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Examining the Effects of Project and Resource-Based Teaching Methods on Social Intelligence, Metacognitive Thinking and Academic Achievement

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This study aimed to reveal the effects of project- and resource-based teaching methods on student teachers' social intelligence, metacognitive thinking skills, and academic achievements. A pretest-posttest control group design, a quasi-experimental method, was used in the study. The study used the purposeful sampling method to determine the study group. The study group consists of four different groups. The study analyzed the collected data by MANOVA and paired samples t-test. The findings obtained from the study showed that there was a significant difference in terms of metacognitive thinking skills and academic achievement between the groups to which different teaching methods were applied. In the study, it was understood that the group to which PBTM was applied was more successful than the other groups in terms of metacognitive thinking skills and academic achievements. It was observed that there was a significant difference between the pre-test and post-test scores regarding the metacognitive thinking skills and academic achievement of the group to which PBTM was applied. On the other hand, it was determined that there was no significant difference in terms of the scores regarding social intelligence levels between the groups to which different teaching methods were applied in the study. It was observed that there was no significant difference between the social intelligence variable pre-test and post-test scores of the groups. In conclusion, the study revealed that different teaching methods used in lessons affected students' social intelligence, metacognitive thinking and academic achievement at different levels.

Introduction

Today, different teaching methods are used in educational environments to provide people with a considerable amount of knowledge, skills and attitudes. The term "teaching method" refers to the entire body of consciously selected and applied actions and activities to accomplish the objectives established during the learning and teaching processes. While

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teaching methods ensure that the teaching process is effectively directed within a specific framework to facilitate learning (Küçükahmet, 2017), they support various learning outcomes and address different facets of education (Teegelbeckers, Nieuwelink & Oostdam, 2023). The success of educational processes solely depends on applying a teaching strategy that ensures the desired teaching and learning activities. It may also support the explicit and precise information, meaningful practices, informative feedback, and robust intrinsic or extrinsic motivation that teaching should offer by increasing the effectiveness, efficiency, and interestingness levels expected from teaching (Reigeluth, 2016). The teaching method is essential for effective and permanent learning attainment (Ulubey, 2015). Indeed, an effectively utilized teaching method potentially brings into prominence different abilities and skills of students. Hence, it helps educational processes succeed by improving students' skills in analytical thinking, synthesis, solving problems, and communicating effectively (Börekçi, 2018). It also serves students to acquire and develop skills, including creative and critical thinking, problem-solving, effective communication, decision-making, research, questioning, interpretation, and empathy (Ulubey, 2015). It is possible to see the results of studies in this context in the literature. In their study, Akerson, Weiland, Park Rogers, Pongsanon, and Bilican (2014) concluded that the use of different teaching methods is effective for the development of imagination and creativity in science. Karadağ (2018) concluded in his study that the teaching method helps students learn more. Çelik (2011) obtained findings showing that different teaching methods have positive effects on students' cognitive and psychomotor development areas. Morgan, Kinston and Sproule (2005) revealed the effect of the teaching method in supporting cognitive development in their study examining whether the applications of different teaching methods have an effect on the motivational climate and student motivation. In particular, teaching methods with diverse attributes used in educational activities in contemporary education significantly contribute to students' becoming individuals who question, research, think abstractly, consider solution-oriented, and learn to learn (Topay, 2013). In this context, teaching methods substantially influence the educational process of individuals, and thus, they become equipped to overcome even global issues. As a result, the features of teaching methods, such as appealing to different learning styles, ensuring active participation, supporting communication and collaboration, and enabling students' knowledge construction, appear to manifest such attainments.

Teaching methods potentially facilitate students' independent learning processes. It enables students to be active in classes and learn by doing and experiencing. It also allows students to use time effectively and interact directly with learning resources. It may also serve students to establish a robust linkage between what they learned in the classroom and real-world situations in line with their everyday issues. Furthermore, it may encourage students' desire to learn through physical and mental activities, supporting them in using various forms of intelligence and improving their thinking principles (Vural, 2006). Considering the stated matters about teaching methods, the methods with diverse characteristics and used in learning and teaching processes implemented in tandem with the contemporary education perspective will anticipatingly overcome numerous difficulties and resolve the issues, leading to a broader range of learning outcomes through blending various teaching methods (Teegelbeckers et al., 2023). The study was carried out based on these predictions. It can be stated that an education carried out with the right teaching method in a suitable learning environment can increase the success of students and enable them to achieve gains in cognitive, affective and psychomotor areas (Çelikoğlu and Deniz, 2020). Alternative teaching methods may be more effective than the teaching methods prescribed by the current program (Kutluca Canbulat and Yüce, 2017). It can also help students develop processing capacities such as selecting, organizing, and connecting sources with other information in the processes of acquiring information, using

