Journal of Computer and Education Research
March 2025 Volume 13 Issue 25
http://dergipark.org.tr/jcer
(ISSN:2148-2896)

Research Article

Effectiveness of the Flipped Classroom Model in Higher Education: A Meta Analysis Study

Metin KUŞ [1,*]

[1] Hitit University, Distance Education Application and Research Center, Çorum, Türkiye

[*] Corresponding Author: metinkus@hitit.edu.tr

Article Info

Received: 24 January 2025
Accepted: 28 February 2025

Keywords: Flipped classroom model, higher education, academic performance, meta-analysis

10.18009/jcer.1625784

Publication Language: English

Abstract

Numerous studies on the impacts of the Flipped Classroom Model (FCM) highlight its growing importance in contemporary education. This meta-analysis synthesizes existing research findings to evaluate the effects of FCM on academic performance, student participation, and satisfaction in higher education institutions (HEIs). A total of 23 studies, encompassing 3,567 students from 14 countries, were included in the analysis. The calculated effect size (d = 0.167) indicates a positive but small effect of FCM on academic performance (Q(23) = 78.226, p < .001). Additionally, findings suggest that FCM enhances student participation and satisfaction by promoting active learning. However, its effectiveness depends on contextual factors such as implementation quality, subject matter, and student demographics. Future research should focus on identifying the specific components of FCM that contribute most significantly to these outcomes and explore strategies for optimizing its implementation across diverse educational setting.

To cite this article: Kuş, M. (2025). Effectiveness of the flipped classroom model in higher education: A meta analysis study. *Journal of Computer and Education Research, 13* (25), 628-653. https://doi.org/10.18009/jcer.1625784

Introduction

Higher Education Institutions (HEIs) are increasingly under pressure to enhance student learning outcomes and demonstrate the effectiveness of their academic programs. While educators have access to a wide range of online teaching tools, it is well-established in the literature that teaching and learning extend beyond the mere application of technology. A key factor in effective teaching is student engagement, which has been identified as critical for fostering meaningful learning (Barkley, 2010; Coates, 2006). This notion is further supported by Bryson and Hand (2007), who found that students were more likely to engage in their learning when they were supported by educators who cultivated inviting learning environments, set high expectations and encouraged the development of meta-cognitive skills.

Contemporary educational practices in HEIs increasingly incorporate blended learning, where students engage in a combination of traditional face-to-face (F2F) instruction and complete supplementary activities outside the classroom, facilitated through various technological resources. Blended learning is becoming a fundamental element of curriculum design and offers learning opportunities that were previously unavailable or inaccessible to students (Lage et al., 2000). A prominent manifestation of this trend is the rise of the Flipped Classroom Model (FCM). In its most common form, the FCM involves the recording of multimedia lectures, enabling students to view the content asynchronously, at their own pace, outside of class. This approach optimizes in-class time for student-centered, synchronous learning activities, such as individual practice (Prober & Khan, 2013). In HEIs settings, it has been suggested that class time should prioritize the application of knowledge (Pluta et al., 2013), thereby providing instructors with opportunities to identify and address errors in student thinking. It could be argued that the FCM, in essence, has been in practice for some time within the broader educational landscape, where students have been required to complete preparatory work prior to class in order to engage in more profound discussions of concepts (Strayer, 2012).

Conceptualization of FCM

The FCM reconfigures traditional instructional model by shifting what was previously taught in class to preparatory work completed outside of class, while in-class time is now dedicated to activities once considered homework (Pierce & Fox, 2012). The COVID-19 pandemic in 2020 gave rise to the adoption and development of blended learning, including the FCM, as a means to ensure the continuity of education during times of disruption (Barriosa et al., 2022). The FCM facilitates technology to deliver instructional content prior to in-person classroom sessions, typically through video lectures or online discussions. This approach allows in-class time to be reserved for more interactive, engaged, and application-oriented learning experiences (Lee et al., 2017). This approach promotes greater student ownership of learning through the completion of preparatory tasks and encourages more interactive engagement during in-class sessions. Advocates of the FCM argue that this pedagogical model offers several advantages: it enables students to learn at their own pace, providing flexibility in when they engage with electronic resources; it optimizes class time for dynamic discussions and problem-solving activities that are directly linked to the aforementioned resources; and it encourages student-led discussions, rather than being entirely driven by the instructor. Consequently, the FCM shifts greater responsibility for learning onto the students, facilitating their progression toward mastery of the material. The significance of this model lies in its potential to equip students, including those already in the workforce, with the critical skills needed to address complex, 21st-century challenges.

The theoretical framework of the FCM is grounded in several key educational theories that emphasize active learning, student-centered pedagogy, and constructivism. The primary theory underlying the FCM is constructivism, which posits that learners build their own understanding and knowledge through experiences and interactions (Piaget, 1973; Vygotsky, 1978). In a flipped classroom, students engage with content independently, often through multimedia resources, which allows them to process information at their own pace. This is aligned with cognitive load theory (Sweller, 1988), which suggests that learning is more effective when extraneous cognitive load is minimized. By delivering content outside the classroom (e.g., via video lectures), students can focus class time on activities that foster deep learning, such as applying concepts through problem-solving or collaborative tasks. Additionally, social constructivism, influenced by Vygotsky's emphasis on social interaction, highlights the importance of peer collaboration during in-class activities, where students can discuss, debate, and construct knowledge together under the guidance of an instructor. The FCM also reflects elements of active learning, which encourages students to be active participants in their learning process rather than passive recipients of information (Bonwell & Eison, 1991). Together, these theoretical underpinnings support the notion that the flipped classroom fosters deeper understanding, critical thinking, and enhanced learning outcomes by creating a dynamic, student-centered learning environment (Bonwell & Eison, 1991).

Effectiveness of FCM on students' academic performance in higher education institutions

Performance outcomes of learning are represented by academic performance (AP) indicating the level attained by students for specific learning goals and demonstrating the competence of students in extracurricular activities as well (Ali et al., 2013). In recent years, many researchers have conducted studies on the effectiveness of the FCM in improving students' academic performance in tertiary education has yielded positive findings across various disciplines. Studies have demonstrated that FCM enhances students' understanding of complex concepts and promotes higher levels of academic achievement compared to traditional teaching methods. For instance, a study by Lai and Hwang (2014) revealed that students in flipped classrooms outperformed their peers in traditional settings on both formative and summative assessments, attributing this success to the increased opportunity for interactive, hands-on learning during class time. Similarly, Zainuddin and Halili (2016) found that FCM encouraged greater engagement and motivation among university students, leading to improved exam scores and overall academic performance. Research also indicates that the model fosters self-directed learning, which is crucial in tertiary education, as students take more responsibility for their learning by reviewing materials at their own pace. However, some studies highlight challenges such as the initial adjustment period for both students and instructors, as well as the technological requirements for effective implementation (O'Flaherty & Phillips, 2015). A two-fold increase in the academic achievement of students in a flipped classroom (İşçi & Yazıcı; 2023; Zengin, 2017), similarly higher score in students who were taught in a flipped classroom environment (Zhonggen & Guifang, 2016). Compared with the traditional teaching approach, the FCM model has the potential to enhance students' learning achievement (Zainuddin & Halili, 2016). Similarly, students who used the FCM model scored higher in the examination than those taught with the traditional method (Behmanesh et al., 2020; Ibrahim & Haruna, 2017; İşçi & Yazıcı; 2023). This is because the model allowed the students to construct their knowledge and take responsibility for their learning which assisted them in having better learning achievement (Asiksoy & Canbolat, 2021). On the other hand, some previous research reported that FCM had no significant effect on students' academic achievement (Cabi, 2018). Despite these challenges, the growing body of research suggests that FCM can be a highly effective pedagogical approach for enhancing academic performance in higher education when implemented with proper planning and support. Most studies consistently highlight the positive impact of FCM on student academic performance, particularly through fostering greater engagement, self-directed learning, and deeper understanding of course material. Many studies have reported statistically significant gains in favour of FCM over the traditional classroom (Ferreri & O'Connor, 2013; Pierce & Fox, 2012; Wilson, 2013). The findings suggest that the model is effective in improving both knowledge retention and the ability to apply theoretical concepts in practical settings. Hence, the hypothesis 1 was formulated as follows:

