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Flipped Learning in Foreign Language Learning in Higher Education: Analysis of Effectiveness and Moderator Variables

Fatkhul Ulum*, & Julham Hukom

Department of Arabic Language Education, Universitas Negeri Makassar, Indonesia

*Corresponding email: fatkhululum@unm.ac.id

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Abstract: Flipped Learning in Foreign Language Learning in Higher Education: Analysis of Effectiveness and Moderator Variables. Many studies have reported that the flipped learning strategies has a significant effect on students' foreign language skills in college compared to traditional learning strategies. However, reports regarding the effectiveness of flipped learning strategies in foreign language learning are very heterogeneous. **Objectives:** Based on this empirical gap, this study aims to synthesize the application of flipped learning strategies in students' foreign language learning in higher education compared to traditional learning strategies. **Method:** This study uses the meta-analysis method to answer the objectives of this study. **Findings:** The results of the analysis of twelve research samples with a random-effect estimation model show that the use of the flipped learning strategies has a more significant effect on students' foreign language skills in college when compared to traditional strategies, with the combined effect size value being in the large effect category ($g = 0.89$; $p < 0.05$). In addition, the results of the moderator factor analysis show that the variables of flipped learning class capacity, ability type, and foreign language type significantly affect the effectiveness of the use of the flipped learning strategies to students' diverse foreign language skills. **Conclusion:** These reports provide strong evidence as recommendations for educators, researchers and educational policy makers regarding the application of flipped learning strategies in foreign language learning in higher education. Regardless of the validity of the results, this study only involved a few research samples. Further research is recommended to combine more samples, or focus on the type of abilities measured, so that it can provide more specific conclusions.

Keywords: effect size, foreign language, flipped learning, meta-analysis, moderator variable.

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INTRODUCTION

The flipped learning strategy is a technology-based active learning approach that is increasingly being applied in higher education environments. The flipped learning method is a learning strategy in blended learning that reverses the "classroom" learning structure and learning methods (Al-Samarraie et al., 2020; Lee et al., 2017; Talbert & Bergmann, 2023). In traditional learning, material is usually given on campus and material can be deepened outside the campus through assignments, discussions, and so on. Unlike traditional learning methods, flipped learning reverses traditional learning activities. Students study the material outside of campus first through video learning resources, printed or electronic modules, or other supporting learning resources. After that, class time is optimized for discussion activities, interactive material deepening, or other advanced learning activities.

Then students deepen their understanding outside of class by completing further evaluations (Bergmann & Sams, 2012; Brewer & movahedazarhouligh, 2018; Talbert & Bergmann, 2023; Vitta & Al-Hoorie, 2023).

The application of flipped learning strategy has the potential to improve foreign language skills because it facilitates flexible learning (Chuang et al., 2018; Fisher et al., 2024; Lee & Wallace, 2018; Safiyeh & Farrah, 2020; Tadayonifar & Entezari, 2020; Turan & Akdag-Cimen, 2020). Every student has different learning needs. By facilitating different learning times, students can learn according to their individual needs (e.g. time, pace, content, learning style) (O'Flaherty & Philips, 2015; Sulistyowati et al., 2024). Facilitating flexible learning has been confirmed to improve students' academic achievement (Huang et al., 2020; Müller et al., 2023). However, control over students' learning evaluation must be carried out strictly (Ihm, 2017). Flipped learning strategies have also been shown to make a significant contribution to 21st century skills, for example critical thinking (Ma, 2023; Nugraheni et al., 2022), collaboration (Suebsom, 2020), communication (Makruf et al., 2021), creativity (Al-Zahrani, 2015; Hsia et al., 2021), digital literacy (Humrickhouse, 2021; Gómez-García et al., 2021), and self-regulated learning (Sletten, 2017; Van Alten et al., 2020; Yoon et al., 2021).

