The Impact of Flipped Learning on L2 Learners' Achievements: A Meta-Analysis

OPEN ACCESS

Volume: 11

Special Issue: 1

Month: January

Year: 2023

E-ISSN: 2582-1334

Received: 12.09.2022

Accepted: 16.12.2022

Published: 20.01.2023

Citation:
Aybirdi, N., Efe, H., & Atasoy Şal, Ç. (2023). The Impact of Flipped Learning on L2 Learners' Achievements: A Meta-Analysis. *Shanlax International Journal of Education, 11*(S1), 41-60.

DOI:
https://doi.org/10.34293/education.v11iS1-Jan.5891

Nilüfer Aybirdi
Ordu University, Turkey
https://orcid.org/0000-0002-1223-3050

Hüseyin Efe
Artvin Çoruh University, Turkey
https://orcid.org/0000-0002-5142-0959

Çağla Atasoy Şal
Ordu University, Turkey
https://orcid.org/0000-0001-8529-7904

Abstract
This study aims to examine the effects of flipped learning on L2 students' overall academic achievements through meta-analysis. Forty studies (e.g., journal articles, M.A/Ph.D. theses and conference papers) on 'flipped classroom', 'flipped learning' and 'academic achievement' were included in this meta-analysis study. The data was analyzed by using Comprehensive Meta-Analysis Software. The random effects model was used in analyzing the overall effect size and the heterogeneity of the studies included in this meta-analysis. The results revealed that flipped learning has statistically significant effect on L2 learners' academic achievements (g=1.303) compared to traditional learning approaches. This result does not differ according to publication type, educational level and four basic language skills and sub-skills, but it differs according to sample size of the selected studies.

Introduction

In recent years, the increasing use of Internet and smart devices with the rapid developments in Information and Communication Technology (ICT) has changed educational paradigms and this change transformed the learners' needs. It has become inevitable to integrate technology into learning process; thus, researchers have suggested novel learning models to meet these needs (Kardaş & Yeşilyaprak, 2015). Flipped learning (or flipped classroom) is one of these models which has gained popularity over the last decade (Eppard & Rochdi, 2017; Karagöl & Esen, 2019). In general terms, flipped learning can be defined as inverting the traditional educational settings by extending online instructional content outside the classroom and vice versa (Lage, Platt, Treglia, & Michael, 2000). In other words, some of the content that is conventionally taught in class with teacher-centered instructions moves out of class activities through internet and technology. Meanwhile, in-class time is attributed to practice and collaborative student-centered activities (Abeysekera & Dawson, 2014; Ataş Akdemir, 2018; Bergman & Sams, 2012; Låg & Sæle, 2019; Özyurt, 2018; Özyurt & Akdemir, 2021). In a flipped classroom, teachers are facilitators and guides who give professional feedback to students while they actively engage in practicing and interacting with their peers and intructors more (Hwang, Lai, & Wang, 2015).

Students receive instructional input by watching videos sent by the instructors, reading online materials, listening audio files and doing other online activities before class; and allocate more time for practice, pair works, more complex tasks, and discussion activities in class (Arnold-Garza, 2014; Bergman & Sams, 2012; Çelebi, Karaaslan, & Demir-Vegter, 2016).

Literature Review

The Benefits and Drawbacks of Flipped Learning Model

Flipped classroom approach offers some advantages for both students and teachers. Learners can follow the lectures at their own pace since there is an option for them to pause and replay the instructors' videos whenever needed (Hsieh, Wu, & Marek, 2016). Moreover, they take their own learning responsibilities and this may increase their self-discipline (Bergmann, Overmyer, & Wilie, 2012; Evseeva & Solozhenko, 2015). Students can also learn at anytime, anywhere as soon as they have an internet connection (Fulton, 2012). Besides, teachers and students use in-class time more efficiently as flipping classroom increases student-teacher and student-student interactions creating a more student-centered instruction (Carhill-Poza, 2019).

Although flipped learning positively contributes to the learning and teaching process, there are some challenges that students and teachers may encounter. One of these drawbacks is that students may have problems in adapting themselves to this new method and may come unprepared to the classroom (Herreid & Schiller, 2013). Furthermore, there may be problems in accessing to internet and required technology for online lectures and materials (Moffrett & Mill, 2014). Flipped learning model may not be also suitable for all learners due to the differences in their learning styles (Moore & Chung, 2015). Learners and teachers should be encouraged and motivated to experience online learning; thus, if they have worry, this method will not be efficient (Yavuz & Özdemir, 2019). Furthermore, heavy workload (preparing videos, controlling students, and finding appropriate materials for students) may be a burden for teachers (Zainuddin & Halili, 2015).

