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Research Article

The effect of intervention studies on foreign language speaking anxiety: A meta-analysis study

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The purpose of this study is to examine the effectiveness of intervention studies addressing foreign language speaking anxiety through a meta-analytical approach. Research on foreign language speaking anxiety was conducted across various databases using targeted keyword phrases. Statistical data were collected and analyzed using Comprehensive Meta-Analysis (CMA) software to compute Hedges' g values. The overall effect size of intervention studies on foreign language speaking anxiety indicates a medium-level effect. Moreover, it was found that intervention type and duration as moderator variables did not significantly influence foreign language speaking anxiety. Based on these findings, it can be concluded that interventions for foreign language speaking anxiety are moderately effective in reducing student anxiety. The study recommends that foreign language teaching programs incorporate strategies to alleviate speaking anxiety, increase awareness among educators, and foster learning environments that promote speaking practice. Furthermore, it is essential to revise educational policies to include measures aimed at reducing speaking anxiety.

Keywords: Foreign language speaking anxiety; Foreign language learning; Meta-analysis

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1. Introduction

Using a foreign language for speaking is among the areas where students experience the highest levels of anxiety. The concept can be defined as the anxiety that an individual feels while speaking in the different language (Campbell & Ortiz, 1991). In foreign language classes, students feel anxiety during their oral presentations due to pronunciation, role-playing and vocabulary tasks, and this anxiety prevents them from communicating in the foreign language (Koch & Terrell, 1991; Price, 1991; Tanveer, 2007). In foreign language classes, students may have anxiety-provoking thoughts during the preparation for speaking, during speaking and after speaking. Before speaking, the student may avoid engaging in foreign language speaking activity. During speaking, they may exhibit behaviours such as trembling and sweating and have difficulty in completing the speaking task (Yalçın & İnceçay, 2014). Anxiety may continue after the speaking task, leading to a sense of failure in the student. With those characteristics, anxiety negatively affects the whole speaking process. Indeed, studies show that anxiety negatively affects speaking achievement (Huang, 2018; Tien, 2018).

In literature, various teaching methods have been tested to develop students' speaking skills and enhance their academic performance. Similarly, some researchers have proposed various

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strategies to identify the causes of foreign language speaking anxiety and to better understand the problems experienced during speech. A growing number of studies emphasize the importance of evaluating the effectiveness of interventions for speaking anxiety. Although the number of studies proposing and testing methods, techniques, and strategies for foreign language speaking anxiety has been steadily increasing, a comprehensive evaluation of the overall effectiveness of these interventions has yet to be sufficiently conducted. When the existing literature is reviewed, it is seen that there are studies examining interventions for public speaking anxiety (Lim et al., 2023; Reeves et al., 2022). Meanwhile, this study focuses on the foreign language education dimension. Moreover, it is challenging to reach a definitive conclusion regarding which methods are more effective in specific contexts and for different student proficiency levels. It is observed that studies addressing foreign language speaking anxiety focus on a specific time frame and educational level (Elahemer & Said, 2022). Therefore, this meta-analysis provides a broader understanding of speaking anxiety since it includes all levels of education and educational interventions and examines all types of publications published until 2024. Furthermore, the type and duration of intervention, which are considered as moderator variables in the study, are accepted to be important since they provide language teachers, parents and curriculum developers with an idea about how these variables affect speaking anxiety. In brief, the use of meta-analysis method can shed light on the effectiveness of intervention studies conducted on foreign language speaking anxiety.

1.1. Foreign Language Learning

Foreign language teaching has been in existence since the early ages as a result of the need for communication. The need to learn a foreign language, usually arising from commercial, religious, political or social reasons, is mostly met in the natural environment of the language without a planned teaching (Meskill, 2002). With the advancement of technology, the intense communication traffic between countries and globalization have emphasized the importance of foreign language teaching (Boyadzhieva, 2014; Çakmak, 2014). With English becoming the lingua franca, it has been taught as a foreign language in the world and in Türkiye for a long time. Furthermore, Turkey is becoming a potential centre of interest due to its historical ties, religious and social values, and importance in politics, trade, and tourism, which leads to a growing interest not only in the country but also in learning Turkish language (Tok & Yıgın, 2013). Apart from teaching Turkish and English as a foreign language, German, French and Spanish have also been taught as a foreign language around the world for many years (Kramsch et al., 2007; Sánchez, 2014; Shan & Xu, 2023). The rising global demand for language learning has emphasized the need for effective and high-quality foreign and second language instruction.

The efficiency of foreign language teaching depends on the qualified teaching of the four basic language skills. To be proficient in a foreign language, it is necessary to use listening, reading, writing and speaking skills effectively, which are collectively categorized under comprehension and expression skills (Kuşdemir & Güneş, 2014). The way an individual acquires basic skills in a foreign language is different from the way of acquiring in the native language. Mother tongue acquisition begins with the child's development of listening and speaking skills, and as those skills are improved through formal education, reading and writing skills are also learnt. However, in foreign language education, the individual learns all these skills together unlike their mother tongue acqusition (Kurudayıoğlu & Sapmaz, 2016). In this respect, it is essential to teach basic language skills as a whole for an effective foreign language teaching. Speaking, recognized as a fundamental expressive skill, holds a significant place in foreign language education as it serves as the primary means of communication.

Speaking skills are defined as the expression of thoughts designed in the mind and emotions felt through sounds (Temizyürek et al., 2016). It is also one of the basic communication tools since it enables the transfer of feelings and thoughts to the interlocutor. In the 21st century, speaking is an essential skill for an individual to have communication, collaboration, entrepreneurial, and

expression skills. Speaking, which is encountered in every aspect of daily life, is as important in learning a foreign language as it is in mother tongue (Sudarmo, 2021). Given that communication in a foreign language predominantly takes place through speaking, teaching speaking should develop students' ability to express themselves, convey their thoughts and communicate with their surroundings. Although many students find speaking in a foreign language enjoyable (Chambers, 1999), it is one of the most challenging skills to teach in language education (Leong & Ahmadi, 2017). One of the reasons for that can be that students in language classrooms are at different levels and have different expectations (de Saint-Léger, 2009). Moreover, foreign language speaking skills are significantly influenced by affective factors such as motivation, willingness to communicate, anxiety and self-efficacy (Uztosun, 2020). Anxiety, which is considered as one of these factors, has a negative effect on speaking skills.