Various studies have conducted experiments on the application of flipped learning strategies in foreign language learning compared to traditional strategies. These reports actually confirm the varying results in the impact of flipped learning strategies. Several reports show that the flipped learning strategy has a significant impact on foreign language learning compared to traditional strategies (Dewi et al., 2023; Hariati et al., 2021; Irawati et al., 2022; Maximilian & Ajeng, 2023; Mufidah et al., 2018; Suherni, 2023). Several reports found the opposite. Foreign language academic achievement using the flipped learning strategy did not show a significant difference compared to the traditional strategy (Syajili & Abadi, 2021; Wardhani et al., 2022). Several moderating factors that can influence the variation of results include the characteristics of the research method and the characteristics of the flipped learning approach itself (Cahyani et al., 2024; Martaputri et al., 2021; Purnomo et al., 2022; Samritin et al., 2023; Vahedi, 2024; Vitta et al., 2023; Sulistyowati et al., 2023).

Based on this case, further research approaches need to be carried out to comprehensively evaluate the factors that cause variations in research results regarding the impact of the flipped learning strategies in foreign language learning. One appropriate approach for this case is the meta-analysis method (Cahyani et al., 2024; Hukom et al., 2023; Kamsurya et al., 2022; Mawardi et al., 2024; Muhtadi et al., 2022). Meta-analysis aims to synthesize or combine various studies with similar topics (Muhtadi et al., 2022; Purnomo et al., 2022; Samritin et al., 2023; Setiawan et al., 2022; Sulistyowati et al., 2023; Zuliana et al., 2025). Meta-analysis focuses on calculating effect size by analyzing statistical information from various studies that examine the same topic (Cahyani et al., 2024; Hukom et al., 2023; Kamsurya et al., 2022; Martaputri et al., 2021; Lipsey & Wilson, 2001; Mawardi et al., 2024; Muhtadi et al., 2022). Meta-analysis combines samples from various studies so that the resulting standard error is smaller (Borenstein et al., 2009).

Previous meta-analyses comparing flipped learning strategies and traditional strategies in foreign language learning in higher education have been reported by Chingkam (2020), Shahnama et al. (2021), Ni et al. (2023), Vahedi (2024), and Vitta and Al-Hoorie (2023). However, the meta-analyses conducted did not focus on examining its impact on language learning. In addition, the evaluation of moderating factors that

may affect students' diverse foreign language learning achievement in higher education between these two variables is also still limited. The meta-analysis report by Sulistyowati et al. (2023) reported that the application of the flipped learning strategy in small class capacities actually had a significant effect compared to large class capacities. However, whether this condition applies to students in higher education also needs to be studied further. In addition, the results of the meta-analysis of Purnomo et al. (2022) showed that the implementation of the flipped learning strategy in schools reported in the current year group had a more significant effect than studies reported in recent years. This report shows that there are several factors that may impact the effectiveness of the implementation of the flipped classroom strategy in language learning in higher education. Furthermore, Samritin et al. (2023) also discovered that the type of ability measured can influence the effectiveness of blended learning on student learning achievement.

Departing from these limitations, this research aims to fill the gap in existing studies by conducting a more comprehensive analysis. Specifically, there are two main objectives to be achieved: (1) evaluating the impact of the flipped learning strategies on foreign language skills in higher education compared to the traditional strategies; and (2) identify moderator variables that can influence the level of effectiveness of flipped learning in higher education environments. To answer these objectives, this research formulates several research questions (RQ) as follows.

RQ 1: How effective is the flipped learning strategies in foreign language learning compared to traditional strategies?

RQ 2: Does the class capacity factor affect the effectiveness of using flipped learning strategies in foreign language learning in higher education?

RQ 3: Does the publication year factor affect the effectiveness of using flipped learning strategies in foreign language learning in higher education?

RQ 4: Does the ability type factor affect the effectiveness of using flipped learning strategies in foreign language learning in higher education?

RQ 5: Does the type of foreign language factor affect the effectiveness of using flipped learning strategies in foreign language learning in higher education?