H1: FCM significantly increases student academic performance of students in higher education institutions

Effectiveness of FCM on students' levels of participation and satisfaction in higher education institutions

The use of FCM has shown considerable effectiveness in enhancing students' participation and satisfaction in HEIs. In a flipped classroom, students engage with instructional content outside of class, such as through videos or readings, and use class time for interactive activities like discussions, problem-solving, and group work. This approach fosters active learning and greater student involvement. Research indicates that students in flipped classrooms tend to demonstrate higher levels of engagement and intrinsic motivation due to the interactive and student-centered nature of the learning environment (Bergmann & Sams, 2012). Additionally, flipped classrooms allow for personalized learning, giving students more control over their pace, which has been linked to increased motivation (Lage et al., 2000). In contrast, traditional lecture-based methods often lead to passive learning, which can contribute to disengagement and lower motivation (Bonwell & Eison, 1991). Overall, the FCM significantly enhances both participation and motivation by promoting an active, learner-centered approach to education. FCM is far better than the traditional teaching approach in terms of increasing students' engagement (Aycicek & Yelken, 2018; Hava, 2021; Smallhorn, 2017; Sofroniou, 2020). For instance, it was found that flipped classroom enhanced students' engagement in comparison to the traditional classroom (Abdel-Maksoud, 2019; Talan & Gulsecen, 2019). FCM model can be a valuable teaching strategy due to its maximum time for practical activities (Samaila et al., 2021) and chances for one-on-one interaction between students and teachers (Özen-Ünal et al., 2023; Xu & Shi, 2018). Overall FCM has positive impact on learning (Larson & Yamamoto, 2013; Lucke et al., 2013), any place/any time access to online multimedia resources, including videos (Boucher et al., 2013; Forsey et al., 2013), working with peers and sharing ideas in class (Ferreri & O'Connor, 2013; Love et al., 2014), increased opportunities for interaction with instructors (Lage et al., 2000; Pierce & Fox, 2012), and greater self-confidence (Ferreri & O'Connor, 2013; Pierce & Fox, 2012). Most studies have reported that attendance, engagement, and motivation increased when FCM was used, with student attendance, in particular, being higher in flipped classrooms than in traditional classrooms (Butt, 2014; Forsey et al., 2013; Lucke et al., 2013). Furthermore, engagement has been shown to increase substantially when FCM was used (Lucke et al., 2013). The FCM has also been shown to have a positive impact on student motivation (Lage et al., 2000), especially when quizzes were a routine part of the assessment component (Wilson, 2013). Hence, the hypothesis 2 was formulated as follows:

H2: FCM significantly increases students' levels of participation and satisfaction in higher education institutions.

In this context, economic constraints faced by universities may drive the adoption of the FCM as a cost-effective, student-centered approach to curriculum delivery, especially considering rising student enrolments, reductions in national funding, and institutional structures that prioritize faculty research over student learning. The rapid advancement of digital technologies within the HEIs presents both a challenge to traditional didactic teaching methods that have prevailed for decades and an opportunity for dynamic, innovative approaches to student learning. Moreover, universities are under increasing pressure to remain at the forefront of technological and educational advancement to sustain student retention and enhance graduate outcomes. Research indicates that to effectively engage students and foster meaningful learning, teaching approaches that extend beyond traditional lecture-based instruction are the most effective (Ferreri & O'Connor, 2013). This shift is driven by two key factors: first, the availability of a wide range of technologies that can enhance student learning; and second, the expectations of students, particularly those from the millennial generation, who demand immediate, interactive learning experiences. In response to these evolving expectations, universities worldwide have acknowledged the integration of technology, which is essential for promoting learning, sustaining student engagement, and improving student satisfaction. In light of these facts, this meta-analytic study will contribute to a better understanding of the FCM concept in all its aspects and will help researchers working in this area by pointing out research gaps and trends. The study is also significant in that it will provide graduate students and other researchers, who may be interested in the FCM concept but lack extensive experience in this field, with the opportunity to collectively view the existing research findings, make comparisons, and easily access relevant studies in the literature. From the perspective of practitioners, the concept of FCM, which can be related to various variables, may raise social awareness. In this context, the current meta-analysis study aims to present the results obtained by examining research conducted between 2016 and 2024 on the FCM concept. The following Research Questions (RQs) have been addressed in the study:

RQ1: What is the impact of the flipped classroom model on student academic performance in Higher Education Institutions?

RQ2: What is the impact of the flipped classroom model on students' participation and satisfaction in Higher Education Institutions?

Method

The approach for conducting this meta-analysis is consistent with a PRISMA protocol (Kitchenham & Charters, 2007; Moher et al., 2016; Page et al., 2021).

Eligibility Criteria

After reviewing related literature, eligibility criteria determined to examine the association between FCM and AP. To minimize publication bias, the aim was to retrieve data from both published and unpublished studies. Inclusion criteria. Studies were considered eligible if they met the following criteria: (i) Studies must fall within the scope of the impact of FCM and AP, (ii) Student AP available in terms of Grade Points Average (GPA), test scores, or self-report, (iii) Studies must report sufficient and appropriate data to calculate effect sizes, (iv) Studies must be publicly available either online or in library archives, (v) Studies must be published in English. Exclusion criteria: to facilitate the replicability of the present meta-analysis, studies were excluded if: (i) Studies which is out of scope and assess a multidimensional or complex phenomenon (ii) Studies that reported insufficient data for effect sizes, (iv) The sample consisted of less than 30 participants (Lin, 2018).

Data Sources and Search Strategies

The following two databases were searched for potentially eligible studies: Web of Science and Google Scholar. To conduct a comprehensive and systematic search, the following keywords were used: “Flipped Classroom Model” OR “Flipped Learning” OR “Inverted Classroom” OR “Flipped Teaching” OR “Reverse Instruction” AND “Academic Performance” OR “Academic Achievement” OR “Academic Outcome” OR “GPA”. A thorough literature search was carried out by two independent researchers in December 2024, across these major databases. Given the fast-evolving nature of social media research, only literature from the past decade (2016–2024) was included. Inter-coder reliability was found to be 0.97 for abstracts/titles and 0.93 for full texts (Freelon, 2013). The first and second researchers independently selected studies through a sequential review of (a) their titles/abstracts and (b) their full texts. In cases where duplicate data were identified, only data from peer-reviewed publications were used. Any disagreements were resolved through discussion.

Results of the Search Strategy

A total of 2950 articles were initially gathered through the search process and entered into a comprehensive coding form. This meta-analysis employed a two-phase screening approach to apply the inclusion and exclusion criteria. In the first phase, both the first and second researchers independently reviewed the titles and keywords of the articles to assess their relevance and ensure the inclusion criteria were strictly followed. During this phase, 2729 duplicate articles were removed. Additionally, studies that did not meet the selection criteria were excluded, (n: 136) leaving 85 articles after the first phase. In the second phase, the full texts of the remaining articles were obtained and carefully reviewed by two researchers. A coding sheet was developed for this stage, and both researchers independently evaluated the full texts to determine their suitability based on the inclusion criteria. As a result, only 23 articles met the criteria and were included in the final analysis. The coding variables included 9 categorical moderators: (a) authors' names and publication year, (b) study title, (c) country, (d) sampling group, (e) educational level, (f) research design, (g) academic performance indicators, (h) constructs, (ı) quality. These moderator variables were determined a priori and incorporated study characteristics into the coding forms and this process was guided by hypothesis and research questions of the study.

