



The effect of material usage on academic achievement in teaching Turkish as a foreign language: a meta-analysis study

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Abstract

The primary objective of this study is to examine the effect of material usage on academic achievement in the teaching of Turkish as a foreign language. The study was conducted using the meta-analysis method in line with this objective. The meta-analysis method is a quantitative paradigm-based approach that brings together independent studies for a specific purpose, analyzes their numerical data, and reaches a conclusion. The study includes 33 meta-analysis-eligible studies conducted between 2015 and 2024, both domestically and internationally, on the teaching of Turkish as a foreign language. The National Thesis Center, Google Scholar, Ulakbim Keşif, YÖK Akademik, and Web of Science search tools were used in the data collection phase. Reliability and validity analyses were performed, and no publication bias was found. Subgroups were created in the study regarding the year of publication, type of publication, type of school, four basic language skills, and types of materials, and moderator/subgroup analyses were performed. Microsoft Excel and Comprehensive Meta Analysis (CMA) Version 4.0.0 software were used for data analysis. The research concluded that material use has a positive effect on academic achievement at a “very large ($d=1.126$)” level. Moderator analyses revealed that the effect values were large for all subgroups, and no significant differences were observed between them. Based on the findings of the study, it was concluded that in Turkish language teaching as a foreign language, all types of materials have a positive effect on academic achievement at every level and for every skill type.

Keywords

Teaching Turkish as a foreign language
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Introduction

Language teaching, as stated in the Common European Framework of Reference for Languages (CEFR), is primarily structured around receptive and productive skills. Receptive skills are defined as listening and reading, while productive skills are defined as speaking and writing (Harmer, 2001). Although the development of each language skill progresses independently, all skills interact with each other and each is important in terms of the individual's social and societal position (Richards & Rodgers, 2014). Listening is considered an important skill in language learning and represents the moment when

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the learner first interacts with the target language (Aksu, 2013; Demirel, 2011; İnal, 2021; Petursdottir & Carr, 2011). Individuals who want to acquire a language begin to understand by listening and, over time, reflect what they understand in their other skills. Individuals who begin to understand a foreign language by listening, eventually need speaking skills to engage in verbal communication (Arı, 2018; Magyar et al., 2022). Individuals who develop their speaking skills, begin to not only exist within the culture of the language they want to learn but also express their own existence verbally. Reading skills are defined as the ability to understand written materials in the target language. The ability to convey feelings and thoughts in writing is called writing skills (Roquet & Pérez-Vidal, 2017). Individuals' ability to perform these four basic language skills, namely reception and production, demonstrates their proficiency in that language (Karatay, 2011).

In language teaching, the use of materials that make learning concrete and easier is considered important. In education, material is defined as any tool, equipment, or resource used in the learning-teaching process to support the achievement of target outcomes (Heinich et al., 2002; Seferoğlu, 2006). These materials increase students' active participation in the learning process, make abstract concepts concrete, and ensure the retention of learned information. Indeed, people remember what they do and say the most, and what they read the least (Dale, 1969). The materials used in the teaching process are tools that enable the information to be conveyed to be made more concrete through the use of more senses, to become more interesting, and to involve students in the learning process. According to Yalın (2010), the use of tools in the teaching process enriches learning environments, attracts attention, facilitates recall, concretizes abstract things, ensures efficient use of time, and simplifies content by making meaning easier to understand. It accelerates learning and facilitates more permanent learning (Duman, 2013). This view is also supported in the international literature. According to Heinich et al. (2002), teaching materials serve the function of attracting attention, guiding learning, and facilitating understanding in the learning environment. Mayer's "Constructivist Multimedia Learning" theory (Mayer, 2021) states that the use of appropriate materials enhances the quality of learning by activating students' cognitive processes. Furthermore, Moreno and Mayer (2007) emphasize that multimedia tools make information more concrete and support learners' active participation. Indeed, studies have shown that the use of materials increases students' interest, making learning more effective and lasting (Issa et al., 2013).

The material to be used in teaching Turkish as a foreign language is largely determined by the student's language level (Duman, 2013). In the Common European Framework of Reference for Languages (CEFR), learners' language proficiency levels are defined from A1 to C2, and the use of materials appropriate for each level supports the development of language skills (Council of Europe, 2001, 2020). While more complex, authentic materials aimed at developing production skills are useful for advanced learners, concrete and visually-oriented materials facilitate participation in the learning process for beginners. For example, when teaching the topic of "vegetables," learning vocabulary through digital applications, reinforcing it with gamified classroom activities, or experiencing it in authentic learning environments (e.g., virtual garden applications) increases the retention of learning (Reinders & Benson, 2017). Furthermore, smart boards, projectors, mobile applications, digital textbooks, and interactive activities are among the important materials in teaching Turkish as a foreign language (Lee, 2021; Temizyürek & Birinci, 2016). National and international studies also reveal that the use of materials increases students' attention, activates cognitive processes, and has a positive effect on language skills (Berk & Açıık, 2021; Çakır & Kana, 2015; Demirel, 2019; Erol et al., 2021; Göker & İnce, 2019; Mayer, 2021; Melanlıoğlu & Atalay, 2016; Newfield, 2011).

