A Meta-Analysis Study on the Effectiveness of Flipped Classroom Learning on Students’ Academic Achievement

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Abstract

Flipped classroom learning (FCL), which is focused on offering online video lectures and expecting students to work on and comprehend the material prior to coming to class, has become a popular strategy in recent years, allowing the instructor to reinforce it with metacognitive exercises. Thus, this study will analyze 58 research results from 54 quantitative studies published between 2007 and 2020 to determine the overall influence of FCL on students’ academic attainment. Relevant research was found using academic publishing databases. After that, the sample was meta-analyzed using the Comprehensive Meta-Analysis software. As moderator factors, the kind of publishing, the educational level, and the length of the application were identified. The data indicate that the FCL has a statistically significant influence on student accomplishment (g = 0.976) in the random-effects model. The sample produced a heterogeneous distribution. Additional subgroup analyses using Analog ANOVA indicated that the only statistically significant variable is the time of the application. The study’s objective is to contribute to the increased use of flipped classrooms in educational settings due to their large impact size on academic success. It has pedagogical consequences for teachers to extend the duration of this approach in their classrooms in order to have a greater impact.

Keywords: Academic achievement, Educational technology, Effect size, Flipped classroom learning, Meta-analysis

Suggested Citation

INTRODUCTION

The effective deployment of technology in education continues to be a topic of great interest and scope internationally. While events such as the coronavirus pandemic can help us to appreciate many of its features, the field of education itself is constantly evolving to meet the needs of society. Today’s teachers use technology to assist them to enable students’ learning, understanding, and participation (Prasjo, Habibi, Mukminin & Yaakob, 2020). They have done so by utilizing methods and resources that were previously unthinkable, such as the FCL, which refers to a blended learning process that places the teacher at the center, in contrast to the traditional education approach that is limited to the school environment. In this model, the students study outside the classroom from the videos prepared by the teacher and come to the lesson ready (Kazu & Kurtoglu, 2020). The homework and activity parts are done in the classroom under the guidance of the teacher. It is to enable students to use their time in the most effective and active way. Since no time is spent on lectures, the time spent in the classroom is used more effectively and efficiently for both students and educators (Latorre-Cosculluela, Suarez, Quiroga, Sobradiel, Lozano & Rodriguez, 2021).

Numerous studies have been conducted on the FCL in educational settings. Generally, it has been discovered that it increases students’ motivation for learning (Davies, Dean & Ball, 2013), academic performance (Albahuoth, 2020; Hajebi, 2020; Kithinji, 2020; Wei et al., 2020), positive attitude towards the lecture (Johnston 2017; McLaughlin, Gharkholonarehe & Davidson, 2014). For example, Ugwuanyi, Nduji, Elejere & Omeke (2020) discovered that implementing this approach to learning had a beneficial effect on students’ physics success. Additionally, Iyioglu (2018) discovered that students who came prepared to class were more engaged in class than others. Kang and Shin (2016) also confirmed that the FCL improved learners’ reflective thinking abilities as well as their information literacy. Elian and Hamaidi (2018), on the other hand, concluded that it was more enjoyable than traditional approaches and supported learning. Webb and Doman (2016) carried out an experimental study to investigate the impacts of this model on students’ success. In conclusion, they discovered that students who learned English using this model had a higher rate of success than those who took a traditional course. Similarly, Bhagat, Chang, and Chang (2016) carried out an experimental study and reached similar results. Indeed, almost all research in this field has found this pedagogical model beneficial in terms of developing students’ academic performance as well as their critical thinking, teamwork, and self-assessment competencies.