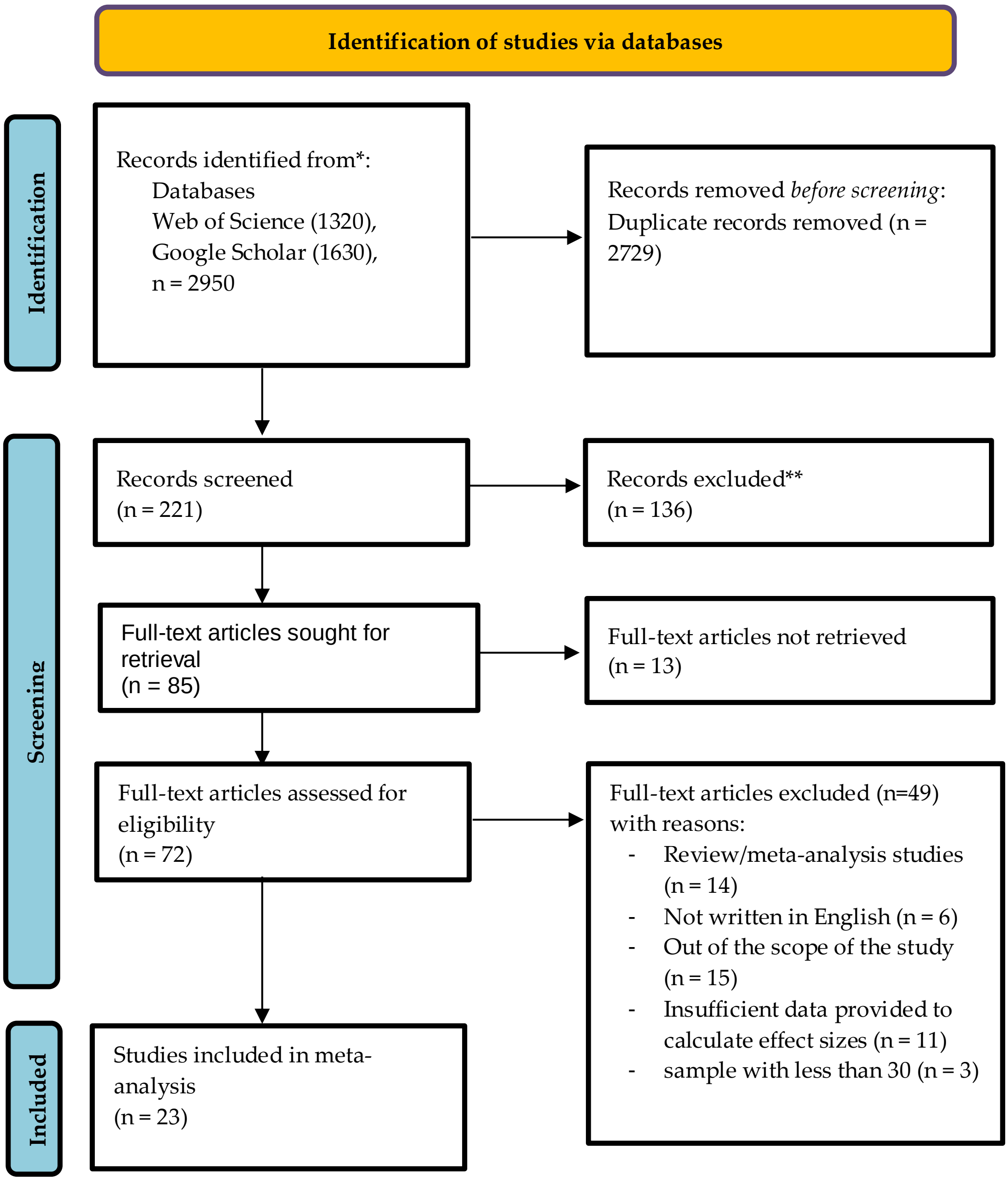

Figure 1. Flow diagram for meta-analysis (Page et al., 2021).

Data Analysis Procedure

After coding all the data and ensuring they met the inclusion criteria for analysis, the prepared dataset was transferred to the JAMOVI 2.5 software package for final verification. Appropriate analysis methods were then selected. Using the MAJOR add-on within JAMOVI, the correlation coefficient was calculated based on the author names, sample sizes (n values), and r values from the studies. A random-effects model was applied to interpret the findings (Jeong, 2016; Kim et al., 2017). This model assumes that errors arise not only from sampling procedures but also from additional between-study variance (Jeong, 2016; Yoo et al., 2020). In analyses using this method, effect sizes are adjusted by the inverse of the variance's weight, accounting for both sampling error and between-study error (Yoo et al., 2020). Effect sizes in the study were calculated following Cohen's guidelines (Lee et al., 2016). The I-square (I^2) statistic was used to estimate the degree of confidence interval overlap and is interpreted as indicating low (25%), moderate (50%), or high (75%) levels of total variance attributable to covariates (Kim et al., 2019). A high I^2 value suggests significant heterogeneity, supporting the use of a random-effects model for the meta-analysis (Hwang et al., 2012).

Publication Bias

Meta-analyses are often susceptible to publication bias, where studies with significant results are more likely to be published, potentially skewing the overall effect size when synthesizing results from multiple studies (Dontre, 2021; Kim et al., 2017). To address this issue, it was assessed the symmetry of the effect distribution by visually inspecting funnel plots and performing Begg and Mazumdar's regression tests (Alenezi & Brinthaupt, 2022; Lim et al., 2021; Mansour et al., 2020). Additionally, trim-and-fill analyses were used to estimate the number of potentially missing studies and evaluate their impact on the overall meta-analytic effect (Shen, 2019). Each study provided details on the number of participants, effect size (Pearson's r), confidence intervals (lower and upper bounds), relative weight, residual values, and the summary effect size if excluded from the analysis. Descriptive statistics were visualized using Microsoft Excel. For moderator analyses, appropriate criteria were applied, and the relevant analyses were incorporated accordingly.

Evaluation Criteria for Quality Assessment of Related Articles

To rigorously assess the methodological quality of the studies included in this meta-analysis, Guidelines of Kitchenham and Charters (2007) were used. While most quality checklists in existing academic literature adhere to a combination of established guidelines, this study proposed a set of questions derived from widely used checklists and guidelines. These questions were designed to evaluate the design, conduct, analysis, and conclusions of each study included in the meta-analysis. The Evaluation Criteria (EC) presented below:

EC1: The aims of the study clearly defined.

EC2: The context in which the study was conducted adequately described.

EC3: The research design appropriate for addressing the study aims.

EC4: The characteristics of participants clearly defined.

EC5: The data collection methods of the study thoroughly described.

EC6: The study has received a sufficient number of citations.

EC7: Study provides a detailed description and justification of the data analysis procedures

EC8: Results of the study clearly presented.

EC9: Discussion and conclusion clearly compare the findings of the study with existing literature.

EC10: The study contributes to existing literature.

The scoring procedure assigned a value of 1 for "Yes" and 0 for "No," allowing studies to score between 0 and 10 points. Papers with a score greater than 8 (>8) were selected for inclusion in this meta-analysis. The results of the quality assessment are presented in Table 1.