Flipped Learning in EFL/ESL Context

In the last two decades, it has become more and more widespread to implement flipped learning model in the field of English language teaching and learning. Thus, the number of the studies showing the effects of flipped learning model on ESL/EFL classrooms has extended (Shahnama, Ghonsooly, & Shirvan, 2021). Several research conducted in EFL/ESL context address that flipped learning model has a significant impact on most EFL students' perception and attitudes (e.g., Adnan, 2017; Ekmekçi, 2017; Karimi & Hamzavi, 2017, Sengul & Bostancı, 2021). Likewise, several research indicates that students like to learn English with flipped learning model (e.g., Haghighi, Jafarigohar, Khoshsima, & Vahdany, 2018; Lee & Wallace, 2018; Qader & Arslan, 2019).

Furthermore, some studies have reported that flipped learning model improved the EFL students' academic performance in four basic language skills (e.g., writing, speaking, listening, and reading) and two sub-skills (vocabulary and grammar). As for writing skill, several research indicate that learners in flipped classroom perform better than the learners in traditional classrooms on writing tests (e.g., Fathi & Rahimi, 2019; Valizadeh & Soltanpour, 2020; Wu, Yang, Hsieh, & Yamamoto, 2020). Similarly, flipped learning model has a greater and positive effect on EFL students' writing skills (Challob, 2021, Ekmekçi, 2017). For example, Qader and Arslan (2019) examined the impact of flipped learning on 66 university students' writing skills. Employing mixed method approach, research established that students in flipped classroom got higher writing scores from the students in non-flipped classroom. As for the reading skills, some research suggests that flipped classroom enhances EFL students' reading comprehension abilities (e.g., Karimi & Hamzavi, 2017; Samiei & Ebadi, 2021). For example, Hashemifardnia, Namaziandost and Shafiee (2018) undertook an experimental study consisting of 50 high school students to observe how flipped learning affects students' reading skills. Researchers discovered that students at experimental group were more successful than the control group.

Moreover, several studies have shown that flipped classroom positively contributed to the EFL

students' listening abilities (e.g., Ahmad, 2016; Etemadfar, Soozandehfar, & Namaziandost, 2020). For instance, El-Sakka (2016) implemented flipped learning method in listening courses of 25 university students and observed that students' listening skills significantly improved. Regarding speaking abilities, numerous studies indicate that flipped learning enhances EFL learners' speaking performances (e.g., Chen & Hwang, 2020; Hashemifardnia, Shafiee, Esfahani, & Sepehri, 2021). For instance, Abdullah and Ismail (2019) analyzed the impact of flipped learning on 27 undergraduate students' speaking abilities through an experimental study and concluded that EFL learners' speaking performances showed a gradual improvement. Furthermore, flipped learning has a positive effect on students' grammar usage (Al-Naabi, 2020; Valizadeh & Soltanpour, 2020). For example, Seçilmişoğlu (2019) undertook a quasi-experimental study with 22 high school students and determined that flipped learning is an influential model for teaching grammar. Students in flipped classroom are also more likely to perform better than students in conventional English vocabulary courses and have better idiomatic learnings (Kırmızı & Kömeç, 2019; Hsieh, Wu, & Marek, 2016). For instance, Özkal (2019) designed a flipped classroom for 55 pre-intermediate students and found that flipped learning is effective in EFL students' vocabulary learnings.

Regarding drawbacks of EFL flipped classroom, a study has shown that students face several challenges including inadequate self-regulation, excessive workload, deprivation of teachers' instant feedback, and lack of required technological devices and internet connection (Vuong, Tan, &Lee, 2018). Another study reveals that learners may have problems in comprehending the content presented in videos or may need instructor or peer mentoring, and thus flipped learning may not be suitable for EFL learners (Milman, 2012). Yang (2017) also concludes that flipped learning is a creative method but only suitable for grammar teaching and motivated learners according to teachers. Moreover, in a study by Adnan (2017), flipped students received higher essay scores but their midterms and final e-portfolio scores did not significantly differed from the traditionally instructed students.

Briefly, previous research has indicated the positive effects of flipped learning on second language teaching and learning together with some disadvantages (e.g., Arslan, 2020; Turan, & Akdağ-Çimen, 2019). There is still no consensus among language teachers and educators on the issue of how flipped learning affects EFL students' academic achievements. Moreover, the participants of the studies on this topic were limited in number and this made it difficult to generalize the findings of the studies. Therefore, a meta-analysis study is needed to strengthen the validity of results obtained from the previous studies and to synthesize the findings of studies with limited sample sizes (Akgöz, Ercan, & Kan, 2004).

However, when reviewing the literature, it can be understood that the meta-analysis studies which have examined the effects of flipped learning on overall language skills (speaking, listening, writing, and reading) and sub-skills (vocabulary and grammar) are restricted in number. For example, Shahnama, Ghonsooly, and Shirvan (2021) undertook a meta-analysis study to see the effectiveness of flipped learning in EFL context and concluded that flipped learning increases EFL students' academic achievements, but did not mention about its effects on language skills and sub-skills. Karagöl and Esen (2019) also conducted a meta-analysis study in the EFL context, and found that flipped learning has a positive effect on EFL students' success, but the researchers did not address the issue of language skills and sub-skills. Therefore, it can be stated that most of the meta-analysis studies have showed the impact of flipped learning on EFL students' academic achievements, but have not examined its effect on respectively each language skill or language area.