Studies examining the use of different materials in teaching Turkish as a foreign language and revealing their effects on different skill types are available in the literature (Balcı & Dünder, 2017; Çalışkan, 2022; Çangal, 2020; Melanlıoğlu & Atalay, 2016; Turkbent, 2019). Meta-analysis combines the results obtained from these studies and leads to a more general conclusion about which material may be more effective for which skill in foreign language teaching. The purpose of meta-analysis studies is to combine the results of previous studies on a subject and analyze them to reach a conclusion (Şen &

Yıldırım, 2020). The large number of studies in the field, the difficulty of examining them individually and reaching a conclusion, and the need for systematic observation of the data call for meta-analysis. Meta-analysis studies are valuable because they present the studies examined comprehensively. There are a limited number of meta-analysis studies in the field of teaching Turkish as a foreign language. The first of these studies was conducted by Doğan and Özçakmak (2014) in 2014 on postgraduate theses related to the teaching of listening skills. Subsequently, meta-analysis studies by Aydın et al. (2015) on articles written on student attitudes and by Ergül et al. (2019) classifying master's theses written between 2009 and 2019 in terms of various variables are included in the literature. Furthermore, Gülden (2023) conducted a meta-synthesis study on works addressing the cultural dimension. A review of the literature reveals no studies examining the effect of material use in teaching Turkish as a foreign language. However, meta-analysis studies investigating the effects of material use on academic achievement, both domestically and internationally, are noteworthy. For example, Akar's (2020) study is a meta-analytic and thematic research examining the effects of interactive whiteboard (smart board) use on academic achievement and shows that interactive whiteboard use has a large and significant effect on academic achievement. Similarly, the meta-analysis conducted by Odabaş and Kahramanoğlu (2023) evaluated the overall effect of mobile device integration in education on academic achievement and found evidence supporting the positive effect of mobile device use on student achievement. A meta-analysis conducted by Dong et al. (2024) examined the effects of mobile learning on science achievement and found that mobile learning increased achievement ($g = 0.857$). These findings indicate that the use of materials has a significant positive impact on academic achievement not only in foreign language teaching but also at various educational levels. Şen and Yıldırım (2020) state that the stages of meta-analysis studies are determining the research topic, identifying the problem situation, conducting a search, identifying suitable studies, conducting quality control reviews, creating a data table, checking coding reliability, deciding on the effect size, conducting analysis, checking publication bias, interpreting effect size values, and reporting the results. This meta-analysis study aims to present master's theses and articles investigating the effect of material use on the four basic language skills in the context of different variables using descriptive statistics, to collect the results of the studies, to analyze them according to effect sizes, to discuss them, and to present them. The criteria for identifying suitable studies and data on coding reliability are presented in the methods section. Considering that the development of the four basic language skills is important in language learning, it is believed that a meta-analysis study on the effectiveness of the materials used on academic achievement will contribute to instructors working in the field of teaching Turkish as a foreign language, language learners, and future studies. The research question designed for this meta-analysis study is: "What is the overall effect of materials used in teaching Turkish as a foreign language on academic achievement?" Variables that may influence material usage were identified for the study. Accordingly, this meta-analysis study sought answers to the following sub-questions:

1. What are the descriptive statistics of studies examining the effect of material use on academic achievement?
2. What is the overall effect size of studies examining the effect of material use on academic achievement?
3. In the teaching of Turkish as a foreign language, the effect of material use on academic achievement:
 - a. How does it vary according to the year of publication?
 - b. according to the type of study?
 - c. according to the four basic language skills?
 - d. according to the type of material?
 - e. according to the type of school?

Method

This study collected and coded research investigating the effect of materials used in teaching Turkish as a foreign language on academic achievement, and the impact of these studies was revealed using the meta-analysis method. The meta-analysis method is defined as the analysis of analyses (Glass, 1976). Meta-analysis allows for the consistent and coherent integration of comprehensive quantitative findings, taking into account the magnitude of effects, and aims to produce meaningful generalizations through the systematic analysis of these findings (Cohen et al., 2001). This study used the meta-analysis method to combine the results of experimental studies on the effect of materials used in teaching Turkish as a foreign language on academic achievement. Following the formulation of the research question, a typical meta-analysis process involves six stages (Field & Gillett, 2010): 1) conducting a literature review; 2) determining and applying inclusion and exclusion criteria; 3) calculating the effect size for each included study; 4) performing the basic meta-analysis; 5) focusing on more comprehensive analyses such as conducting publication bias analysis and investigating moderator variables; and 6) reporting the results obtained. In this study, the stages listed in bullet points were followed.

Data Collection

Experimental studies are considered reliable studies within quantitative research methods (Büyüköztürk et al., 2015). The study is based on domestic and international studies that investigated the effect of materials used for the four basic language skills on academic achievement in data collection. The steps followed are listed below in order.

1. After entering the keyword “Turkish as a Foreign Language” in the search term section of the National Thesis Center, all works containing these words were included, regardless of word order, and the search field “all” was selected, resulting in 919 theses.
2. After entering the keyword “Turkish for Foreigners” in the search term section of the National Thesis Center, all fields were selected for the search, resulting in 433 theses.
3. Google Scholar, Web of Science, Ulakbim Discovery, and YÖK academic search tools were used for article searches. Google Scholar is noted as the most comprehensive search engine (Şen & Yıldırım, 2020). The keywords “Turkish as a Foreign Language,” “Turkish for Foreigners,” and “Impact” were entered together in the search field, and a total of 20 articles were found. International databases such as ERIC, Scopus, Springer Link, Taylor & Francis, Global, and Sage Journals were also examined, but no studies different from those obtained were found.
4. After the screening phase, a total of 1352 theses were reviewed during the selection phase, and 146 theses were selected that covered the period between 2015 and 2024, were prepared using quantitative research methods and techniques, and investigated the effect of material use. Of the 146 theses, 51 focusing on the four basic language skills were selected. Subsequently, theses providing the experimental and control group values and standard deviation values required for analysis were selected, and it was concluded that 27 theses were usable.
5. Out of the articles, three usable ones were selected based on the following criteria: publication between 2015 and 2024, non-derivation from theses, and provision of the necessary values for analysis.
6. Studies focusing on all four core language skills during the inclusion phase were treated as separate studies for each language skill and coded accordingly. Consequently, since one study was treated as four separate studies, the number of theses was calculated as 30.
7. The study includes a total of 661 experimental groups and 675 control groups from 30 theses and 3 articles, comprising a study group of 1,336 individuals. A summary of the selection process for the studies included in the study is provided in the PRISMA (2021) flow chart in Figure 1.

