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The Effect of Project-Based Learning Approach on Students' Academic Achievement: A Mixed Meta-Method

Proje Tabanlı Öğrenme Yaklaşımının Öğrencilerin Akademik Başarılarına Etkisi: Bir Karma Meta-Yöntemi

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ABSTRACT

The main purpose of this study is to investigate the effect of a project-based learning approach on students' academic performance through a mixed meta-method. For this reason, a dual methodological approach meta-analytical of quantitative data and meta-thematic of qualitative data was used in determining the effect size in the quantitative dimension while the positive and negative aspects together with the recommendation were determined in the qualitative dimension. To this end, meta-analysis was conducted using data from 26 studies and meta-thematic from 8 studies. In order to determine the effect size, CMA and MetaWin were conducted, and the effect size was calculated at a large level with the value of g =.83 [-.02; 1.68], and a significant difference of $p<.05$. In the meta-thematic analysis, the effect of project-based learning was found to have a positive effect as well as a little negative impact on students' academic performance. In both the meta-analysis and meta-thematic analysis, the findings showed that the project-based learning approach has a great effect on the students' academic performance. Some recommendations were also provided through the participants' views.

Keywords: Project-based learning, academic achievement, mixed meta-method, students

ÖZ

Bu çalışmanın temel amacı, proje tabanlı öğrenme yaklaşımının öğrencilerin akademik performansı üzerindeki etkisini karma meta-yöntem ile araştırmaktır. Bu amaçla, nicel boyutta etki büyüklüğünün belirlenmesinde meta-analitik, nitel boyutta verilerin meta-tematik analizi olmak üzere ikili bir metodolojik yaklaşım kullanılmıştır. Nitel boyutta proje tabanlı öğretimin olumlu ve olumsuz yönler ile öneriler belirlenmiştir. Bu amaçla, 26 çalışmanın verileri meta-analiz ve 8 çalışmanın verileri ise meta-tematik analiz için kullanılmıştır. Etki büyüklüğünü belirlemek için CMA ve MetaWin programlarından yararlanılmış ve etki büyüklüğü g=.83 [-.02; 1.68] olarak anlamlı düzeyde ($p<.05$) bulunmuştur. Meta-tematik analiz boyutunda, proje tabanlı öğrenmenin etkisinin öğrencilerin akademik performansı üzerinde olumlu etkisinin yanı sıra bazı olumsuz etkilerinin de olduğu tespit edilmiştir. Katılımcıların görüşleri aracılığıyla önerilere de yer verilmiştir. Meta-analizde ve meta-tematik analizde elde edilen bulgular proje tabanlı öğrenmenin akademik performans üzerinde büyük bir etkiye sahip olduğunu göstermiştir.

Anahtar Kelimeler: Proje tabanlı öğrenme, akademik başarı, karma meta-yöntem, öğrenciler

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Introduction

Teaching and learning approaches as theoretical concepts which describe on a meta-level of how learning should be facilitated for effective teaching and learning to take place at any level of learning are described in a diversity of terms and corresponding concepts. These include active-based learning, learner-centered learning, reflective-based learning, experiential-based learning, problem-based learning, interdisciplinary learning, and transformative learning. In the education system, student achievement and skills are usually measured by standardized assessments where performance-based have been prioritized (Cörvers, et al., 2016, p. 353). Assessment can be seen as a tool that helps teachers establish the mutual and long-lasting relationship with students and provide them with feedback. The students take action and make their own plan for the next project once they received feedback. For these reasons, project-based learning assessment needs to be well planned in advance before the implementation of the lesson itself (Özdemir, 2006, p. 13).

The advancement in modern-day technology has exposed the need for certain learning approaches in determining the academic success of learners. However, there is a need to develop a tool that could be used to measure more than just memorization of information. Nowadays, many countries have adopted a project-based learning approach which has become popular. In these approaches, compared to traditional programs, where students start with theory and progress to practice, the student must remove from practice that theory needs to be learned. (Prince & Felder, 2006, p. 130). Project-based learning is crucial as it helps the development of high levels of cognitive and practice skills of the learners. It develops students' certain skills such as teamwork, communicative, investigative skills, critical analysis, lifelong learning, and solving real-life problems. These will help the students to develop a critical thinking opportunity to establish a meaningful connection between their learning experiences.

Project-based learning is commonly used today in many kinds of literature which include a student-centered and dynamic classroom approach. It emphasizes the importance of students' active exploration of real-world issues and problems, which draws attention to the fact that learning by discovery is conducive to students' gaining in-depth skills (Wurdinger & Bezon, 2009, p. 215). In project-based learning, learners are expected to look for a solution to a real matter by presenting scenarios or problems of life. This method necessitates teachers to specify projects that encourage learners to create their plans personally or in groups, solve the problems they face, test their ideas, and make a presentation of their projects to their peer groups (Wurdinger & Bezon, 2009, 215). The project-based learning approach does not only inculcate deep knowledge of the subject in the students, but it also equips them with valuable soft skills such as effective communication, tolerance, teamwork, collaboration, and the ability to create new ideas. During these processes' learners are encouraged to be more independent individuals, creative, critical thinkers, and problem identifiers and solvers by creating questions in their own methods This is very crucial as it will help them improve a feeling of ownership during the learning process and the outcome.