1.2. Foreign Language Speaking Anxiety

Anxiety is an affective factor that not only reduces students' foreign language learning performance but also leads to a loss of motivation for language learning (Russell, 2020). Anxiety usually arises during moments of evaluation, in unfamiliar environments and places where anxiety has previously been felt, or in uncertain situations and positions of being the center of attention (Bailey, 2020). The anxiety felt while learning in a new language is considered as one of these types of anxiety. Foreign language anxiety can be observed in reading (Matsuda & Gobel, 2001), listening (Kim, 2002), speaking (Chou, 2018), and writing (Chou, 2013) skills. Among the four language skills, speaking is considered the most anxiety-inducing for language learners (Luo, 2014). Bashori et al. (2022) defines foreign language speaking anxiety as a psycho-cognitive phenomenon experienced by many students. Students with foreign language speaking anxiety experience stress, anxiety and anger while speaking in the target language and have difficulties in the language learning process (Suleimenova, 2013). Foreign language speaking anxiety prevents students from achieving proficiency in the foreign language. Students experiencing foreign language speaking anxiety may panic during unprepared speech, hesitate to speak in front of others, and avoid the risk of expressing themselves (Horwitz et al., 1986). If students who can read, listen and write in the target language fall behind in speaking skills, it will prevent the development of foreign language skills in a holistic manner. Therefore, it is crucial to include practices aimed at reducing speaking anxiety in language classrooms.

Many methods and strategies have been suggested to overcome speaking anxiety in foreign language classrooms. Those suggestions include changing feedback types (Zarei & Rezadoust, 2020), incorporating project-based work (Tsiplakides & Keramida, 2009) and increasing teacher effectiveness (Ansari, 2015). Furthermore, collaborative learning (Mon, 2019), flipped learning (Abdullah et al., 2021) and, in parallel with the technological advancements in recent years, technology-assisted teaching tools have been used in language classrooms (Chen, 2024). Although the number of studies proposing and testing methods, techniques, and strategies for foreign language speaking has been steadily increasing, a comprehensive evaluation of the overall effectiveness of these interventions has yet to be sufficiently conducted. The existing literature largely consists of individual studies, and large-scale reviews directly comparing the effectiveness of different interventions remain limited (Elahemer & Said, 2022). This lack of comparative research makes it challenging to identify the most effective strategies for reducing foreign language learners' speaking anxiety. Moreover, it complicates reaching a clear conclusion regarding which methods are more effective in specific contexts and at different proficiency levels.

This study aims to comprehensively evaluate the effectiveness of interventions designed to reduce speaking anxiety in the context of foreign language learning using the meta-analysis method. By systematically synthesizing existing findings in the literature, the study seeks to provide a more holistic perspective on the field. It is expected to guide practitioners and researchers by comparing the effectiveness of different interventions. Additionally, the study will analyze the effectiveness of intervention type and duration as key variables. In this regard, the

study aims to offer a systematic evaluation of interventions targeting speaking anxiety in foreign language education, making significant contributions to both theoretical and applied domains. The aim of this study is to investigate the effect of interventions on foreign language speaking anxiety through meta-analysis. Within this scope, answers to the following questions were sought:

RQ 1) How effective are educational intervention studies on foreign language speaking anxiety?

RQ 2) How do moderator variables—type of intervention and duration of intervention—affect participants' foreign language speaking anxiety?

2. Method

2.1. Research Design

In this study, meta-analysis method was used since it was aimed to systematically examine the experimental studies on foreign language speaking anxiety by bringing them together to draw a general conclusion (Arthur et al., 2001; Littel et al., 2008). In this respect, the effect sizes of the existing studies were calculated, and the significance of interventions for foreign language speaking anxiety was evaluated (Ellis, 2010). *The Preferred Reporting Items for Systematic and Meta-Analysis (PRISMA)* flowchart was used in the process of identifying the studies (Page et al., 2021).

2.2. Literature Review

Within the scope of the research, experimental studies on foreign language speaking anxiety were searched in national and international databases, including Academic Search Ultimate, Education Research Complete, Emerald Insight, ERIC, Google Scholar, ProQuest Dissertations and Theses Global, Science Direct, Springer Link, Taylor & Francis, Wiley Online Library Full Collection, Sage Journals, Scopus, ULAKBİM, and the Turkish Council of Higher Education National Thesis Center, using the following keywords:

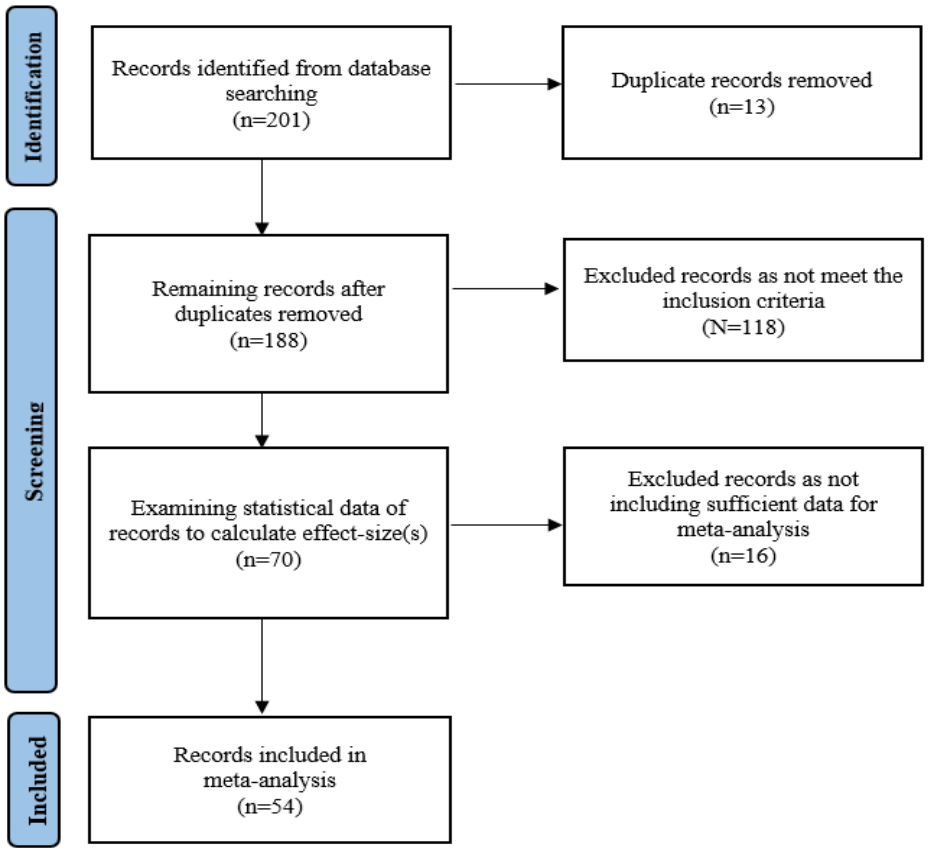
- Pattern 1: foreign language, speaking anxiety, experimental
- Pattern 2: foreign language, speaking anxiety, treatment
- Pattern 3: foreign language, speaking anxiety, intervention
- Pattern 4: speaking skills, anxiety, experimental
- Pattern 5: speaking skills, anxiety, treatment
- Pattern 6: speaking skills, anxiety, intervention

During the scanning process, duplicate studies were removed when the same article appeared in multiple databases (f=10). Thus, 188 scientific publications were identified as a result of the literature review.