METHOD

Research Design

This study uses a group contrast meta-analysis design to measure the effectiveness of application the flipped learning strategies on students' foreign language skills compared to the traditional strategies, as well as to analyze several moderator variables that may affect the effectiveness of the flipped learning strategies on students' foreign language skills. This design was chosen because the meta-analysis study combines samples from various studies with the same topic, so that the resulting standard error is lower. This will have an impact on drawing more accurate research conclusions than a single study. Figure 1 presents the procedures for this meta-analysis.

Criteria Inclusion

To ensure that the literature or studies included in this meta-analysis are relevant to the research objectives and facilitate interpretation and generalization of findings, we determined the inclusion criteria, including: (1) research reports that can be accessed online. This is to ensure study transparency; (2) research reports that test the impact of flipped learning strategy applications on foreign language learning in higher education; (3) research reports using experimental designs; (4) research reports must report the types of abilities measured in higher education and the

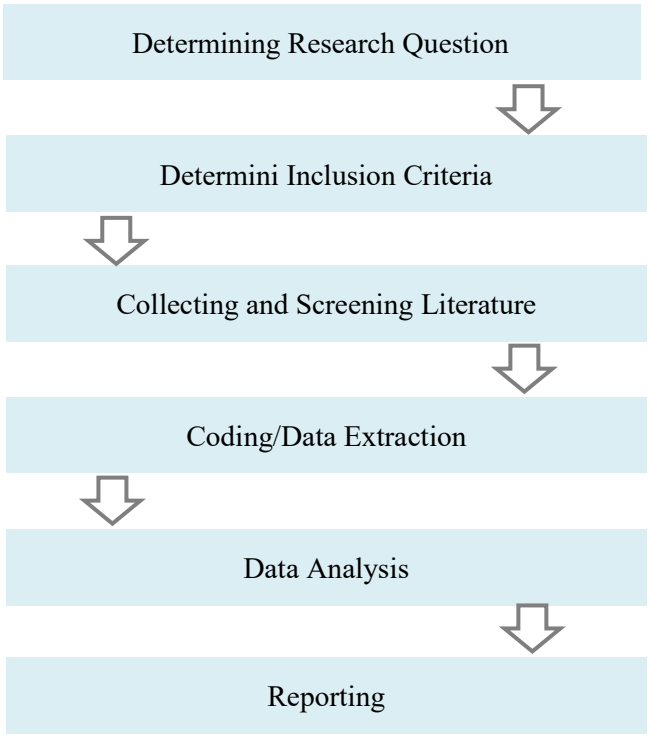
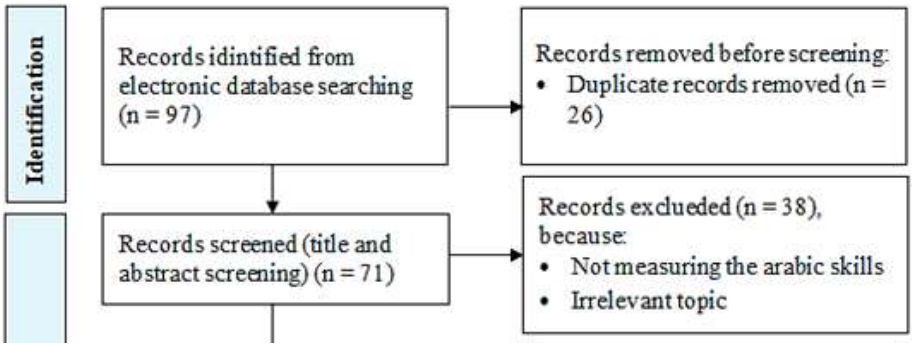


Figure 1. Meta-analysis study procedure

types of foreign languages; (5) research reports must report sufficient statistical information.