information, and distributing information. In this context, a teaching method can be seen as an effective way to organize and direct learning by combining the efforts of teachers and students (Deringöl, 2020). Accordingly, it utilized two alternative teaching methods that might satisfy the demands of the modern educational approach, including active learning and practice-based activities with novel technology (Phillips & Trainor, 2014). These strategies involved project-based teaching methods emphasizing teamwork and cooperation and resource-based teaching methods prioritizing more individual practices and activities. In PBL, students are exposed to real-life problems in a natural environment. With this method, students can manage their own learning processes, meet their learning needs, and also improve their ability to work individually and in groups. Since the implementation of PBL takes place over a certain period of time, it is tolerated for students to make mistakes and compensate for their mistakes. In the method, learning environments are integrated with technology, allowing students to develop higher-order thinking and 21st century skills (Kocaman, 2016). On the other hand, KTÖY meets the special learning needs of students. The method supports individual efforts to find, analyze, interpret and adopt information. In KTM, different resources are used to create interpretive content with supporting tools and learning supports. KTÖY allows the use of environments containing many different resources and special hardware and software tools. In this way, the method can offer a series of guiding and explanatory options throughout the teaching and learning processes. This provides support for students' individual development by supporting their interests, experiences, learning styles, needs and ability levels. It also helps students develop skills and abilities such as analysis, synthesis, interpretation and organizing information (Hill &Hannafin, 2001).

Project-Based Teaching Method (PBTM)

Project-based learning is a teaching method where students actively seek solutions to issues that arise in the project process and improve their problem-solving and decision-making skills and abilities (Taşpınar, 2009). Projects are a vital component of project-based learning. These projects typically arise from questions that students' innate curiosity prompts (Bell, 2010) and are determined by their interests, experience, and abilities. Students pose questions through researching, examining, and observing projects and aspire to address these questions. Since the projects retain suitable quality for group and individual study, it is viable to define the PBTM as a learning approach that focuses on the student (Metin & Aral 2016).

PBTM retains a multidimensional structure. With this method, students potentially discuss concepts and make predictions while posing questions of different qualities. Students may concurrently reach conclusions by analyzing the data they collect, discussing their ideas and thoughts with others, posing new questions, and finding solutions to issues of different natures (Blumenfeld et al., 1991). Since the PBTM involves active knowledge structuring, students may also advance the stages of analysis, synthesis, and evaluation (Kocaman, 2016). There are study results that support the situations stated in the literature (Börekçi, 2018; Iwamoto, Hargis, & Vuong, 2016; Johnson & Cuevas, 2016; Tonbuloğlu et al., 2013). In this context, it is possible to state that project-based teaching is an effective method for developing diversified skills and abilities among students. It is also explicit that PBTM effectively provides students with meaningful and permanent knowledge and skills of various qualities. This method aspires to equip students with knowledge and skills they can utilize in real life. These attributes include critical thinking, problem-solving, collaborative working and learning, and the ability to communicate in different ways, creating a necessity to cognize the required content and skills (BIE, 2003) in addition to life skills, use of technology, cognitive processes, and self-control skills, attitudes, tendencies, and beliefs. The results

obtained from studies conducted in this direction are available in the literature (Cheong, 2010; Sart, 2014; Tonbuloğlu vd., 2013). While PBTM escalates the skills of engaging higher-order thinking effectively and working individually and in groups (Kocaman, 2016), it is ideal for students in this context by significantly fostering them to manage their learning processes by assuming personal responsibilities.