To address these gaps in literature, the present meta-analysis study have tried to investigate how flipped learning affect the EFL learners' achievements on each of four basic language skills and two sub-skills rather than making a general statement regarding their achievements. Furthermore, the effectiveness of flipped learning on all language skills and sub-skills may be clarified for teachers and researchers who wish to implement this method in their courses and studies.

Objectives of the Study

This study seeks to (1) combine the previous studies examining the effects of flipped learning on EFL learners' achievements in four language skills and two sub-skills using a comprehensive meta-analysis, (2) assist teachers and researchers in analyzing the effects of flipped learning and give them the necessary information about the topic in a shorter form and time, and (3) contribute the literature by compiling the findings of relevant studies. This study sought to answer the following specific research questions:

- What is the effect of flipped learning on EFL/ESL learners' academic achievements?
- Is there any relationship between the research type (e.g., article, thesis, and conference paper) and the contribution of flipped learning on academic achievement?
- Is there any relationship between the sample size and the contribution of flipped learning on academic achievement?
- Is there any relationship between the educational level (e.g., primary school, secondary school, high school, and university) and the contribution of flipped learning on academic achievement?
- What is the effect of flipped learning on EFL learners' achievements in four basic language skills (e.g., writing, reading, speaking, and listening) and two sub-skills (vocabulary and grammar)?

Research Methodology

Research Design

The present study utilizes meta-analysis method to analyze the findings of previous studies. A meta-analysis study systematically combines the results of individual studies to reach a new conclusion (Berman & Parker, 2002). Specifically, this paper aimed to do a quantitative synthesis of previous quantitative research examining how flipped learning affects EFL learner's academic achievements regarding overall language skills (e.g., speaking, listening, writing, and reading) and sub-skills (e.g., vocabulary and grammar).

Data Collection Procedures

This study analyzed the quantitative data collected from journal articles, conference papers and MA or PhD theses as a part of meta-analysis. The databases such as ProQuest, Turkish Council of Higher Education National Thesis Centre, Google Scholar, ERIC, Web of Science, and Academia were scanned through using keywords as 'flipped learning', 'flipped classroom', 'EFL/ESL', 'students' achievements'. These keywords were cooperatively determined by the researchers to limit the results and find the most related sources regarding the topic while reviewing the literature. Moreover, the databases were selected regarding their average citation count, vast indexing capacities in social sciences, and ease of use. Related articles, conference papers and MA or PhD theses were gathered after scanning these databases (Figure 1). The relevance of the studies was collaboratively determined by the researchers of the present study and an independent researcher who has a doctorate degree in ELT studies. After reading study titles and abstracts, relevant studies were determined and irrelevant studies and the studies which did not meet the inclusion criteria were excluded.

Inclusion Criteria

Before the literature review, the authors of this paper determined the exclusion and inclusion criteria. While determining the inclusion criteria, the researchers benefitted from the previous meta-analysis studies by Karagöl and Esen (2019), and Vitta and Al-Hoorie (2020). This study used the following inclusion criteria:

- Experimental or quasi-experimental research design must be employed in the studies.
- Flipped learning model must be applied to experimental group while traditional learning models must be applied to the control group.
- Publication dates of the studies must be between the years 2015 and 2021.
- Participant of the studies must be EFL/ESL learners.
- Studies must be reported in English.
- Sufficient data must be provided in studies to calculate the effect size.
- The participants' learning outcomes and perceptions must be reflected with quantitative data.

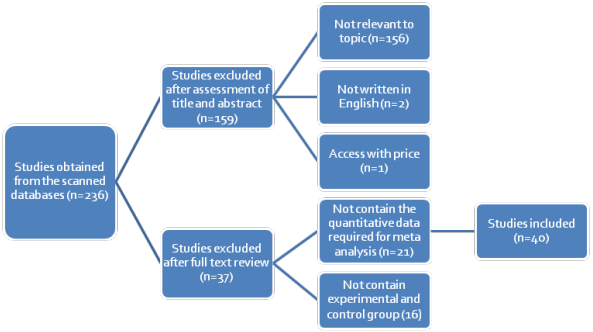

Figure 1 A Flow Showing Literature Review Process

Data Coding

After the elimination process, researchers prepared a coding form to provide the necessary information needed to analyze quantitative data. This coding form was generated in Microsoft Excel and covered the titles of the studies, the researchers who undertook the study, the regions and periods that the studies were conducted, the numbers of the participants who attended the study in experimental and control groups, and information about which language skills and sub-skills were analyzed in the studies (Figure 2). Data coding was conducted by the authors of this paper. Moreover, 25% of the studies were randomly recoded by another researcher who completed her PhD in ELT methodology to ensure a reliable coding process. Inter-coder reliability between the two coders was calculated as 93% using a reliability formula developed by Miles and Huberman (1994). Coders discussed the coding of studies which they disagreed on until reaching a consensus.