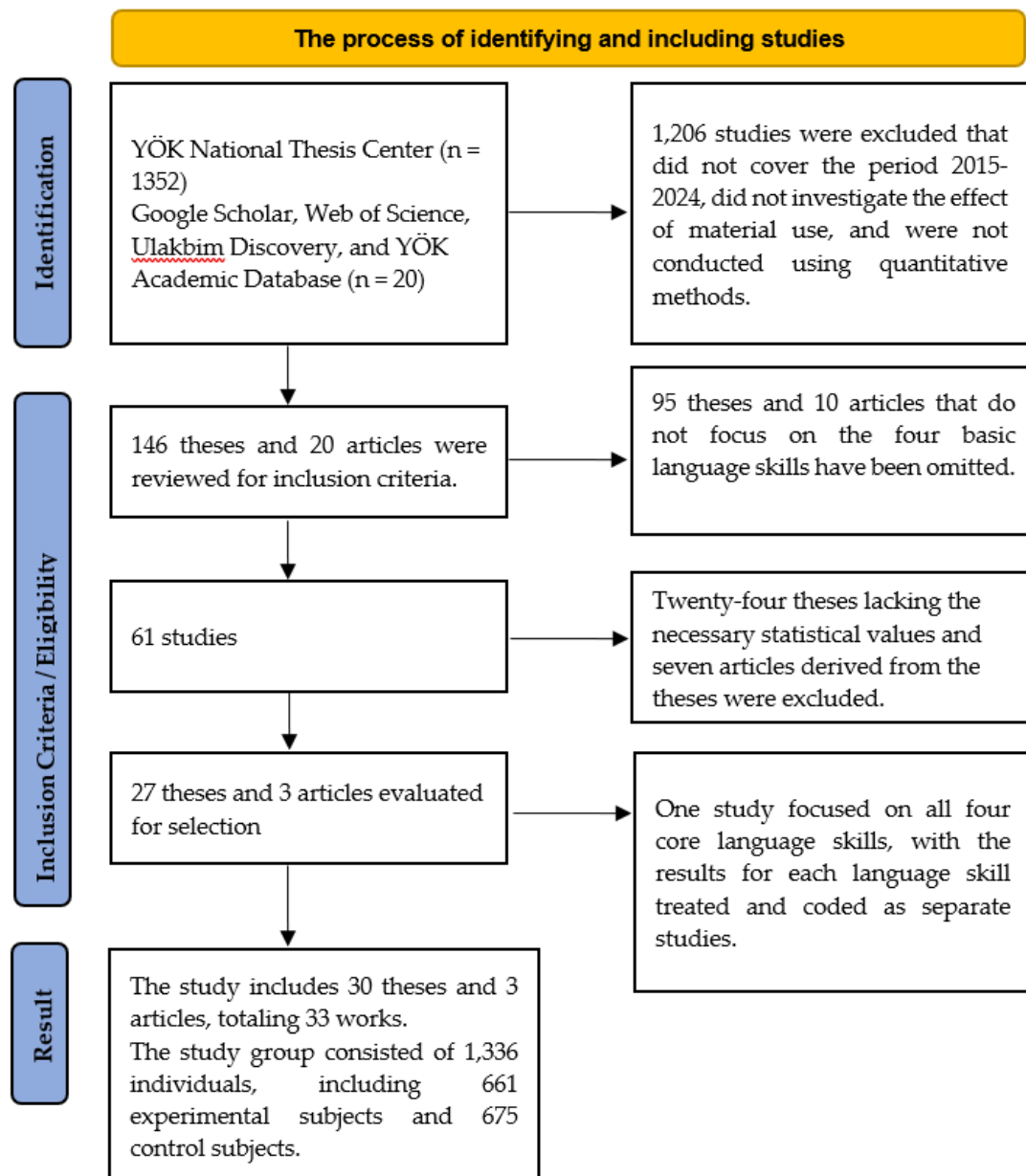


Figure 1. PRISMA flow diagram for the study selection process

A total of 33 studies, including 30 theses and 3 research articles, were selected from 1,372 studies using the aforementioned processes and meta-analysis was performed. In this context, the descriptive characteristics of the studies included in this research are presented in Table 1.

Table 1. Descriptive Characteristics of Studies

Study	The Four Basic Language Skills	Material Type	School Type	Type of Study
Arslan, 2023	Reading	Audio-Visual	Higher Education	Thesis
Balcı ve Dündar, 2017	Reading	Audio-Visual	Higher Education	Article
Baykan, 2023	Reading	Audio-Visual	Higher Education	Thesis
Çalışkan, 2022	Reading	Digital	Higher Education	Thesis
Gerek, 2022	Reading	Audio-Visual	Higher Education	Thesis
İnal, 2021	Reading	Digital	Elementary School	Thesis
Memiş, 2018	Reading	Audio-Visual	Higher Education	Thesis
Şimşek, 2024	Reading	Games and Activities	Higher Education	Thesis
Alan, 2019	Writing	Audio-Visual	Higher Education	Thesis
Aydın, 2019	Writing	Audio-Visual	Higher Education	Thesis
Çangal, 2020	Writing	Digital	Higher Education	Thesis
Dalioğlu, 2023	Writing	Audio-Visual	Higher Education	Thesis
Hamaratlı, 2015	Writing	Audio-Visual	Higher Education	Thesis
Harmankaya, 2023	Writing	Games and Activities	Higher Education	Thesis
İnal, 2021	Writing	Digital	Elementary School	Thesis
Kadan, 2020	Writing	Audio-Visual	Higher Education	Thesis
Melanlıoğlu and Atalay, 2016	Writing	Audio-Visual	Higher Education	Article
Özşavli, 2017	Writing	Audio-Visual	Higher Education	Thesis
Serpen, 2024	Writing	Audio-Visual	Higher Education	Thesis
Turkben, 2019	Writing	Audio-Visual	Higher Education	Article
Öncü Yiğit, 2024	Writing	Games and Activities	Higher Education	Thesis
Berk, 2019	Listening	Audio-Visual	Higher Education	Thesis
Çakır, 2015	Listening	Audio-Visual	Higher Education	Thesis
Ergun, 2023	Listening	Audio-Visual	Higher Education	Thesis
İnal, 2021	Listening	Digital	Elementary School	Thesis
Sevtekin, 2020	Listening	Audio-Visual	Middle School	Thesis
Şimşek, 2021	Listening	Audio-Visual	Higher Education	Thesis
Gün, 2015	Speaking	Digital	Higher Education	Thesis
İnal, 2021	Speaking	Digital	Elementary school	Thesis
Karagülle, 2020	Speaking	Games and Activities	Higher Education	Thesis
Özdemir, 2021	Speaking	Audio-Visual	Higher Education	Thesis
Seyhan, 2021	Speaking	Games and Activities	High School	Thesis
Tataroğlu, 2019	Speaking	Games and Activities	Higher Education	Thesis