2.3. Inclusion Criteria

The publications identified in the study were reviewed based on the inclusion criteria (educational intervention, intervention for foreign language speaking anxiety, publication language Turkish-English, quasi-experimental design). Therefore, studies with simple experimental design (f=50), psychological intervention studies (f=31), and studies discussing speaking anxiety in the native language (f=37) were excluded from the study. Studies that did not have the necessary statistical data (e.g. mean, standard deviation, sample size, p and t values) for effect size calculation were also excluded (f=16). As a result, 54 publications focusing on the effect of intervention studies on foreign language speaking anxiety were included in the study. This process is summarized in Figure 1.

Figure 1
PRISMA flow diagram of the study selection



The seven studies included in the research had different experimental groups where the same type of intervention was applied (Chen, 2024; Ding, 2023; Ibatova, 2022; Liu & Aryadoust, 2022; Satar & Özdener, 2008; Yusof, 2018; Zarrinabadi et al., 2023). Furthermore, in the two studies, the effect of the same intervention on the sub-dimensions of the measurement tool was determined (Aktaş, 2023; Güzel, 2016). Therefore, the combined effect size was calculated for these studies. The statistical values of the studies (e.g., mean, standard deviation, and sample size for the experimental and control groups) were entered into the Comprehensive Meta-Analysis [CMA] software, and the "subgroups within study" option was used to calculate the combined effect sizes. For example, Ibatova (2022) conducted the study with two different experimental groups, and these groups received synchronous text-based instruction and synchronous audio-based instruction interventions respectively. Both intervention types were classified under the category of technology-based language teaching. Therefore, a single effect size was calculated for the two interventions. However, in the study of Pan et al. (2022), two different interventions were applied to the two different experimental groups. For this reason, no combination was made for this study. Since the research was conducted in 2024, studies carried out up to 2023 were included. However, one study was included in the study because its online publication date was 2022 (Chen, 2024) and one study was included in the study because its first publication date was 2023 (Jin, 2024).

2.4. Coding Procedure

In order to collect the necessary data from the studies for meta-analysis, a coding form, including the reference of the article, sample size, dependent and independent variables, quantitative values, education level, type and duration of intervention, was developed. Information regarding the included studies was entered into this form. The duration of the intervention was classified as 0-4 weeks, 5-8 weeks, and 9+ weeks (Çalık & Wiyarsi, 2024).

Several steps were followed to ensure reliability during the coding process of the studies analyzed. To determine the coding reliability, 14 publications (25%) randomly selected among the studies were coded by the author of the study and then by a researcher taking the "Meta-Analysis in Science Education" graduate course (e.g. Khishfe & Abd-El Khalick 2002; Khisfe & Lederman 2006). The analyses made by the two experts were compared. The agreement rate of the coding was calculated by Miles and Huberman's (1994) formula and determined to be 96%.

2.5. Effect Size Calculation

In meta-analysis studies, Cohen's *d* and Hedges' *g* are commonly used to calculate effect size (Vekli & Çalik, 2023). Since Hedges' g is more accurate and less biased than Cohen's d in small samples (Borenstein et al., 2010), Hedges' g calculation was used in this study. The effect size was calculated based on the random effects model. When the combined effect sizes from the nine articles mentioned above and two effect sizes calculated from a single study were included, 55 different effect sizes were calculated from 54 studies. The relevant studies were transferred to the CMA program, and the Hedges' g value was calculated using the following data:

- 51 studies (51 studies, one of which includes two different experimental groups) reported mean scores, standard deviations and sample sizes for the experimental and control groups.
- Two studies reported the mean difference, sample sizes of experimental and control groups, and the p-value.
- One study reported sample sizes and t values for the experimental and control groups.
- One study reported sample sizes and p values for the experimental and control groups.

In the study, the range specified by Güler et al. (2022) was taken as basis for the interpretation of effect sizes. In this respect, an effect size of .15 was considered as negligible, .40 as small, .75 as medium, 1.10 as large, 1.45 as very large, and greater than 1.45 as excellent.

2.6. Heterogeneity Test and Meta-Analysis Model

In meta-analysis studies, heterogeneity plays an effective role in determining the statistical model (fixed and random effects model) to be applied in meta-analysis (Huedo-Medina et al., 2006). In the fixed effects model, it is assumed that the studies in the meta-analysis have a single true effect size, while in the random effects model, it is assumed that the effect sizes of the studies may vary (Borenstein et al., 2010). The data obtained on heterogeneity are presented as evidence for the use of the random effects model (Hedges & Vevea, 1998). In this study, heterogeneity was determined using the Q and I^2 statistics. As shown in Table 1, the Q value was calculated to be 1014.166, which exceeds the critical value of 72.153 for 54 degrees of freedom at the 95% significance level in the chi-square (χ^2) table. Furthermore, the *p*-value is statistically lower than 0.05. In the study, the l2 value was calculated as 94.675. According to the heterogeneity criteria proposed by Higgins et al. (2003), this value indicates a high level of heterogeneity. These values indicate that the heterogeneity criterion for using the random effects model in the meta-analysis has been met.