A cursory review of the literature reveals that numerous independent studies have examined the model’s impact on learners’ academic success. Unfortunately, their findings are so complex that they are useless to researchers and educators. According to various researchers, this approach increases academic achievement (Bolati & Korucu, 2020; Çalışkan, 2019; Gökdaş & Gürsoy, 2018; Najmi, 2020), has moderate effect (Sağlam & Aslan, 2018), or has no effect (Abdullatif, 2020). In light of this situation, the current authors set out to conduct a reputable meta-analysis study known as analysis of analysis (Glass, 1976), in an attempt to systematize the interpretation of previous studies’ findings and to guide future research. With an effort to conduct a meta-analysis that could be used to synthesise the findings was undertaken by Karagöl and Esen in 2018. A similar research also has been reported by Chen, Wang, & Chen (2018); Lag & Saele, (2020); Zheng, Bhagat, Zhen, & Zhang (2020), however, no truly international meta-analysis covering the period 2007-2020 has been conducted. As evidenced by the findings of a meta-synthesis study conducted by Kozikoğlu, (2019), interest in applying FCL has increased in recent years, and the number of local studies has grown steadily since 2017. The rise of distance education, particularly in the aftermath of the coronavirus pandemic, has also increased its popularity, and the continuation of education based on this model has gained prominence throughout the world. As a result, it is believed that a meta-analysis of the issue is necessary to evaluate the quantitative findings of recent studies examining the impact of this approach on academic success. The following questions were posed in support of this primary objective:

- What is the magnitude of the effect of FCL on academic achievement?
- How does the impact of FCL on academic success differ according to moderator factors (publication kind, intervention length, and educational level)?
METHOD

The meta-analysis quantitative approach is selected premised on meta-analytic processes, that include (1) undertaking a literature review, (2) conducting an investigation the moderation effect of a study’s character traits on the outcome measures, (3) trying to calculate the effect sizes of each study’s outcome measurements, and (4) investigating the moderation effect of a study’s features on the outcome measures.

1. Review of the Literature and Selection Criteria

The Firat University Social and Human Sciences Ethics Committee assessed that this work was ethically acceptable at its 97132852/302.14.01/ numbered meeting on 21/12/2020. As a consequence, data were collected from articles, master’s theses, and doctoral dissertations that met the criteria for inclusion specified in Table 1. Between September and December 2020, publications were chosen utilizing national and international databases that are used in the field of education and are available online, including ERIC, Web of Science, EBSCOHost, Google Scholar, SCOPUS, PROQUEST, and CHE Thesis Center. Additionally, the research’s bibliography section indicated older papers that may not have been made available online.

Table 1. Study selection criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Inclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publication period</td>
<td>Completed between 2007 and 2020.</td>
</tr>
<tr>
<td>Publication type</td>
<td>An essay published in a peer-reviewed publication on a national or international level, or a master’s or doctorate thesis.</td>
</tr>
<tr>
<td>Language</td>
<td>English or Turkish.</td>
</tr>
<tr>
<td>Research design</td>
<td>A randomized controlled trial includes a control group. The control group should be instructed in the usual manner, whereas the experimental group should be instructed in the FCL manner.</td>
</tr>
<tr>
<td>Outcome</td>
<td>Academic success</td>
</tr>
<tr>
<td>Implementation</td>
<td>Evaluate the FCL’s impact in the area of education.</td>
</tr>
<tr>
<td>Accessibility</td>
<td>The whole text is accessible.</td>
</tr>
<tr>
<td>Data</td>
<td>The sample size, the standard deviation, and the mean values are all provided.</td>
</tr>
</tbody>
</table>

Figure 1. The search procedure

The researchers developed a list of keywords to aid in resource discovery. During the search, binary combinations of terms such as 'FCL+ academic performance,' ‘inverted learning+ academic success,’ and ‘inverted classes+ learning result’ were searched in all databases. In all, the keyword search
returns 945 articles and theses as a result of the search technique. Following that, 358 studies were discarded due to duplication, and 277 were discarded due to their inadequacy for the research topic. 256 more studies were considered unsuitable based on the inclusion criteria. As a consequence, the research sample was composed of 54 studies. However, since Yousefzadeh and Salimi (2015) demonstrated the influence of the FCL on performance in their study via collaboration with five other disciplines, the researchers were able to expand the sample size to 58. The search and selection procedure are shown in Figure 1 using a Prisma flow diagram.