When examining the information in Table 1, it is seen that the selected studies were conducted between 2015 and 2024. When the statistics related to the four basic language skills in the studies included in the meta-analysis are examined, it is seen that 8 (24.2%) studies focused on reading, 13 (39.4%) studies focused on writing, 6 (18.2%) studies focused on listening, and 6 (18.2%) studies focused on speaking skills. When examining the statistics on the type of material in the studies included in the meta-analysis, 7 (21.2%) studies focused on digital materials, 6 (18.1%) focused on game and activity-based materials, and 20 (60.7%) focused on visual and auditory materials. When examining the statistics regarding the type of school in the studies included in the research, 4 (12.1%) studies conducted in elementary schools, 1 (3%) study conducted in middle schools, 1 (3%) study conducted in high schools, and 27 (81.9%) studies conducted in higher education were included in the analysis.

Meta-analysis studies ensure that the researcher reviews the field being studied by scanning all sources and forms an opinion about the field. In this study, studies focusing on experimental research on the four basic language skills have been grouped under three main headings: digital applications, game- and activity-based applications, and applications using visual and auditory materials. The

diversity of the tools or methods used necessitates grouping them to make the research more understandable. When conducting meta-analysis studies, specifying which source search tools were used and which criteria were used to select the studies demonstrates that the studies are based on a scientific foundation (Şen & Yıldırım, 2020, p. 20).

Data Encoding

The studies to be used in the data coding phase were first collected in a file. Subsequently, three working files were created: “digital applications,” “game and activity-based applications,” and “applications using visual and auditory materials.” The relevant studies were numbered and placed into these files. This phase is referred to as the study coding phase. The coding phase is considered important to prevent confusion arising from the large number of studies and to facilitate data entry. After the data were coded in the files to be transferred to the data table, the data coding phase was initiated.

During the data coding phase, data from the studies were collected under fifteen different headings in the Excel file: the code of the study, the design of the study, the type of study, data related to the experimental and control groups, year of publication, material used, type of material, four basic language skills, type of school, and type of publication.

Errors may occur during the transfer of numerical data when coding data. These errors can affect the reliability of the study and lead to incorrect conclusions. In this meta-analysis study, to account for the possibility of errors during data coding, the data were recoded by an expert in the field, and differences between coders were examined. No inconsistencies were observed between coders for this study.

The explanation of coded data facilitates the meta-analysis studies for readers. Explanations regarding the coding performed in the study are stated below:

1. The types of materials used in the study have been grouped into three categories. These categories are named “digital materials” for studies using digital applications, “game and activity-based materials” for studies using game and activity-based applications, and “visual and auditory materials” for applications using visual and auditory tools.
2. It has been coded as an article or thesis depending on the type of publication.
3. To see which language skill the studies focused on, the studies were coded into four groups based on the four core language skills: listening, speaking, reading, and writing.
4. Depending on the institution where the work was conducted, higher education institutions, elementary schools, middle schools, and high schools have been coded.
5. No grouping has been made for the publication year variable.

Data Analysis

After the studies to be used in meta-analysis studies are determined according to specific criteria and the data table is created, the effect sizes of the studies are examined. The researcher must calculate the effect sizes using a common scale with the statistics obtained from the collected studies. Standardized mean difference, correlation, and odds ratios are the most commonly used effect size values in meta-analysis studies (Şen & Yıldırım, 2020).

In meta-analysis studies, studies conducted on a single group or on two groups are addressed by calculating effect sizes. It would not be accurate to mention a single method for combining data. Different methods are used in different studies for the same purpose (Shachar & Neumann 2002). In this study, studies with experimental and control groups and pretest and posttest scoring were included in the analysis.

A heterogeneity test is performed to select the statistical method to be used in meta-analysis studies. When $p > 0.05$ or $Q < df$, it is stated that the effect size of the studies examined is homogeneous. Conversely, when $Q > df$ or $p < 0.05$, it is stated that the studies are heterogeneous. This study is a heterogeneous study ($p < 0.05$) and a random effects model has been preferred. It is suggested that studies in the social sciences generally show diversity in terms of effect sizes and therefore should be analyzed using a random effects model (Field & Gillett, 2010; Pigott & Polanin, 2020).

The aim in analyzing the data is to determine the effect size value obtained by dividing the mean differences by the sum of the standard deviations (Hunter & Schmidt, 1990). In order to determine the effect sizes of the studies, it is necessary to look at a standardized mean difference because the studies differ from each other. The value obtained by dividing the mean differences observed in the studies by the standard deviation values is called the standardized mean difference (Şen & Yıldırım, 2020). In other words, it is called the effect size (Kablan et al., 2013). It is expressed in three ways: Cohen's d , Hedges' g , and Glass's (Δ). According to the Cohen's d value, the effect size is classified as follows: Values less than 0.15 are insignificant, values between 0.15 and 0.40 are small, values between 0.40 and 0.75 are medium, values between 0.75 and 1.10 are large, values between 1.10 and 1.45 are very large, and values of 1.45 and above are considered excellent (Ay Emanet & Kezer, 2021).

In this study, the data obtained from the data were coded using the Excel 2016 program. The obtained data were analyzed using the CMA 4.0 analysis program.

Findings

The findings section of the meta-analysis study must include the model used (random or fixed effects model) and the mean effect size values for both models, a forest plot for the studies included in the meta-analysis, the heterogeneity values of the studies, and the subgroup and moderator analyses of the studies (Şen & Yıldırım, 2020).