Data Collection

Data collection for this meta-analysis study used online databases such as Google Scholar, Scopus, Web of Science, JSTOR, and ERIC. To facilitate the process of collecting data that meets the research inclusion criteria, we used keywords ("eksperimen" OR "experimental") AND ("flipped learning" OR "flipped classroom" OR "kelas terbalik") AND ("bahasa" OR "language"). Initial data collected based on identified keywords, then screening was carried out, both on the title and abstract as well as the entire body of the article. The initial data collected were then filtered through four stages of PRISMA. The data collection process produced 12 research samples (see Figure 2). However, because several studies examined more than one dependent variable, there were 18 studies analyzed.



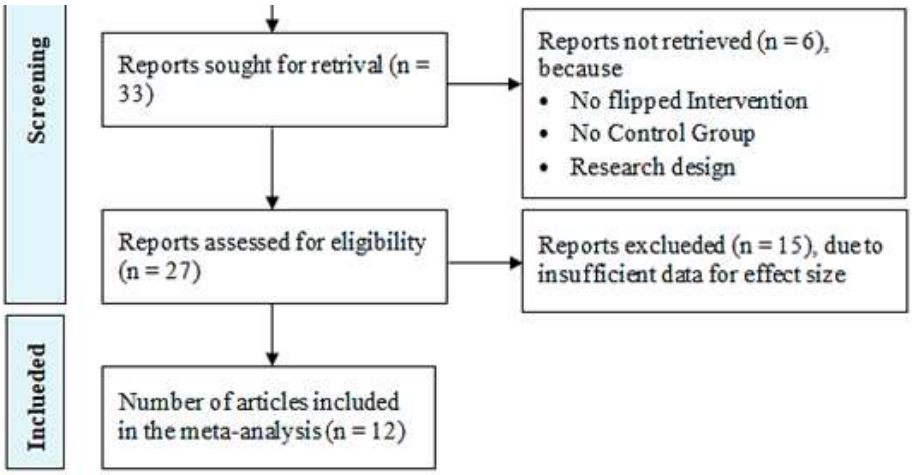


Figure 2. Screening process the literature uses PRISMA

Data Extraction

Statistical information from the experimental (flipped learning) and control groups such as mean values, standard deviations, and sample sizes were collected to facilitate data analysis. Table 1 presents the summary results of data extraction.

Data Analysis

The stages in the meta-analysis scheme applied include: 1) measuring the effect size of each study on the effect of the use of the flipped learning strategies on foreign language skills in higher education; 2) calculating the overall effect size and evaluating the issue of publication bias;

Table 1. The results of data extraction

Studies	Flipped Learning			Traditional			t	p
	Mean	SD	N	Mean	SD	N		
Suherni (2023) a	34.44	15.87	25	27.08	16.51	24		
Suherni (2023) b	70.28	23.17	25	49.92	15.36	24		
Suherni (2023) c	59	25.54	25	44.83	18.39	24		
Suherni (2023) d	56.4	20.18	25	41.67	19.09	24		
Suherni (2023) e	61.2	20.83	25	44.17	12.22	24		
Irawati et al. (2022)	76.22	9.57	30	63.78	16.88	30		
Hariati et al. (2021)	78.17	11.33	30	66.5	14.39	30		
Maximilian and Ajeng (2023)	71.04	10.4	25	59.12	10.85	25		
Yan et al. (2024) a	150.11	33.47	137	144.57	30.97	475		
Yan et al. (2024) b	196.61	33.15	137	170.99	37.79	475		
Yan et al. (2024) c	132.67	24.18	137	125.02	22.85	475		
Assaf et al. (2022)	40.6	5.39	60	30.37	4.49	60		
Mufidah et al. (2018)	70.2	6.5	30	51.1	7.49	30		
Alzabun et al. (2022)	45.29	4.46	14	38.13	8.77	15		
Fitri et al. (2022)	71.98	11.97	47	68.46	13.53	47		
Rahmah and sukmara (2022)			16			16		0.00
Dewi et al. (2023)			28			19		0.00
Anggraini and Rafiola (2024)			35			35	2.09	