2. Coding the Study’s Characteristics

The studies’ data were coded by creating an Excel file and sequentially numbered the experiments. To assure the reliability of the data encoded in the study, the coding procedure was carried out by two coders, one of whom has a PhD in the subject of curriculum teaching and education, and another of whom is an expert in that sector. After the coding procedure was done, the programmers’ compatibility was determined. Calculation of inter-encoder dependability (consensus / (consensus + disagreement) x 100) (Miles & Huberman, 1994) and revealed a 96% reliability.

A meta-analysis study’s validity is proportional to the validity of the research it incorporates (Petitti, 2000). The validity results from the research included in the study were analyzed in this context, and every effort was taken to assure their validity. Additionally, papers that used erroneous data and research techniques were excluded from the meta-analysis, which increased their validity.

3. Data Analysis

The data analysis procedure includes calculating the effect size for each study, assessing publication bias, doing a heterogeneity test, and calculating the overall effect size. The data were analyzed using the Comprehensive Meta-Analysis (CMA) Version 3.

RESULTS

This section contains the meta-analysis results and an investigation of moderator factors.

1. Meta-Analysis Findings of the Studies Included in the Research

In meta-analyses, the effect size of each study is utilized to draw a general conclusion. The meta-analysis approach included 58 publications in order to estimate the impact of the FCL on student academic progress, and the effect size for each study was calculated. The results of the general effect size and heterogeneity tests are shown in Table 2.

<table>
<thead>
<tr>
<th>Model</th>
<th>K</th>
<th>ES</th>
<th>Lower</th>
<th>Upper</th>
<th>Test of Mean</th>
<th>Heterogeneity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fixed</td>
<td>58</td>
<td>0.808</td>
<td>0.740</td>
<td>0.876</td>
<td>23.262</td>
<td>.000</td>
</tr>
<tr>
<td>Random</td>
<td>58</td>
<td>0.976</td>
<td>0.802</td>
<td>1.151</td>
<td>10.945</td>
<td>.000</td>
</tr>
</tbody>
</table>

The heterogeneity test is significant ($Q_{model} = 362.786; df (Q) = 57; p = .000$), as shown in Table 2. Furthermore, $I^2$ value of greater than 75% indicates high heterogeneity (Higgins & Thompson, 2002), 84% means high heterogeneity ($I^2 = 84.288$). As a result, both the significance of Q value and $I^2$ value show that there is a lot of diversity in the effect sizes in this meta-analysis. The effect size of the fixed effect model was 0.808, and the effect size of the random-effect model was 0.976, both of which were significant ($p = .00 <.05$). According to Cohen (1988) effect size categorization, the latter corresponds to a ‘high impact’ value. Figure 2 shows a forest plot of the experiments to show the distribution of effect size values derived from the random-effects model.
The black vertical lines in the forest plot reflect the effect size of the relevant meta-analysis research, while the horizontal lines around it indicate that the impact size of that study is within the 95% confidence interval. In other words, the bigger the confidence interval, the longer the horizontal line. The study with the largest confidence interval was ascribed to Şahin (2019), whereas the study with the lowest confidence interval was published by Peterson (2016), according to the forest plot shown in Figure 2.

When the effect sizes of the studies included in the meta-analysis are examined in Figure 2, the study with the lowest effect size (g = 0.091) is attributed to Al-Abdullatif (2020), while the study with the largest effect size (g = 3.637) is attributed to Şahin (2019). While 36 studies (62.06%) have effect sizes less...
than the average effect size, it can be seen that 22 studies (37.93%) have a value greater than the average effect size of the study.

Figure 3. Funnel plot of standard error by effect size

To measure publication bias, a funnel plot, the standard fail-safe N, and Orwin’s fail-safe N were utilized. As demonstrated in Figure 3, the funnel plot exhibits a symmetrical distribution. As a consequence, there was no publication bias in the present meta-analysis. The typical fail-safe N found that 9704 more investigations would be needed to negate the effect size, which was much larger than 300 (5k+10). Additionally, Orwin’s fail-safe N revealed that it would take 4631 missing studies to reduce Hedges’ g to an insignificant level (0.01). As a consequence of the data analysis, it was determined that publication bias had no influence on this meta-analysis.