This meta-analysis study, which investigated the effect of material use on academic achievement and whether there were differences in terms of various variables, used 33 studies. In the first stage, descriptive statistics were presented; in the second stage, effect sizes related to academic achievement, heterogeneity distribution values, and confidence intervals were presented; and in the third stage, findings regarding whether there were any differences between subgroups were presented through moderator analyses.

Average effect sizes, heterogeneous distribution values, and confidence intervals of studies conducted on academic achievement

Heterogeneity tests are performed to determine the suitability of effect sizes for normal distribution. Data related to the test performed are presented in Table 2.

Table 2. Average Effect Size, Confidence Intervals, and Heterogeneity Distribution Table of Studies Included in the Meta-Analysis According to the Effect Model

Model Type	N	Z	Heterogeneity Value (Q)	Hedges'g	95% Confidence Interval		P
					Lower Limit	Upper Limit	
Fixed Effects Model	33	18.696	105.596	1.101	0.986	1.217	0.000
Random Effects Model	33	10.334	105.596	1.126	0.912	1.339	0.000

The confidence intervals, effect sizes, and statistics regarding the heterogeneous distributions of the studies included in the meta-analysis are presented in Table 2. According to the fixed effects model, material use had a positive effect on academic achievement with an effect size of 1.101 in favor of the experimental group; according to the random effects model, it had a positive effect with an effect size of 1.126 ($p=0.000$) in favor of the experimental group ($p=0.000$). Looking at the heterogeneity values, the Q value is seen to be 105.596. Looking at the chi-square table with 32 degrees of freedom, the critical value is seen to be approximately 53.672 at a 95% significance level. In this meta-analysis study, the calculated $Q=105.596$ value is greater than the critical value, indicating that the distribution is

heterogeneous. Due to the heterogeneous nature of the distribution in the study, analyses based on the random effects model were performed, aiming to eliminate biases arising from the heterogeneity of the sample (Yıldız, 2002).

Table 3. Forest Plot of Effect Sizes and Confidence Intervals for Studies Included in the Meta-Analysis

Study	E.S.	S.E.	V.	L.L.	U.L.	Z.	p.	-4	0	+4
Alan, 2019	2,517	0,419	0,175	1,697	3,338	6,013	0,000			
Arslan, 2023	0,526	0,351	0,123	-0,162	1,213	1,499	0,134			
Aydın, 2019	0,634	0,318	0,101	0,010	1,258	1,993	0,046			
Balcı ve DüNDAR, 2017	1,874	0,521	0,271	0,853	2,895	3,598	0,000			
Baykan, 2023	1,603	0,331	0,110	0,954	2,252	4,842	0,000			
Berk, 2019	0,797	0,263	0,069	0,281	1,312	3,030	0,002			
Çakır, 2015	1,108	0,351	0,123	0,420	1,796	3,155	0,002			
Çalışkan, 2022	0,870	0,373	0,139	0,140	1,601	2,336	0,019			
Çangal, 2020	0,528	0,227	0,051	0,084	0,973	2,330	0,020			
Dalioğlu, 2023	1,350	0,345	0,119	0,674	2,025	3,915	0,000			
Ergun, 2023	2,349	0,406	0,165	1,553	3,145	5,782	0,000			
Gerek, 2022	0,875	0,367	0,135	0,155	1,595	2,382	0,017			
Gün, 2015	0,407	0,359	0,129	-0,297	1,111	1,134	0,257			
Hamaratlı, 2015	1,104	0,403	0,162	0,315	1,893	2,742	0,006			
Harmankaya, 2023	1,032	0,392	0,154	0,264	1,800	2,633	0,008			
İnal, 2021-D	1,583	0,270	0,073	1,054	2,112	5,865	0,000			
İnal, 2021-K	1,729	0,276	0,076	1,187	2,270	6,260	0,000			
İnal, 2021-O	1,799	0,279	0,078	1,252	2,347	6,442	0,000			
İnal, 2021-Y	1,457	0,265	0,070	0,938	1,977	5,502	0,000			
Kadan, 2020	1,429	0,252	0,063	0,935	1,923	5,672	0,000			
Karagülle, 2020	0,849	0,361	0,130	0,142	1,555	2,353	0,019			
Melanlıoğlu ve Atalay, 2016	0,575	0,382	0,146	-0,173	1,323	1,506	0,132			
Memiş, 2018	0,801	0,396	0,157	0,025	1,577	2,024	0,043			
Özdemir, 2021	0,551	0,437	0,191	-0,306	1,407	1,260	0,208			
Özsavlı, 2017	0,634	0,365	0,133	-0,081	1,348	1,738	0,082			
Serpen, 2024	1,095	0,382	0,146	0,346	1,844	2,864	0,004			
Sevtekin, 2020	1,265	0,391	0,153	0,499	2,032	3,236	0,001			
Seyhan, 2021	0,189	0,413	0,170	-0,620	0,998	0,458	0,647			
Şimşek, 2021	1,425	0,400	0,160	0,641	2,209	3,562	0,000			
Şimşek, 2024	2,730	0,485	0,236	1,778	3,681	5,623	0,000			
Tataroğlu, 2019	0,095	0,332	0,110	-0,555	0,746	0,288	0,774			
Türkben, 2019	0,239	0,282	0,080	-0,315	0,792	0,845	0,398			
Yiğit, 2024	1,815	0,426	0,181	0,981	2,649	4,264	0,000			

In the forest plot presented in Table 3, the effect sizes and directions of the studies are shown on the right side of the graph, while the lines indicate the effect sizes within the 95% confidence interval between the lower and upper bounds. When examining the data on effect sizes, the lowest effect size is 0.095 in a positive direction, and the highest effect size is 2.730 in a positive direction. Thirty-three studies have a positive effect size.

Moderator Analysis Results of Studies Conducted on Academic Achievement

The study examined whether the effect of material usage on academic achievement in the teaching of Turkish as a foreign language differed across variables such as publication type, the four core language skills, material type, school type, and publication year. To determine the magnitude of effects across these variables, subgroups were formed and moderator analyses were employed.

The results of the moderator analysis obtained from the classification of studies on the academic achievement variable according to publication type are presented in Table 4.