3. Findings

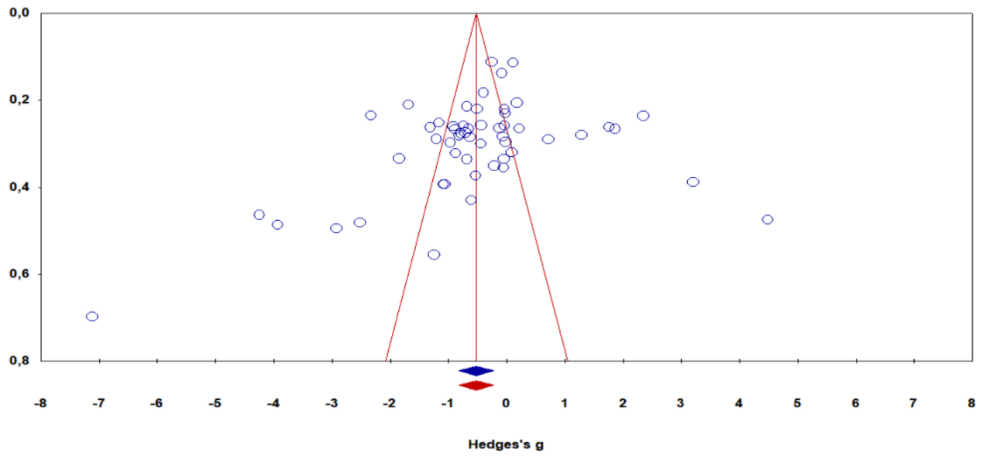
3.1. Findings on Publication Bias

In the study, publication bias was assessed by examining the funnel plot and using the classic fail-safe N test and Orwin's fail-safe N test, Duval and Tweedie's trim and fill test and Egger's Regression Test. Firstly, the funnel plot was visually analyzed. The results of the funnel plot reveal that there is a symmetrical structure between standard error and effect size. Since the visual interpretation of the funnel plot is subjective, Duval and Tweedie's Trim and Fill Analysis was conducted. The analysis revealed no significant difference between the observed and adjusted values.

Table 1
Findings regarding the heterogeneity test

Model	*N*	*Effect-size and 95% confidence interval*					*Test of null (2-tail)*		*Heterogeneity*				*Tau-squared*			
		Point estimate	*SE*	*Variance*	*Lower limit*	*Upper limit*	*Z*	*p*	*Q*	*df*	*p*	*I-Squared*	*Tau-Squared*	*SE*	*Variance*	*Tau*
Fixed	55	−.313	.034	.001	−.380	-.245	−9.072	<.001	1014.166	54	<.001	94.675	1.182	0.317	0.101	1.087

Figure 2
Funnel plot of standard error by effect-size



To further investigate the potential publication bias, the classic fail-safe N and Orwin's fail-safe N values were calculated. As shown in Table 2, the classic fail-safe N value is 1725. This indicates that 1670 additional articles with non-significant findings would be required to invalidate the effect of intervention studies on foreign language speaking anxiety. Similarly, Orwin's fail-safe N value (see Table 3) indicates that 63 additional articles with an effect size of zero would be needed to render the mean effect size of this meta-analysis insignificant. Besides, Egger's regression test was conducted, and based on the p significance value obtained from the test, no publication bias was detected (p = .085 > .05). In this respect, all these findings indicate that there is no publication bias.

Table 2
The findings of the classic fail-safe N test

Z-Value for observed studies	−11.14738
p-Value for observed studies	0.00000
Alpha	0.05000
Tails	2.00000
Z for alpha	1.95996
Number of observed studies	55.00000
Number of missing studies that would bring p value to 4 alpha	1725.0000

Table 3
Findings of Orwin's fail-safe N test

Hedges' *g* in observed studies	−0.31276
Criterion for a 'trivial' Hedges' *g*	−0.10000
Mean Hedges' *g* in missing studies	0.00000
Number missing studies needed to bring Hedges' *g* under 0.1	118.00000

3.2. The Findings on the Overall Effect of Intervention Studies on Foreign Language Speaking Anxiety

The effect sizes of intervention studies on foreign language speaking anxiety are summarized using a stem-and-leaf plot (Table 4). It is expected that there will be a positive increase in the measurement of variables such as academic achievement and attitude after the intervention (e. g., Am et al., 2023; Gökmen, 2021). Since anxiety is a negative variable, it is expected to show a decreasing trend following the intervention (e.g., Reeves et al., 2022). As shown in Table 4, 14 of the effect size values are lower than -1.00. In addition, 7 of the effect sizes vary between −1 and −0.5, while 24 of them are −0.5 and above.

Table 4
Stem and leaf plot of the effect-sizes

Frequency	*Stem*	*Leaf*
1	−7	1
1	−4	2
1	−3	9
3	−2	359
2	−1	68
6	−1	001223
17	−0	55556666677788899
14	−0	00000000122344
4	0	0112
1	0	7
2	1	278
1	2	3
1	3	2
1	4	4

The findings of the basic values (Hedges *g*, standard error and *p*) of the studies included in the meta-analysis are shown in Table 5 and the forest plot is shown in Appendix 2. When Table 5 is examined, it is observed that 55 effect sizes were calculated from 54 studies. According to Table 5, 37 of the effect sizes are significant ($p < .05$) whereas 18 are not significant ($p > .05$). In the study, the overall effect size for the random effects model was found to be −0.522, indicating that intervention studies have a medium level effect on foreign language speaking anxiety. After the analysis, it was observed that there are three studies whose effect sizes differ significantly from the effect sizes of other studies (Elgmal, 2023; Othman, 2023; Zahran & Qoura, 2022). Since the effect sizes of these studies were significantly larger/smaller than the others, a sensitivity analysis was made to examine their effect as potential outliers on the overall effect size. When these studies were excluded from the meta-analysis, the overall effect size was calculated as −0.441. The difference between the effect size calculated before (−0.522) and after (−0.441) excluding these studies was calculated as −0.081. This difference, which has minimal impact on the publication bias analysis, indicates that it would not affect the interpretation of the results. The forest plot for the sensitivity analysis is shown in Appendix 2.

Table 5
The findings of the basic values of the studies included in the meta-analysis

Study name	*Hedges' g*	*SE*	*p*
Abuhussein et al. (2023)	−1.314	0.263	.000
Akdag-Cimen and Cesme (2022)	0.218	0.265	.411
Aktas (2023)	−1.686	0.210	.000
Ali (2022)	1.286	0.281	.000
Aydin (2019)	−0.627	0.285	.028
Azizimajd (2023)	−0.883	0.267	.001
Bedaiwy (2022)	−0.023	0.230	.921
Bozkurt and Aydin (2023)	−0.047	0.335	.889
Canbay (2022)	−2.922	0.495	.000
Chen (2024)	−0.013	0.296	.965
Chen and Hwang (2020)	−1.158	0.252	.000
Chen and Hwang (2022)	−0.682	0.214	.001
Chen et al. (2022)	−0.119	0.264	.652
Dariyemez (2020)	−0.704	0.274	.010
Dewi and Wilany (2023)	−0.434	0.258	.092
Ding (2023)	−0.083	0.138	.548
Duran-Gercekcioglu (2019)	−0.445	0.300	.138
El-Bassuony (2010)	−0.784	0.276	.005

