

The Impact of Peer Learning on Student Outcomes in Higher Education: Meta-Analytic Evidences from Türkiye

Yükseköğretimde Akran Öğreniminin Öğrenci Çıktıları Üzerindeki Etkisi: Türkiye’den Meta-Analitik Kanıtlar

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Abstract

The aim of this study is to examine the impact of peer learning in higher education on student outcomes in the context of Türkiye. For this purpose, databases such as Web of Science, Scopus, EBSCOHOST, and TR Index were used to access research focused on peer learning in the Turkish context. Additionally, to access grey literature, searches were conducted in the YÖK Thesis database, DergiPark, and Google Scholar databases in both English and Turkish. Various inclusion and exclusion criteria were developed for this study. Based on these criteria, 12 primary studies were included in the analysis. A meta-analysis was conducted to combine the statistical findings of the primary studies. This meta-analysis was conducted under the random effects model. It was found that the overall impact of peer learning on student outcomes in higher education in Türkiye is at a low level with $ES = .33$ [$CI = .19-.48$]. Furthermore, it was observed that the average effect sizes statistically differed according to the types of peer learning.

Keywords: Achievement, Attitude, Higher Education, Meta-Analysis, Peer Learning

Özet

Bu çalışmanın amacı, yükseköğretimde akran öğrenmesinin öğrenci çıktıları üzerindeki etkisini Türkiye bağlamında incelemektir. Bu amaçla, Türkiye’de akran öğrenmesine odaklanan araştırmalara erişmek için Web of Science, Scopus, EBSCOHOST ve TR Dizin gibi veri tabanları kullanılmıştır. Ayrıca, gri literatüre erişmek için YÖK Tez veri tabanı, DergiPark ve Google Scholar veri tabanlarında hem İngilizce hem de Türkçe aramalar yapılmıştır. Bu çalışma için çeşitli dahil etme ve hariç tutma kriterleri geliştirilmiştir. Bu kriterlere dayanarak, 12 birincil çalışma analize dahil edilmiştir. Birincil çalışmaların istatistiksel bulgularını birleştirmek için bir meta-analiz yapılmıştır. Bu meta-analiz rastgele etkiler modeli altında gerçekleştirilmiştir. Türkiye’de yükseköğretimde akran öğrenmesinin öğrenci çıktıları üzerindeki genel etkisinin $ES = .33$ [$CI = .19-.48$] ile düşük düzeyde olduğu bulunmuştur. Ayrıca, ortalama etki büyüklüklerinin akran öğrenmesi türlerine göre istatistiksel olarak farklılaştığı görülmüştür.

Anahtar Kelimeler: Başarı, Tutum, Yükseköğretim, Meta-Analiz, Akran Öğrenmesi

The importance of students’ interactions with each other in educational processes is frequently emphasized for achieving lasting and meaningful learning. Peer learning is one of the methods that enhances such interactions among students, allowing them to learn from each other and ensuring effective teaching (Eberlein et al., 2008; Ender & Kay, 2001; Topping, 2005). Peer learning stands out as an effective practice in educational processes due to its

features, such as fostering a supportive school environment, increasing school commitment, promoting positive social relationships (Kara et al., 2020), and developing a sense of belonging among students (Cemalcılar, 2010; Türkmenoğlu & Baştuğ, 2017). Additionally, for shy students, peer learning helps create a stress-free and comfortable environment with their peers, which positively impacts the teaching process (Ofilas et al., 2023).

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Classroom activities, active learning processes, group work, and the use of digital environments are potential application areas for peer learning. The presence of these application areas supports peer learning by enabling students to cooperate and support each other's learning, assist each other in learning and teaching processes, and improve their academic achievements (Crouch & Mazur, 2001; Mazur, 1997). Therefore, peer learning is an important method preferred in higher education for fields such as education, sports, nursing, and medicine (Bouffard & Reid, 2012; Furrer & Skinner, 2003; Melnyk, 2010; Pring & Thomas, 2004; Sackett, 1997). The reason for this could be that peer learning can be implemented without special arrangements, regardless of whether the group is large or small (Özcan, 2017).