1. Findings Regarding the Moderator Variables

The meta-analysis sampled articles, master’s theses, and doctoral dissertations. Due to the shortage of master’s and doctoral theses, they were merged and assigned to the ‘theses’ subgroup in the moderator analysis. Table 3 summarizes the analysis’s results.

<table>
<thead>
<tr>
<th>Moderator Variable</th>
<th>Heterogeneity</th>
<th>p</th>
<th>K</th>
<th>ES</th>
<th>CI (95%)</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Publication type</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Article</td>
<td>0.207</td>
<td>0.649</td>
<td>38</td>
<td>0.994</td>
<td>[0.759; 1.229]</td>
<td>0.12</td>
</tr>
<tr>
<td>Thesis</td>
<td>0.207</td>
<td>0.649</td>
<td>20</td>
<td>0.917</td>
<td>[0.678; 1.155]</td>
<td>0.12</td>
</tr>
</tbody>
</table>

According to Table 3, the article type has the largest impact size (g = 0.994), while the thesis type has the smallest effect size (g = 0.917). There is no discernible variation in the kind of research published ($Q_b = 0.207; p = 0.649 > .05$).

The meta-analysis consists of studies conducted at the elementary, secondary, high school, and university levels. To help explain the observed heterogeneity, we included education level in the moderator analysis. Table 4 summarizes the analysis’s results.
According to Table 4, the maximum impact size (g = 1.021) occurs in high school, while the lowest effect size occurs in secondary school (g = 0.604). It may be inferred that no significant difference exists between the studies’ educational levels (Qb = 1.528; p = 0.676 >.05).

To assist analysis, the different time periods used to assess FCL pedagogy applications were classified as ‘2-5 weeks’, ‘6-9 weeks’, ‘10-13 weeks’, and ‘14 weeks and above’. Table 5 summarizes the results.

### Table 4. Effect of FCL on academic achievement according to education levels

<table>
<thead>
<tr>
<th>Moderator Variable</th>
<th>Heterogeneity</th>
<th>p</th>
<th>K</th>
<th>ES</th>
<th>CI (95%)</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Education Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary school</td>
<td>1.528</td>
<td>0.66</td>
<td>6</td>
<td>0.804</td>
<td>[0.538; 1.110]</td>
<td>0.146</td>
</tr>
<tr>
<td>Secondary school</td>
<td>22</td>
<td>0.604</td>
<td>[0.788; 1.340]</td>
<td>0.141</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High school</td>
<td>7</td>
<td>1.021</td>
<td>[0.530; 1.512]</td>
<td>0.251</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University</td>
<td>23</td>
<td>0.917</td>
<td>[0.595; 1.239]</td>
<td>0.164</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

According to Table 4, the maximum impact size (g = 1.021) occurs in high school, while the lowest effect size occurs in secondary school (g = 0.604). It may be inferred that no significant difference exists between the studies’ educational levels (Qb = 1.528; p = 0.676 >.05).

To assist analysis, the different time periods used to assess FCL pedagogy applications were classified as ‘2-5 weeks’, ‘6-9 weeks’, ‘10-13 weeks’, and ‘14 weeks and above’. Table 5 summarizes the results.

