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FLIPPED LEARNING STUDIES IN SCIENCE-RELATED DISCIPLINES: A META-SYNTHESIS

BİLİMLE İLGİLİ DİSİPLİNLERDE TERS YÜZ EDİLMİŞ ÖĞRENME ÇALIŞMALARI: BİR META-SENTEZ

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ABSTRACT

This study aimed to synthesize the qualitative and mixed-method studies that used the Flipped Learning Model (FLM) in science-related disciplines. This study is a meta-synthesis study and prefers qualitative research as a methodology. The current study adopted case study as a design. The authors used many databases to find the studies they would review. These databases are Elsevier, SpringerLink, Taylor & Francis, Sage, EBSCO, Wiley, JSTOR, and Scopus. Using various keywords and inclusion-exclusion criteria, four qualitative and nine mixed-method research studies were reviewed. This review highlighted the objectives, research groups, data collection instruments, data analysis, validity and reliability, results, and recommendations of these studies. The results showed that investigating the impact of the FLM on students' academic performance was the most prominent aim of the studies. We also found that the FLM studies were mostly conducted with participants from older age groups and that interviews, observations, and various documents were the most commonly used data collection tools. In addition, we found that the studies achieved what they aimed to achieve with the FLM. Based on these results, there is a need for studies that reflect the implementation steps of FLM in a much more detailed and explicit way.

ÖZET

Bu çalışma, bilimle ilgili alanlarda Ters Yüz Edilmiş Öğrenme Modeli (TYÖM) kullanan nitel ve karma araştırmaları sentezlemeyi amaçlamıştır. Nitel araştırma desenlerinden durum çalışması deseninin kullanıldığı bu çalışma bir meta-sentez çalışmasıdır. Çalışmada Elsevier, SpringerLink, Taylor & Francis, Sage, EBSCO, Wiley, JSTOR ve Scopus veri tabanları kullanılmıştır. Dâhil etme-etmeme ölçütleri ve çeşitli anahtar kelimeler kullanarak dört nitel dokuz karma araştırma çalışması incelenmiştir. Bu çalışmaların amaçları, araştırma grupları, veri toplama araçları, veri analizi, geçerliliği ve güvenilirliği, sonuçları ve önerileri vurgulandı. Sonuçlar, TYÖM'ün öğrencilerin akademik performansları üzerindeki etkisinin araştırılmasının çalışmaların en belirgin amacı olduğunu, TYÖM araştırmalarının daha çok üst yaş grubundan katılımcılarla yapıldığını, görüşme, gözlem ve çeşitli dokümanların en çok kullanılan veri toplama araçları olduğunu ortaya koymuştur. Ayrıca, incelenen çalışmalarda hedeflenen amaca genel olarak TYÖM ile ulaşıldığı belirlenmiştir. TYÖM'ün farklı değişkenler üzerindeki etkilerini daha detaylı ve açık şekilde incelemek için daha fazla araştırma yapılmasına ihtiyaç vardır.

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Introduction

The constructivist learning approach encourages students to learn, interpret, and use knowledge to solve the problems they face (Rababah, 2021). In this context, students are expected to have skills such as decision-making, creative thinking, problem-solving, and critical thinking (Banihashem et al., 2021). Models, strategies, and methods based on the constructivist learning approach are used in educational environments to gain these skills. These learning pathways are effective in providing students with the desired skills (Chuang, 2021). On the other hand, they are less preferred due to some problems such as content creation and time (Gijbels et al., 2005). Therefore, teachers have started to prefer using blended learning models (van Alten, 2020), which enable flexible learning (Wanner & Palmer, 2015) and flexible time (Johnson et al., 2012) by using digital learning resources and communication tools in the learning process. The blended learning model (BLM), which first emerged in the United States (Bergmann & Sams, 2008), is a model that combines face-to-face and online education (Jdaitawi, 2020). The model allows students to participate in face-to-face and online learning activities synchronously and asynchronously (Hew & Cheung, 2014). Bruggeman et al. (2021) emphasize that BLM is more effective than traditional models. Graham (2006) states that teachers prefer BLM because it allows them to use time flexibly, increases achievement and student-teacher interaction. BLM has many sub-models including laboratory rotation, individual rotation, flipped learning, flexible model, self-blending model, and enriched virtual model (Krismadinata et al., 2020). Among these models, the use of the Flipped Learning Model (FLM) by teachers is becoming increasingly common (Hwang et al., 2021).