Similarly, in higher education, the use of peer learning in teaching processes encourages students to interact with each other, share knowledge and skills, increases their participation, motivation, and attitudes towards the course, supports their social development, and ensures lasting and meaningful learning (Alpaslan, 2017; Atli et al., 2018; Gok, 2018; Türkmenoğlu & Baştuğ, 2017). Additionally, research shows that peer support positively affects students' adaptation, happiness, and school attendance (Collings et al., 2014; Lane, 2018). Thus, it can be said that in peer-supported teaching, students develop positive attitudes, gain knowledge and skills (Ofias et al., 2023). Moreover, when examining global practices in higher education, it is seen that some universities provide peer support to help new students transition to university life, which positively affects their adaptation (Pascarella & Terenzini, 2005; Ruthkosky & Castano, 2007) and success (Atli et al., 2018; Colvin & Ashman, 2010; Heirdsfield et al., 2008; Palmer et al., 2015).

The literature review reveals that studies on peer learning focus on students' achievement, attitude, and skills, or compile studies related to these variables (Loda et al., 2019; Tai et al., 2016). It has also been identified that numerous meta-analyses outside Türkiye have been conducted on this topic. These meta-analyses concluded that peer education positively impacts academic achievement (Cohen et al., 1982; Cook et al., 1986; Leung, 2015; Mathes & Fuchs, 1994; Rohrbeck et al., 2003). Peer education has been found to focus on vocational and social skills (Choi et al., 2021; Ginsburg-Block et al., 2006; Zhang et al., 2022), potentially enhance learning (Guraya & Abdalla, 2020), increase theoretical knowledge and procedural skills (Zhang et al., 2022), positively affect students' cognitive skills (Balta et al., 2017), and improve course performance and social adaptation (Bengesai et al., 2023). Additionally, studies have shown that peer-led learning is associated with higher cognitive achievement compared to non-peer-led learning (Zha et al., 2019). Another study indicated that peer education could be used as a practical method with scientific evidence supporting its positive effects (Choi et al., 2021). In Türkiye, although many studies on

peer education exist (Altundağ & Kolsuz, 2023; Çavuşoğlu & Çelik Eren, 2024; Kömürçü et al., 2023; Oral, 2022; Türkmenoğlu & Baştuğ, 2017), there are few studies combining individual research on this topic. However, Subaşı Çağlar's (2021) study found that peer education improved clinical skills among nursing students.

Theoretical Framework

Vygotsky, the pioneer of the social constructivism approach, asserts that learning from someone more knowledgeable than oneself is more effective than learning alone (Bacanlı, 2006). Vygotsky also proposed that cognitive development is not solely an individual phenomenon but is influenced by social interactions (Koç, 2020). In social constructivism, learning is defined as a product that emerges from interactions with family, friends, and culture. Individuals construct knowledge through these interactions (Özden, 2005; Yurdakul, 2015). In peer teaching, social learning that arises from peers interacting with and imitating each other is also utilized (Ercan & Yıldırım Orhan, 2016). Therefore, this research is based on the theory of social constructivism.

Theoretically rooted in social constructivist and collaborative learning theories, peer learning aims to develop cognitive, social, motor, and vocational skills (Cohen, 1992). In this context, peer-assisted learning encompasses peer counselling, peer tutoring, and peer assessment, involving interactive teaching-learning processes where the roles of tutor and tutee are shared. A successfully structured learning process requires defining topics and goals, providing opportunities for critical inquiry and reflection, and employing an assessment approach aligned with learning objectives (Boud, 2001; Gaustad, 1993; Jenkins & Jenkins, 1987).