### Table 5. Effect of FCL on academic achievement according to the intervention length

<table>
<thead>
<tr>
<th>Moderator Variable</th>
<th>Heterogeneity</th>
<th>p</th>
<th>K</th>
<th>ES</th>
<th>CI (95%)</th>
<th>SE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duration of intervention</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2-5 weeks</td>
<td>9.321</td>
<td>0.025</td>
<td>14</td>
<td>1.181</td>
<td>[0.680; 1.682]</td>
<td>0.256</td>
</tr>
<tr>
<td>6-9 weeks</td>
<td>28</td>
<td>0.791</td>
<td>[0.622; 0.961]</td>
<td>0.086</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10-13 weeks</td>
<td>7</td>
<td>1.766</td>
<td>[1.059; 2.473]</td>
<td>0.361</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14 weeks and above</td>
<td>9</td>
<td>0.726</td>
<td>[0.445; 1.007]</td>
<td>0.143</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

According to Table 5, the maximum impact size (g = 1.766) was achieved between 10-13 weeks, while the minimum effect size (g = 0.726) was achieved after 14 weeks. By comparing the effect sizes between the groups generated according to the length of the intervention (Qb = 9.321; p = 0.025<.05), it is possible to conclude that there is a significant difference in the experimental group according to the time this model was used.

## DISCUSSION

In a globalizing world, today’s youth, dubbed Generation Z, want to incorporate technology actively into their educational and training processes, just as they do in other aspects of their life. Additionally, the emergence of technology and a variety of electronic devices has garnered considerable attention in educational settings (Tamur et al., 2020), more recently, the coronavirus pandemic has compelled humanity to safeguard itself by suspending all activities that involve face-to-face communication (Kurtoğlu Yalçın & Kazu, 2020). That is why, with the aid of technology, a great deal of labor, as well as education, has been maintained online (Ioannou & Ioannou, 2020). Additionally, education and training have to be conducted remotely, as is the case with all employees. A number of novel learning techniques and courses based on educational technologies and theories have gained popularity (Chang, Lee, Tang & Hwang, 2021), moreover, the FCL, a technology-based education paradigm, has gained favor. Recent work on the FCL, which is scheduled to be implemented in the next years, has yielded a variety of outcomes. Numerous meta-analyses have been conducted over the last decade to examine the impact of FCL and its relationship to learning effectiveness (Algarni, 2018; Chen et al., 2018; Cheng et al., 2019; Hew & Lo, 2018; Hu et al., 2018; Kang & Shin, 2016; Karagöl & Esen, 2018; Lag & Saele, 2020; Orhan, 2019; Shi et al., 2019; Zheng et al., 2020). Each of these research showed a modest to moderate positive impact size in favor of technology-integrated settings vs conventional ones. With the need to update these types of studies, this study used meta-analysis to assess the influence of FCL on students’ academic accomplishment, to create a bigger picture, and to throw light on researchers, since there are many studies in this subject. In this context, the meta-analysis procedure incorporated 58 results from 54 research that used the experimental technique to assess the influence of this model on student accomplishment and satisfied the requirements. The study revealed that the distribution of the studies included in the meta-analysis was diverse (Q value = 362.786, degrees of freedom = 57, p = .000) was found to be heterogeneous. On the other hand, since it is well established that $I^2$ value more than 75% indicates strong heterogeneity (Higgins & Thompson, 2002), $I^2 = 84.288$ and 84% proved to be high heterogeneity. Thus, this finding revealed that the large variation of impact sizes may be explained by...
the diversity of study designs, types, application periods, evaluation, population, and quality. The study revealed that only time of intervention explained a considerable degree of effect size variability among the moderator factors identified to account for the heterogeneity.

Given that the random-effects model is more applicable in the area of social sciences (Field, 2010), the outcomes in this research were interpreted appropriately. The meta-analysis discovered an average effect size of $g = 0.976; p = .00$ for the studies considered. According to Cohen’s (1988) classification, a large effect was concluded on this classification. In other words, FCL seems to have a significant favorable influence on academic attainment. While Karagöl and Esen (2018) discovered an average impact size $d = .56$ based on 55 study findings, Orhan (2019) obtained a similar conclusion. Similarly, Hu et al. (2018), Hew and Lo (2018), Zheng et al. (2020), Zhu (2021) found that FCL had a beneficial effect on academic attainment. In this regard, one may observe that comparisons of experimental research examining the FCL’s influence on academic success have shown a beneficial effect. In response to this statement, our current research is deemed to give a more nuanced understanding of the influence of this style of learning on learners’ accomplishment when compared to the conventional technique.