Resource-Based Teaching Method (RBTM)

Resource-based learning is a teaching method that enables students to perform activities by directly comparing multiple learning resources individually or in groups and interpret their learning by interacting with print, non-print, and human resources (Sitepu, 2010). The primary objective of RBTM is to augment resource diversity by using diverse learning settings and to enable students to use these resources effectively in line with their goals. Hence, this context allows students to be involved in the learning process by utilizing resources of diverse qualities to maximize their learning experience and attain learning goals through an entertaining and effective learning process (Lasaka, Jamaludin & Saneba, 2017). The resource-based teaching method requiring individual efforts on the part of students to find the information they need, analyze, interpret, and adapt also supports the development of learning with applications that satisfy particular learning demands (Alsa, Kusumawati & Nuriyatin, 2018). The method emphasizes the criticalness and significance of resources, especially in self-learning scenarios (Wati, 2016), and ensures that the active learning process proceeds successfully (Apriliana & Subanti, 2015). It is also practical to use the RBTM alone or as a supplement means for any method in various courses, events, and activities for students enrolled in diverse fields and levels. The primary reason for this convenience is that students use the method of self-learning and reflection to acquire and develop knowledge and skills of different qualities (Dsouza, 2016). Furthermore, the involvement of the method in several topics, such as learning and feedback, learning materials, individualization, and the role of the teaching in the learning-teaching process (Dsouza, 2016), contributes to this situation substantially.

It is conceivable to presume that project- and resource-based teaching methodologies will significantly aid students in several learning and teaching processes, considering their structures, characteristics, and other circumstances mentioned about the methodologies. However, it is also conspicuous that there were limited studies in the literature focusing on the effects of PBTM on students' social intelligence and various metacognitive thinking abilities, and hardly any studies assessing the PBTM relationship with these topics. Therefore, this study considered a predicament that project- and resource-based teaching methods might positively contribute to the different aspects of students. From this point forth, the study analyzed the effects of applying project- and resource-based teaching methods separately and combinedly in classes on students' social intelligence, metacognitive thinking skills, and academic achievement. Consequently, the study aimed to answer the following questions.

(1) Considering social intelligence, metacognitive thinking, and academic achievement levels, is there a statistically significant between-group difference that utilized different teaching methods?
(2) Is there a statistically significant difference in terms of the change in social intelligence, metacognitive thinking and academic achievement levels in the groups using different teaching methods?

a) Is there a statistically significant difference in the change of social intelligence, metacognitive thinking, and academic achievement levels in the group in which PBTM method was applied?
b) Is there a statistically significant difference in the change of social intelligence, metacognitive thinking, and academic achievement levels in the group in which PBTM and RBTM methods were applied together?
c) Is there a statistically significant difference in terms of the change in the levels of social intelligence, metacognitive thinking, and academic achievement in the group in which RBTM method was applied?
d) Is there a statistically significant difference in terms of the change in the levels of social intelligence, metacognitive thinking, and academic achievement in the group in which traditional methods were applied?

Method

Research Design

Since the aim was to identify the effects of different teaching methods on students' social intelligence, metacognitive thinking, and academic achievement levels, and the samples were non-random, the study employed a quasi-experimental design with a pretest-posttest control group. In educational research, where unbiased sampling is challenging (McMillan and Schumacher, 2014), the quasi-experimental approach is one of the quantitative research techniques used to ascertain the effect of teaching methods on various variables (Fraenkel et al., 2012). Table 1 displays the pretest-posttest control group design used in the study.

Table 1. Pretest-posttest design with control group

Group	Pretest	PBTM	RBTM	Traditional Methods	Posttest
Group 1	✓	✓			✓
Group 2	✓	✓	✓		✓
Group 3	✓		✓		✓
Group 4	✓			✓	✓

Study Group

The study group consisted of preservice teachers from the Psychological Counseling and Guidance department who took the information technologies course at Kafkas University in the fall semester of the 2018-2019 academic year. The study also identified its group through the purposeful sampling method, and accordingly, it comprised 138 participants in four different groups. The pretests performed before the study revealed that the students in the groups reflected comparable characteristics in terms of social intelligence, metacognitive thinking, and academic achievement variables. Accordingly, the pretest results indicated that the group displayed similar characteristics for these variables (p>.05). The study applied a different teaching method to each group, selecting them randomly. Table 2 lists the number of students in the study group and the teaching methods applied.