Figure 2 Coding Form

Researchers	Title	Context	Participants	Language Skills and Sub-Skills
Elfatah and Ahmed (2016)	The Effect of Flipping Classroom on writing skill in english as a foreign language and students' attitude towards flipping	Saudi Arabia	EG: 30 University students CG: 30 University students	Writing
Chatta and Haque (2020)	Improving paragraph writing skill of saudi EFL university students using flipped classroom instruction	Saudi Arabia	EG: 31 University students CG: 32 University students	Writing
Leis, Cooke and Tohei (2015)	The effects of flipped classroom on english composition writing in an EFL environment	Japan	EG: 11 University students CG: 11 University students	Writing
Alpat (2019)	The Effect of flipped learning supported critical thinking instruction on the critical disposition and L2 writing skills	Turkey	EG: 15 EFL students CG: 15 EFL students	Writing

Mubarok, Cahyono and Astuti (2019)	Effect of flipped classroom model on indonesian EFL students' writing achievement across cognitive styles	Indonesia	EG: 29 university students CG: 29 university students	Writing
Abedi. keshmirshekan and Namaziandost (2019)	The comparative effect of flipped classroom instruction verus traditional instruction and Iranian intermediate EFL leaners english composition writing	Iran	EG: 16 intermediate university students CG: 16 intermediate university students	Writing
Abdelrahman, Dewitt, Alias and Rahman (2017)	Flipped learning for ESL Writing in a sudanese school	Sadan	EG: 14 Secondary school students CG:14 Secondary school students	Writing
Ekmekci (2017)	The flipped writing classroom in Turkish EFL contents: A comparative study on a New Model	Turkey	EG: 23 ELT preparatory class students CG:23 ELT preparatory class students	Writing
Qader and Arslan (2019)	The effect of flipped classroom instruction in writing: A case study with Iraqi Efl learners	Iraq	EG: 34 University students CG:34 University students	Writing
Soltanabadi, Izadpanah and Namaziandost (2021)	The effect of flipped classroom on Iranian adolescents: Elementary EFL learners vocabulary recall and retention	Iran	EG: 24 adolescent elementary learners CG:24 adolescent elementary learners	Vocabulary
Kim (2018)	Effects of flipped learning on the learning of english vocabulary	Korea	EG: 27 University students CG:30 University students	Vocabulary
Hsieh Wu, and Mark (2016)	Using the flipped classroom to enhance EFL learning	Taiwan	EG: 24 sophomore english majors CG:24 sophomore english majors	Vocabulary

Abdullah (2016)	The effect of flipped classroom instruction on enhancing english grammar and vocabulary learning for secondary commercial schools graduates	Egypt	EG: 29 secondary commercial school graduates CG:29 secondary commercial school graduates	Vocabulary and grammar
Zarrinfard, Rahimi, and Mohserni (2021)	The impact of flipped classroom on learning outcome in a general english course: Grammar and vocabulary gains in focus	Iran	EG: 25 university students CG:35 university students	Vocabulary and grammar
Li (2015)	Enhancing EFL speaking via flipped classroom model and constructive role plays	Thailand	EG: 8 university students CG:8 university students	Speaking
Al-Ghamdi and Al-Bargi (207)	Explorint the application of flipped classroom on EFL saudi students speaking skill	Saudi Arabia	EG: 21 university students CG:21 university students	Speaking
Li and Suwanthep (2017)	Integration of flipped classroom model for EFL speaking	Thailand	EG: 46 university students CG:46 university students	Speaking
Yesilcmar (2019)	Using the flipped classroom to enhance adult EFL Leaners speaking skills	Turkey	EG: 11 academicians CG:11 academicians	Speaking
Bezzazi (2019)	The effect of flipped learning on EFL leaners public speaking in Taiwan	Taiwan	EG: 40 University students CG:40 University students	Speaking
Chen and Hwang (2020)	Effects of a concept mapping based flipped learning approach on EFL students english speaking performance, critical thinking awarness and speaking anxiety	Taiwan	EG: 37 first year college students CG:35 first year college students	Speaking
Karimi and Hamzavi (2017)	The effect of flipped model of instruction on EFL learners reading comprehension learners attitude in focus	Iran	EG: 25 university students CG:25 university students	Reading