According to Bloom (1976), an effective learning experience includes aligning instructional methods with students' cognitive and affective traits, establishing meaningful relationships between entry and target behaviors, and incorporating active participation, reinforcement, feedback, and correction processes. In peer learning, students take on both teaching and learning roles, which supports the development of autonomous, entrepreneurial, and independent personalities. Additionally, it fosters a sense of solidarity and cooperation, contributing to healthy social relationships. This team spirit helps reduce destructive behaviors like peer bullying and competition in and out of the classroom. Consequently, peer learning aids students in focusing on learning goals, discovering and developing themselves, respecting individual differences, recognizing their self-worth, and adopting a sense of responsibility and democratic attitudes (Crouch et al., 2007).

Different forms of peer learning groups, such as near-peer or cross-peer, can enhance students' self-confidence and create a positive learning climate through



cooperation and coordination. Moreover, feedback in learning and teaching processes positively influences their capacity to perceive and interpret learning goals and personal development expectations (Colaco et al., 2006; Harden & Laidlaw, 2013; McLachlan, 2002; Wenghofer et al., 2006). A well-structured peer learning pattern requires participants' voluntary involvement, quality guidance and support services, a reliable learning climate, and empathetic communication. An anxiety-free learning environment and an organizational culture that emphasizes active, sharing, and awareness-focused evaluation of learning outcomes (cognitive, affective, and motor) are also crucial (Lakdizaji et al., 2013).

In summary, while the teacher-centered approach characterizes a hierarchical, one-way learning model focused primarily on information transfer, the peer learning approach is perceived as a model emphasizing interaction, equal and democratic participation, and the learning of cognitive, affective, and especially motor skills (Karpicke and Blunt, 2011; Stigmar, 2016). Ultimately, interaction within pairs or groups in a constructivist understanding facilitates students' acquisition of diverse views and attitudes through their own experiences. This makes mental and social learning processes more dynamic (Vygotsky, 1978; Winstone et al., 2017).

In higher education, where learning objectives and content are more complex and multidimensional, there is a need to diversify and enrich learning environments. This necessity mandates efficient use of time and human resources. Particularly in the acquisition of professional and social skills, peer learning is crucial in fields requiring professionalism, such as physical education, nursing, teacher education, language instruction, and computer programming. Higher education programs that include both theoretical knowledge and practical skills cannot rely solely on teacher-centered information transfer and limited practical activities. Therefore, the research problem of this study is to examine the impact of peer learning in higher education on student outcomes and whether this impact varies according to moderator variables.

Research Objective

It is possible to say that findings from Türkiye are valuable and significant for comparing results from meta-analyses conducted in different countries and for identifying similarities and differences in peer teaching among these countries. In this regard, consolidating the findings of experimental research on peer teaching conducted in Türkiye will contribute to big data. Based on the findings from studies conducted in Türkiye, this research aims to achieve a more comprehensive conclusion by examining the impact of peer teaching in higher education on student outcomes. Accordingly, the following sub-problems are addressed:

1. Does peer teaching in higher education have an impact on student outcomes?
2. Does the impact of peer teaching in higher education on student outcomes vary according to moderator variables?

Method

Meta-analysis is a method used to synthesize the statistical findings of primary research studies (Borenstein et al., 2021). In this study, the meta-analysis method was chosen to synthesize the findings of primary research on the effects of peer learning (PL) on student outcomes in higher education in Türkiye. This study was conducted following the systematic review guide prepared by Kolaski et al. (2024).

Eligibility Criteria

To align with the purpose of this study, the following inclusion and exclusion criteria were used:

Intervention: The primary studies must use PL as an intervention tool. PL could be conducted face-to-face or be technology-supported, such as online or web-based.

Implementation of PL: The primary studies must involve peer students. Studies were excluded if the group defined as peers, were not students. In other words, if the peers were not students (e.g., if the peers were teachers or nurse mentors), those studies were excluded.

Outcomes: The primary studies must focus on learning outcomes related to students' cognitive, affective, psychomotor, vocational skills, or social skills.