1. Type of Publication

The studies included in the meta-analysis were chosen from theses and publications because they were authorized by at least one juror or referee. The publication type was chosen as a moderator variable since articles and theses are deemed to be more detailed than presentation papers. There was no significant difference in terms of publishing type between the two categories of publications. This result was consistent with Cheng et al. (2019), Kang & Shin (2018), Orhan (2019), Alten et al. (2019), Tutil & Yazar (2021) who discovered no significant influence of publishing type on the efficacy of FCL.

2. Education Level

The meta-analysis covers articles written at the elementary, secondary, secondary, and post-secondary levels of education. The effect of the moderator variable on the teaching level on the average effect size was examined; however, no significant difference was observed, and it was concluded that the FCL of the teaching level could not account for the effect on academic achievement. Karagöl & Esen (2018), Cheng et al. (2019), Lag & Sæle (2019); Hew & Lo (2018), Orhan (2019), Alten et al. (2019) also conducted a meta-analysis on the effect of the FCL on it is understandable that the results of these investigations corroborate this conclusion.

3. Intervention

In this meta-analysis, another moderator variable was discovered to be the length of applying the model to the experimental group. At the conclusion of the investigation, it was determined that there is a substantial difference in response to the duration of the FCL application to the experimental group. In other words, the magnitude of this model’s influence on academic accomplishment changes according to the FCL’s application time to the experimental group. The current research discovered that a medium-duration intervention (10-13 weeks) resulted in the biggest impact magnitude. The primary issue might be that excessively lengthy periods introduce possible variance, while too short durations do not allow for validation of the method’s efficacy (Zheng et al., 2020). It has long been recognized that the brief length of FCL makes it difficult to discern the model’s contribution to learners’ accomplishment via an inventive impact (Clark, 2015). Without a doubt, this outcome will help throw light on future study, since it was shown that the aforementioned model should be employed for at least 10 weeks in order to get significant results about its efficacy on success. Similarly, Zheng et al. (2020) determined that the moderate application period had the largest impact size for this approach’s efficacy on academic success in their research. In comparison, Cheng et al. (2019), Karagöl and Esen (2019), Shi et al. (2019) included the length of intervention as a moderator variable in their meta-analyses, but found no statistically significant difference.

CONCLUSION AND IMPLICATIONS

The integration of technology into educational settings has started, and the process of formulating education policy via the use of technology has begun. Integrating technology into the teaching and
learning process improves the quality of education and alters how instructors teach and students learn. FCL, one of the technology-integrated teaching and learning methodologies, is founded on the premise that learners study a topic at home and class time is used for reinforcing activities and what was formerly referred to as homework. This innovative strategy has been deemed beneficial for learners since it allows them to study the topic at their own speed. Additionally, it is beneficial for instructors who are under pressure to adopt active learning methodologies while still conveying content via conventional lectures. Additionally, this report indicated that by incorporating technology into teaching, FCL has a significant impact on learners’ academic progress. The globe is being compelled to employ technology to accomplish objectives during contemporary epidemic times. As a result, educators may predict that they will need to continue facilitating face-to-face education alongside online instruction in the future. This circumstance necessitates an examination of study results on the impact of FCL on academic attainment. The purpose of this research is to do a meta-analysis of these investigations. These results are quite encouraging and give insight into the future deployment of the FCL. According to Cohen's categorization, this research ended with a high impact size. On the other hand, it is recognized that the impact size varies with the length of the intervention, with a preference for medium duration interventions.