Ibanian (2018)	The effect of using the flipped learning strategy on developing university students reading comprehension in EFl and their attitude towards the strategy	Jordan	EG: 37 university students CG:35 university students	Reading
Hasgemifadnia, Namaziandost and Shafiee (2018)	The effect of implementing flipped classrooms on Iranian junior high school students reading comprehension	Iran	EG: 25 pre-intermediate students CG:25 pre-intermediate students	Reading
Chavangklang and suppasetseree (2018)	Enhancing that efl university students reading comprehension through a flipped cooperative classroom	Thailand	EG: 37 university students CG:34 university students	Reading
Bataineh and Al-Sakal (2021)	To flip or not to flip: Potential effects on EFL reading comprehensive	Jordan	EG: 38 tenth-grade students CG:33 tenth-grade students	Reading
Fulguetas and Bautista (2020)	Flipped classroom: Its eeffects on ESL Learners critical thinking and reading comprehension levels	Phillippines	EG: 106 senior high school students CG:106 senior high school students	Reading
Fardin Rad and Tajaddini (2021)	Flipped learning on reading and grammar achievement at a language institute in Kerman-Iran	Iran	EG: 30 university students CG:34 university students	Reading and Grammar
vaezi, Afghari, and Lotfi (2019)	Investigating listening comprejension through flipped classroom Approach does authenticity matter?	Iran	EG1: 40 university students EG2: 40 university students CG:39 university students	Listening
Namaziandost, Rezaei, Elemadfar and Alekasir (2020)	Implementing a flipped model of instruction in the EFL listening classroom impact on comprehension	Iran	EG: 30 advanced EFL learners CG:30 advanced EFL learners	Listening

Elernadfar, Soozandehfar and Namaziandost (2020)	An account of EFL learners listening comprehension and critical thiniking in the flipped classroom model	Iran	EG: 20 intermediate EFL learners CG:20 intermediate EFL learners	Listening
Jafarigohar, Haghighi, Khoshsima and Vahdand (2019)	Incorporation of flipped learning into EFL classroom performance and preception	Iran	EG: 30 university students CG:30 university students	Listening and speaking
Amiryousefi (2019)	The incorporation of flipped learning inti conventional classes to enhance EFL learners L2 speaking L2 listening and engagement	Iran	EG1: 23 university students EG2: 22 university students CG:22 university students	Listening and speaking
Webb and Doman (2016)	Does the flipped classroom lead to increased gains on learining outcomes in ESL/EFL contexts?	US and China	EG: 39 students CG:25 students	Grammar
Dincer (2020)	The effects of flipped learning model on EFL students grammar proficiency and laerner autonomy	Turkey	EG: 19 students in a military school CG:18 students in a military school	Grammar
Bezzazi (2019)	Learning english grammar through flipped learning	Taiwan	EG: 67 university school CG:65 university school	Grammar
Nuon and Champakaew (2017)	Effects of ICT-Aidede flipper classroom on grammar achievement	Thailand	EG: 40 university school CG:41 university school	Grammar
Al-Harbi and Alshumaimeri (2016)	The flipped classroom impact in grammar class on EFL saudi secondary school students performances and attitudes	Saudi Arabia	EG: 20 secondary school students CG:23 secondary school students	Grammar
Noroozi Rezvani and Meri-Golestan (2020)	The effect of flipped classroom on i2 learners development and retention of grammatical knowledge	Iran	EG: 30 EFL learners CG:30 EFL learners	Grammar

Adnan (2017)	Perceptions of senior year ELT students for flipped classroom a materials development course	Turkey	EG: 31 university learners CG:39 university learners	Reading
Ozturk and cakiroglu (2021)	Flipped learning design in EFL classroom implementing self regulated learning strategies to develop language skills	Turkey	EG: 24 university learners CG:25 university learners	Overalll

Data Analysis Procedures

In this study, Comprehensive Meta Analysis (CMA) software was utilized in data analysis process. Means, standard deviations and sample sizes were used to calculate the effect sizes of all studies and overall effect size. The effect sizes of the previous studies can be calculated with fixed or random effects models in a meta-analysis study. It is presumed that all the studies have the same true effect size in the fixed effects model while each study has different true effect size in the random effects model. Fixed effects model can be practical when all the studies included in meta-analysis have similar functions and when the purpose of the meta-analysis is to generalize the research findings to an identified population, not to other populations. On the contrary, random effects model can be suitable when the effect sizes show a heterogeneous distribution (Borenstein, Hedges, Higgins, & Rothstein, 2009). Therefore, calculating the heterogeneity of the study helps the researchers decide which model to use.

Publication Bias

Publication bias is considered as a common problem that researchers face when undertaking a meta-analysis study. It arises from the tendency to choose studies which are published in journals and report only significant results. Therefore, unpublished studies (e.g., M.A or PhD. theses or conference papers) were included in this study to prevent publication bias. Moreover, the present study examined the publication bias through classic fail-safe N and funnel plot analyses.

Findings

Findings Regarding the Research Question: "What is the effect of flipped learning on EFL/ESL learners' academic achievements?"

In this meta-analysis study, the overall effect size of 40 studies was calculated to examine the effect of flipped learning on EFL students' achievements. Table 1 provides overall effect size and heterogeneity tests' results.