Method: The primary studies must be conducted using experimental or quasi-experimental designs. The control group must use traditional teaching methods. Single-sample experimental designs were excluded. The primary studies must also contain sufficient statistical data to calculate effect sizes, such as means, standard deviations, standard errors, number of participants in experimental and control groups, F-values, t-values and their associated p-values, Pearson's r, Cohen's d, Hedge's g, Odds ratios, and other related statistics.

Report: The primary studies must be published articles, conference papers, doctoral dissertations, or master's theses.

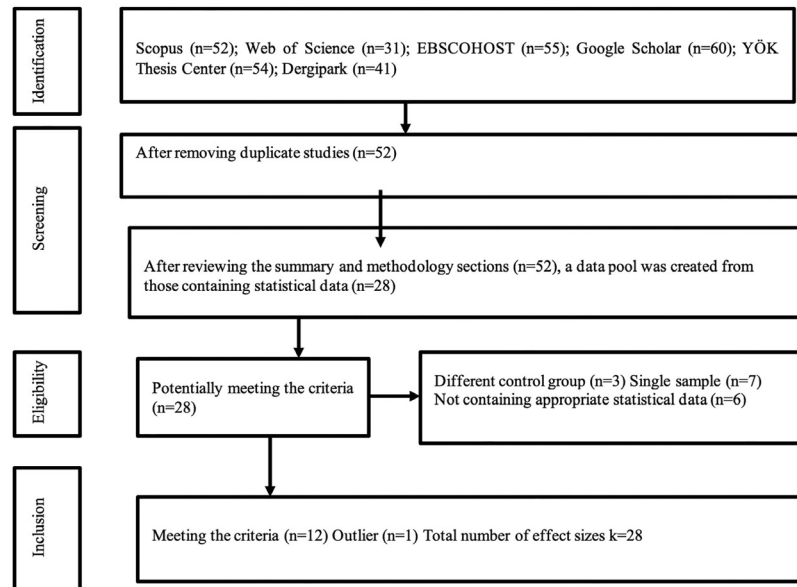
Location: The primary studies must be conducted in higher education institutions in Türkiye.

Time Frame: There was no time limitation for the studies. The primary studies must have been reported before 2024. Searches were concluded on March 2, 2024.

Search Strategy

Electronic databases were used to access primary studies. The databases included Web of Science, Scopus, EBSCOHOST, and TR Dizin. The EBSCOHOST database includes ERIC, Medline, and Academic Search Ultimate, which allow simultaneous searching across multiple databases.

Figure 1
Data flow Diagram



Grey literature was accessed through YÖKtez, DergiPark, and Google Scholar. The keywords used in these databases included “peer learning,” “peer teaching,” “peer instruction,” “peer mentoring,” “peer-assisted learning,” “tutor learning” in English, and “akran öğretimi,” “akran destekli öğrenme,” “akran öğrenme,” “akran danışmanlığı,” “tutor,” and “mentor” in Turkish. Additionally, in Web of Science, Scopus, and EBSCOHOST databases, Türkiye was selected as the country location. The data flow diagram is presented in ■ Figure 1.

Data Extraction

A coding form prepared by the researchers was used to determine the characteristics of the primary studies. The coding form included the following information: authors of the study, year of publication, type of report, research design, PL environment (face-to-face, online, hybrid), type of PL according to the status of the peer, duration of PL implementation, academic discipline in which PL was applied, and student outcomes. The coding was performed by the first two researchers. The inter-coder reliability was calculated using Cohen’s Kappa coefficient and was found to be $\kappa = .87$. Discrepancies in coding were discussed among the researchers, and in some cases, experts in research methodologies were consulted to make final decisions. The details of the coding are presented in ■ Table 1.