Table 2. Clasification of effect sizes

Effect Size	Interpretation
0.00 ≤ effect Size < 0.20	Ignored
0.20 ≤ effect Size < 0.50	Small
0.50 ≤ effect Size < 0.80	Moderate
0.80 ≤ effect Size < 1.30	Large
1.30 ≤ effect Size	Very Large

and 3) analyzing moderator variables to identify factors that moderate the effect of the flipped learning model on foreign language skills in higher education. The calculation of effect size in this study uses the Hedges'g formula (Borenstein et al., 2009), because it accommodates sample sizes that tend to be small. In addition, this formula provides a more consistent and fair comparison between studies with various sample sizes. Table 2 presents the classification of effect sizes based on the classification developed by Cohen et al. (2018). Meanwhile, the statistical model used to calculate the overall effect size is determined based on the assumption of heterogeneity. If the distribution of effect sizes between studies is heterogeneous, the random-effect model is used, otherwise if it is homogeneous, the fixed-effect model is used. Furthermore, the analysis of potential publication bias uses the File-Safe N (FSN) test (Rothstein et al., 2005).

■ RESULT AND DISCUSSION

Overview of Primary Studies

Table 3 presents a summary of the studies that were the objects of meta-analysis consisting of the studies, experimental class capacity, publication year range, type of ability measured, and type of foreign language studied. The distribution of class capacity shows that thirteen studies (n = 13 or 72.22%) were conducted in small class capacities (d" 30), while five studies (n = 5 or 27.78%) were conducted in large class capacities. Reviewed from the year of publication, it shows that sixteen studies (n = 16 or 88.89%) were published in the 2022-2025 period, while two studies (n = 2 or 11.11%) were published in the 2018-2021 period. In terms of the abilities measured, it shows that three studies (n = 3 or 16.67%) measured grammar, one study (n = 1 or 5.55%) measured learning outcomes, two studies (n = 2 or 11.11%) measured listening skills, one study (n = 1 or 5.55%) measured basic linguistics, five studies (n = 5 or 27.78%) measured reading skills, two studies (n = 2 or 11.11%) measured speaking skills, and four studies (n = 4 or 22.22%) measured writing skills. In addition, in terms of the type of foreign language studied, there were thirteen studies (n = 13 or 72.22%) in English subjects, three studies (n = 3 or 16.67%) in Arabic subjects, and two studies (n = 2 or 11.11%) in Japanese subjects.

Table 3. Summary of the studies that were the object of the meta-analysis

No	Author	Class Capacity	Year Publication	Ability Type	Foreign Language Type
1	Suherni (2023) a	Small	2022-2025	Listening	English
2	Suherni (2023) b	Small	2022-2025	Reading	English
3	Suherni (2023) c	Small	2022-2025	Writing	English
4	Suherni (2023) d	Small	2022-2025	Speaking	English
5	Suherni (2023) e	Small	2022-2025	Grammar	English
6	Irawati et al. (2022)	Small	2022-2025	Grammar	English

7	Hariati et al. (2021)	Small	2018-2021	Reading	English
8	Maximilian and Ajeng (2023)	Small	2022-2025	Reading	English
9	Yan et al. (2024) a	Large	2022-2025	Listening	English
10	Yan et al. (2024) b	Large	2022-2025	Reading	English
11	Yan et al. (2024) c	Large	2022-2025	Writing	English
12	Assaf et al. (2022)	Small	2022-2025	Basic Linguistic	Arabic
13	Mufidah et al. (2018)	Small	2018-2021	Writing	Arabic
14	Alzabun et al. (2022)	Small	2022-2025	Grammar	Arabic
15	Fitri et al. (2022)	Large	2022-2025	Reading	Japanese
16	Rahmah and sukmara (2022)	Small	2022-2025	Writing	Japanese
17	Dewi et al. (2023)	Small	2022-2025	Learning Outcome	English
18	Anggraini and Rafiola (2024)	Large	2022-2025	Speaking	English

The Effectiveness of Flipped Learning Method on Foreign Language Ability in Higher Education Compared with Traditional Method