Project-Based Learning (PBL)

The project-based learning (PBL) can be traced back to John Dewey's Reconstructivism and Active Model of Learning; Kilpatrick's Project Method; and Bruner's Discovery Learning Models. These methods and models can be regarded as the basic foundations of PBL (Korkmaz and Kaptan, 2001, 193). PBL is constructivism and constructionism based in which they explained that learners are capable of constructing their ideas, knowledge and experience through the interaction with situation or environment. Numerous studies have been carried out by many researchers where they concentrated on PBL and were found to be more efficient than many other learning approaches. PBL has very distinctive features; however, the foremost important feature is that the student and teacher design the project, and work together on a selected scenario while trying to search out a solution to a real problem (Iriondo et al., 2019, p. 389). The teacher develops activities and engages the students in problem-based learning while, he/she should provide the setting and encourage the technique of problem formulation to problem-solving via taking some small step homework by presenting students with convenient instruments or methods (Chen & Yang, 2019, p. 72). Korkmaz and Kaptan (2001, p. 194) argued that PBL is an independent learning which supports the students' long-life skills and knowledge. They also outlined the stages involved in this process such as identifying the topic and sub-topics, organizing an internal group, creating a project environment by the group members, implementing the project, planning the presentation of the project, making the presentation, and finally, the having the assessment stage. The basic objective of this method is to give a hand to students to realize their potential, and their own way of learning and acquiring new skills (Yurttepe, 2007, 11).

In a nutshell, PBL can be regarded as a learning procedure of grasping and resolving complicated problems or situations. "Learners as individual or group work and actively occupy

with purposeful missions and complicated scenarios to achieve a perceptible result. The fundamental goal of PBL is to encourage learners to take responsibility for their learning process in education, to improve their positive vague manners, and to focus them to collaborate (Ayaz & Söylemez, 2015, p. 275). The PBL approach is also aimed at gaining student's scientific skills to increase students' academic achievement.

Project-Based Learning Assessment

The PBL assessment is reliable and as well authentic as it measures skills that are not measurable through other standardized tests. Assessment during a PBL implementation gives a teacher an insight into students' learning skills, and how effective they are in deciding while working in a group. Students' awareness of their strengths and weaknesses relies on the effectiveness and positive way of the assessment process and feedback (Kavlu, 2015, p. 48). The PBL assessment might be regarded as an effective tool of evaluating the achievements of learners during the teaching and learning process. With PBL, the assessments of student's proficient skills are measured via a performance-based evaluation. Through collaboration with peer groups or teachers, solving real-life issues, and investigation via profound learning and exploration, learners can improve their critical thinking towards the problems they may come across in today's daily life (Ayaz & Söylemez, 2015, p. 275). These skills will also help them prepare for the issues faced in the 21st century. It can be seen that the PBL approach is basically not only helpful in improving the students' motive towards learning science subjects but also geared them toward a meaningful amount of academic achievement. On the other hand, the students' skills such as cognitive, affective the psychomotor will be positively developed with the effective use of the PBL approach (Baran et al., 2018, p. 223).

Although numerous studies have been carried out on the effect of the PBL on students' performance, and the recommendations made by the researchers and the magnitude of these recommendations are yet to be identified. For these reasons, in this study, the effect of the PBL approach on learners' performance across all levels in high schools is the basic foundation.

The Purpose of the Study

The purpose of the research is to examine the effectiveness of the PBL on students' academic achievement through the use of meta-analysis and meta-thematic analysis. Thus, the study will examine the following:

1. The effect size of the PBL approach on students' academic achievement.
2. The positive and negative impact on academic achievement of students of the PBL approach.

Methodology

In this paper, the mixed-meta method consisting of two stages was employed to determine the effect of the PBL on students' academic achievement. In this regard, the determination of the effect of the PBL was carried out within the scope of a mixed-meta method through quantitative meta-analysis and qualitative meta-thematic analysis. The mixed-meta method can be defined as a method that includes the analysis of quantitative and qualitative data based on a document review with a holistic perspective (Batdı, 2021, p. 6). In other words, Batdı (2020) expressed mixed-meta as a comprehensive and rich-content method that allows qualitative and quantitative data to be re-analyzed and combined. In short, the mixed-meta method can be defined as meta-analysis involving meta-thematic analysis. While conducting a mixed-meta study, there is a need to include scientific published/accepted quantitative (meta-analysis) and qualitative (meta-thematic analysis) data in the analysis. For this reason, the analysis method of the studies carried out with the mixed-meta method was conducted in two different dimensions of meta-analysis and meta-thematic analysis.