Table 2. Pretest-posttest design with control group

Group	Teaching Method	Male	Female	Total
Group 1	PBTM	20	16	36
Group 2	PBTM-RBTM	15	20	35
Group 3	RBTM	19	16	35
Group 4	Traditional Methods	18	14	32

Data Collection Tools

The study utilized three separate data collection tools. The initial tool the Tromso Social Intelligence Scale (TSIS) was a self-report style measurement scale consisting of 21 items, developed by Silvera, Dahl, and Martinussen (2001) to assess the social intelligence level. The scale was a five-point Likert design. While scoring the responses to the scale's items, the lowest and highest scores were '1' and "5," respectively. Although Doğan and Çetin (2009) computed the internal consistency reliability coefficient (Cronbach Alpha) for the entire scale as .83, the current study calculated this value as .80.

The second data collection tool was the Metacognitive Thinking Skills (MTS) Scale developed by Tuncer and Kaysi (2013) and consisted of 18 items. The scale had a five-point Likert design, and the highest and lowest response scores were 'Strongly Agree = 5' and 'Strongly Disagree = 1,' respectively. Although the scale's internal consistency reliability coefficient (Cronbach Alpha) was .88 in its original form, this study calculated it as .86.

Finally, the academic achievement test the researchers generated using the information technology course curriculum served as the third data collection tool in the study. The researchers followed the necessary test development stages while preparing for the academic achievement test. Experts with varied titles from diverse domains provided opinions and inputs at every stage of the test development process. Finally, using the outcomes and expert opinions, the study aimed to ensure the test validity and reliability by performing the test on the group as a pre-test and post-test. Academic achievement test statistics are presented in Table 3.

Table 3. Academic achievement test statistics

Number of People Applied	138
Number of questions	43
Average Score	31.5
Standard Deviation	11.76
Skewness	-1.25
Kurtosis	.05
Average Item Difficulty Index	.63
Average Item Discrimination Index	.57
KR20 (Alpha)	.95

Procedure

The study used pre-tests to determine whether the groups shared similar characteristics in terms of variables before the teaching procedure. Before starting the trial, the researchers similarly informed each group about PBTM, RBTM, and the entire process. The study applied the teaching methods for each group randomly. According to the intended teaching methods, the researchers generated an outline syllabus for the groups. The teaching process of the study took place six weeks. Table 4 summarizes the 6-week teaching processes of the groups.

Table 4. 6-Week teaching application processes of the groups

	Group 1	Group 2	Group 3	Group 4
1. Week	PBTM	PBTM + RBTM Prac. 1	RBTM Prac. 1	Direct instruction method / Question and answer teaching method
2. Week			RBTM Prac. 2	
3. Week			RBTM Prac. 3	
	Presentation of projects	Presentation of projects		
4. Week	PBTM	PBTM + RBTM Prac. 4	RBTM Prac. 4	Direct instruction method / Question and answer teaching method
5. Week			RBTM Prac. 5	
6. Week			RBTM Prac. 6	
	Presentation of projects	Presentation of projects		

Data Analysis

In the study, which considered two main and four sub-research questions, Multivariate analysis of variance (MANOVA) test was used to answer the first question. MANOVA is a test used to identify the significance level of the difference between groups. Scheffe test one of the post-hoc tests was also used to determine the group or groups that contributed to this difference. In the study, the Scheffe test was used because the number of groups and students in the groups was different, and the variances were equal. Similarly, the study utilized a paired samples t-test to address the second research question. The paired samples t-test is a method used to determine the significance of the difference between the scores of two related samples on a dependent variable.

Findings

Considering social intelligence, metacognitive thinking, and academic achievement levels, is there a statistically significant between-group difference that utilized different teaching methods?

The study applied different teaching methods to each group and performed a MANOVA test to identify whether there was a significant between-group difference in social intelligence, metacognitive thinking, and academic achievement. It additionally utilized the Scheffe test to specify which group or groups contributed to the difference. As a result, Table 5, Table 6, and Table 7 display results from MANOVA and Scheffe tests, respectively.

Table 5. MANOVA test results for the between-group differences in social intelligence, metacognitive thinking, and academic achievement variables

	Wilk's Lambda (Λ)	F	p	R^2
Intercept	.003	15024.740	.000	.997
Method	.462	13.346	.000	.227

The detailed analysis of Table 5 indicated a statistically significant between-group difference in terms of social intelligence, metacognitive thinking, and academic achievement variables (Λ = .462, F=13.346 p <.05).

