning- Teaching Activities

Defining the problem:

The instructor introduces the lesson by asking the students the following questions:

- What are the endangered animals you know? Why are they extinct?
- What harm do you think people do to nature?

After talking over such questions, the instructor gives the following instructions:

"Now I am going to tell you about Chris, an Australian biologist, let's look at Chris's condition together!" and present the slide regarding the problem status. The instructor makes a description if there are unknown or incomprehensible words.

Sorting out what students know and what they should know:

After the presentation, the instructor reflects the problem on the blackboard and distributes the "Problem Chart". The instructor asks the students to identify the problems with their group members and write what they know and what they do not know about the problem on the "Problem Chart".

Generating possible solutions and determining hypotheses:

After filling in the relevant sections of the "Problem Chart", students discuss with their group members how they can solve the problem and determine the possible solutions.

Setting learning goals: Goals are set to gather information about the identified possible solutions.

Collecting and sharing information:

In accordance with the established goals, students begin the stage of collecting.

Measurement and evaluation

Group observation Form, Reflective Diary, Preparing a poster for a self-evaluation and peer review form.

Appendix 3. Problem Statement (Environmental Problems)

Chris is a 60-year-old Australian biologist. During and after university, this researcher conducted research on the barrier reef, where biodiversity is high, and contributed to identifying new coral species. At the age of 32, he left his birthplace, Lizard Island, and went to work in Japan. After working in Japan for 28 years, Chris decided to retire and live a quiet life in touch with nature where he grew up. After returning to Lizard Island, he was surprised by the sight he encountered. The island, which consisted of a small number of households in its childhood, has become a tourist destination with an influx of tourists coming to see the Australian Great Barrier Reef, covered with hotels, tour companies, buses, boats, and planes going to and from everywhere. After dives for exploration and observation purposes, Chris observed that some of the corals were lost, and therefore other species of living things were affected. As a scientist and nature lover, he decided to step up and protect marine life.