Table 5 continued

Study name		*Hedges' g*	*SE*	*p*
Elgmal (2023)		−7.116	0.698	.000
Gedemen (2022)		−0.062	0.284	.828
Gundogan (2020)		−0.536	0.374	.152
Guzel (2016)		0.116	0.114	.309
Hamzaoglu (2015)		−0.536	0.374	.152
Hanafiah et al. (2022)		−2.516	0.481	.000
Hung et al. (2023)		0.089	0.320	.780
Ibatova (2022)		2.348	0.236	.000
Jin (2024)		−0.967	0.298	.001
Karsli (2022)		−0.913	0.260	.000
Khiari (2018)		−1.202	0.290	.000
Kilicarslan (2014)		−0.686	0.336	.041
Kiyak (2023)		−0.055	0.355	.876
Kocer (2019)		−0.209	0.351	.551
Liu (2021)		−0.254	0.112	.023
Liu and Aryadoust (2022)		0.179	0.206	.385
Lu et al. (2018)		0.716	0.290	.014
Madzlan et al. (2020)		−0.818	0.281	.004
Nasri et al. (2022)		−2.327	0.236	.000
Othman (2023)		−4.246	0.464	.000
Oz (2017)		−1.085	0.393	.006
Ozdemir (2018)		−0.033	0.259	.899
Pan et al. (2022)	Subgroup 1	1.756	0.261	.000
	Subgroup 2	1.860	0.266	.000
Pribly et al. (2001)		−1.244	0.555	.025
Punar and Uzun (2019)		−0.612	0.430	.155
Salem (2019)		−3.928	0.486	.000
Satar and Ozdener (2008)		−0.399	0.183	.029
Siyli and Kafes (2015)		−1.062	0.393	.007
Sukmana et al. (2023)		3.205	0.388	.000
Turgut (2019)		−0.656	0.266	.014
Turkben (2019)		−1.845	0.334	.000
Yangin-Ersanli and Unal (2022)		−0.873	0.321	.007
Yuruk (2022)		−0.738	0.260	.004
Yusof (2018)		−0.036	0.221	.871
Zahran & Qoura (2022)		4.488	0.475	.000
Zarrinabadi et al. (2023)		−0.509	0.220	.021
Random		**−0.522**	**0.153**	**.001**

3.3. Findings on Moderator Variables

In the study, intervention type and intervention duration were identified as moderator variables. An examination of Table 6 indicated that no statistically significant difference was observed between the intervention types (Q-value = 5.920; df = 5; and $p > .05$). The average effect sizes of the intervention types range from −2.165 to −0.015. According to the effect size classification by Güler et al. (2022), flipped learning ($g = -0.015$) falls within the small range, technology-assisted language teaching ($g = -0.446$) and theater and drama practices ($g = -0.710$) are in the medium range, learning based on active interaction ($g = -0.946$) is in the large range, psychology-supported language teaching ($g = -1.233$) is in the very large range, and dynamic assessment ($g = -2.165$) is in the huge range.

Analysis of Table 7 revealed no statistically significant difference between the durations of the interventions (Q-value = 0.469; df = 2; and $p > .05$). The average effect sizes of the intervention

Table 6
Moderator analysis findings according to the intervention type

Type of Intervention	*N*	*Point estimate*	*SE*	*Confidence interval (95%)*		*Z-Value*	*p-Value*	*Q-Value*	*df (Q)*	*p-Value*
				Lower limit	*Upper limit*					
Dynamic assesment	2	−2.165	2.063	−6.209	1.879	−1.049	.294			
Flipped learning	4	−0.015	0.714	−1.414	1.384	−0.021	.983			
Learning based on active interaction	2	−0.946	0.899	−2.708	0.816	−1.052	.293			
Psychological support-based language learning	5	−1.233	0.331	−1.881	-0.585	−3.728	.000			
Technology assisted language teaching	30	−0.446	0.182	−0.803	-0.090	−2.456	.014			
Theater and drama practices	3	−0.710	0.166	−1.036	-0.384	−4.265	.000			
Total between								5.920	5	.310

Note. * Other intervention types were excluded as they included only a single study (n=9).

Table 7
Moderator analysis findings according to the intervention duration

Implementation Duration	*N*	*Point estimate*	*SE*	*Confidence Interval (95%)*		*Z-Value*	*p-Value*	*Q-Value*	*df (Q)*	*p-Value*
				Lower limit	*Upper limit*					
Long-term	22	−0.598	0.232	−1.051	−0.144	−2.580	−.010			
Mid-term	13	−0.552	0.160	−0.865	−0.239	−3.454	−.001			
Short-term	6	−0.413	0.190	−0.785	−0.041	−2.179	−.029			
Total between								0.469	2	.791

durations range from −0.598 to −0.413. According to the effect size classification by Güler et al. (2022), all of them are in the medium-level effect range.

4. Discussion

4.1. Overall Effectiveness

This study examined whether intervention studies significantly influence foreign language speaking anxiety, analyzing 54 studies using the meta-analysis method. At the end of the study, it was found that 43 of the studies whose effect sizes were calculated had a negative effect size and 12 of them had a positive effect size. The overall effect size value of intervention studies falls within the medium-level effect category. This indicates that the interventions are partially effective in reducing the level of speaking anxiety. According to the meta-analysis results, some intervention studies were categorized huge effect size. This may be due to the content of the teaching intervention or the student's level of readiness for the intervention. For example, four of the technology-assisted intervention studies were classified under the huge effect size (Aktaş, 2023; Hanafiah et al., 2022; Nasri et al., 2022; Salem, 2019). Furthermore, the huge effect value revealed by interactive teaching (Türkben, 2019), dynamic assessment (Othman, 2023), psychological support-based language teaching (Canbay, 2022), and flipperentiation (Elgmal, 2023) interventions appears to enhance its own effectiveness on speaking anxiety. Another remarkable finding in the study is the studies that were found to have a negative effect on anxiety (Akdağ-Çimen & Çeşme, 2022; Güzel, 2016; Hung et al., 2023; Liu & Aryadoust, 2022). This result may be due to the readiness level of the sample, the duration of the intervention or the profile of the practitioner. In the studies of Akdağ-Çimen and Çeşme (2022) and Liu and Aryadoust (2022), it was observed that the intervention had a slightly positive effect on anxiety. Güzel (2016) stated that the method used should serve as an additional setting for traditional language classrooms, and it should not overshadow conventional practices. In the study of Hung et al. (2023), it was stated that the experimental group did not have enough time to get used to the intervention. However, among the studies in which a substantial effect was found, there are also studies reporting that although anxiety increased in the experimental group, it decreased (Ibatova, 2022; Pan et al., 2022; Sukmana et al., 2023; Zahran & Qoura, 2022). The reason for this situation might be the measurement tool used. Since anxiety is a negative variable, it is possible that reverse-coded items were included in the measurement tool. The related studies were examined in detail in this respect, but no relevant statement was found. Therefore, the findings were included in the research as presented in the original studies.