Quality Appraisal

To assess the quality of the experimental studies, The Joanna Briggs Institute (JBI) Critical Appraisal Tools checklists developed by Tufanaru et al. (2020) were used. JBI Critical Appraisal Tools consist of separate checklists for quasi-experimental and randomized controlled trials (RCTs). The checklist developed for quasi-experimental studies consists of 9 items, while the one developed for randomized controlled

trials consists of 13 items. The quality of the primary studies was evaluated using the formula: Score/Total score ($\times 100$). For example, for a non-RCT study, the score would be $7/9 = 77.77\%$; for an RCT, it would be $8/13 = 61.54\%$, etc.

Characteristics of the Studies

Twelve studies met the inclusion criteria for this study. An outlier study with $n=1$ was excluded from the statistical analyses (Gok, 2014). Therefore, a total of 11 studies were included in the statistical analyses. The experimental studies included in this dataset had a participant count ranging from a minimum of 37 to a maximum of 132, with a mean of 74.63 and a standard deviation of 31.33, totaling 821 participants. These experimental studies were published between 2009 and 2023, including 8 articles, 2 unpublished doctoral dissertations, and 1 master’s thesis. Ten studies implemented PL face-to-face, while one study implemented it online. Furthermore, 10 studies were conducted at the undergraduate level, and one at the post-secondary level. The general characteristics of the primary studies are presented in ■ Table 2.

Synthesis Methods

Some primary studies focused on multiple student outcomes (e.g., Gok, 2012), while others were conducted with multiple groups (e.g., Gülçek, 2015). Therefore, the effect sizes produced independently by each primary study were coded. Consequently, some studies were represented by multiple effect sizes. In other words, the unit of analysis for this study was considered to be the effect sizes independently produced by each primary study. The samples of the primary studies had different characteristics. If the primary studies were conducted with different samples and had different characteristics, the use of the



random effects model is recommended (Borenstein et al., 2021). Given the characteristics of the primary studies that constituted this research, statistical analyses were conducted using the random effects model. When the sample size was not sufficiently large, Hedge's g index was preferred as the effect size (Lin & Aloe, 2021). In this study, it was decided that the effect sizes of some studies were not sufficient, and Hedge's g index was chosen as the effect size.

Furthermore, the distribution of effect sizes was examined for publication bias using various techniques. These techniques have their own strengths and weaknesses (Kepes et al., 2023). Therefore, the results of publication bias analysis were interpreted together. Funnel plot, classic fail-safe test, Egger's test, and Duval and Tweedie Trim and Fill (DTTF) test were used for publication bias analysis. Moreover, Q total [$Q(t)$], Q between [$Q(b)$], and I^2 statistics were used to examine the heterogeneity of effect sizes from various aspects. $Q(b)$ tests were used to examine the differentiation of effect sizes according to moderator variables. Statistical analyses were conducted using the CMA.3.0 program. Additionally, outlier effect sizes were not included in the analysis."

Findings

A total of $k=28$ effect sizes were generated from the primary studies. The effect sizes ranged from $ES=-0.22$ to $ES=1.73$, with a mean effect size of $ES=0.33$ [$CI=0.19-0.48$]. It can be said that the impact of PL on student outcomes is weak. The total heterogeneity was found to be $Q(22) = 60.18$, $p < .01$, with a heterogeneity level of $I^2=55.13$ for the dataset. The distribution of effect sizes can be considered moderately heterogeneous.