Table 1. Result of quality assessment

Authors	The Name of Publishing Journal	Number of Citations	Quality Score
Gómez-Tejedor et al., (2020)	Computers & Education	42	10
Talan & Gulsecen, (2019)	Turkish Online Journal of Distance Education	26	8
Samaila et al., (2024)	Journal of Applied Research in Higher Education	7	9
Saglam & Arslan (2018)	World Journal of Education	65	8
Celik et al., (2021)	Electronic Journal for Research in Science & Mathematics Education	16	8
Bintz et al., (2024)	Frontiers in Education	0	8
Gondal et al., (2024)	Cogent Education	3	8
Tsai et al., (2016)	Univ Access Inf Soc	50	9
Kay et al., (2019)	Journal of Computing in Higher Education	159	10
Mengesha et al., (2024)	BMC Medical Education	1	9
Aydin & Demirer (2022)	International Journal of Educational Technology in Higher Education	30	8
Kim (2018)	Korean Journal of English Language and Linguistics	15	9
Angelini & García-Carbonell (2019)	International Journal of Educational Technology in Higher Education	52	8
Boyraz & Ocak (2017)	Journal of Language and Linguistic Studies	89	9
Karaoglan Yılmaz et al., (2017)	Turkish Online Journal of Educational Technology	16	8
Teng (2017)	The Journal of AsiaTEFL	55	8
Afzal & Masroor (2019)	Journal of the College of Physicians and Surgeons Pakistan	22	8
Shaari et al., (2021)	Studies in English Language and Education	17	8
Leis & Brown (2018)	The EUROCALL Review	22	8
Sun & Wu (2016)	International Review of Research in Open and Distributed Learning	222	10
Sadik & Abdulmonem (2021)	Anatomical Sciences Education	113	9
Huang et al., (2020)	BMC Medical Education	49	8
Hava (2021)	Contemporary Educational Technology	42	8
Total Research: 23 Total Sample Size: 3567			

Finding

Description of Studies

Table 1 shows that 23 studies on academic performance (k = 23) and a total sample of 3567 participants were analyzed. Studies published between 2016 and 2024 were included in the meta-analysis. The main characteristics of these studies are summarized in Table 2. All 23 studies were published in peer-reviewed journals. Academic achievement was measured using final grades, achievement tests, performance assignments and FCM constructs were academic performance, student engagement, satisfaction and success. Among the retrieved studies, Türkiye emerged as the leading contributors, with 7 studies. The meta-analysis included samples of students in tertiary education. The analysis and results of the research presented in tables and figures.

Table 2. Characteristic of the studies

Authors and the year of publication	Study Title	Country	N	R^2	Grade Level	Academic Performance Indicator	FCM Construct	Research Design
Gómez-Tejedor et al., (2020)	Effectiveness of flip teaching on engineering students' performance in the physics lab	Spain	1233	0.013	HEIs	Final Grades	Academic performance	Experimental
Talan & Gulsecen, (2019)	The Effect of a Flıpped Classroom on Students' Achıevements, Academic Engagement and Satisfaction Levels	Türkiye	119	0.470	HEIs	Final grades, Academic engagement scale	Students' achievement and engagement	Quasi-experimental
Samaila et al., (2024)	A new guided flipped learning model for lifelong learning	Nigeria, Malaysia, Saudi Arabia	173	0.070	HEIs	ICT Achievemet Test, Engagement Questionnaire	Students' achievement and engagement	Quasi-experimental
Saglam & Arslan (2018)	The Effect of Flipped Classroom on the Academic Achievement and Attitude of Higher Education Students	Türkiye	56	0.232	HEIs	Achievement Test, Attitude Scale	Academic achievement, Student attitudes	Quasi-experimental
Celik et al., (2021)	The Effects of the Flipped Classroom	Türkiye	84	0.090	HEIs	Self-efficacy and Attitude Scale	Self-efficacy, Attitudes	Sequential explanatory design

	Model on the Laboratory Self-Efficacy and Attitude of Higher Education Students							
Bintz et al., (2024)	Components of the flipped classroom in higher education: disentangling flipping and enrichment	Germany	413	0.024	HEIs	Achievement Test	Learning Success	Quasi-experimental
Gondal et al., (2024)	Impact of the flipped classroom on students' academic performance and satisfaction in Pharmacy education: a quasi-experimental study	Pakistan	92	0.036	HEIs	Achievement Test, Satisfaction Survey	Academic performance, satisfaction	Quasi-experimental
Tsai et al., (2016)	How to solve students' problems in a flipped classroom: a quasi-experimental approach	China, Taiwan	126	0.050	HEIs	Performance assignments	Computing skills	Quasi-experimental
Kay et al., (2019)	A comparison of lecture-based, active, and flipped classroom teaching approaches in higher education	Canada	103	0.044	HEIs	Online Quizzes, Student Learning Experience Survey	Active learning	Convergent parallel design
Mengesha et al., (2024)	Assessing the effectiveness of flipped classroom teaching–learning method among undergraduate medical students at gondar university, college of	Ethiopia	100	0.077	HEIs	Online instructional materials interactive activities.	Academic performance, Student engagement, and satisfaction	Quasi-experimental

	medicine and health sciences: an interventional study							
Aydin & Demirer (2022)	Are flipped classrooms less stressful and more successful? An experimental study on college students	Türkiye	44	0.378	HEIs	Course success test, The Assignment Stress Scale	Assignment stress, Academic achievement	Quasi-experimental
Kim (2018)	Effects of Flipped Learning on the Learning of English Vocabulary	Korea	57	0.149	HEIs	Vocabulary proficiency tests	Flipped learning	Quasi-experimental
Angelini & García-Carbonell (2019)	Enhancing students' written production in English through flipped lessons and simulations	Spain	121	0.276	HEIs	Students' progress in written production	Ssimulation-based and flipped instruction	Quasi-experimental
Boyraz & Ocak (2017)	Implementation of flipped education into Turkish EFL teaching context	Türkiye	90	0.209	HEIs	Academic success and retention of knowledge	Impact of FCM	Quasi-experimental
Karaoglan Yılmaz et al., (2017)	The Effect of Structure in Flipped Classroom Designs for Deep and Surface Learning Approaches	Türkiye	119	0.353	HEIs	Achievement test	Impact of FCM	Quasi-experimental
Teng (2017)	Flipping the classroom and tertiary level EFL students' academic performance and satisfaction	Hong Kong	90	0.335	HEIs	Academic assessment and Questionnaire	Academic performance and satisfaction levels	Quasi-experimental
Afzal & Masroor (2019)	Flipped classroom model for teaching undergraduate students in radiology	Pakistan	40	0.002	HEIs	The scores clerkship test	Impact of FCM	Quasi-experimental
Shaari et al.,	Investigating	Malaysia	133	0.369	HEIs	Improvement	Impact of	Quasi-

(2021)	the impact of flipped classroom on dual language learners' perceptions and grammatical performance					in English grammar	FCM	experimental
Leis & Brown (2018)	Flipped learning in an EFL environment: Does the teacher's experience affect learning outcomes?	Japan	38	0.287	HEIs	Composition-writing proficiency	Impact of FCM	Quasi-experimental
Sun & Wu (2016)	Analysis of Learning Achievement and Teacher–Student Interactions in Flipped and Conventional Classrooms	China	181	0.00.	HEIs	Teacher–student interaction questionnaire, learning achievement	Impact of FCM	Quasi-experimental
Sadik & Abdulmonem (2021)	Improvement in student performance and perceptions through a flipped anatomy classroom: shifting from passive traditional to active blended learning	Saudi Arabia	46	0.044	HEIs	Delivering the anatomy course	Impact of FCM	Quasi-experimental
Huang et al., (2020)	Effects of a quasi-experimental study of using flipped classroom approach to teach evidence-based medicine to medical technology students	Taiwan	62	0.413	HEIs	Improve their learning efficiency, Satisfaction survey	Impact of FCM	Quasi-experimental
Hava (2021)	The Impact of Digital Citizenship Instruction through Flipped Classroom	Türkiye	147	0.006	HEIs	Learning performance, self-regulated learning,	Impact of FCM	Quasi-experimental

	Model on Various Variables	

HEIs: Higher Education Institutions

The characteristics and results of the studies are presented in Table 2. According to the analysis results, the effect size (d) was calculated as 0.167 and the standard error (se) was 0.035. p < 0.001 indicates that the calculated effect is statistically significant. The 95% confidence interval is [0.097 - 0.238], indicating that the effect size is positive and small.