In light of the study results, it was determined that the FCL had a significant influence on students’ academic progress. In light of the findings, it was thought suitable to offer the following recommendations:

- It was recognized that the length of the application was a distinguishing factor in the FCL’s academic accomplishment. The effect sizes of studies conducted on the experimental group over a period of 10–13 weeks were shown to be larger. As a result, researchers may be advised to extend the time period during which the FCL was applied to the experimental group.
- To encourage meta-analysis studies and obtain reliable results, researchers may be advised to clearly write values such as mean, standard deviation, and sample size in their studies. Otherwise, excluding studies limits the breadth of the meta-analysis investigation.
- This meta-analysis examined the FCL’s influence on academic attainment. However, there is research in the literature that examines the influence of this paradigm on student attitude, motivation, and self-efficacy. Meta-analysis research in these areas may be conducted in the future.

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**NOTE:** References marked with ‘*’ indicate studies included in meta–analysis.
Ters Yüz Sınıf Modelinin Öğrencilerin Akademik Başarılara Etkisi Üzerine Bir Meta-Analiz Çalışması

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Özet
Ters yüz sınıf modeli, geleneksel eğitim sürecinin tersine işleyen, öğretmenin rehber öğrencinin aktif olduğu, sınıf içi ve sınıf dışı eğitim faaliyetlerinden oluşan teknoloji tabanlı eğitim yaklaşımlarından biridir. Bu çalışmanın amacı, son dönemde popülarlığını artırmış olan ters yüz sınıf modelinin öğrenci başarısına etkisini araştıran yurt içinde ve yurtdışında yayınlanmış nicel çalışmaların meta-analizini gerçekleştirmektir. Çalışma nicel bulguları sistematik olarak inceleyen meta-analiz yöntemiyle yürütülmiştir. Bu kapsamda ters yüz sınıf modelinin başarıya etkisi raporlanan olan makale ve tezler, ERIC, Web of Science, EBSCOHost, Google Scholar, SCOPUS, PROQUEST, YÖKTE veri tabanları taramış, konu ile ilgili 945 çalışmaya ulaşılmış, kriterlere uygun 54 çalışmadan 58 araştırma bulgusu meta-analiz çalışmasına dahil edilmiştir. Yayın türü, yayın yılı, öğretim kademesi ve uygulama süresi moderatör değişken olarak belirlenmiştir. Veriler CMA programı kullanılarak analiz edilmiştir. Araştırma sonucunda, ters yüz sınıf modelinin öğrenci başarısı üzerine etkisi rastgele etkiler modeline göre istatistiksel olarak anlamalı düzeyde yüksek etkiye (Hedges’s g=0,976) sahip olduğu görülmüştür. Ayrıca, meta-analize dahil edilen çalışmalarda raporlanan etki büyüklüklerinin heterojen dağılm gösterdiği gözlemlenmiştir (Qmodel=362,786; df(Q)=57; p= 0,000). Yapılan alt grup analizler ile (Analog ANOVA, Meta-Regresyon) meta-analize dahil edilen çalışmalarda raporlanan etki büyüklüklerinin heterojen dağılımanın altında yatan sebepler test edilmiştir. Test edilen değişkenlerden sadece uygulama süresi değişkeninin istatistiksel olarak anlamalı olduğu (Qₚ=9,321; p=0,025) tespit edilmiştir. Ters yüz sınıf modelinin akademik başarı üzerindeki etkisi baz alarak bu çalışmanın modelin sınıflarda kullanımının artmasını sağlayacağı düşünülmektedir. Çalışmanın elde edilen sonuçlarca dayanarak, bu modelin akademik başarı üzerinde etkili olabildiği için uzun süre uygulanması gerektiği öne sürülmüştür.

Anahtar kelimeler: Akademik başarı, Eğitim teknolojileri, Etki büyüklüğü, Meta-analiz, Ters yüz sınıf modeli