Research Design

Meta-Analysis

In this study, the adopted quantitative dimension of the study involved meta-analysis to identify the effect of the PBL approach on students' academic achievement. The related research in the literature was reviewed by re-evaluation of the results of independent studies performed on certain related topics (Talan et al., 2020, p. 480). Meta-analysis is referred to as a process of integrating quantitative research findings with the use of statistical tools. Meta-analysis involves thoroughly reviewing and interpreting academic literature. On the other side, the meta-analysis can be regarded as a group of quantitative numerical tools that is used to analyze, integrate and interpret research findings across independent research (Strohmeier, 2014, p. 1). A meta-analysis, by its actual nature, gives a mix of countless quantitative discoveries in a reliable and cognizant manner by producing a record of the effect sizes and plans to infer significant speculations by dissecting these discoveries in a coordinated manner (Cohen et al., 2001). In order to describe the study more effectively, quantitative data could be involved in meta-analysis (Dinçer, 2018).

Meta-Thematic Analysis

In this study, the adopted qualitative dimension involves meta-thematic analysis to broaden and obtain more detailed and comprehensive information in respect to the scope of this study (Batdı, 2017a). The term meta-thematic analysis was first postulated by Batdı (2017b). Meta-thematic is used to reach in-depth and comprehensive information on the study subject while bringing raw data to the qualitative dimension of the research Batdı, (2017a). Meta-thematic analysis is a type of analysis that involves a verbal or textual analysis process based on document review. In this kind of analysis, the main purpose is to combine the qualitative findings of the studies conducted on the researched subject by creating themes and codes. It is also the act of re-interpreting the themes and codes obtained from previous research by the researcher as a result of the review of qualitative studies on the relevant studies (Batdı, 2019). The purpose of using the meta-thematic analysis in this study is to express the raw data or processed themes and codes on a common level in the studies reached based on document analysis and to express them again as themes and codes (Batdı, 2019). Thus, meta-thematic analysis is the extraction of themes and codes from the raw data or the re-thematization of themes.

Data Collection

In the *quantitative* dimension of this study, the relevant studies on the effect of the PBL on students' academic achievement were searched on commonly used data base in both Turkish and English such as *ScienceDirect, Scopus, Academia, MagazinePark, CoHE Thesis, Google Scholar, Springer Link* and *Web of Science* using keywords as "PBL, project-oriented education, project-based approach and the impact of the PBL approach on students' academic achievement.". After scanning the above-mentioned sources, 1450 meta-analyses and 180 meta-thematic research were obtained respectively.

In the *qualitative* dimension of this study (*meta-thematic analysis),* after a thorough review of obtained research from the data bases, 8 studies that contained students' individual views within the scope of the study were selected in line with document analysis by the use of content analysis. While selecting these 8 studies composing of the qualitative dimension of this study, the date of publication was determined from 2018 to 2021. The main purpose of content analysis is to achieve certain concepts and clarify the existing relationships among them. Therefore, the data of the study are conceptualized, conceptual similarities are summarized, and coded on a particular theme, and the interpretations of the results are made after the necessary adjustments (Yıldırım & Şimsek, 2016). To draw qualitative results, similar research on the PBL and codes were regrouped in a certain conformity, and the conclusions are reflected as models. However, to guarantee reliability and justification, the participant statements from the other studies in which the themes and code were deduced are outlined within the text to validate them. Without any alteration or adjustment, direct quotations were given in order to enhance the reliability of the present study. As a result, the codes and page number of the studies were determined.

Inclusion and Exclusion Criteria in Meta-Analysis

Due to the large number of studies carried out on the effect of the PBL approach, the inclusion criteria were determined for the study. The inclusion criteria used in this study can be stated as follows: the studies including the effects of PBL on achievement scores of learners (achievement score means the difference between inputs and outputs in a training program consistent with program objectives); the studies carried out in English and Turkish national and international published journals, books, and unpublished theses/dissertations carried out in a recent year. In the inclusion criteria, some empirical studies containing experimental groups and control groups based upon pre- and post-test-controlled model groups of sample sizes; means and standard deviations were also included. However, some of these studies that were obtained from the abovementioned databases were excluded from the analysis as a result that they do not meet the above-outlined criteria for this study. The criteria and reasons for the inclusion and exclusion of these studies from the analysis are shown in the below PRISMA diagram as a template.