Table 3. Meta-analysis Results

	Sample		*Effect Size Statistic*				*Heterogeneity*				***Publication Bias***
	k	**N**	**Estimate *(d)***	**se**	***p***	**%95 CI**	**Tau²**	**I²**	**Q**	***p***	**Begg and Mazumdar p**
Academic Performance	23	3567	0.167	0.035	<.001	[0.097 – 0.238]	0.018	%72.24	78.226	<.001	0.077

According to the heterogeneity analysis, Tau² value was calculated as 0.018. The I^2 value is 72.24%, indicating that the heterogeneity between the studies is high. The Q statistic was found to be 78.226 and p < 0.001, indicating that the heterogeneity was statistically significant. These results show that there are significant differences between the studies.

In terms of publication bias, the Begg and Mazumdar test result was calculated as p = 0.077. This value indicates that publication bias is not statistically significant but may be a low-level effect. Overall, the findings of this meta-analysis suggest that there is a statistically significant but small effect size between variables related to academic performance and a high level of heterogeneity across studies.

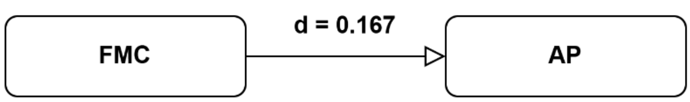

Figure 2. Theoretical Model of Meta-Analysis

Table 4 presents the results of the subgroup analysis. In this analysis based on the academic performance variable, 23 studies (k = 23) and a total of 3,567 participants were examined. The effect size (d) for the intercept was 0.291 with a standard error (se) of 0.078.

The corresponding p-value was 0.005, with a confidence interval (95% CI) of [0.066 - 0.372]. These values indicate that the cut-off point is significant.

The effect size calculated for the Affected by FCM group was -0.032 with a standard error of 0.044. The corresponding p-value is 0.458 and the confidence interval lies between [-0.119 - 0.054]. These values indicate that the effect size of this subgroup is not statistically significant. In terms of heterogeneity statistics, the I² value was found to be 72.84%, which indicates a high level of heterogeneity in the studies. The Q statistic was calculated as 77.830.

Table 4. Meta-analysis Results

Academic Performance	*Sample*		*Effect Size Statistic*				*Heterogeneity*	
Subgroup	**k**	**N**	**Estimate *(d)***	**se**	**p**	**%95 CI**	**I²**	**Q**
Intercept	23	3567	0.291	0.078	0.005	[0.066 – 0.372]	%72,84	77.830
Affected by FCM			-0.032	0.044	0.458	[-0.119 – 0.054]		

According to the Begg and Mazumdar test, p = 0.077 suggesting no evidence of publication bias. The forest plot and funnel plot for the results are presented in the following figures respectively.

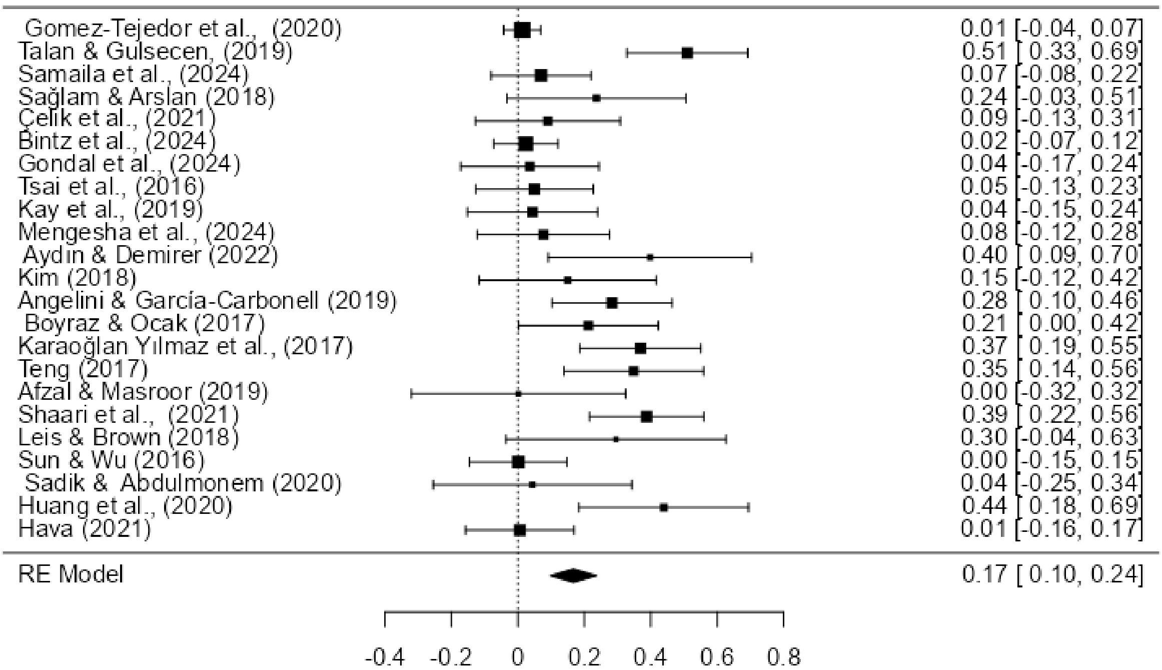

Figure 3. Forest plot of academic performance results

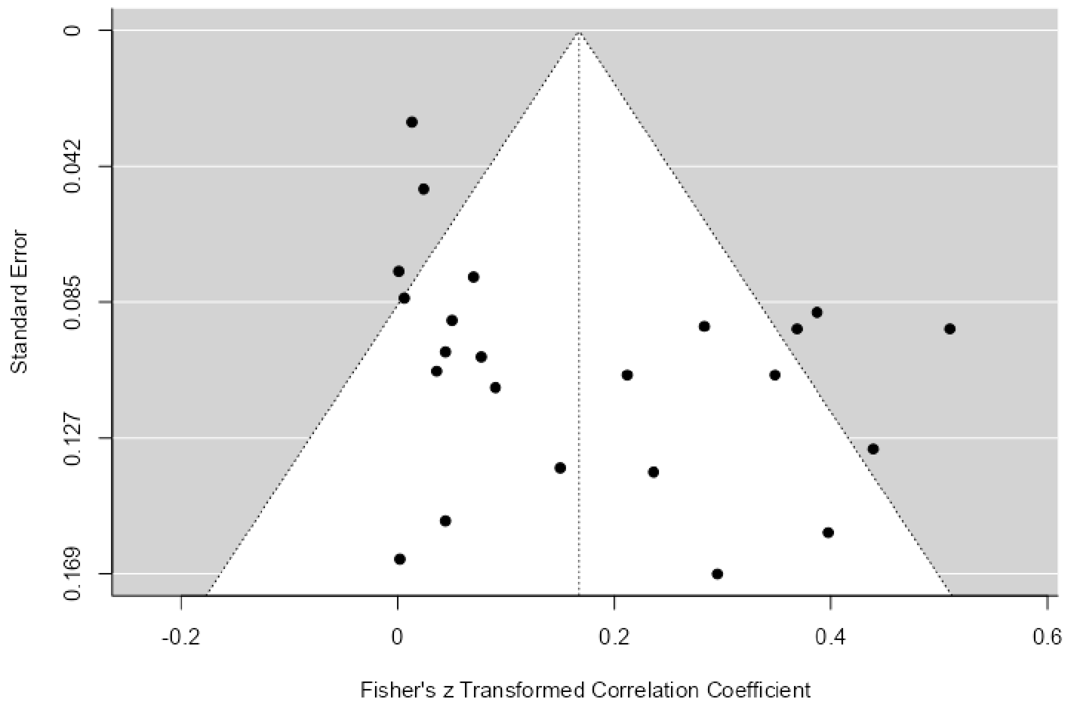

Figure 4. Funnel plot of academic performance result

Discussion

The flipped classroom model (FCM) has emerged as a pedagogical approach that inverts the traditional teaching-learning process by delivering instructional content outside the classroom, typically online, and using class time for interactive activities. This meta-analysis examines the impact of FCM on student academic performance (AP) and students' participation and satisfaction in tertiary education.