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**Bulgarlar ve Tartırm:** Meta-analiz çalışmalardan her bir kişinin etki büyüklüğünden yola çıkarak genel bir sonuç çıkarılmaya çalıştır. Ters yüz sınıf modelinin öğrencilerin akademik başarısına etkisi incelemek amacıyla 58 çalışma meta-analiz sürecine dahil edilmiş, meta-analize dahil edilen tüm çalışmalara yönelik etki büyüklüğü hesaplanmıştır. Onemle sayısı 20’nin altında olan çalışmalar olmasına sebebiyle etki büyüklüğü hesaplanırken ‘Hedges’s g’ değerleri kullanılmaktır. Heterojenlik durumu ile ilgili bilgi veren bir diğer değer de I² değeridir. I² değerinin %75’in üzerinde olması yüksek heterojenliğin bir göstergesi olup (Higgins ve Thompson, 2003), araştırıldığında I²=84,288 bulunurak %84 yüksek düzeyde heterojen olduğu yorumu yapılabiliriktir. Elle edilen veriler incelendiğinde sabit etki modeli etki büyüklüğünün 0,808 ve rastgele etki modeli etki büyüklüğünün 0,976 olduğu ve anlamlı olduğu (p=0.00<0.5) görülmektedir. Etki büyüklüğü değerleri 0,20 ila 0,49 arasında olduğunda küçük düzeyde bir etki, 0,50 ila 0,79 arasında ise orta düzeyde bir etki, 0,80’den daha yüksek değerlerde ise geniş düzeyde bir etki olduğunu göstergenktir. Hesaplanan rastgele etki büyüklüğünün 0,976’tir. Bu sonuç etki büyüklüğü sınıflamasına göre “geniş bir etki” değeri karşılık gelmektedir Cohen (1988). Ulkmızde ters yüz sınıf modelinünün başları üzerindeki etkisi için Cohen (1988)’in sınıflamasına göre orta düzeyde bir etki olduğu yorumu yapılmaktadır. Yurtşındası bu konuda yapılan meta-analiz çalışmlardan Zheng vd. (2020) etki büyüklüğünün .66 bulurken, Lag ve Sæle (2020) etki büyüklüğünü .35 bularak küçük etki bulduğunu raporlamıştır. Buna göre, son dönemde ülkemizde ters yüz sınıf modelinin akademik başarı üzerindeki etkisini ölçen deneylerin sayısı arttı ve olumlu etki yaptığı yorumunun yapılmaktadır.

Moderatör değişkenlerin etki büyüklüğü üzerinde etkisi araştırılmak istenmiştir. Analog ANOVA analize edilen çalışmalarda en az bir jüri veya hakemin onayandığı geçtiği için tez ve makalelerden seçilmiştir. Meta-analize dahil edilen çalışmalardan 38’i makale türünde, 20’si ise tez türündedir. Araştırılmaların yayın türünde göre etki büyüklüğüne bakıldığında, en yüksek etki büyüklüğünün makale türünde (EB=0,994) sahip olduğu, tez türünde (EB=0,917) makale türünde nazaran daha düşük etki büyüklüğine sahip olduğu sonucuna varılmıştır. Meta-analize alınan araştırmların yayın türünde göre oluşan gruplar arası etki büyüklüklerine bakıldığında (Qₛₐ=0,207; p=0,649>,05) araştırımların yayın türünde göre anlamlı bir fark olmadığını, yayın türünün ortalamada etki büyüklüğü üzerinde etkili olmadığını saptanmıştır.


Ters yüz sınıf modelinin başarıya etkisi üzerine yapılan meta-analiz çalışmasında, söz konusu modelin deney grubuna uygulama süresi bir diğer moderatör değişken olarak belirlenmiştir. Analizi kolyaştrmak adına uygulama süreleri ’2-5 hafta’, ’6-9 hafta’, ’10-13 hafta’ ve ’14 hafta ve üzeri’ şeklinde kategorize edilmiştir. En yüksek etki büyüklüğünde (EB=1,766) 10-13 hafta arası uygulanan çalışmalar sahipken, en düşük etki büyüklüğünde (EB=0,726) 14 hafta ve üzeri uygulanan çalışmaların sahip olduğu sonucuna varılmıştır. Meta-analize alınan araştırımların uygulama sürelerine göre oluşan gruplar arası etki büyüklüklerine bakıldığında (Qₛₐ=9,321; p=0,025>,05) araştırımların deney grubuna ters yüz sınıf