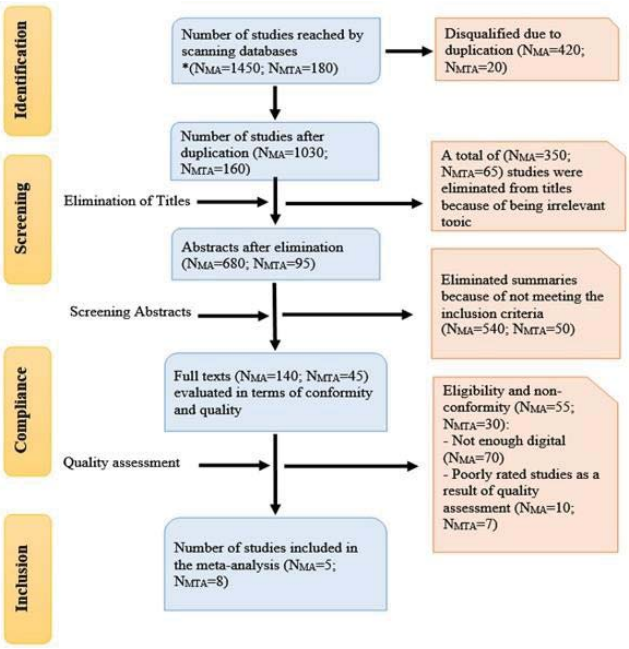

Figure 1.
PRISMA Diagram

The studies scanned for the achievement scores were collected with the consideration of the dates between 2001 and 2021 while the ones for the qualitative data were between 2018 and 2022. As shown in *Figure* 1, following the scanning of the above-mentioned databases, 1450MA and 180MTA studies were retrieved in total. Due to duplication of the studies during retrieval 420MA and 160MTA from studies were excluded. 350MA and 65MTA studies were eliminated due to unrelated topics, while 540MA and 50MTA were eliminated because of not satisfying the inclusion criteria. On the examination of the other 140MA and 45MTA studies with regards to their suitability and quality, 55MA and 30MTA studies that were found to in non-conformity, were excluded from the analysis. 70MA in which did not include enough digital data were also eliminated. 10MA and 7MTA of poorly rated studies as a result of quality measurement were withdrawn from the included studies. Thus, several 5MA and 8MTA studies that met the inclusion criteria and the pre-determined research problem were involved.

Coding Process

Within the scope of this meta-analysis and meta-thematic analysis of the present study, the coding process was carried out manually. This has come in line with the statement made by Merriam (2009) in which she argued that the coding process can be done either manually with a keyboard or using a computer program package such as the MAXQDA-11 quantitative data analysis program. In the sequel of the analysis, the studies included were underwent a coding process to compare and construct the studies retrieved from the literature review. As a consequence of the analyses, the positive effect of the PBL on students' academic achievement, the negative effect of the PBL on students' academic performance, and the suggestions for the students' academic achievement were examined under the 3 themes.

Data Analysis

In the quantitative dimension of the study, the achieved data was tabularized with codes on a Microsoft Office Excel program using a descriptive analysis filter while findings were calculated as frequency percentages. Afterward, the effect size of individual study, heterogeneity test, and CMA 3.0 Software program (Borenstein & Rothstein, 1999) were used for the calculation of each study's publication bias. The studies analyzed in this research were interpreted using Cohen's (1992) rules in which $g \leq 0.20$ is less, while $g = 0.50$ is moderate and $g \geq 0.80$ is a large effect size.

Findings

In this section of the research, the findings relevant to the analysis of the use of the PBL-based applications in the teaching environment through the mixed-meta method have been presented. The data of the study were interpreted in two parts as meta-analysis and meta-thematic analysis.

Findings related to Meta-Analysis

Meta-analysis findings are given in Table 2. The findings of the achievement scores of the learners of the related studies according to REM are presented. When these findings were evaluated, the effect level was seen as g =.83 [-.02; 1.68]. As a result of the analysis, this effect level was found to be at a large level according to the Thalheimer and Cook (2002) classification. Based on the related findings, it can be stated that the effects of the related applications on the achievement scores of the learners are positive. However, a meaningful difference was recorded regarding the test type scores achieved ($p<.05$).

Table 1.
Meta-Analysis Results

Test Type	Models	n	g	95% Confidence interval		Heterogeneity		
				Lower	Upper	Q	p	I^2
Achievement Scores	FEM	5	.60	.34	.85	40.64	.00	90.16
	REM	5	.83	-.02	1.68			

When examined the heterogeneity test type value reached in Table 2, it is observed that the effect sizes of achievement scores (Q=40.64; $p<.05$) are heterogeneously distributed. However, it can be said that the 90% variance observed in the I^2 value (90.16%) is owing to the real variance between studies. The I^2 value with 25% shows low heterogeneity, 50% shows medium while 75% and over shows high heterogeneity value (Cooper et al., 2009). In this context, a high level of heterogeneity indicates the presence of moderator variables that affect the overall effect size. When the analysis results are examined, it may be said that project-based implications have a positive effect on the education process.