Table 1 Heterogeneity and Average Effects Size Regarding the Effect of FL on Academic Achievement

		95% CI				Heterogeneity		
Model	**K**	**ES**	**Lower**	**Upper**	**Q**	**Df (Q)**	**P**	**L^2**
Fixed	40	0.955	0.869	1.041	380.938	39	362.786	89. 762
Random	40	1.303	1.026	1.580				

Cochran's Q statistic and the I^2-statistic were used to demonstrate the heterogeneity of the studies. Q value (Q=380,938; p=0,000) and I^2 value (I^2=89,762) suggested high heterogeneity in the studies included in this meta-analysis. This means that the true effect sizes of the studies were different. Therefore, random effects model was used as a meta-analysis model to calculate the effect size. Moreover, the results showed that the overall effect size of random effects model was 1.303, which was statistically significant. According to Cohen's (1988) size effect classification, this value indicates strong effect (>1.00). This analysis shows that flipped learning has a positive effect on learners' academic achievements.

The forest plot analysis in Figure 3 shows the distribution of effect size values calculated with the random effects model.

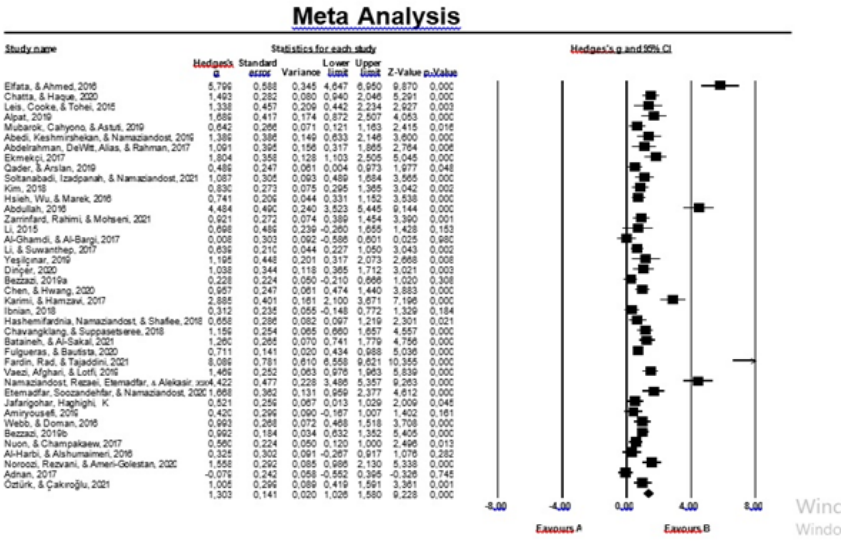

Figure 3 The Forest Plot Presenting the Effect Size Values

Midpoint of the black square-shaped boxes in the horizontal lines represents the effect size and horizontal lines passing through it represent the confidence intervals of the relevant study. The length of the horizontal lines shows the width of confidence intervals. It is apparent from the forest plot that Elfatah and Ahmed's (2016) study displays the largest confidence interval whereas Bezzazi's (2019) study has the smallest one. According to the analysis, the other studies share similar values of weight percentages. Likewise, the study with the lowest effect size (g = -0.079) belongs to Adnan (2017), while the study with the largest effect size (g = 3.637) belongs to Fardin, Rad, and Tajaddini (2021). While 28 studies' (70%) effect sizes are below the average, 12 studies' (30%) effect sizes are above the average effect size of the present study. The diamond below the studies represents the overall effect size of the studies included. This shape is not on the vertical line at an effect size=0 and this means that there is a significant difference between experimental and control groups. While 39 studies have positive effect sizes, only one study has negative effect size. Therefore, it can be concluded that the majority of the studies included in this meta-analysis show that experimental group (flipped) outperforms the control group (non-flipped) in terms of academic achievement.

Furthermore, classic fail-safe N analysis (Table 2) shows that the analysis results are reliable because the p value is less than the alpha value (Borenstein et al., 2009).

Table 2 Classic fail-safe n analysis

z value	**24,57425**
p value	**.00**
Alpha	**.05**
Z for alpha	**1.95**
N	**40**
p>number of missing studies	**6243**

Likewise, the funnel plot analysis in table 3 shows that there is no publication bias in this meta-analysis study. The symmetry in the funnel proves the absence of bias in the studies included in the meta-analysis (Sterne et al., 2011).

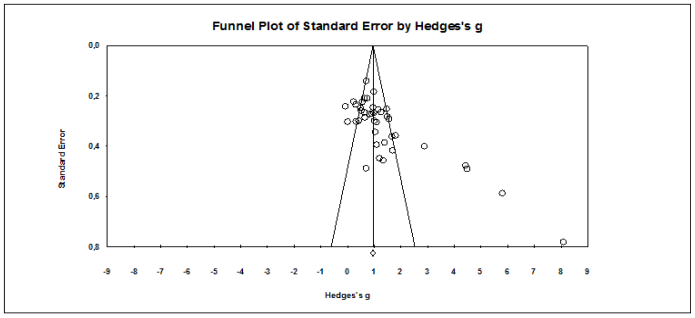

Figure 4 Funnel Plot Analysis

Findings Regarding the Research Question: "Is there any relationship between the research type (e.g., article, thesis, and conference paper) and the contribution of flipped learning on academic achievement?"