Impact on Academic Performance

Research Question 1 (RQ1) explores the impact of the flipped classroom model on student academic performance in HEIs. The hypothesis (H1) posits that FCM significantly increases academic performance. The overall effect size of 0.167 suggests a small but positive impact of FCM on academic performance. This finding aligns with previous studies, such as those by Bishop and Verleger (2013) and O'Flaherty and Phillips (2015), which highlight the benefits of FCM in fostering deeper understanding and better retention of knowledge, resulting in improved academic outcomes. Several factors may contribute to this effect. The flipped model allows students to engage with learning materials at their own pace, promoting better preparation for in-class activities. The interactive and collaborative nature of in-class sessions fosters higher-order thinking skills, such as analysis and synthesis, which are crucial for academic success. Moreover, students have more opportunities for individualized support from instructors during class time, which may help address specific learning gaps. However, it is essential to note that the effect size, while positive, is relatively modest. This could be due to variations in how FCM is implemented across different studies, including differences in content delivery methods, the extent of in-class activities, and the level of instructor support. Further research should explore these moderating factors to understand better how to maximize the benefits of FCM on academic performance.

Impact on Participation and Satisfaction

Research Question 2 (RQ2) investigates the impact of FCM on students' participation and satisfaction, with Hypothesis 2 (H2) suggesting that FCM significantly enhances these aspects. The interactive and student-centered nature of FCM inherently encourages higher levels of participation. By shifting passive learning to pre-class activities, class time is utilized for discussions, problem-solving, and collaborative projects, which require active student involvement. Studies like Abeysekera and Dawson (2015) have highlighted that FCM can increase student engagement by providing a more dynamic and interactive learning environment. This increased engagement often translates to higher satisfaction levels, as students feel more involved and invested in their learning process. Moreover, the autonomy and flexibility provided by FCM can cater to diverse learning preferences, further enhancing satisfaction. Additionally, Chen et al. (2018) found that students in flipped classrooms reported higher levels of engagement and satisfaction compared to those in traditional settings. The active learning components of FCM, such as group work and discussions, create a more dynamic and inclusive learning environment, which is conducive to greater student involvement. The increased satisfaction can be attributed to the perceived autonomy and control over learning that FCM provides. Students appreciate the flexibility to learn at their own pace before class and the opportunity to clarify doubts and deepen their understanding during in-class activities. Despite these positive outcomes, the success of FCM in increasing participation and satisfaction may depend on several factors, including the quality of pre-class materials, the design of in-class activities, and the overall course structure. Instructors play a crucial role in facilitating effective FCM environments by providing clear guidance and creating a supportive atmosphere that encourages active participation.

The overall effect size of 0.167, though moderate, indicates that FCM is an effective instructional strategy in HEIs. It suggests that while the model may not drastically transform academic outcomes, it contributes positively to both academic performance and the overall learning experience. The integration of FCM can be particularly beneficial in courses that require higher-order thinking skills and active participation. However, it is important to note the variability in the implementation of FCM across different contexts and subjects, which may account for the variation in effect sizes observed in the meta-analysis. Factors such as the nature of the course content, the instructors' expertise in facilitating active learning, and the students' readiness to adapt to this model play significant roles in determining the effectiveness of FCM.

Conclusion

The findings of this meta-analysis indicate that the Flipped Classroom Model has a positive impact on academic performance, student participation, and satisfaction in HEIs. While the overall effect size for academic performance (d = 0.167) is modest, it suggests that FCM can contribute to improved learning outcomes when implemented effectively. Furthermore, by emphasizing active learning, FCM fosters higher levels of student engagement and satisfaction. The results underscore the importance of contextual factors in shaping the effectiveness of FCM. Future research should aim to pinpoint the specific elements of FCM that most significantly influence academic performance, participation, and satisfaction, as well as explore long-term effects through longitudinal studies. By doing so, educators can maximize the potential of FCM to enhance student learning experiences in HEIs.

Ethical Committee Permission Information

Since this study did not collect data from human or animal subjects, it is not within the scope of studies requiring ethics committee approval. However, the principles of scientific research and publication ethics were followed in the preparation of the study.

Author Contribution Statement

Metin KUŞ: *Conceptualization, design, literature review, methodology, data collection, data analysis, interpretation, writing, and editing.*

References

Abdel-Maksoud, N. F. (2019). Investigating the effect of blending MOOCs with flipped classroom on engagement in learning and course grades. *International Educational Research*, *2*(2), 8–25. https://doi.org/10. 30560/ier.v2n2p8

Abeysekera, L., & Dawson, P. (2015). Motivation and cognitive load in the flipped classroom: Definition, rationale, and a call for research. *Higher Education Research & Development*, *34*(1), 1-14.

Alenezi, W., & Brinthaupt, T. M. (2022). The use of social media as a tool for learning: Perspectives of students in the faculty of education at Kuwait University. *ContemporaryEducationalTechnology*, *14*(1), 340.

Ali, S., Haider, Z., Munir, F., Khan, H., & Ahmed, A. (2013). Factors contributing to the students' academic performance: a case study of Islamia university sub-campus. *Am J Educ Res.* 1, 83-9. https://doi.org/10.12691/education-1-8-3

Asiksoy, G., & Canbolat, S. (2021). The effects of the gamified flipped classroom method on petroleum engineering students' pre-class online behavioural engagement and achievement. *International Journal of Engineering Pedagogy (iJEP)*, *11*(5), 19–36. https://doi.org/10.3991/ijep.v11i5.21957

Aycicek, B., & Yelken, T. Y. (2018). The effect of flipped classroom model on students' classroom engagement in teaching English. *International Journal of Instruction*, *11*(2), 385–398. https://doi.org/10.12973/iji.2018.11226a

Barkley, E. (2010). *Student engagement techniques: A handbook for college faculty*. Jossey-Bass.

Barriosa, T. A., Rojasa, S. L., Movillab, J. S., Ibáñeza, S. F. U., & Taboadaa, A. H. (2022). Characterization of flipped classroom model in higher education: A perception from educational resilience during covid-19 pandemic. *Procedia Computer Science* 203, 575-582. https://doi.org/10.1016/j.procs.2022.07.082

Behmanesh, F., Bakouei, F., Nikpour, M., & Parvaneh, M. (2020). Comparing the effects of traditional teaching and flipped classroom methods on midwifery students 'practical learning: The embedded mixed method. *Technology, Knowledge and Learning*, *27*, 599–608. https://doi.org/10.1007/s10758-020-09478-y

Bergmann, J., & Sams, A. (2012). Bergmann, J., & Sams, A. (2012). *Flip your classroom: Reach every student in every class every day.* International Society for Technology in Education; ASCD.

Bishop, J. L., & Verleger, M. A. (2013). The flipped classroom: A survey of the research. *ASEE National Conference Proceedings*, *30*(9), 1-18.

Bonwell, C. C., & Eison, J. A. (1991). *Active learning: Creating excitement in the classroom*. ERIC Clearinghouse on Higher Education.