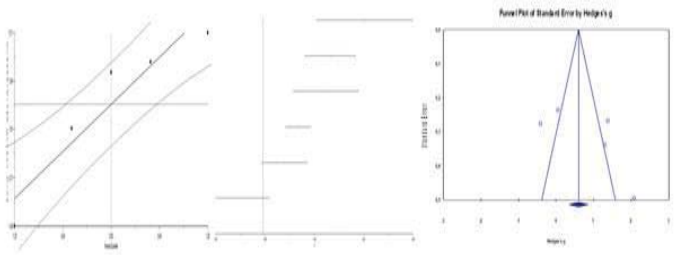

Figure 2.
Plots

Figure 2 indicates the Normal Quantile Plot, Funnel Plot, and Effect Size CI Plot, showing the probability of publication bias of the meta-analysis dataset. Related images calculated with MetaWin and CMA analysis programs usually lead to deviations in the calculated effect size (Borenstein et al., 2013). In the study, the results of the Classic Fail-Safe Number were examined to examine the publication bias, and it was understood that if 60 more studies on the effect of related applications on achievement scores were attached to the analysis, the significant effect would decrease to zero. Considering that these values are high within the framework of the research and that too many studies are required to be reached, it has been understood that the publication bias has no effect (Cheung & Slavin, 2011) and therefore the procedures are reliable. In addition, when the Normal Quantile Plot Chart in Figure 2, which is reached with the MetaWin analysis program, is investigated, it is stated that the studies included in the analysis are between two lines, meaning the effect size level distribution of the studies means reliable intervals (Rosenberg et al., 2000). At the same time, when the effect size CI plot values are examined, it is seen that there is a harmony between the study data. In this case, it can be said that the applications based on the PBL are in the reliable range.

Findings of Meta-Thematic Analysis

Regarding the qualitative dimension of the study, the participants' views regarding the impact of the PBL approach were carefully reviewed to outline participants' individual perceptions of the PBL approach. As a result of content analysis of the 8 studies included in the qualitative dimension of this research, three themes which include the positive aspect, negative aspect, and the recommendation were made. These themes are coded as well, based on the participants' direct statements which are extracted from the 8 studies included in the qualitative dimension (meta-thematic) of this study.

Figure 3.
Positive Aspects of PBL

The theme on which the participants' views about the positive aspect of the PBL approach is presented in Figure 3. Under this theme, numerous codes such as finding the topics interesting, more understandable; as practice be very important, the lessons be very important were reached. To

be precise, a statement coded from the 571249-43 study, stated as:*" I find the topics interesting, things that are used in our life-like real life"* can be exemplified. Another example from the 624800-52 study code can be stated as "*I wrote twice a week about everything because practice is very important."*. The other example from the study coded as the 571249-53 is that "*We all worked together, we had a lot of fun, and we met our audience members."*. The above-mentioned example code shows that the participants' perception of the effect of the PBL approaches on academic performance is positive and interesting at the same time.

Figure 4 represent themes and codes for the participants' views toward the PBL approach in which they pointed out some negative aspects of the PBL approach. The code such as boring, challenging, time consuming, and not contributing is formed. To illustrate, in the 624800-p56, a participant stated that "*The lessons are a bit difficult in general, by the way, I think it is so difficult but for now."* (p51); *"I find it challenging because it requires a lot of creativity."* (p53); *and "In general, it is difficult for me."* (p56). The other study code as 702469-p72 stated that "*We do not have enough prior knowledge to realize this stage, and I'm having a hard time finding what I want in homework."* (p66). Another example is from the study coded as 571249-p53 stating "*It did not contribute to my communication with my friends during the project work, and it is difficult to implement in crowded classrooms because noise reduces efficiency."* (p64). The participant from the 695169-p83 study said that "*I have difficulties in setting goals due to time constraints; they didn't even bring material if it was out of their interest, and they were reluctant to attend the class."* (p83). In these themes and codes, the participants pointed out the negative aspects of the PBL approach.