Table 6. Between-group differences on social intelligence, metacognitive thinking, and academic achievement variables

Independent Variables	Dependent Variables	Sum of Squares	Average of Squares	Sd	F	p	R^2
Adjusted Model	Social Intelligence	118.348	39.444	3	.837	.476	.018
	Metacognitive Thinking	872.168	290.722	3	7.609	.000	.146
	Academic Achievement	1164.702	388.234	3	37.663	.000	.457
Intercept	Social Intelligence	604720.968	604720.968	1	12835.419	.000	.990
	Metacognitive Thinking	817770.146	817770.146	1	21404.098	.000	.994
	Academic Achievement	137652.325	137652.325	1	13353.894	.000	.990
Method	Social Intelligence	118.333	39.444	3	.837	.476	.018
	Metacognitive Thinking	872.168	290.722	3	7.6097	.000	.146
	Academic Achievement	1164.702	388.234	3	37.663	.000	.457

According to Table 6, there was a statistically significant between-group difference in terms of metacognitive thinking (F =7.60, p <.05, R^2 = .146) and academic achievement (F=37.66, p <.05, R^2 = .457) variables . However, there was no statistically significant between-group difference for the social intelligence variable (F= .837, p >.05, R^2 = .018).

Table 7. Scheffe test results of the groups for the social intelligence, metacognitive thinking, and academic achievement levels

Dependent Variable		Method(I)	Method(J)	p
Social Intelligence	Scheffe	RBTM	PBTM	.958
			PBTM-RBTM	.526
			Traditional Methods	.777
		PBTM	RBTM	.958
			PBTM-RBTM	.823
			Traditional Methods	.966
		PBTM-RBTM	RBTM	.526
			PBTM	.823
			Traditional Methods	.982
		Traditional Methods	RBTM	.777
			PBTM	.966
			PBTM-RBTM	.982
Metacognitive Thinking	Scheffe	RBTM	PBTM	.031
			PBTM-RBTM	.997
			Traditional Methods	.399

			RBTM	.031
		PBTM	PBTM-RBTM	.056
			Traditional Methods	.000
			RBTM	.997
		PBTM-RBTM	PBTM	.056
			Traditional Methods	.287
			RBTM	.399
		Traditional Methods	PBTM	.000
			PBTM-RBTM	.287
			PBTM	.011
		RBTM	PBTM-RBTM	1.000
			Traditional Methods	.000
			RBTM	.011
		PBTM	PBTM-RBTM	.009
			Traditional Methods	.000
Academic Achievement	Scheffe		RBTM	1.000
		PBTM-RBTM	PBTM	.009
			Traditional Methods	.000
			RBTM	.000
		Traditional Methods	PBTM	.000
			PBTM-RBTM	.000

Considering the metacognitive thinking variable, detailed analysis of Table 7 revealed a significant difference between groups with combined application of the 'RBTM and PBTM' (p = .031 < .05)' and 'PBTM and the traditional method (p = .000 < .05). Correspondingly, considering the academic achievement variable, there was also a statistically significant difference among all groups except for those RBTM and the groups with combined application of the PBTM and RBTM (p = 1.000 > .05). However, the study identified no significant difference between the groups in terms of the social intelligence variable (p > .05).

Is there a statistically significant difference in terms of the change in social intelligence, metacognitive thinking and academic achievement levels in the groups using different teaching methods?

The findings below display the dependent group's t-test results to identify social intelligence, metacognitive thinking, and academic achievement between-group differences resulting from diverse teaching method applications.

Comparison of pre-test and post-test scores of the PBTM-applied group

Table 8 lists the paired samples t-test results by the pre-test and post-test scores for the social intelligence, metacognitive thinking, and academic achievement variables of the PBTM-applied group.

Table 8. Paired samples t-test results by the pre-test and post-test scores of the PBTM-applied group

	D	SS	sd	t	p
Social Intelligence	-2.694	8.501	35	1.902	.065
Metacognitive Thinking	-4.916	8.391	35	3.515	.001
Academic Achievement	-8.500	3.393	35	15.030	.000

Analysis of Table 8 indicated that there was a significant difference in the PBTM-applied group in terms of metacognitive thinking (p = .001) and academic achievement (p = .000) variables, whereas there was no significant difference in terms of social intelligence (p =

.065).