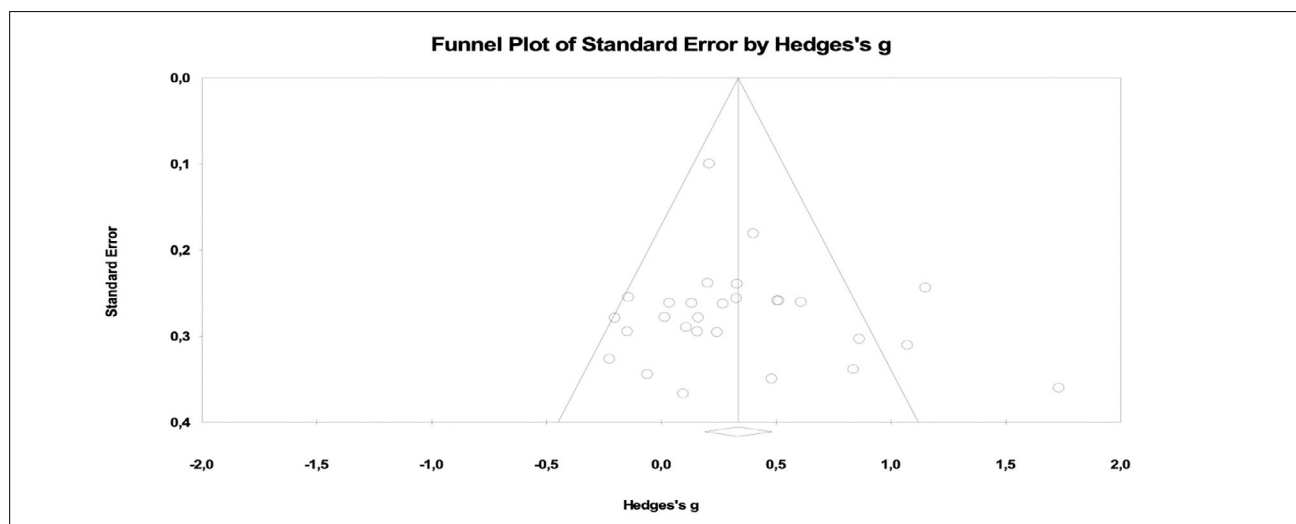
The classic fail-safe test for publication bias resulted in $N=300$, with a critical value of $5k+10=28.5+10=150$. Considering that the calculated N (300) is greater than

the critical N (150), it can be concluded that the average effect size is reliable. Egger's regression test did not reveal publication bias ($t=0.82$; $p=0.42$). Furthermore, the DTTF test indicated that adding $k=4$ studies to the right of the average effect size would result in a symmetric distribution of effect sizes. The corrected effect size value was calculated as $ES=0.41$ [$CI=0.27-0.56$], $Q=81.19$. The difference between the corrected and calculated effect sizes, $\Delta ES=0.08$, was found to be small. It can be said that the difference is minimal.

Upon examination of the Funnel Plot graph, it was observed that there are effect sizes with larger standard errors to the left of the mean effect size. The Funnel Plot is presented in Figure 2. Considering the above publication bias results, it can be concluded that the distribution of effect sizes exhibits a low level of publication bias.

Heterogeneity and moderator analyses for categorical variables are presented in Table 2. Remarkable findings are as follows: The effect of PL on student outcomes varies statistically significantly based on PL type ($Q=4.28$, $p=.04$). PL conducted in reciprocal form has a higher effect size [$ES=.51$, $CI=.29-.73$] compared to PL conducted in cross tutor form [$ES=.20$, $CI=.01-.39$]. While PL conducted reciprocally has a moderate effect on student outcomes, PL conducted in cross-tutor form has a weak effect. Apart from PL type, no statistically significant differences were found for other categorical variables examined in this study. Nevertheless, some effect sizes are noteworthy when compared. Considering student outcomes, the effect of PL on academic achievement is higher than its effect on skills and attitudes. Regarding academic disciplines, the effect of PL is high in the field of Mathematics [$ES=.97$, $CI=.41-1.52$], while it is quite weak in Physical Education [$ES=.13$, $CI=-.14-.40$] and Language [$ES=.15$, $CI=-.27-.56$].

Figure 2
Funnel Plot



The regression analysis modeling the relationship between continuous variables and effect size is presented in ■ Table 3. The continuous variables - research quality, publication year, sample size, and experiment duration - do not statistically predict the effect sizes.

Discussion, Conclusion, and Recommendations

In this study, the statistical findings of basic research on the effect of Peer Learning (PL) on student outcomes were synthesized using meta-analysis techniques. In this context, heterogeneity and moderator analyses were conducted for the 28 effect sizes obtained from 11 basic studies.