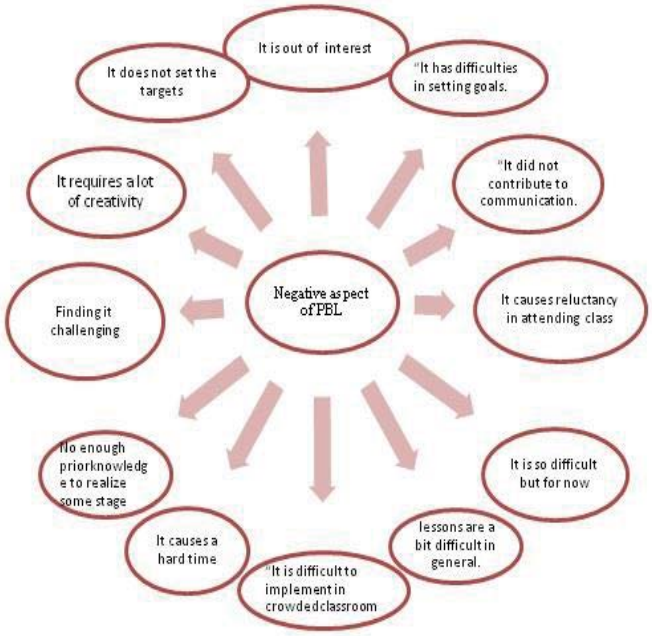

Figure 4.
Negative Aspects of PBL

In *Figure 5,* the themes and codes from several studies in respect to the recommendations made by the participants such as the need for this approach to be adopted and used at all times that it should be continued were formed. The statement made by some of the participants is coded. An example from the study coded as 603544-p83 is that "*You just have to adapt it to the needs of your students."* (p83)". Another example coded as 603544-p89 is: "*If people behave consciously, love the environment, then everything can be good."*. A participant from the study coded as 695169-p166 stated that "*They also need to apply what they think that it requires regular time allocation." And "People need to get this training in their spare time."* (p166). Another example from the study coded as 624800-p60 stated that "It *will be necessary for my job in the future."* (p60). The participants in the included studies related to the PBL were also presented some recommendations that directly or indirectly affect students' academic performance.

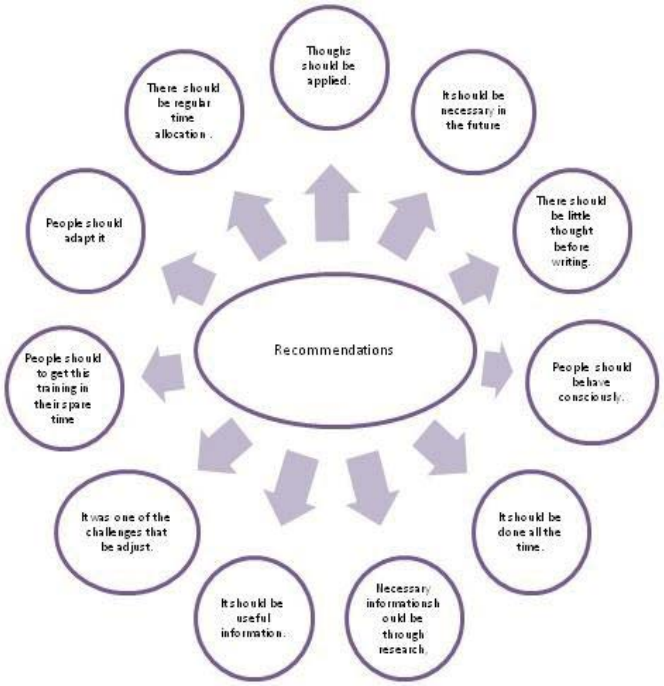

Figure 5.
Recommendations

Discussion, Conclusion, and Recommendation

The current study is made up of meta-analysis and meta-thematic analysis of the effect of the PBL approach on students' academic performance. In this study, the meta-analysis dimension includes 5 studies that are in accordance with the pre-determined aim purpose of this study. The findings obtained in the meta-analysis dimension, clearly indicate that the PBL approach has a positive effect on students' academic achievement with the effect level of *g*= .83 [-.02; 1.68]. According to Thalheimer and Cook's (2002) classification, this effect size is at a large level. These findings indicate a significant positive impact of the PBL approach than ever observed through the past reviews, hence, indicating that the PBL has been becoming more effective in the 20th and 21st century (Markham et al., 2003; Thomas, 2000). Although this study does not only examine the positive impact of the PBL approach on the students' academic performance but also the negative aspects, it recommends the use of the project-based approach rather than another traditional way of instruction. Meanwhile, this does not mean that other traditional ways of teaching should at a level be abandoned rather they should be used at certain levels.

While looking at the qualitative analysis dimension of this study, three themes were formed based on meta-thematic analysis. The themes include positive aspects, negative aspects, and the recommendation of a PBL approach on students' academic achievement scores. Related to the positive domain theme, it is seen that the PBL approach motivates students while learning, allowing them to take responsibility for their learning. One of the findings of this current study which is in good conformance with the study findings made by Al-Mutawa (2018) shows the effectiveness of the PBL in moderating critical thinking skills, cooperation, effective communication, and academic performance as its processes has a great impact. The findings of study also outline the other positive aspects of the PBL approach as encouraging students' higher order of thinking and problem-solving, higher engagement and interaction with learning content. The findings are supported by similar results on the positive addictive of the PBL on students' academic achievement in the related literature (Meyer, 1997).

As for the negative aspect of the PBL approach of this study, apart from the claims that favored the positive side of the PBL approach, the findings in this part revealed some negative aspects of the PBL approach, as it affects both students' learning and their academic achievement. Students find it difficult to adapt to the process and challenging because it requires a lot of creativity. It is also difficult to implement in crowded classrooms. It is very difficult to evaluate the student's individual achievement. This claim is supported by the findings of Holubova (2008), more time is required to identify the problem in PBL. The findings of this study also identified the tendency for students to lose concentration in learning and focus only on the project. These findings are compatible with the results of Aslanides et al. (2016). Another negative aspect of the PBL is that the teachers may find it difficult to adopt as stated by a participant in the qualitative data because of the complexity associated with classroom management. The results of this paper also ascertained that the complexity of the PBL approach may slow the lesson while increasing students' individual needs for help during the implementation of the PBL.