Boucher, B., Robertson, E., Wainner, R., & Sanders, B. (2013). "Flipping" Texas State University's physical therapist musculoskeletal curriculum: Implementation of a hybrid learning model. *Journal of Physical Therapy Education*, *27*(3), 72.

Bryson, C., & Hand, L. (2007). The role of engagement in inspiring teaching and learning. *Innovations in Education and Teaching International*, *44*(4), 349–362. http://dx.doi.org/10.1080/1 4703290701602748

Butt, A. (2014). Student views on the use of a flipped classroom approach: Evidence from Australia. *Business Education and Accreditation*, *6*(1), 33–44.

Cabi, E. (2018). The impact of the flipped classroom model on students 'academic achievement. *International Review of Research in Open and Distributed Learning*, 19(3), 202–221. https://doi.org/10.19173/irrodl.v19i3.3482

Chen, Y., Wang, Y., Kinshuk, D., & Chen, N.-S. (2018). Is FLIP enough? Or should we use the FLIPPED model instead? *Computers & Education*, 124, 51-63.

Coates, H. (2006). *Student engagement in campus-based and online education: University connections*. Routledge.

Dontre, A. J. (2021). The influence of technology on academic distraction: *A review. Human Behavior and Emerging Technologies*, 3(3), 379–390. https://doi.org/10.1002/hbe2.229

Ferreri, S., & O'Connor, S. K. (2013). Instructional design and assessment. Redesign of a large lecture course into a small group learning course. *American Journal of Pharmaceutical Education*, 77(1), 1–9. https://doi.org/10.5688/ajpe77113

Forsey, M., Low, M., & Glance, D. (2013). Flipping the sociology classroom: Towards a practice of online pedagogy. *Journal of Sociology*, *49*(4), 471–485.

Freelon, D. (2013). ReCal OIR: Ordinal, interval, and ratio intercoder reliability as a web service. *International Journal of Internet Science*, *8*(1), 10–16

Hwang, K.-H., Yoo, Y.-S., & Cho, O.-H. (2012). Smartphone overuse and upper extremity pain, anxiety, depression, and interpersonal relationships among college students. *J. Korea Contents Assoc.12*, 365–375. https://doi.org/10.5392/JKCA.2012.12.10.365

Ibrahim, A., & Haruna, A. J. (2017). Effects of flipped and conventional teaching approaches on performance and retention ability of students in advance financial accounting in Abubakar Tafawa Balewa University Bauchi, Nigeria. *Jurnal Psikologi Malaysia*, *31*(2), 12-20.

İşçi, T.G. & Yazıcı, K. (2023). The effect of the use of the flipped learning model in the social studies course on the students' academic success and higher-order thinking skills. *International e-Journal of Educational Studies*, 7 (13), 46-64. https://doi.org/10.31458/iejes.1216865

Jeong, G.-C. (2016). Relationships among mental health, internet addiction, and smartphone addiction in university students. *J. Korea Contents Assoc*. *16*, 655–665. https://doi.org/10.5392/JKCA.2016.16.04.655

Kim, H. J., Min, J. Y., Kim, H. J., & Min, K. B. (2017). Accident risk associated with smartphone addiction: A study on university students in Korea. *J. Behav. Addict.* 6, 699–707 https://doi.org/10.1556/2006.6.2017.070

Kim, H. J., Min, J. Y., Kim, H. J., & Min, K. B. (2019). Association between psychological and self-assessed health status and smartphone overuse among Korean college students. *J. Ment. Heal. 28*, 11–16. https://doi.org/10.1080/09638237.2017.1370641

Kitchenham, B., & Charters, S. (2007). Guidelines for performing Systematic Literature Reviews in Software Engineering (EBSE 2007–001). *Tech Rep*. https://doi.org/10.1145/1134285.1134500

Lage, M. J., Platt, G. J., & Treglia, M. (2000). Inverting the classroom: A gateway to creating an inclusive learning environment. *The Journal of Economic Education*, *31*(1), 30–43.

Lai, C. L., & Hwang, G. J. (2014). A learning cycle-based flipped classroom approach to developing students' practical skills in a science course. *Journal of Educational Technology & Society*, 17(3), 1-12.

Larson, S., & Yamamoto, J. (2013). Flipping the college spreadsheet skills classroom: Initial empirical results. *Journal of Emerging Trends in Computing and Information Sciences*, *4*(10), 751–758.

Lee, J., Lim, C., & Kim, H. (2017). Development of an instructional design model for flipped learning in higher education. *Educational Technology Research and Development*, *65*, 427–453. https://doi.org/10.1007/s11423-016-9502-1

Lee, K. E., Kim, S.-H., Ha, T.-Y., Yoo, Y.-M., Han, J.-J., Jung, J.-H., & Jang, J.-Y. (2016). Dependency on smartphone use and its association with anxiety in Korea. *Public Health Rep.* 131, 411–41 https://doi.org/10.1177/003335491613100307

Lim, W. P., Loo, J. Y., Lee, K., Pui, H. M., & Ting, T. T. (2021). The impact of social media on student's academic performance: A survey on TAR UC computing students in Malaysia during COVID-19 pandemic. In *Proceedings of the International Conference on Digital Transformation and Applications*. https://doi.org/10.56453/icdxa.2021.1017

Lin, L. (2018). Bias caused by sampling error in meta-analysis with small sample sizes. *Plos One,* 13(9), e0204056. https://doi.org/10.1371/journal.pone.0204056

Love, B., Hodge, A., Grandgenett, N., & Swift, A. W. (2014). Student learning and perceptions in a flipped linear algebra course. *International Journal of Mathematical Education in Science and Technology*, *45*(3), 317–324.

Lucke, T., Keyssner, U., & Dunn, P. (2013). The use of a classroom response system to more effectively flip the classroom. In *Frontiers in education conference, 2013 IEEE* (pp. 491–495). IEEE. https://doi.org/10.1109/fie.2013.6684872

Mansour, A., Almutairi, H., Alwehaibi, I., Alshowaiman, A., Alsaif, M., & Almutairi, E. (2020). The impact of using social media on the academic performance of Qassim University students, Unaizah, Saudi Arabia. *International Journal of Medicine in Developing Countries*, *4*(12), 2085-2093. https://doi.org/10.24911/ijmdc.51-1600133225

Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., & Stewart, L. A. (2016). Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Rev. Esp. De Nutr. Hum. Y Diet*. 20, 148-160. http://www.systematicreviewsjournal.com/content/4/1/1

O'Flaherty, J., & Phillips, C. (2015). The use of flipped classrooms in higher education: A scoping review. *The Internet and Higher Education*, *25*, 85–95.

Özen-Ünal, D., Yazıcı, E., & Arabacıoğlu, T. (2023). Implications from a modelling based flipped mathematics course. *International e-Journal of Educational Studies,* 7 (15), 465-483. https://doi.org/10.31458/iejes.1286927

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., … Moher, D. (2021). The PRISMA 2020 statement: An updated guideline for reporting systematic reviews. *BMJ, 372*, n71. https://doi.org/10.1136/bmj.n71

Piaget, J. (1973). *To understand is to invent: The future of education*. Viking Press.

Pierce, R., & Fox, J. (2012). Instructional design and assessment: Vodcasts and active learning exercises in a "flipped classroom" model of a renal pharmacotherapy module. *American Journal of Pharmaceutical Education*, 76(10), 1–5.

Pluta, W., Richards, B., & Mutnick, A. (2013). PBL and beyond: Trends in collaborative learning. *Teaching and Learning in Medicine*, 25(1), 9–16.

Prober, C., & Khan, S. (2013). Medical education reimagined: A call to action. *Academic Medicine*, 88, 1407–1410.

Samaila, K., Masood, M., & Chau, T. (2021). Enhancing student's engagement and ICT skills through modified flipped classroom model. *4th International Conference on Education 2021 "Innovative and Sustainable Education in Times of Challenges,"* 78–87.