The results of this study indicate that the effect of PL on student outcomes is weak. The impact of PL on students' academic achievements, skills, and attitudes is weak. Bengesai et al. (2023) generally reported a weak effect of PL on higher education, while Choi et al. (2021) found a weak effect specifically in nursing education. Similarly, Zhang et al. (2022) observed a weak effect of PL on professional skills in the healthcare field. Choi et al. (2021) also noted a moderate effect of PL on student attitudes in nursing. It is acceptable to acknowledge the contradiction between the findings of these two studies. The source of this contradiction may stem from the differences in school cultures among different higher education programs. Alternatively, different countries' cultures may also contribute to this situation. Balta et al. (2017) and Choi et al. (2021) have also observed that the effect of PL varies according to countries. In this context, comprehensive studies covering different countries' cultures and different higher education programs (such as teacher education, engineering education, medicine, etc.) can be conducted.

This study also observed that the effect of PL types on student outcomes varies. Choi et al. (2021) and Alegre Ansuátegui et al. (2018) observed that PL types have different effects on student outcomes and that cross-tutor is more effective. In contrast, this study found that reciprocal tutoring is more effective. This contradictory situation may be related to students' perceptions, beliefs, values, attitudes towards peers, mentorship, or counselling in different countries. Research examining students' perceptions, beliefs, and values towards teaching/mentoring peers can be conducted.

In this study, it was concluded that peer learning (PL) is more effective in the fields of science and mathematics. Similarly, Bengesai et al. (2023) observed that PL is a more effective teaching model in science education compared to other fields. Öz (2024), revealed that PL produces higher effect sizes in areas such as physics, chemistry, biology, and mathematics. In Türkiye, research focused on PL is more concentrated in the fields of basic sciences, computer science, and language. In the international literature, however, research focused on PL is more prevalent in higher

education programs such as medicine, nursing, sports, teacher education, and engineering (Choi et al., 2021; Zhang et al., 2022). Therefore, it can be said that research focused on peer learning in higher education in Türkiye is limited. Future research could examine the impact of peer learning in areas such as medicine, nursing, health, and teacher education specific to Türkiye. Additionally, fundamental research on PL generally focuses on academic achievement. Moreover, the impact of PL on students' motivation, self-efficacy, communication skills, and higher-order thinking skills could be investigated.

Limitations

This study is limited to experimental research with control groups. Advanced research including quasi-experimental designs could be conducted. Additionally, this study is limited to quantitative research on peer teaching. Meta-synthesis studies synthesizing findings from qualitative research on peer teaching could be carried out. Furthermore, this study is confined to the higher education level. Future research could analyze peer teaching at primary and secondary education levels.



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Table 1
Information Related to Codings

Group	Code
Study	Studies (publication year)
Student outcomes	The student outcomes have been coded as achievement, skills, and attitude.
PL environment	The PL environment has been coded as face-to-face and online.
PL type	The coding has been done based on the role and status of peers. If the peer roles of teaching and learning are reciprocal, it is coded as reciprocal; if not, and the roles of teaching and learning between peers are fixed, it is coded as cross-tutor.
Education program	The program of higher education has been coded according to its purpose as teacher education, nursing education, physical education, and others.
Higher education type	Higher education duration has been coded as postsecondary and undergraduate.
Academic discipline	Coding has been done according to the academic discipline where PL was implemented. For example, it has been coded as science, math, physical education, etc
Experimental design	Randomized control trials (RCT) and non-randomized control trials (non-RCT) have been coded.
Implementation time	The unit of application duration has been coded as weeks. If the primary research lasted for one semester, it was coded as 14 weeks.
Class	The coding was done according to the class level where the implementation took place. If two classes were combined, they were coded similarly.
Sample size	The number of participants involved in the experiment was coded as follows: 1-50, 51-100, and 100-150.
Research quality	The coding was done according to the Joanna Briggs Institute (JBI) Critical Appraisal Tools checklist.
Report type	Articles were coded as published, while doctoral and master's theses were coded as unpublished based on their publication type.
Publication year	The publication years of the studies were coded in five-year intervals as follows: 2000-2013, 2014-2018, and 2019-2023.