With respect to the recommendations of participants toward the use of a PBL approach, this part has identified several suggestions and recommendations such as time allocation, and the need for it to be implemented at all times. As this approach requires basic orientation before implementing it to realize its impact on students' academic performance, it is required to teach the learners how to work with one another in the group and manage conflict within themselves (Grant, 2002). Stoller (2006) mentioned the key criteria for a PBL approach to be effective the following way that it should: 1) be both project and process-oriented, 2) be beyond a single lesson period, 3) encourage

skills integration, 4) provide students with promote in language and learning the scope, 5) students should work in groups, teams, and on their own, 6) students should take the responsibility for their learning, 7) students should have their view in designing the process and product, 8) allow for a period to focus on both language and direct teaching when required, 9) conclude with students' reflection on process and product. For these complex criteria, this approach should be given special concentration. If the related learning method can be applied acutely, both students and teachers may experience the positive learning outcome of the method. Finally, the findings of this study suggest that the PBL approach has a high efficiency on students' academic achievement.

Limitations

As a tradition of any study, this study also has its limitations: it includes only the studies in English and Turkish languages, a meta-analysis that has a control group with pre-test and post-test, and the analysis that has high quality with validity and reliability quality scales. Thus, in further studies, the scope of the study can be extended and the scanned databases may be expanded. The examined topic which is PBL can be also studied in terms of different grades as moderators in meta-analysis.

Etik Komite Onayı: Bu çalışma, araştırma yöntemi olarak belge analizi kullandığı için etik kurul onayına ihtiyaç duymamaktadır.
Hakem Değerlendirmesi: Dış bağımsız.
Yazar Katkıları: Fikir- V. B.; Tasarım-Denetleme-Kaynaklar- Y. T.; Veri Toplanması ve İşlemesi; Analiz ve Yorum- V. B.I; Literatür Taraması- S. J.; Yazıyı Yazan- V.B., Y.T., S.J.; Eleştirel İnceleme- V. BI.
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Genişletilmiş Özet

Amaç

Proje temelli öğrenme, John Dewey'in Yeniden Yapılandırmacılık ile Aktif Öğrenme Modeli'ne, Kilpatrick'in Proje Yöntemine ve Bruner'in Keşfederek öğrenme Modeline dayanmaktadır. Bu modellerin, proje tabanlı öğrenmenin (PTÖ) temel dayanakları olarak kabul edilebildiği belirtilebilir (Korkmaz ve Kaptan, 2001, 193). Proje tabanlı öğrenme, öğrencilerin durum veya çevre ile etkileşimleri yoluyla kendi fikir, bilgi ve deneyimlerini oluşturabileceklerini açıkladıkları yapılandırmacılık temelli bir öğrenme modeli olarak belirtilebilir. PTÖ'nün çok belirgin özellikleri vardır; ancak en önemli özelliği öğrenci ve öğretmenin projeyi tasarlaması ve gerçek bir soruna çözüm bulmaya çalışırken seçilen bir senaryo üzerinde birlikte çalışmalarıdır (Iriondo vd., 2019, 389). PTÖ yaklaşımının etkin kullanımı ile öğrencilerin bilişsel, duyuşsal, psikomotor gibi becerilerinin olumlu yönde gelişebildiği ifade edilmiştir (Baran, Maskan ve Yaşar, 2018, 223). PTÖ yaklaşımının öğrenci performansına etkisi konusunda bazı araştırmalar yapılmış olmasına rağmen bu çalışmada, PTÖ yaklaşımının lise kademesi öğrencilerinin akademik performansına etkisi araştırılmak istenmiştir. Bu amaçla, meta-analiz ve meta-tematik analiz kullanılarak PTÖ'nün öğrencilerin akademik başarısı üzerindeki etkisi incelenmiştir. Böylece, PTÖ yaklaşımının öğrencilerin akademik başarılarına olan etki büyüklüğü (meta-analiz) ile ilgili yaklaşımın öğrencilerin akademik başarılarına olumlu ve olumsuz etkileri (meta-tematik analiz) araştırılmıştır.

Yöntem

Bu çalışmada PTÖ yaklaşımının öğrencilerin akademik başarılarına etkisini belirlemek amacıyla iki aşamadan oluşan karma-meta yöntem kullanılmıştır. Bu kapsamda ilgili yaklaşımının etkisinin belirlenmesi, nicel boyutta meta-analiz ve nitel boyutta ise meta-tematik analiz yoluyla gerçekleştirilerek bir karma-meta yöntem uygulanmıştır. Karma-meta, nicel ve nitel verilerin doküman incelemesine dayalı olarak bütüncül bir bakış açısıyla analizini içeren bir yöntem olarak tanımlanabilir (Batdı, 2021, 6).