The first objective of this study was to measure the effectiveness of using flipped learning strategies on foreign language ability in higher education compared to traditional strategies. Table 4 presents the results of the calculation of the effect size of each study using CMA software. The effect size of the 18 studies analyzed ranged from 0.33 to 2.69, with a confidence level of 95%. Figure 3 presents a summary of the classification of effect size by Cohen et al. (2018), there are two studies (n = 2) included in the very large effect category, there are eight studies (n = 8) included in the large effect category, three studies (n = 3) included in the moderate effect

Table 4. Effect size for every study

No	Author	Effect Size	Confidence Interval		Standard error
			Lower Limits	Upper Limits	
1	Suherni (2023) a	0.45	-0.11	1.01	0.28
2	Suherni (2023) b	1.01	0.43	1.60	0.30
3	Suherni (2023) c	0.62	0.06	1.19	0.29
4	Suherni (2023) d	0.74	0.17	1.31	0.29
5	Suherni (2023) e	0.98	0.39	1.56	0.30
6	Irawati et al. (2022)	0.89	0.37	1.42	0.27
7	Hariati et al. (2021)	0.89	0.37	1.41	0.27
8	Maximilian and Ajeng (2023)	1.10	0.52	1.69	0.30
9	Yan et al. (2024) a	0.18	-0.01	0.37	0.10
10	Yan et al. (2024) b	0.70	0.50	0.89	0.10
11	Yan et al. (2024) c	0.33	0.14	0.52	0.10
12	Assaf et al. (2022)	2.05	1.61	2.49	0.22
13	Mufidah et al. (2018)	2.69	1.99	3.38	0.35
14	Alzabun et al. (2022)	0.99	0.24	1.74	0.38
15	Fitri et al. (2022)	0.27	-0.13	0.68	0.21
16	Rahmah and sukmara (2022)	1.26	0.51	2.00	0.38
17	Dewi et al. (2023)	1.25	0.62	1.87	0.32
18	Anggraini and Rafiola (2024)	0.49	0.02	0.96	0.24

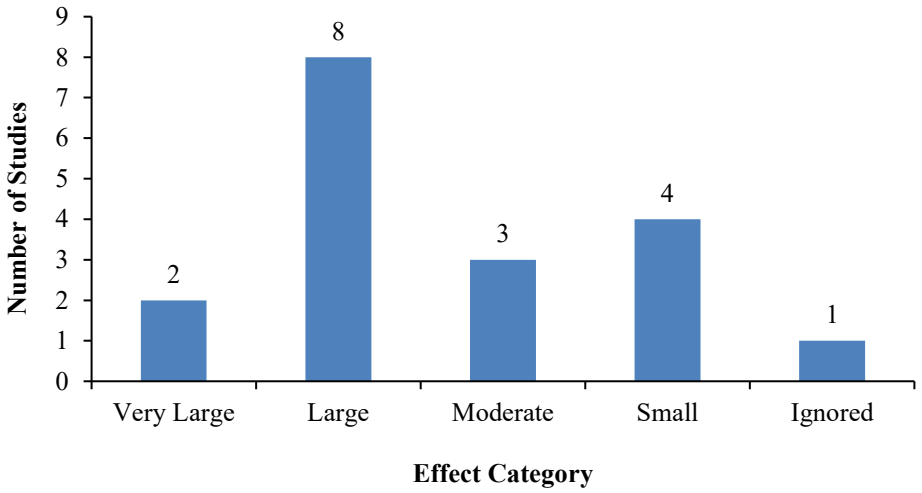


Figure 3. Classification of effect sizes of flipped learning strategies on foreign language learning in higher education

category, four studies (n = 4) included in the small effect category, and one study (n = 1) included in the ignored effect category.