4.2. Discussion of Moderating Factors

The meta-analysis indicated that the type of intervention had no statistically significant impact on participants' speaking anxiety. Rather than focusing on a single method or strategy, this meta-analysis study included all types of interventions. This made it necessary to consider different interventions together. Therefore, some intervention types may be more appropriate for foreign language speaking anxiety than others. As a result of the analysis, it was found that there were interventions demonstrating strong effects between the studies. When the intervention types were analyzed individually, dynamic assessment-based interventions were classified under the category of huge effect size. Dynamic assessment is an effective approach for enhancing students' language skills in second and foreign language teaching (Anton, 2009). In parallel with this finding, Gilani et al. (2021), in their study in which they examined five international peer-reviewed articles, found that dynamic assessment can be used in an EFL classroom settings to support the development of students' speaking skills. In the study, it was determined that psychological support-based language teaching was categorized under a wide range of effect. Anxiety is not only a crucial factor in education but also one of the most frequently discussed concepts in psychology (Zeidner & Matthews, 2010). Therefore, there are meta-analysis studies in the literature evaluating numerous psychological interventions addressing speaking anxiety. In these studies, it was found

that interventions aimed at reducing speaking anxiety have small, moderate, or large significant effects (Ebrahimi et al., 2019; Reeves et al., 2022). It can be said that the results of the study are in line with the findings of this study. In the study, it was determined that learning through active interaction was classified under the category of large effect size. In today's classroom environment shaped by the constructivist approach, students are expected to interact with their peers and teachers while constructing knowledge (Koç, 2006). In terms of foreign language teaching, it is stated in the studies carried on that interactive and cooperative learning approach improves students' foreign language speaking skills positively (Namaziandost et al., 2019). In the study, it was found that theatre and drama practices and technology-assisted language teaching were classified under the category of medium-level effect size. In drama activities, group members engage in role-playing, which positively affects their speaking, diction, and pronunciation skills. Research in the literature also supports this finding of the study (Aykac & Cetinkaya, 2013; Kardas & Koc, 2017). Similarly, in parallel with this study, it has been reported that technology has positive effects on speaking anxiety. Lim et al. (2023), in their meta-analysis study examining the effect of virtual reality on public speaking anxiety, found that virtual reality has a statistically significant effect on reducing public speaking anxiety. Another important finding of the study was that flipped learning was classified under the category of negligible effect size. This result may be due to the readiness level of the sample, intervention duration or the profile of the practitioner. Indeed, many studies in language teaching (Amiryousefi, 2019; Chen Hsieh et al., 2017; Santhanasamy & Yunus, 2022) emphasize the positive outcomes of flipped learning.

The meta-analysis showed that the duration of the intervention had no statistically meaningful impact on participants' speaking anxiety. This finding contradicts previous studies in the literature (Ratanasiripong et al., 2012; Sarpourian et al., 2022). In the study, it was found that all intervention durations were classified under the category of medium-level effect size. Intervention duration has often been a subject of debate in educational research. Studies suggesting that interventions with long duration provide higher effect sizes compared to shorter ones, have been carried out (Dignath & Büttner, 2008). However, some researchers state that the intervention duration is not determinative on the effectiveness of the intervention (Bangert-Drowns et al., 2004). Although the intervention durations in this study were classified under the medium-level effect size, it was found that long-term interventions had the highest effect size. Therefore, it can be said that long-term interventions are more effective in reducing foreign language speaking anxiety. However, due to conflicting findings in the literature, the impact of long-term interventions on students' ability to maintain motivation remains an important issue that requires further investigation. As the duration of interventions increases, it is essential to assess whether students can sustain their commitment to the intervention.

5. Conclusion

The findings of this study provide valuable insights into how foreign language teachers can more effectively implement interventions to reduce speaking anxiety in their classrooms. First, the results of the meta-analysis indicate that technology-supported interventions (Aktaş, 2023; Hanafiah et al., 2022; Nasri et al., 2022; Salem, 2019) are effective. In this regard, teachers can integrate online chat platforms, virtual reality applications, or interactive language learning software into their curricula to help reduce students' speaking anxiety. Such technologies can facilitate speaking practice and contribute to lowering anxiety levels. Additionally, interactive teaching methods (Türkben, 2019) and dynamic assessment approaches (Othman, 2023) have been found to yield a large effect size. Accordingly, teachers can actively engage students in speaking activities and encourage them to learn from their mistakes. Furthermore, language instruction incorporating psychological support (Canbay, 2022) has been shown to have positive effects on speaking anxiety. Based on this, teachers can create a supportive classroom environment by considering students' emotional states. Moreover, long-term interventions have been found to demonstrate higher effect sizes. As the duration of interventions increases, maintaining students'

motivation becomes a critical factor. Therefore, teachers should strengthen feedback mechanisms and develop strategies to enhance students' engagement in the learning process. In conclusion, this study highlights the necessity for teachers to implement various intervention strategies to reduce foreign language speaking anxiety. For an effective intervention, teachers are recommended to consider students' individual needs, establish a supportive classroom environment, and utilize technology as a pedagogical tool.

6. Limitations and Suggestions

Considering the average effect size of this meta-analysis, it can be concluded that the interventions were partially effective in reducing students' foreign language speaking anxiety. This means that some interventions were not successful in reducing speaking anxiety. Therefore, studies can be carried out to investigate the reasons behind this situation. One limitation of the current study is that it concentrated solely on two moderator variables. Therefore, different variables such as the level of education can be used in future studies. In the studies examined, the level of education was often given as language level (A-B-C), so it was decided that it would not be proper to analyze it. For this reason, descriptive data of the study group can be included more in future studies. The development of speaking skills is a holistic process. Future studies can not only examine speaking performance but also consider different variables that affect speaking success, such as motivation and attitude. Since the current study includes some outliers, more studies are needed to deepen the implementation processes and to investigate the large effect obtained from these studies. Finally, it was observed that there were studies in which language learning anxiety measurement tool was used to measure foreign language speaking anxiety. Foreign language speaking anxiety measurement tools can be prepared considering the education levels.