■ **Table 2**

Characteristics of the Studies

Characteristics of the Research								
Study	Outcome	Discipline	PL type	Report	Design	Qalty	Simple	Duration
Gok (2018)	Achievement	Science	Reciprocal	A	Quasi-exp	100	59	7
Demirci and Şekercioğlu (2009)	Achievement	Science	Reciprocal	A	Quasi-exp	89	78	4
Gok (2014)	Achievement	Science	Reciprocal	A	Experimental	62	98	5
Bulut (2019)	Achievement	Science	Reciprocal	A	Quasi-exp	89	60	14
Altintas et al. (2016)	Achievement	Computer programming	Cross tutor	A	Quasi-exp	78	60	14
Uzuner Yurt and Aktas (2016)	Achievement	Language	Cross tutor	A	Experimental	62	57	6
	Attitude							
	Skill							
Gok (2012)	Achievement	Science	Reciprocal	A	Quasi-exp	67	132	14
Gok (2012)	Attitude	Science						
Mirzeoğlu (2014)	Attitude	Physical education	Cross tutor	A	Quasi-exp	89	45	12
	Achievement							
	Skill							
Olpak et al. (2018)	Attitude	Mathematic	Reciprocal	A	Quasi-exp	67	46	14
	Achievement							
Koç (2020)*	Achievement	Computer programming	Cross tutor	D	Quasi-exp	100	69	5
	Skill							
Balcı (2023)	Achievement	Physical education	Cross tutor	D	Quasi-exp	78	37	14
	Attitude							
Gülçek (2015)	Achievement	Science	Cross tutor	M	Quasi-exp	67	128	2

* Online, A: Article, D: Dissertation, M: Master, Quasi-exp: Quasi-experimental

Table 3
Moderator and Heterogeneity Analysis

Group	k	ES	LL	UL	Q(b)	df	p
Student outcomes					1.03	2	.60
Achievement	17	.40	.20	.60			
Attitude	6	.24	-.07	.55			
Skill	5	.24	-.11	.59			
PL environment					.07	1	.79
Face to face	26	.34	.19	.50			
Online	2	.27	-.25	.79			
PL type					4.28	1	.04
Cross tutor	17	.20	.01	.39			
Reciprocal	11	.51	.29	.73			
Class					1.74	4	.78
1,00	5	.39	-.02	.79			
2,00	5	.50	.16	.85			
2 and 3	2	.44	-.16	1,05			
3,00	8	.26	-.03	.55			
Not detected	8	.26	-.01	.52			
Academic discipline					8.96	4	.06
Science	10	.45	.22	.68			
Physical education	8	.13	-.14	.40			
Computer programming	5	.30	-.01	.61			
Language	3	.15	-.27	.56			
Mathematic	2	.97	.41	1,52			
Higher education type					.03	1	.86
Undergraduate	26	.34	.18	.50			
Postsecondary	2	.30	-.17	.76			
Experimental design					.80	1	.37
Quasi-experimental	25	.36	.20	.51			
Experimental	3	.15	-.29	.58			
Report type							
Published	20	.37	.20	.54	.76	1	.38
Unpublished	8	.22	-.07	.51			



Table 4
Meta Regression

Covariate	Coefficient	Standard	.95	.95	Z-value	p
		Error	Lower	Upper		
Intercept	-18.74	55.93	-128.35	90.88	-.34	.74
Quality	.001	.01	-.01	.02	.40	.69
Sample size	.001	.001	-.01	.01	-.15	.88
During of exp.	.001	.02	-.03	.04	.22	.82
Report year	.01	.03	-.04	.06	.34	.74
Q (4) = .76 p = .94						

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