The results of the overall effect size calculation (See Table 5) obtained a value of Q = 124.28> ÷2 (df = 17; p = 0.05) which interprets the heterogeneous distribution of effect sizes. The overall effect size (based on random effects) is in the large category (g = 0.89; p <0.01) (Cohen et al., 2018). These results confirm that the application of the flipped learning strategy has a large and significant effect on students' foreign language learning in higher education compared to traditional strategies. The flipped learning strategies offers several advantages when compared to traditional methods, one of which is personalization of learning. Each student has a different learning speed. The flipped learning strategies can facilitate students to repeat difficult material and speed up material that is easy for them (Sulistyowati et al., 2024). This is not facilitated by traditional strategies. In addition, because class time is no longer used for material presentation, educators can maximize language learning by providing personal feedback in writing, speaking, or reading practices. This aspect has the potential to have an impact on improving their learning achievement.

Table 5. Overall effect sizes analysis

Estimation Method	k	g	95% Confidence Interval	p	df	Heterogeneity		
						Q	p	i^2
Random-Effect	18	0.89	[0.65-1.17	0.00	17	124.28	0.00	86.32
Fixed-Effect	18	0.61	[0.53-0.71	0.00	17			

Publication Bias

Publication bias analysis aims to ensure that the distribution of effect sizes is normal and remains stable against changes in sample size and effect size (Bernard et al., 2014; Nugraha & Suparman, 2021). The results of the publication bias analysis (See Table 6) show that the p-value of the Z statistic < 0.05. This value indicates that there is no publication bias problem.

The Effectiveness of the Flipped Learning Method on Foreign Language Ability in Higher Education Based on Moderator Variables

The results of the heterogeneity analysis for several moderator factors, such as experimental class capacity, year of publication, ability type, and foreign language type are presented in Table 7.

Table 6. Results of publication bias analysis

Classic FSN	
Z	15.42
p	0.00
FSN	1097

Table 7. Results of moderator variable analysis

Moderator Variable	N	Effect Size	Std. error	p-value	Heterogeneity		
					Q-value	df (Q)	p-value
Experimental Class Capacity							
Large (> 30)	5	0.47	0.05	0.00	24.93	8	0.00
Small (≤ 30)	13	0.99	0.09	0.00	35.73	10	0.00
Qb					26.14	1	0.00
Publication Year							
2018-2021	2	0.76	0.18	0.00	0.45	1	0.00
2022-2025	16	0.58	0.04	0.00	85.47	17	0.00
Qb					0.88	1	0.35
Ability Type							
Grammar	3	0.93	0.20	0.00	0.04	1	0.00
Learning Outcomes	1	0.75	0.12	0.00	4.03	3	0.03
Listening	2	0.20	0.09	0.03	0.82	1	0.04
Basic Linguistic	1	2.05	0.39	0.00	0.00	0	0.04
Reading	5	0.78	0.08	0.00	3.68	5	0.00
Speaking	2	0.69	0.15	0.00	1.19	2	0.03
Writing	4	0.36	0.09	0.00	0.94	1	0.00
Qb					76.11	6	0.00
Foreign Language Type							
English	13	1.11	0.05	0.00	38.05	12	0.00
Arabic	3	0.70	0.12	0.00	2.10	2	0.00
Japanese	2	0.52	0.14	0.00	30.20	3	0.00
Qb					16.46	2	0.00

Based on the results of the analysis of the moderator factor of the experimental class capacity, it shows the Qb-value = 26.14, this value is greater than the ÷2 value (df = 1; p = 0.05). This value interprets that the class capacity factor influences the use of flipped learning strategies in foreign language learning compared to traditional strategies. The flipped learning strategy in language learning is most effectively used in class capacities d" 30 students (g = 0.99; p < 0.05) compared to class capacities > 30 students (g = 0.47; p < 0.05). This finding is in line with the meta-analysis reports of Cahyani et al. (2024), Purnomo et al. (2022), and Sulistyowati et al. (2023) which interpret that the use of flipped learning strategies in small class capacities has a significant effect compared to large class capacities. However, the findings of this meta-analysis confirm that the use of flipped learning strategies still has a significant effect on class capacities d" 30 and class capacities > 30 students compared to the use of traditional strategies. This meta-analysis report provides strong evidence that to produce maximum foreign

language skills, it is better to apply it to small class capacities.