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Data availability: Data generated or analyzed during this study are available from the authors on request.

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Note: The meta-analyses included in the study are starred (*) in the list.

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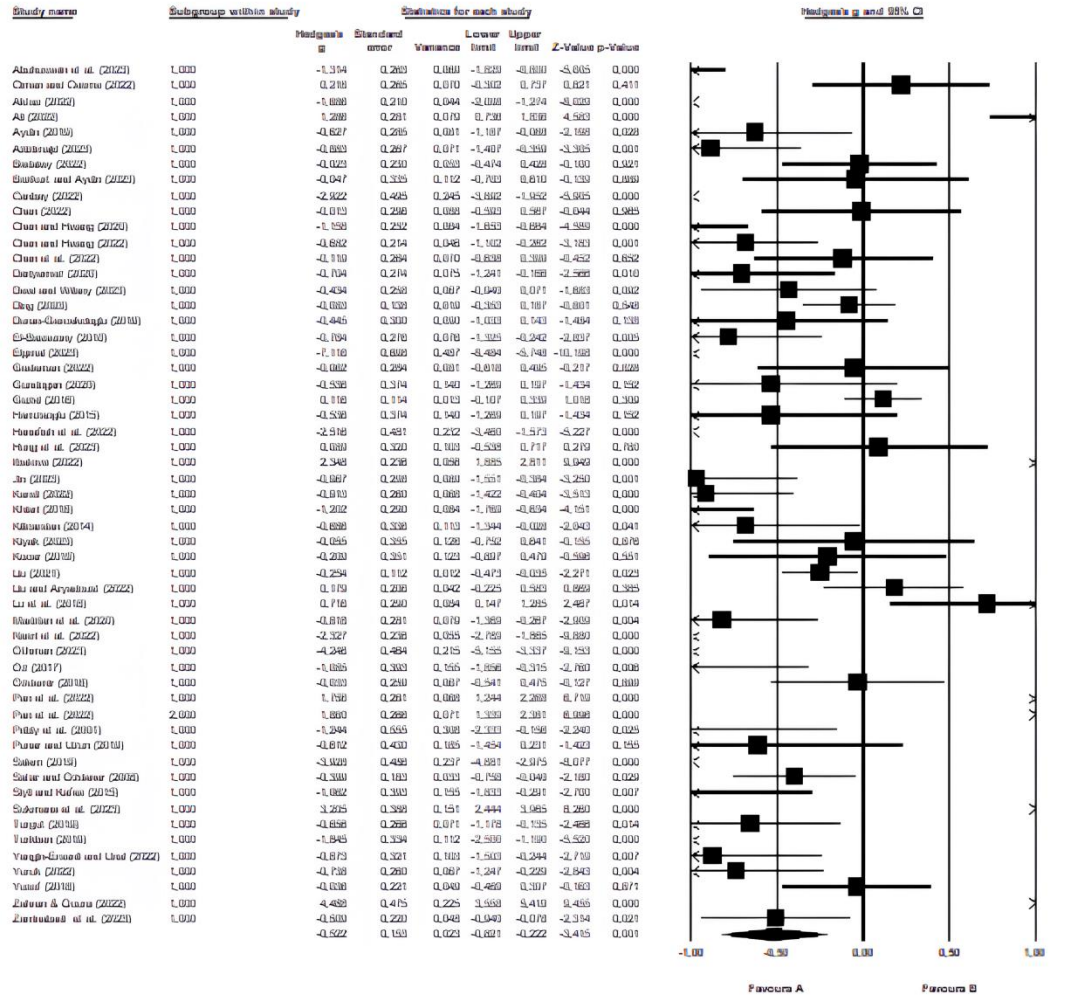
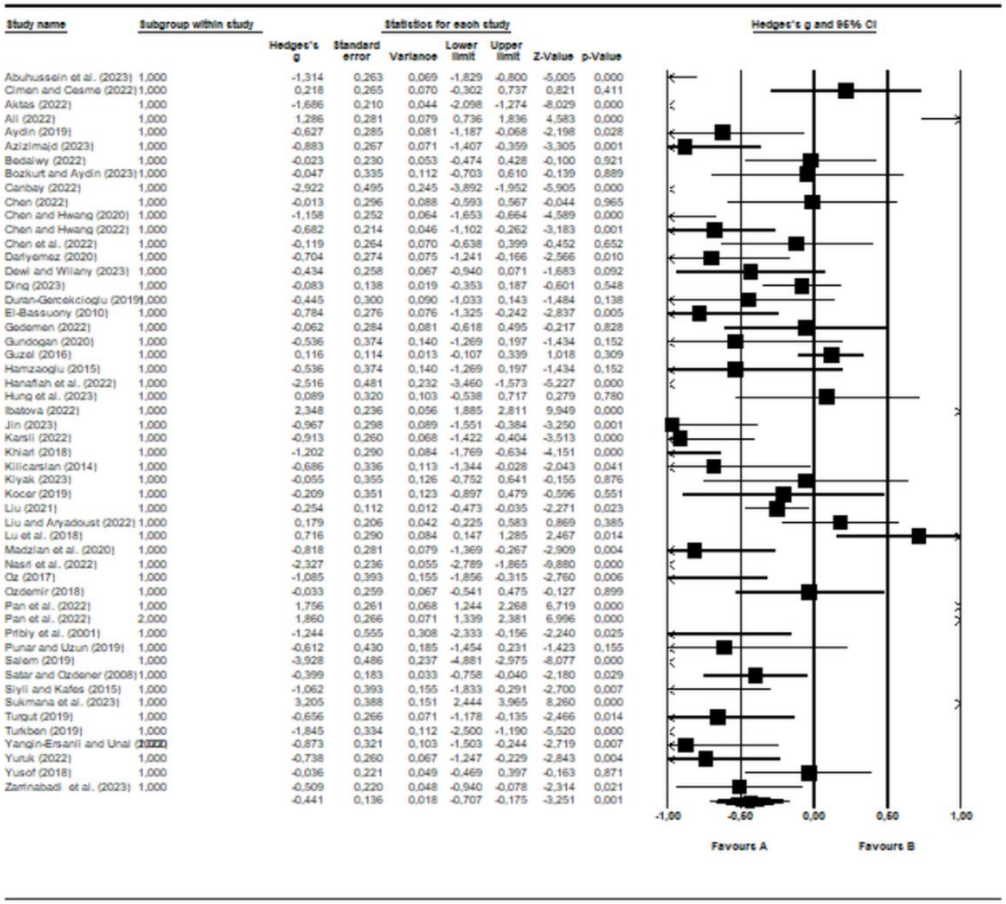
Appendix 1. Forest Plot