Table 4. Moderator Analysis Results by Publication Type of Studies

Publication Type	N	Hedges'g	95% Confidence Interval		Q between	x ² critical value	p
			Lower Limit	Upper Limit			
Thesis	30	1.158	0.938	1.379			
Article	3	0.773	0.052	1.493			
Total	33	1.125	0.910	1.339	1.006	3.841	0.316

When the data in Table 4 regarding the effect of material usage on academic achievement is evaluated according to effect size classification, the effect size for theses was calculated as 1.158 at a 95% confidence interval, indicating a “very large” effect level; the effect size for articles was calculated as 0.773 at a 95% confidence interval, indicating a “large” effect level. When examining the heterogeneity between groups, the Q between value $Q=1.006$, $x^2=3.841$, the Q value is lower than the x^2 value, so it can be said that there is no significant difference between the groups ($p=0.316$).

The results of the moderator analysis obtained from the classification of studies on the academic achievement variable according to school type are presented in Table 5.

Table 5. Moderator Analysis Results of Studies by School Type

School Type	N	Hedges'g	95% Confidence Interval		Q between	x ² critical value	p
			Lower Limit	Upper Limit			
Elementary school	4	1.641	1.117	2.164			
Middle school	1	1.265	-1.022	1.400			
High school	1	0.189	0.083	2.448			
Higher education	27	1.057	0.836	1.279			
Total	33	1.151	0.618	1.684	6.436	12.838	0.092

When the data in Table 5 regarding the effect of material usage on academic achievement is evaluated according to effect size classification, the effect size for elementary school was calculated as 1.641 at a 95% confidence interval, indicating an “excellent” effect level; the effect size for middle school was calculated as 1.265 at a 95% confidence interval, indicating a “very large” effect level; for high school, the effect size was calculated as 0.189 at a 95% confidence interval, indicating a ‘negligible’ effect level; for higher education, the effect size was calculated as 1.057 at a 95% confidence interval, indicating a “large” effect level. When examining the heterogeneity between groups, the Q between value is $Q=6.436$, and when compared to the $x^2=7.815$ value, the Q value is lower than the x^2 value, so it can be said that there is no significant difference between the groups ($p=0.092$).

The results of the moderator analysis obtained from the classification of studies on the academic achievement variable according to their publication years are presented in Table 6.

Table 6. Moderator Analysis Results by Publication Year of Studies

Publication Year	N	Hedges'g	95% Confidence Interval		Q between	x ² critical value	p
			Lower Limit	Upper Limit			
2015	3	0.868	0.168	1.568			
2017	2	1.158	0.242	2.074			
2018	2	0.686	-0.186	1.559			
2019	5	0.792	0.274	1.309			
2020	4	1.005	0.434	1.576			
2021	7	1.309	0.868	1.751			
2022	2	0.873	0.016	1.729			
2023	5	1.359	0.820	1.898			
2024	3	1.824	1.082	2.566			
Total	33	1.112	0.812	1.412	8.387	15.507	0.397

When the data on the effect of material usage on academic achievement in Table 6 is evaluated according to effect size classification, the effect size for 2015 was calculated as 0.868 at a 95% confidence interval, indicating a “large” effect level; the effect size for 2017 was calculated as 1.158 at a 95% confidence interval, indicating a “very large” effect level; for 2018, the effect size was calculated as 0.686 at a 95% confidence interval and represents a ‘medium’ effect level; for 2019, the effect size was calculated as 0.792 at a 95% confidence interval and represents a “large” effect level; For 2020, the effect size was calculated as 1.005 at a 95% confidence interval and represents a “large” effect level; For 2021, the effect size was calculated as 1.309 at a 95% confidence interval and represents a “very large” effect level; For 2022, the effect size was calculated as 0.873 at a 95% confidence interval, indicating a “large” effect level; For 2023, the effect size was calculated as 1.359 at a 95% confidence interval, indicating a “very large” effect level; For 2024, the effect size was calculated as 1.824 at a 95% confidence interval, indicating an “excellent” effect level. When comparing the Q between value examining heterogeneity between groups (Q=8.387) with the x² value (x²=15.507), the Q value is lower than the x² value, so it can be said that there is no significant difference between the groups (p=0.397).

The results of the moderator analysis obtained from the classification of studies on the academic achievement variable according to the four basic language skills are presented in Table 7.

Table 7. Moderator Analysis Results According to the Four Core Language Skills of the Studies

Language skill	N	Hedges'g	95% Confidence Interval		Q between	x ² critical value	p
			Lower Limit	Upper Limit			
Listening	6	1.395	0.903	1.886			
Speaking	6	0.670	0.171	1.169			
Reading	8	1.345	0.904	1.787			
Writing	13	1.080	0.748	1.413			
Total	33	1.126	0.785	1.467	5.377	7.815	0.146

Table 7 presents data on the effect of material usage on academic achievement. When evaluated according to the four basic language skill classifications, the effect size for listening skills was calculated as 1.395 at a 95% confidence interval, indicating a “very large” effect level. The effect size for speaking skills was calculated as 0.670 at a 95% confidence interval, indicating a “moderate” effect level; for reading skills, the effect size was calculated as 1.345 at a 95% confidence interval, indicating a “very large” effect level; for writing skills, the effect size was calculated as 1.080 at a 95% confidence interval, indicating a “large” effect level. When examining the heterogeneity between groups, the Q between value is Q=5.377, and when compared to the x²=7.815 value, the Q value is lower than the x² value, so it can be said that there is no significant difference between the groups (p=0.146).

The results of the moderator analysis obtained from the classification of studies on the academic achievement variable according to the type of material used are presented in Table 8.