Bu çalışmanın meta-analiz boyutunda, PTÖ'nün öğrencilerin akademik başarılarına etkisi ile ilgili çalışmalar Türkçe ve İngilizce olarak yaygın şekilde kullanılan ScienceDirect, Scopus, Academia, CoHE Thesis, Google Scholar, Springer Link ve Web of Science veri tabanlarından "Proje tabanlı öğrenme, proje odaklı eğitim, proje tabanlı yaklaşım ve proje tabanlı öğrenme yaklaşımının akademik başarı üzerindeki etkisi" gibi anahtar kelimeler kullanılarak taranmış ve sırasıyla 1450 meta-analiz ve 180 meta-tematik araştırmaya ulaşılmıştır.

Meta-tematik analiz boyutunda ise ilgili yaklaşım konusunda doküman analizine dayalı olarak elde edilen 180 araştırmadan çalışmanın kapsamı esas alınarak öğrencilerin bireysel görüşlerini içeren 8 çalışma, içerik analizine uygun şekilde analiz edilmiştir. Çalışmaların yayım yılları 2018 ile 2021 yılları arasında olacak şekilde belirlenmiştir. Bu çalışmada analizlere dâhil edilme ve hariç tutulma kriterleri ve gerekçeleri PRISMA diyagramında (Şekil 1) sunulmuştur. Araştırmanın nicel verileri betimsel analiz kullanılarak Microsoft Office Excel programında kodlarla tablolaştırılmış, bulgular ise frekans yüzdesi olarak hesaplanmıştır. Daha sonra, her bir çalışmanın yayın yanlılığının, bireysel çalışmanın etki büyüklüğünün, heterojenlik testinin bulunması için CMA 3.0 Programı (Borenstein & Rothstein, 1999) kullanılmıştır.

Sonuç

Meta-analiz boyutunda elde edilen bulgulara göre PTÖ yaklaşımının g = .83 [-.02; 1.68]. Thalheimer ve Cook (2002) sınıflamasına göre büyük düzeyde olduğu anlaşılmıştır. Bu bulgular, PTÖ yaklaşımının geçmiş incelemelerde gözlemlenenden çok daha fazla olumlu etkisi olduğunu göstermektedir, dolayısıyla proje tabanlı öğrenmenin 20. ve 21. yüzyılda daha etkili hale geldiğini göstermektedir (Markham ve diğerleri, 2003; Thomas, 2000). Bu çalışmada meta-tematik analize dayalı olarak üç tema oluşturulmuştur. Temalar, PTÖ'nün olumlu yönleri, olumsuz yönleri ve öğrencilerin akademik başarı puanları üzerinde PTÖ yaklaşımının kullanımına ilişkin önerileri içermektedir. Olumlu temayla ilgili olarak, PTÖ yaklaşımının öğrencileri öğrenirken motive ettiği ve onlara öğrenmelerinin sorumluluğunu alma fırsatı verdiği anlaşılmaktadır. Al-Mutawa (2018) tarafından yapılan çalışma bulgularıyla uyumlu olan bu bulgular arasında, PTÖ'nün eleştirel düşünme becerilerini, işbirliğini, etkili iletişimi ve akademik performansı düzenlemedeki olumlu etkisi de görülmektedir. Araştırmanın bu bulguları, ilgili literatürde PTÖ'nün öğrencilerin akademik başarılarına olumlu katkısına ilişkin benzer sonuçlarla desteklenmektedir (Meyer, 1997). PTÖ yaklaşımının olumsuz yönüne gelince, öğrencilerin sürece uyum sağlamakta zorlanabildikleri ve çok fazla yaratıcılık gerektirdiği için zorlanabildikleri, kalabalık sınıflarda uygulanmasının zor olduğu belirtilmiştir. Bu bağlamda, PTÖ'nün uygulamadaki zorluğunun öğrencilerin bireysel yardıma ihtiyaçlarını artırdığı ve dersi yavaşlatabildiği ortaya çıkmıştır. PTÖ'nün kullanımına

yönelik önerilere ilişkin olarak şu önerilere ulaşılmıştır: hem proje hem de süreç odaklı olmalı, becerilerle entegrasyonu sağlamalı, öğrencilere dil ve içerik öğrenme konusunda destek sağlamalı, öğrenciler gruplar halinde, takımlar halinde ve kendi başlarına çalışmalı, öğrenciler kendi öğrenmelerinin sorumluluğunu almalı, öğrenciler süreç ve ürünü tasarlarken kendi görüşlerine sahip olmalıdır. İlgili öğrenme yöntemi etkin olarak uygulanabilirse, hem öğrenciler hem de öğretmenler yöntemin olumlu öğrenme sonucunu görebilir. Son olarak, olumsuz yönleri olmasına rağmen, bu çalışmanın sonuçları PTÖ yaklaşımının öğrencilerin akademik başarıları üzerinde olumlu yönde büyük bir etkiye sahip olduğunu göstermektedir.