Appendix 2. Sensitivity Analysis



Study name	Subgroup within study	Hedges's g	Standard error	Variance	Lower limit	Upper limit	Z-Value	p-Value
Abuhussein et al. (2023)	1,000	-1,314	0,263	0,069	-1,829	-0,800	-5,005	0,000
Cimen and Cesme (2022)	1,000	0,218	0,265	0,070	-0,302	0,737	0,821	0,411
Aktas (2022)	1,000	-1,686	0,210	0,044	-2,098	-1,274	-8,029	0,000
Ali (2022)	1,000	1,286	0,281	0,079	0,736	1,836	4,583	0,000
Aydin (2019)	1,000	-0,627	0,285	0,081	-1,187	-0,068	-2,198	0,028
Azizimajd (2023)	1,000	-0,883	0,267	0,071	-1,407	-0,359	-3,305	0,001
Bedaiwy (2022)	1,000	-0,023	0,230	0,053	-0,474	0,428	-0,100	0,921
Bozkurt and Aydin (2023)	1,000	-0,047	0,335	0,112	-0,703	0,610	-0,139	0,889
Canbay (2022)	1,000	-2,922	0,495	0,245	-3,892	-1,952	-5,905	0,000
Chen (2022)	1,000	-0,013	0,296	0,088	-0,593	0,567	-0,044	0,965
Chen and Hwang (2020)	1,000	-1,158	0,252	0,064	-1,653	-0,664	-4,589	0,000
Chen and Hwang (2022)	1,000	-0,682	0,214	0,046	-1,102	-0,262	-3,183	0,001
Chen et al. (2022)	1,000	-0,119	0,264	0,070	-0,638	0,399	-0,452	0,652
Dariyemez (2020)	1,000	-0,704	0,274	0,075	-1,241	-0,166	-2,566	0,010
Dewi and Wilany (2023)	1,000	-0,434	0,258	0,067	-0,940	0,071	-1,683	0,092
Ding (2023)	1,000	-0,083	0,138	0,019	-0,353	0,187	-0,601	0,548
Duran-Gercekcioglu (2019)	1,000	-0,445	0,300	0,090	-1,033	0,143	-1,484	0,138
El-Bassuony (2010)	1,000	-0,784	0,276	0,076	-1,325	-0,242	-2,837	0,005
Gedemen (2022)	1,000	-0,062	0,284	0,081	-0,618	0,495	-0,217	0,828
Gundogan (2020)	1,000	-0,536	0,374	0,140	-1,269	0,197	-1,434	0,152
Guzel (2016)	1,000	0,116	0,114	0,013	-0,107	0,339	1,018	0,309
Hamzaoglu (2015)	1,000	-0,536	0,374	0,140	-1,269	0,197	-1,434	0,152
Hanafiah et al. (2022)	1,000	-2,516	0,481	0,232	-3,460	-1,573	-5,227	0,000
Hung et al. (2023)	1,000	0,089	0,320	0,103	-0,538	0,717	0,279	0,780
Ibatova (2022)	1,000	2,348	0,236	0,056	1,885	2,811	9,949	0,000
Jin (2023)	1,000	-0,967	0,298	0,089	-1,551	-0,384	-3,250	0,001
Karsli (2022)	1,000	-0,913	0,260	0,068	-1,422	-0,404	-3,513	0,000
Khiari (2018)	1,000	-1,202	0,290	0,084	-1,769	-0,634	-4,151	0,000
Kilicarslan (2014)	1,000	-0,686	0,336	0,113	-1,344	-0,028	-2,043	0,041
Kiyak (2023)	1,000	-0,055	0,355	0,126	-0,752	0,641	-0,155	0,876
Kocer (2019)	1,000	-0,209	0,351	0,123	-0,897	0,479	-0,596	0,551
Liu (2021)	1,000	-0,254	0,112	0,012	-0,473	-0,035	-2,271	0,023
Liu and Aryadoust (2022)	1,000	0,179	0,206	0,042	-0,225	0,583	0,869	0,385
Lu et al. (2018)	1,000	0,716	0,290	0,084	0,147	1,285	2,467	0,014
Madzlan et al. (2020)	1,000	-0,818	0,281	0,079	-1,369	-0,267	-2,909	0,004
Nasri et al. (2022)	1,000	-2,327	0,236	0,055	-2,789	-1,865	-9,880	0,000
Oz (2017)	1,000	-1,085	0,393	0,155	-1,856	-0,315	-2,760	0,006
Ozdemir (2018)	1,000	-0,033	0,259	0,067	-0,541	0,475	-0,127	0,899
Pan et al. (2022)	1,000	1,756	0,261	0,068	1,244	2,268	6,719	0,000
Pan et al. (2022)	2,000	1,860	0,266	0,071	1,339	2,381	6,996	0,000
Pribly et al. (2001)	1,000	-1,244	0,555	0,308	-2,333	-0,156	-2,240	0,025
Punar and Uzun (2019)	1,000	-0,612	0,430	0,185	-1,454	0,231	-1,423	0,155
Salem (2019)	1,000	-3,928	0,486	0,237	-4,881	-2,975	-8,077	0,000
Satar and Ozdener (2008)	1,000	-0,399	0,183	0,033	-0,758	-0,040	-2,180	0,029
Slyli and Kafos (2015)	1,000	-1,062	0,393	0,155	-1,833	-0,291	-2,700	0,007
Sukmana et al. (2023)	1,000	3,205	0,388	0,151	2,444	3,965	8,260	0,000
Turgut (2019)	1,000	-0,656	0,266	0,071	-1,178	-0,135	-2,466	0,014
Turkben (2019)	1,000	-1,845	0,334	0,112	-2,500	-1,190	-5,520	0,000
Yangin-Ersanli and Unal (2022)	1,000	-0,873	0,321	0,103	-1,503	-0,244	-2,719	0,007
Yuruk (2022)	1,000	-0,738	0,260	0,067	-1,247	-0,229	-2,843	0,004
Yusof (2018)	1,000	-0,036	0,221	0,049	-0,469	0,397	-0,163	0,871
Zamnabadi et al. (2023)	1,000	-0,509	0,220	0,048	-0,940	-0,078	-2,314	0,021
		-0,441	0,136	0,018	-0,707	-0,175	-3,251	0,001