Comparison of pretest-posttest scores of the group with combined application of the PBTM and RBTM

Table 9 displays the findings acquired from the paired samples t-test used to compare the pre-test and post-test scores of the students in the group with combined application of the PBTM and RBTM for social intelligence, metacognitive thinking, and academic achievement variables.

Table 9. Paired samples t-test results of the pre-test and post-test scores in the group with combined application of the PBTM and RBTM

	D	SS	sd	t	p
Social Intelligence	2.685	10.177	34	1.561	.128
Metacognitive Thinking	-.028	10.051	34	.017	.987
Academic Achievement	-11.028	3.560	34	18.326	.000

According to Table 9, there was a statistically significant difference in the group with combined application of the PBTM and RBTM in terms of the academic achievement (p = .000) variable; however, there was no meaningful difference in social intelligence (p = .128) and metacognitive thinking (p = .987) variables.

Comparison of pre-test and post-test scores of the RBTM-applied group

Table 10 indicates the paired samples t-test results for the social intelligence, metacognitive thinking, and academic achievement pre-test and post-test scores of the students in the RBTM-applied group.

Table 10. Paired samples t-test results for the pre-test and post-test scores of the RBTM-applied group

	D	SS	sd	t	p
Social Intelligence	-.628	11.760	34	.316	.754
Metacognitive Thinking	.428	8.070	34	.314	.755
Academic Achievement	-10.000	4.530	34	13.057	.000

Analysis of Table10 revealed that there was a significant difference in the academic achievement (p = .000) variable in the RBTM-applied group; however, there was no significant difference in terms of social intelligence (p = .754) and metacognitive thinking (p = .755) variables.

Comparison of pretest-posttest scores of the traditional method-applied group

Table 11 presents the paired samples t-test results for the pre-test and post-test scores of the students in the traditional method-applied group for social intelligence, metacognitive thinking, and academic achievement variables.

Table 11. Paired samples t-test results for the pre-test and post-test scores of the students in the traditional methods-applied group

	D	SS	sd	t	p
Social Intelligence	-.375	12.795	31	.166	.869
Metacognitive Thinking	-.125	9.348	31	.076	.940
Academic Achievement	-3.062	5.186	31	3.340	.002

According to Table 11, there was a significant difference in the traditional method-applied group in terms of the academic success (p = .002) variable; however, there was no significant difference in terms of the social intelligence (p = .869) and metacognitive thinking (p = .940) variables.

Discussion and Conclusion

Differences between groups applied different teaching methods in terms of social intelligence, metacognitive thinking and academic achievement levels

The primary objective of this study was to reveal the effects of applying project- and resource-based teaching methods separately and combinedly in lessons to assess students' social intelligence, metacognitive thinking skills, and academic achievement levels. The study also identified the differences between the pre-test and post-test scores of the students on social intelligence, metacognitive thinking skills, and academic achievement variables based on within-group and between-group evaluation of the four separate groups. Accordingly, the study findings revealed a significant between-group difference in metacognitive thinking skills and academic achievement variables, whereas it identified no substantial difference for the social intelligence variable. The study also concluded that the teaching methods implemented in courses positively influenced students' social intelligence, metacognitive thinking skills, and academic achievements at varying levels. The diverse characteristics of the teaching methods may have generated this outcome by raising students' learning motivation through application-based mental activities (Vural, 2006) and enabling them to engage in active learning via utilizing new technologies (Phillips & Trainor, 2014). Similar documented findings in the literature also support this conclusion (Akerson et al., 2014; Akyüz, 2016; Erdem, 2015; Kao, Yuan, & Wang, 2023; Karadağ, 2018; Teegelbeckers et al., 2023). According to the results obtained from the study, different teaching methods used in the courses had positive contributions to the students' metacognitive thinking skills and academic success. However, the methods did not have a similar effect on the social intelligence levels of the students.

The current study revealed that PBTM was more effective than other methods in leading students to develop metacognitive thinking skills. Hence, it is possible to assert that the participation of students in learning-based activities individually or collectively in PBTM-applied groups may have positively influenced their thinking, creativity, analysis, synthesis, reconstruction, and problem-solving attributes (Başbay, 2007). Additionally, PBTM may have positively contributed to students' development of real-life skills such as handling complex problems, critical thinking, and analyzing and evaluating information (English and Kitsantas, 2013). There are also several comparable studies supporting these conclusions in the literature (Başbay, 2007; Börekçi, 2018; Cheong, 2010; Sart, 2014; Tonbuloğlu et al., 2013). In no PBTM-applied groups, however, the other teaching methods were ineffective in developing students' metacognitive thinking skills level. Lacking to complete learning-related activities and neglecting to acquire specific real-world skills may have led to this predicament in no

PBTM-applied groups. These teaching methods applied in these groups could not help students improve their cognitive processes. At the same time, students' knowledge of cognitive processes and their ability to control these processes (Flavell, 1976) could not be improved with these methods.