Table 8. Moderator Analysis Results by Type of Study Material

Material Type	N	Hedges'g	95% Confidence Interval		Q between	x ² critical value	P
			Lower Limit	Upper Limit			
Digital	7	1.212	0.762	1.662			
Games and Events	6	1.052	0.520	1.585			
Audiovisual	20	1.114	0.831	1.397			
Total	33	1.127	0.908	1.345	0.220	5.991	0.896

Table 8 presents data on the effect of material usage on academic achievement. When evaluated according to effect size classifications by material type, the effect size for digital materials was calculated as 1.212 at a 95% confidence interval, indicating a “very large” effect level. For game- and activity-based materials, the effect size was calculated as 1.052 at a 95% confidence interval, indicating a “large” effect level. For visual and auditory materials, the effect size was calculated as 1.114 at a 95% confidence interval, indicating a “very large” effect level. When examining the heterogeneity between groups, the Q between value $Q=0.220$, $x^2=5.991$, the Q value is lower than the x^2 value, so it can be said that there is no significant difference between the groups ($p=0.896$).

Publication Bias

The funnel plot illustrating bias in the reliability of the meta-analysis study is shown below.

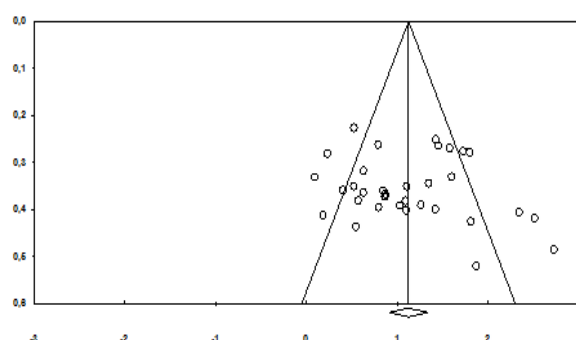


Figure 2. Effect size distribution graph of studies included in the meta-analysis

In the funnel plot, the distribution of effect sizes of individual studies within the funnel lines and in a symmetrical manner does not indicate publication bias. However, if the effect sizes are distributed outside the funnel lines and asymmetrically, publication bias may occur. In this regard, when examining Figure 2, it can be stated that the effect sizes of the studies related to the academic achievement variable show a distribution close to symmetry in the graph. The funnel graph's Begg and Mazumdar Kendall tau:0.16, $p=0.18$ and Egger bias value for publication bias is $-1.84586/4.72881$, which is the value range that should be within the 95% confidence interval. In this study, it was found to be 1.44148, $p=0.37$. While p values <0.05 are required as an indicator of bias, they were found to be larger in this study. These values indicate that there is no publication bias.

The Safe N (fail-safe N) value was proposed by Rosenthal (1979) to assess publication bias. The method developed by Rosenthal offers a simple approach to evaluate the effect of missing studies on the overall experimental effect estimate. Safe N determines the number of unpublished studies required to render the effect size of a statistically significant data set insignificant (Şen & Yıldırım, 2020).

Table 9. Rosenthal's Table of Safe N Values

Z value for observed values	18.65123
p value for observed studies	0.000
Alpha	0.050
Tails	2.000
Z for alpha	1.95996
Number of observed studies	33
fail-safe N	2956

When examining the analysis results given in Table 9, the number of studies obtained from the meta-analysis according to Rosenthal's Safe N method is 2956. In order to achieve a $p>0.05$ value, in other words, to render the effect size insignificant, 2956 more studies need to be conducted.

Similar safe N values to Rosenthal's have been proposed by other researchers (Orwin, 1983; Rosenberg, 2005). Orwin's method is also similar to Rosenthal's. It provides the number of studies required to reduce the effect size value of the data to a desired value.

Table 10. Orwin's Safe N Value Table

Hedges' g in observed studies	1.10110
Criterion for a trivial Hedges' g	0.0500
Mean Hedges' g in missing studies	0.00000
Number missing studies needed to bring Hedges' g under 0.10	694

When examining the analysis results presented in Table 10, it is necessary to conduct 694 more experimental studies to reduce the effect size of the studies to a low level and render the overall effect size meaningless.

Conclusion, Discussion and Suggestions

This meta-analysis study examines the effect of materials used in teaching Turkish as a foreign language on academic achievement. Thirty-three studies focusing on academic achievement were included in this meta-analysis, and the effect size was calculated using the CMA program. Referencing Cohen's effect size value ranges, it was concluded that the use of materials in teaching Turkish to foreigners to develop the four basic language skills has a positive effect size of 1.126, which is considered "very large." This result shows that the use of materials in teaching Turkish to foreigners can increase academic success. Yalın (2010) states that students have different learning styles, with some learning better by listening, some by reading, and some by speaking. The use of materials ensures that multiple senses are engaged and that learning is more permanent (Dale, 1969; Duman, 2013; Kuşçu, 2017). Gardner (1983) states that humans have different types of intelligence and that these should be taken into account in learning. Meta-analysis studies on the effect of material use on academic achievement indicate that material use positively affects academic achievement (Cho et al., 2018; Kablan et al., 2013; Kärchner et al., 2022; Kul et al., 2018;). Koçak et al. (2021) reviewed meta-analysis studies on factors affecting academic achievement and found that material use positively affects academic achievement.

In the study, effect sizes were calculated for various variables, and moderator analyses were conducted to examine whether there were any differences between subgroups. As a result of the analyses conducted in the publication type subgroup, it was concluded that there were 3 articles and 30 thesis studies; the effect size of the articles was 0.773 and at a large effect level, while that of the theses was 1.158 and at a very large effect level. No significant difference was found between the two groups. These results indicate that studies on material usage in both articles and theses positively affect academic achievement at a noteworthy level.

According to the analyses conducted in the school type subgroup, four studies were conducted in elementary school, one in middle school, one in high school, and twenty-seven in higher education; The effect size of the studies conducted in primary schools was 1.641, indicating an excellent effect level; the effect size of the study conducted in middle schools was 1.265, indicating a very large effect level; the effect size of the study conducted in high schools was 0.189, indicating a small effect level; and the effect size of the studies conducted in higher education was 1.057, indicating a large effect level. The teaching of Turkish as a foreign language at the elementary, middle school, and high school levels began in 2016 with the PİKTES project. In this regard, it can be stated that the studies to be carried out at these levels will increase as long as the project continues. It is also stated that it is important to carry out studies at every level in order to view the teaching of Turkish to foreigners as a whole (Ergül et al., 2019). The impact of the studies conducted in primary schools is seen to be excellent. This shows that the use of materials in teaching Turkish as a foreign language in primary schools increases academic achievement to an excellent level. Among refugees living in Turkey, the number of children in the 5-9 age group is stated to be approximately 530,000 (Refugees Association, 2024). Primary school students are in the concrete operations stage based on their age (Yapıcı & Yapıcı, 2005). Considering that materials both facilitate language teaching and make teaching more concrete, their use in this age group can be expected to further increase academic achievement. The absence of a significant difference between the groups shows that the use of materials is effective at every level.