A moderator analysis was undertaken to see whether the effect of flipped learning differs according to publication types. Table 3 presents that studies do not show significant difference in terms of publication type since effect sizes of publication type do not show statistical difference and p value is not less than 0,05 (p= 0,656>0.05). Hence, it can be asserted that the contribution of flipped learning on academic achievement does not change in terms of the publication type of the studies.

Table 3 Effect of FL on Academic Achievement According to the Publication Type

Moderator Variable	Heterogeneity	p	K	ES	CI (95%)	SE
Publication type						
Article	0.844	0.656	36	1.332	[1.037; 1.627]	0.150
Thesis			3	1.152	[1.142; 2.262]	0.546
Conference			1	0.560	[0.082; 2.221]	0.868

Findings Regarding the Research Question: "Is there any relationship between the sample size and the contribution of flipped learning on academic achievement?"

According to Table 4, maximum effect size belongs to the studies whose sample sizes are between 1-30 students (g=1.730) while minimum effect size belongs to studies whose sample sizes are between 61 and more (g=0.791). Furthermore, there is statistically significant difference between groups since p value is less than 0,05 (p= 0,006<0.05). Hence, it can be concluded that the contribution of flipped learning on academic achievement is higher in studies consisting of 31 to 60 participants.

Table 4 Effect of FL on Academic Achievement According to Sample Size

Moderator Variable	Heterogeneity	p	K	ES	CI (95%)	SE
Sample size						
1-30	10.279	0.006	5	1.210	[0.538; 1.110]	0.415
31-60			20	1.730	[0.788; 1.340]	0.199
61 or more			15	0.791	[0.530; 1.512]	0.216

Findings Regarding the Research Question: "Is there any relationship between the educational level (e.g., primary school, secondary school, high school, and university) and the contribution of flipped learning on academic achievement?"

Table 5 shows that studies conducted in secondary schools have maximum effect size (g=1,637) while studies conducted in high schools have minimum effect size (g=0,058). Furthermore, there is not statistically significant difference between groups since p value is not smaller than 0,05 (p= 0,8400>.05). The results of this analysis imply that studies do not show statistically significant difference in terms of education level. Hence, it can

be mentioned that the contribution of flipped learning on academic achievement does not change in terms of the educational level of the participants in studies.

Table 5 Effect of FL on Academic Achievement According to Education Levels

Moderator Variable	Heterogeneity	p	K	ES	CI (95%)	SE
Education Level						
Primary school	0.841	0.840	1	1.087	[-0.712; 2.885]	0.918
Secondary school			4	1.637	[0.706; 2.568]	0.475
High school			4	1.058	[0.170; 1.947]	0.453
University			31	1.303	[0.976; 1.630]	0.167

Findings Regarding the Research Question: "What is the effect of flipped learning on EFL learners' achievements in four basic language skills (e.g., writing, reading, speaking, and listening) and two sub-skills (e.g., vocabulary and grammar)?"

Table 6 illustrates that studies conducted to examine students' reading skills have the largest effect size (g=1.767) while studies conducted to examine students' speaking skill have the smallest effect size (0.667). However, the effect sizes of these subgroups do not show a significant difference and p value is not less than 0.05 (p= 0,343>.05). Therefore, it is apparent that flipped learning has a positive effect on EFL students' writing, listening, reading and speaking skills, and grammar and vocabulary knowledge and this effect does not statistically differ according to the language skills and areas.

Table 6 Effect of FL on Academic Achievement According to Language Skills and Sub-Skills

Moderator Variable	Heterogeneity	p	K	ES	CI (95%)	SE
Language Skills and Areas						
Writing	6.769	0.343	10	1.454	[0.850; 2.058]	0.308
Listening			5	1.613	[0.771;2.455]	0.430
Reading			7	1.767	[1.051; 2.483]	0.365
Speaking			7	0.667	[-0.045; 1.379]	0.363
Grammar			5	0.885	[0.066; 1.705]	0.418
Vocabulary			5	1.509	[0.672; 2.345]	0.427
Overall			1	1.005	[-0.854; 2.863]	0.948

Discussion

This meta-analysis study aimed to examine the effects of flipped learning on EFL/ESL students' academic achievements. After the implementation of inclusion criteria, 40 relevant studies were included in the analysis process. The studies' publication types were mostly journal articles (n=36), and thesis (n=3) and conference papers (n=1) were not common types used in this meta-analysis. The sample sizes of the studies mostly consisted of 31 to 60 participants (n=20), and 61 or more participants (n=15). The sample size of 1 to 30 participants (n=5) constituted the minority of this study. The participants were mostly students at universities (n=31), and rarely students at primary schools (n=1), secondary schools (n=4) and high schools (n=4). The studies included in this meta-analysis investigated the effects of flipped learning on students' writing (n=10), listening (n=5), reading (n=7), speaking (n=7) and overall skills (n=1), and grammar (n=5) and vocabulary (n=5) knowledge. The analysis was undertaken with random effects model because of the heterogeneity level (Q=380.938; p=0,000; I^2=89.762) of the studies. Moreover, the classic fail-safe N analysis and funnel plot analysis showed that there was no publication bias in the studies included in this meta-analysis.