The study findings indicated that various teaching methods applied in the courses were effective in fostering academic success. The diverse teaching method applications in groups by its intended purpose (Bayındır, 2008) potentially improved students' academic success levels, affecting them positively. Additionally, the capacity of teaching methods to support the active learning process (Phillips & Trainor, 2014) with practices involving applied and new technologies has also substantially contributed to this scenario. Many studies in the literature reported comparable outcomes with the conclusions of the current study (Aliyah, Suyitno & Agoestanto, 2014; Karaçallı, 2011; Kuncoro & Junaedi, 2018; Peng, Wang & Sampson, 2017; Ramadani & Har, 2013). Yet, Dane, Kudu, and Balkı (2009) also emphasized that teaching methods are merely one of the many variables affecting academic success. Therefore, using different teaching methods in classes appears to favorably influence students' academic success by promoting their learning process effectively (Kargın, Güldenoğlu & Şahin, 2010).

The study findings revealed that alternative teaching methods applied in the classes did not significantly influence the social intelligence levels of the students. Accordingly, it is possible to assert that this outcome is the result of the applied teaching methods' failure to help students comprehend, grasp, and assist in using emotional information about others, as well as their failure to support the development of student's ability to provide efficiency and high performance towards their social intelligence levels (Emmerling & Boyatzis, 2012). The number of studies examining the effects of different teaching methods on students' social intelligence levels is very limited in the literature. The current study results are considerably significant in this regard. However, the study results contradict Dsouza's (2016) findings, emphasizing that RBTM substantially improves speaking, listening, language, and communication skills. It is also necessary to consider that PBTM, which is based on the versatile development of intelligence (Doğanay & Tok, 2007) and supports the integration of different intelligence domains with education (Talu, 1999), did not manifest an expected outcome in the context of social intelligence levels.

Changes in social intelligence, metacognitive thinking and academic achievement levels in groups where different teaching methods are applied.

Considering the responses to the second primary research question, the study findings proved that PBTM extensively improved students' metacognitive thinking skills and academic achievement. It appears that while researching, analyzing, and observing issues related to their interests, experiences, and abilities (Metin & Aral 2014), the PBTM enabled students to substantially develop skills such as analysis, synthesis, evaluation, decision-making, and problem-solving (English & Kitsantas, 2013), leading to ensuing such an outcome. There are also several studies with similar findings in the literature (Bilgin, Karakuyu & Ay, 2015; Börekçi, 2018; Cheong, 2010; Iwamoto, Hargis, & Vuong, 2016; Johnson & Cuevas, 2016; Tonbuloğlu et al., 2013). According to the current study findings, PBTM is a teaching method supporting students' metacognitive thinking and academic achievements. Yet, the same findings also indicated that PBTM failed to yield similar effects on students' social intelligence levels, arguably because it generated no expected effect on students' skills and abilities, such as communicating with other students, comprehending them, and interpreting

their behavior (Korkmaz, 2001). At this juncture, it is also critical to highlight the absence of any study in the literature analyzing the effects of PBTM on social intelligence levels. Therefore, the current study outcomes are of the most significance, and deeming this context in future studies will anticipatingly make significant contributions to the literature.