Shen, J. (2019). Social-media use and academic performance among undergraduates in biology. *Biochemistry and Molecular Biology Education, 47*(6), 615-619.

Smallhorn, M. (2017). The flipped classroom: A learning model to increase student engagement not academic achievement. *Student Success, 8*(2), 43–53. https://doi.org/10.5204/ssj.v8i2.381

Sofroniou, A. (2020). Learning and engagement in the flipped classroom of analytical mathematics. *Journal of Education, Society and Behavioural Science*, *33*(11), 93–111.

Strayer, J. (2012). How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learning Environments Research*, 15, 171–193.

Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, 12(2), 2-285.

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Wilson, S. G. (2013). The flipped class: A method to address the challenges of an undergraduate statistics course. *Teaching of Psychology*, *40*(3), 193–199.

Xu, Z., & Shi, Y. (2018). Application of constructivist theory in flipped classroom — take college English teaching as a case study. *Theory and Practice in Language Studies*, *8*(7), 880–887. https://doi.org/10.17507/tpls.0807.21

Yoo, J. H., Cheon, E. Y., & Kim, H. (2020). Effects of empathy, self-control, and smartphone dependency on interpersonal relationship in nursing students. *J. Korea Acad. Ind. Coop. Soc*. 21, 82–90. https://doi.org/10.5762/KAIS.2020.21.4.82

Zainuddin, Z., & Halili, S. H. (2016). Flipped classroom research and trends from different fields of study. *International Review of Research in Open and Distributed Learning*, 17.

Zengin, Y. (2017). Investigating the use of the Khan Academy and mathematics software with a flipped classroom approach in mathematics teaching. *J Educ Technol Soc*. 20, 89-100.

Zhonggen, Y., & Guifang, W. (2016). Academic achievements and satisfaction of the clicker-aided flipped business English writing class. *Educ Technol Soc*. 19, 298-312.

Appendix 1: References of the Studies Included in the Meta-Analysis

Afzal, S., & Masroor, I. (2019). Flipped Classroom Model for Teaching Undergraduate Students in Radiology. Journal of the College of Physicians and Surgeons Pakistan, 29(11), 1083–1086. https://doi.org/10.29271/jcpsp.2019.11.1083

Angelini, M. L., & García-Carbonell, A. (2019). Enhancing students' written production in English through flipped lessons and simulations. *International Journal of Educational Technology in Higher Education*, *16*(1), 2.

Aydin, B., & Demirer, V. (2022). Are flipped classrooms less stressful and more successful? An experimental study on college students. *Int J Educ Technol High Educ, 19, 55* https://doi.org/10.1186/s41239-022-00360-8

Bintz, G., Barenberg, J., & Dutke, S. (2024). Components of the flipped classroom in higher education: Disentangling flipping and enrichment. *Front. Educ.* 9,1412683 https://doi.org/10.3389/feduc.2024.1412683

Boyraz, S., & Ocak, G. (2017). Implementation of flipped education into Turkish EFL teaching context. *Journal of Language and Linguistic Studies, 13*(2), 426-439.

Celik, H., Pektas, H. M., & Karamustafaoğlu, O. (2021). The effects of the flipped classroom model on the laboratory self-efficacy and attitude of higher education students. *Electronic Journal for Research in Science & Mathematics Education (EJRSME) 25*(2), 47-67.

Gómez-Tejedor, J. A., Vidaurre, A., Tort-Ausina, I., Molina-Mateo, J., Serrano, M. A., Meseguer-Dueñas, J. M., & Riera, J. (2020). Effectiveness of flip teaching on engineering students' performance in the physics lab. *Computers & Education, 144*, 103708. https://doi.org/10.1016/j.compedu.2019.103708

Gondal, S. A., Khan, A. Q., Cheema, E. U., & Dehele, I. S. (2024). Impact of the flipped classroom on students' academic performance and satisfaction in Pharmacy education: a quasi-experimental study, *Cogent Education*, 11(1), https://doi.org/10.1080/2331186X.2024.2378246

Hava, K. (2021). The effects of the flipped classroom on deep learning strategies and engagement at the undergraduate level. *Participatory Educational Research*, *8*(1), 379–394. https://doi.org/10.17275/per.21.22.8.1

Huang, H., Chou, C., Leu, S., You, H., Tiao, M., & Chen, C. (2020). Effects of a quasi-experimental study of using flipped classroom approach to teach evidence-based medicine to medical technology students. *BMC Medical Education, 20 (31), 2-9.* https://doi.org/10.1186/s12909-020-1946-7

Karaoglan Yılmaz, F. G., Öztürk, T., & Yılmaz, R. (2017). The effect of structure in flipped classroom designs for deep and surface learning approaches. *Turkish Online Journal of Educational Technology*, Special Issue for IETC 2017, 732- 750.

Kay, T., MacDonald, T., & DiGiuseppe, M. (2019). A comparison of lecture-based, active, and flipped classroom teaching approaches in higher education. *Journal of Computing in Higher Education. 31,* 449–471. https://doi.org/10.1007/s12528-018-9197-x

Kim, W. Y. (2018). Effects of flipped learning on the learning of English vocabulary. *Korean Journal of English Language and Linguistics, 18*(4), 470-485. https://doi.org/10.15738/kjell.18.4.201812.470

Leis, A., & Brown, K. (2018). Flipped learning in an EFL environment: Does the teacher's experience affect learning outcomes? *The EUROCALL Review*, 26 (1), 3-13.

Mengesha, A. K., Ayele, H. S., Misker, M. F., & Beyna, A. T. (2024). Assessing the effectiveness of flipped classroom teaching–learning method among undergraduate medical students at Gondar University, college of medicine and health sciences: An interventional study. *BMC Medical Education*, 24:1108. https://doi.org/10.1186/s12909-024-06105-7

Sadik, A., & Abdulmonem, W. (2021). Improvement in student performance and perceptions through a flipped anatomy classroom: shifting from passive traditional to active blended learning. *Anatomical Sciences Education*, 14(4), 482-490. https://doi.org/10.1002/ase.201

Saglam, D., & Arslan, A. (2018). The effect of flipped classroom on the academic achievement and attitude of higher education students. *World Journal of Education*, 8(4), 170-176. https://doi.org/10.5430/wje.v8n4p170

Samaila, K., Al-Samarraie, H., Tsong, C. K., & Alzahrani, A. İ. (2024). A new guided flipped learning model for lifelong learning, *Interactive Learning Environments,* https://doi.org10.1080/10494820.2024.2412063

Shaari, N. D., Shaari, A. H., & Abdullah, M. R. (2021). Investigating the impact of flipped classroom on dual language learners' perceptions and grammatical performance. *Studies in English Language and Education*, *8*(2), 690-709.

Sun, J. C., & Wu, Y. (2016). Analysis of learning achievement and teacher- student interactions flipped classroom and conventional classrooms. *Intenational Review of Research in Open and Distrubuted Learning*. 17 (1), 79-99.

Talan, T., & Gulsecen, S. (2019). The effect of a flipped classroom on students' achievements, academic engagement and satisfaction levels. *Turkish Online Journal of Distance Education*, *20*(4), 31–60. https://doi.org/10.17718/tojde.640503

Teng, M. F. (2017). Flipping the classroom and tertiary level EFL students' academic performance and satisfaction. *The Journal of Asia TEFL 14(4), 605-620* http://dx.doi.org/10.18823/asiatefl.2017.14.4.2.605

Tsai, C., Shen, P., Chiang, Y., & Li, C. (2016). How to solve students' problems in a flipped classroom a quasi-experimental approach. *Univ Access Inf Soc 16, 225–233* https://doi.org/*10.1007/s10209-016-0453-4*