The aim of the first research question was to determine the effect of flipped learning on EFL/ESL learners' academic achievements. The overall effect size of the studies was calculated as 1.303 using Hedge's g measure according to random effects size

model. This result showed that flipped learning model has a strong effect on EFL/ESL student's academic achievement according to the classification of Cohen et al. (2007). Likewise, Karagöl and Esen (2019) found that the flipped learning model has a moderate effect (g=0.560) on EFL/ESL students' academic achievements according to their meta-analysis consisting of 55 studies. Shahnama, Ghonsooly and Shirvan (2021) also concluded that flipped learning has large and positive effect on EFL/ESL student's success through a meta-analysis including 69 studies. Moreover, meta-analysis studies conducted in different areas to examine the effect of flipped learning on academic achievements found similar results (Orhan, 2019; Aydın et al., 2020; Hew & Lo, 2018).

The second research question sought to determine whether the effect of flipped learning on students' academic achievements differs according to publication type of the studies. Publication type was one the moderators of this study. The finding of the moderator analysis showed that the effect of flipped learning on EFL/ESL students' academic achievement does not differ according to the publication type (p=0.656). This result is in accordance with the meta-analysis studies of Karagöl and Esen (2019), Kazu and Yalçın (2022) and Cheng et al. (2019).

The third research question examined whether the effect of flipped learning on students' academic achievements differs according to sample sizes of the studies. Sample size was another moderator of this study. According to the findings of moderator analysis, studies consisting of 30 to 61 participants have more positive effect on students' achievements. However, this finding is not in line with the meta-analysis study of Karagöl and Esen (2019) who implied that flipped learning is more effective on small groups rather than large groups. Similarly, this finding is not consistent with that of Zheng et al. (2020) and Cheng et al. (2019) who found no significant difference between the effects of sample sizes. A possible explanation for this contradiction may be the differences in numbers of the studies included in different meta-analyses.

The fourth research question aimed to determine whether the effect of flipped learning on students' academic achievements differs according to educational levels of the participants. As another moderator of this study, different educational levels do not have different impact on students' academic achievements (p=840). This finding was also reported by Orhan (2019), Lag and Sæle (2019) and Alten et al. (2019).

The last research question investigated the effect of flipped learning on EFL learners' achievements in four language skills and two sub-skills. In reviewing literature, no data was found related to the effect of flipped learning on basic language skills and sub-skills in a meta-analysis study. Therefore, the most significant finding of this study is that flipped learning model has more positive effect on students' reading skills (g=1.767) and have less positive effect on students' speaking skills (g=0.667).

Conclusion

The main goal of the current study was to determine how flipped learning method affects EFL/ESL students' academic achievements. The findings clearly indicate that flipped learning has a positive effect on students' achievements and educators may prefer flipped learning model to tradition learning models while teaching English as a second or foreign language. The research also shows that publication type and educational level do not alter the effect of FL on students' achievement while FL has more positive effects on groups consisting of 31 to 60 students. The most significant finding to emerge from this study is that flipped learning improves EFL/ESL students' overall language skills, but it has the strongest effect on reading skills and has the weakest effect on speaking skills of the EFL/ESL students. These findings provide the following insights for future research:

- Reviewing the literature, it has been found that most studies focus on the effect of flipped learning on students' writing skills, and generally ignore other skills (reading, speaking, listening) and sub-skills (grammar, vocabulary, pronunciation). More research needs to be undertaken to examine the overall language skills.
- As most studies are undertaken at the higher education level, further research is required to determine the effect of flipped learning method on primary or secondary school level.

- Research undertaken to examine the effect of flipped learning on students' achievements should clearly demonstrate the statistical data to help and encourage meta-analyst.
- This study is limited in examining the effect of FL on only academic achievements. Thus, further studies may focus on the effects of flipped learning regarding students' motivation, attitudes and perceptions.

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Author Details

Nilüfer Aybirdi, *Ordu University, Turkey,* ***Email ID****: niluferaybirdi@hotmail.com*

Hüseyin Efe, *Artvin Çoruh University, Turkey,* ***Email ID****: hefe@artvin.edu.tr*

Çağla Atasoy Şal, *Ordu University, Turkey,* ***Email ID****: caglaatasoysal@hotmail.com*