The study findings proved that students' academic achievement scores were significantly higher in RBTM-applied and traditional methods-applied groups separately and in groups where PBTM and RBTM were applied combinedly. This outcome might have arisen because these methods potentially assist students in generating their self-knowledge through structuring, working independently as individuals, and acquiring reliable outputs with different strategies and methods (Çiftçi, 2014). The methods might have also led students to improve their affective traits such as self-perception, self-efficacy, motivation, and study habits (Arıcı, 2007; Balay, Kaya & Çevik, 2014; Pietersen & Howie, 2001; Wang, 2004). Among these methods, in particular, the effective use of the RBTM structure that supports students' active learning (Apriliana & Subanti, 2015) and increases motivation (Wijaya, 2019) might have positively fostered academic success. These findings are also consistent with Kuncoro and Junaedi (2018), asserting that the computer-driven RBTM and PBTM increased the learning rate to over 75%. Yet, the current study found that applying RBTM and traditional methods separately, albeit PBTM and RBTM combinedly, yielded no significant result on the student's metacognitive thinking skills and social intelligence levels. This outcome might arise because students in these groups failed to use methods successfully and could not develop skills such as analysis, synthesis, evaluation, decision-making, and problem-solving (English & Kitsantas, 2013). At the same time, this may have been caused by the methods being ineffective in encouraging students to develop different knowledge and skills through self-learning and reflection (Dsouza, 2016). Although the literature review identified several studies reporting that PBTM improved students' metacognitive thinking skills (Cheong, 2010; Johnson & Cuevas, 2016; Tonbuloğlu et al., 2013), this method failed to generate a comparable result on the students who participated in the current study. Yet, the present study findings disagreed with Dsouza's (2016) results, reporting that RBTM improved skills related to analysis, interpretation, synthesis, and organization, as well as reading, writing, speaking, listening, language, and communication skills. Hence, it is viable to conclude that the methods applied in the current study remained incapable of developing students' abilities such as grasping, comprehending, and using emotional information and providing high performance (Emmerling & Boyatzis, 2012), practical thinking, and social adaptation (Yermentaeyeva et al., 2014).

In conclusion, this study revealed that there was a significant difference between the groups in which different teaching methods were applied in the lessons in terms of test scores regarding metacognitive thinking skills and academic achievement levels. The study findings also revealed that the PBTM-applied group was more successful than others in elevating metacognitive thinking skill levels. This situation was also similar in within-group pre-test and post-test scores in the PBTM-applied group. However, it was observed that the same results did not occur for the social intelligence levels of the students in the PBLM-applied group. The current study identified no significant within-group difference in terms of the scores of the social intelligence levels. This context also applies to the within-group pre-test and post-test scores. Based on this, it can be said that the effects of different teaching methods applied to groups on the social intelligence levels of the students participating in the study are similar. These findings and results obtained from the study will make significant contributions to the field by revealing the effects of applying different teaching methods in courses on students' social intelligence, metacognitive thinking skills and academic achievement.

Furthermore, it will serve as a guide for researchers conducting field-related research.

Limitations and Recommendations

The research group of the study is limited to teacher candidates in the Psychological Counseling and Guidance department who take the Information Technologies course. The fact that the research group had two day and two secondary education classes, and the researcher conducted the lessons of these classes had an impact on this situation. The fact that the researcher carried out the application processes in all classes can be seen as a limitation of the study. Quantitative data was collected and analyzed in the study. Not presenting quantitative data supported by qualitative data can be seen as a limitation of the study. Qualitative data was not used in the study because the large number of groups and students in the groups made the collection and analysis process of qualitative data difficult. The implementation process of the study was limited to a period of six weeks. This method was followed in order to manage the groups well and ensure that the process is carried out effectively and efficiently. The fact that the students have no previous experience with project making processes can be seen as a limitation for the study. In addition, the fact that students' skills in using computer programs are not developed is a notable limitation in this context. The possibility that these situations may have affected the results obtained from the study can also be cited as a limitation. In this context, practical implications for future studies can be expressed as follows:

- The research group of the study consists of teacher candidates from the Psychological Counseling and Guidance department. In future studies, studies can be carried out with students from different departments.
- Quantitative data were examined in detail in the study. In future studies, quantitative and qualitative data can be collected and analyzed together.
- The study examined the effects of different teaching methods on students' social intelligence, metacognitive thinking and academic achievement levels. The effects of the teaching methods used in the study on different variables can be examined.
- The implementation process of the study was carried out in a total of six weeks. In future studies, the application period may be extended over a longer period of time.
- It was observed that the students did not have experience in making projects before the implementation process of the study. In this context, students were given detailed information about the project process. To get more effective results, students who have experience in doing projects can be worked with.
- It was determined that the students in the study group did not have sufficient skills in using computers and computer programs. In the study, students were given training in this context. In order to obtain more effective results in future studies, it may be recommended to include students with advanced skills in using computers and computer programs.

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