Analyses of the years in which the studies were published show that 12 studies were conducted between 2015 and 2019, and 21 studies were conducted between 2020 and 2024. The highest impact size was observed in studies conducted in 2024. This result shows that material usage has diversified with technology in recent years and that developments have made materials more effective in teaching Turkish as a foreign language. Furthermore, the increase in studies conducted in recent years indicates a growing interest in the field of teaching Turkish to foreigners (Can, 2023).

As a result of the analyses conducted within the subgroup of the four basic language skills, it was found that six studies focused on listening skills, six on speaking skills, eight on reading skills, and thirteen on writing skills. The effect size for listening skills was 1.395, indicating a *very large* effect size; for speaking skills, it was 0.670, indicating a *moderate* effect size; for reading skills, it was 1.345, indicating a *very large* effect size; and for writing skills, it was 1.080, indicating a *large* effect size. It was observed that the effect sizes for listening and reading skills were higher than those for speaking and writing skills. Listening and reading skills are defined as *receptive skills* in the CEFR (Council of Europe, 2020). In language learning, receptive skills represent learning, while productive skills reflect the ability to reproduce what has been learned. The type of material used influences the language skill to be developed (Duman, 2013). Accordingly, selecting materials appropriate for the specific language skill targeted for development will enhance the retention of learning. The absence of a significant difference among the groups indicates that the use of materials is effective for each skill.

The analysis conducted on the subgroups of material types used to enhance language proficiency determined that seven studies were carried out using digital applications, six studies were based on games and activities, and twenty studies utilized visual and auditory materials. When examining the effect levels of these materials, it was observed that digital materials had an effect size of 1.212, indicating a very large effect; visual and auditory materials had an effect size of 1.114, also showing a very large effect; and game and activity-based materials had an effect size of 1.052, which corresponds to a large effect. Today, with rapidly advancing technological developments, language teaching with digital applications is gaining increasing importance. Digital applications are effective in the development of each of the four basic language skills (Babacan, 2023). Furthermore, access to digital applications is not limited to the classroom but also provides ease of accessibility to students outside the classroom. Language learners can communicate with any native speaker of the target language via digital applications, regardless of distance. This demonstrates the critical importance of digital applications in the cultural transmission process, both verbally and non-verbally. Moreover, virtual worlds are being created in language teaching through developing web tools, which removes

boundaries in reaching the target language (Ata et al., 2010). İnal and Arslanbaş (2021) stated that different applications such as Padlet, Voki, and Quizlett can be used for the development of each skill. Considering the influential role of mobile devices on language learning (Cho et al., 2018), it can be said that digital applications provide great convenience to language learners and teachers. The positive effect of digital applications on academic achievement has also been demonstrated in different meta-analysis studies conducted in Türkiye (Ayaz et al., 2016; Kalkanoglu, 2024; Öztö, 2022). Similarly, there are meta-analysis studies proving the success of using digital materials in foreign language teaching. Batdı (2021) concluded in his meta-analysis study that the use of technology in foreign language teaching has an effect size of 1.196, representing a very large effect. Yu and Trainin (2022) concluded in their meta-analysis study that technological applications have a moderately positive effect on academic achievement in second language teaching. Game and activity-based applications put the student directly in a central position. Especially in younger age groups, teaching with games is effective and attracts children's attention (Akdoğan, 2004). Games that elevate learning by doing and experiencing are of great importance in language teaching (Engin et al., 2010). Additionally, skills such as communication and collaborative learning develop with games. Karakoç et al. (2022), in their meta-analysis study investigating the effect of learning with games on academic achievement, concluded that game-based learning has an effect size of 1.695, indicating an excellent effect on students. Visual and auditory materials make the learning process more concrete. The education process becomes more efficient with visual and auditory materials prepared by considering the age, interests, and language levels of the students. Furthermore, considering the age groups of students in primary and secondary education, visual and auditory materials such as posters, audio recordings, and cartoons offer more enjoyable and fun learning environments for students (Kuşçu, 2017). Kansızoglu (2017), in their meta-analysis study on the effect of graphic organizers as a visual and auditory material on academic achievement in language learning, concluded that it has an effect size of 0.897, indicating a high-level effect. The absence of any significant difference between the groups suggests that every type of material is effective, and the choice of material type to be used, considering the learners' ages, is important in terms of facilitating learning.

This meta-analysis study revealed the effects of materials used in teaching Turkish as a foreign language on academic achievement, and showed that material use generally created a large, positive effect. Specifically, the use of digital applications, game and activity-based materials, and visual and auditory tools demonstrated a great impact on the development of language skills. The studies indicate that the use of materials is effective at every age and education level, and moreover, that this effect is at an excellent level at the primary school level. In terms of language skills, the effect sizes for listening and reading skills were observed to be higher. These findings reveal that material use makes students' language learning more effective and permanent, and that technology is playing an increasingly important role in this process. Consequently, it can be stated that the use of materials in Turkish language teaching is a significant tool for increasing academic achievement, and future studies in this field could further enhance the diversity and effectiveness of the materials used.

Considering the rapid advancement of technology, future studies may recommend increasing the use of digital tools. Specifically, mobile applications and online platforms could be utilized more extensively in language learning. It can be suggested that studies comparing the effects of different age groups, while considering the language learners' ages, could facilitate the development of effective teaching strategies. It can also be stated that increasing the number of studies utilizing applications that provide learning opportunities beyond the classroom (so that students' learning is not confined to school) would both ease the process for remote language learners and enhance cultural transfer.

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