The results of the publication year factor analysis obtained a Qb value of 0.88. This value is smaller than ÷2 (df = 1; p = 0.05). These results interpret that the publication year factor does not affect the effectiveness of using the flipped learning strategy compared to traditional strategies. The use of the flipped learning strategy in foreign language learning in higher education reported in the 2018-2021 range produced an effect size of g = 0.76 (Moderate Effect), and that reported in the 2022-2025 range produced an effect size of g = 0.58 (Moderate Effect) (Cohen et al., 2018). In addition, the p-value of the Z statistic in both publication year groups was less than 0.05, indicating that the use of the flipped learning strategy in foreign language learning in higher education had a significant effect on both publication year groups (2018-2021 and 2022-2025). A similar meta-analysis was also found by Purnomo et al. (2022) that the use of flipped learning strategies has a significant influence on student learning achievement at School, both reported in 2016 to 2019 and 2020 to 2023. This report provides strong evidence that the use of flipped learning strategies continues to have a significant effect compared to traditional strategies, both in the past and present.

The results of the analysis of the ability type factor obtained a Qb value of 76.11, this value is greater than the ÷2 value (df = 6; p = 0.05). This result interprets that the ability type factor influences the effectiveness of the use of flipped learning strategies in foreign language learning for students in higher education compared to traditional strategies. The results of the analysis also show that the application of the flipped learning method in foreign language learning is most effective in improving basic abilities such as basic linguistics (g = 3.11; p < 0.05), grammar (g = 0.93; p < 0.05), general learning achievement (g = 0.75; p < 0.05), and reading skills (g = 0.78; p < 0.05) compared to more difficult skills such as writing (g = 0.36; p < 0.05) and speaking skills (g = 0.69; p < 0.05). However, the p-value of the Z statistic in all aspects of the ability type group is less than 0.05, which interprets that the implementation of the flipped learning method is significantly effective in improving all skills analyzed when compared to the traditional learning method.

Based on the results of the analysis of the moderator factor of the type of foreign language, it shows the Qb-value = 16.46, this value is greater than the ÷2 value (df = 2; p = 0.05). These results interprets that the variable type of foreign language ability significantly affects the effectiveness of the use of the flipped learning strategies on students' diverse foreign language abilities. The implementation of the flipped learning strategies is most effectively applied to English learning (g = 1.11; p < 0.05), followed by Arabic (g = 0.70; p < 0.05), then Japanese (g = 0.52; p < 0.05). This variation may be because English has a strong influence in various countries compared to Arabic and Japanese, so many students are already familiar with English vocabulary. English is also often studied as an international language at various levels of education in schools, unlike Arabic and Japanese which are only studied in certain groups. This then makes English vocabulary familiar to the ear, and it is easier to find learning resources. However, the p-value of the Z statistic in all aspects of the foreign language type group is less than 0.05, which interprets that the application of the flipped learning method is significantly effective in the three types of foreign language learning analyzed to improve all skills analyzed.

■ CONCLUSION

Meta-analysis of twelve research samples provides important information that the use of the flipped learning strategies has a more significant effect on students' foreign language skills in higher education compared to traditional strategies. In addition, we found that the effectiveness of the

use of the flipped learning approach on foreign language skills was influenced by the variables of the experimental class capacity, the type of ability measured, and the type of foreign language being studied. Therefore, it is important for educators to consider these factors when designing and implementing the flipped learning strategies in foreign language learning.

Although the use of the flipped learning strategies is confirmed to have a significant impact on students' foreign language skills, these results are only based on twelve studies with certain criteria. Several similar studies were not analyzed because the statistical information needed was insufficient. For the purposes of this study, only four moderator variables of the study were studied. Meanwhile, we have not included several other variables, such as the material taught, the duration of the experiment, the type of technology used, and so on. Therefore, further research is recommended for in-depth investigation to determine the effectiveness of the use of the flipped learning strategies using several characteristics or moderator variables that have not been studied.

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