FLM includes digital tools and many learning approaches that provide flexible and effective learning environments (Andujar et al., 2020; Johnson, 2013). In FLM, also defined as inverted learning (Demiralay & Karataş), teaching materials created by professional instructors are sent to students through online tools. Students learn the basic information and concepts related to the subject before the face-to-face session. In the classroom, the subject is deepened through activities that will allow students to do individual and group work (Bishop & Verlager, 2013). Objectives of remembering and understanding levels are gained outside the classroom, while higher-level objectives are gained in the classroom (Nerantzi, 2020). Therefore, students have the opportunity to apply what they have learned outside of the classroom through FLM (Park et al., 2021).

FLM has many advantages both for students and teachers. It enables student-centered (Wanner & Palmer, 2015) and laboratory activities in the classroom (Kuroki & Mori, 2021). Moreover, FLM provides students with flexible time (Baepler, et al., 2014), flexible content, and active learning opportunities (Hwang et al., 2021; Park et al., 2021). It also provides students with opportunities to evaluate their learning (Bergman & Sams, 2012). Finally, FLM allows students to learn at their own learning pace (Bishop & Verleger, 2013). FLM also contributes to teachers. Regarding teachers, with FLM, teachers become aware of their students' learning styles (Fulton, 2012). In addition, FLM allows teachers to focus more on learning (Rutkowski & Moscinska, 2013). On the other hand, FLM has some disadvantages for both teachers and students. It increases teachers' workload, which means that teachers spend more time creating content (Enfield, 2013). FLM may be inadequate for students who do not have individual learning habits and have low self-regulation skills (Talbert, 2012). At the same time, students who cannot adapt to group activities may experience low motivation (Johnson, 2013). FLM requires the identification of the technology to be used in the learning process (Sargent & Casey, 2020). With all its pros and cons, the use of FLM has become widespread in recent years, and with this, whether FLM is used correctly or not has become the focus of researchers' attention.

The literature has investigated whether FLM is effective in many different fields such as engineering (Al Mamun et al., 2022), mathematics (Lo & Hew, 2021), foreign language (Shahnama et al., 2021), and geometry (Love et al., 2014). In addition, related research studies reported many findings in terms of the effectiveness of FLM. For example, Chang and Hwang (2018) found that FLM positively increased students' motivation to learn. Jamridafrizal and Wibawa (2021) reported that students developed a positive perception of FLM. Andersen et al. (2020) concluded that learning materials used in FLM can successfully establish a relationship between the science curriculum at school and science center visits. Cho and Lee (2018) concluded that students in FLM classes were more successful than those in traditional classes. Similarly, Karagöl and Esen (2019) reported that FLM had a positive effect on academic achievement. On the other hand, Lee et al. (2021) concluded that FLM negatively affected student achievement, while Yestrebsky (2015) concluded that it positively affected it. The literature shows that there are quantitative (Aljaser, 2017), qualitative (Ogden, 2015) and mixed-method research (Love et al., 2014) studies examining the effectiveness of FLM. The literature also reveals that there is an increase in meta-analysis studies that reveal the impact of FLM on different variables (Cheng, et al., 2019; Hew & Lo, 2018; Karagöl &Esen, 2019; Kızkapan, 2023; van Alten, et al., 2019; Yakar, 2021). For example, Hew and Lo (2018) found a significant effect in favor of FLM in 28 studies. These studies meta-analyzed the studies on FLM

using quantitative methods and discussed whether the results of the studies could be generalized to the population. Therefore, these studies also tried to reach absolute knowledge. Although there are many studies on FLM, not enough studies evaluate these studies from a qualitative perspective. This is noteworthy because these studies need to be examined to raise awareness among teachers and students on the use of FLM. Therefore, in this study, it was decided that there is a need for a meta-synthesis and was examined the studies from a qualitative perspective based on the interpretive paradigm. Thus, it was aimed to fill the gaps in FLM use among researchers, instructors, and students by providing a different perspective on the use of FLM.

Meta-synthesis is the process of bringing together and evaluating studies on a subject with a critical approach (Çalık & Sözbilir, 2014). Meta-synthesis aims to qualitatively examine the results of studies that address a topic from different perspectives and to reveal their similarities and differences. Meta-synthesis also helps researchers who want to investigate a topic to see the research trends on that topic. Therefore, this study will enable researchers to be aware of the studies conducted on FLM and enable them to evaluate the existing literature. In addition, this study aims to provide information about the aims, methods, results, conclusions, and suggestions of FLM studies from a qualitative perspective. Hence, this study is worthy in terms of guiding researchers who will conduct studies on the use of FLM in the future. In addition, this study will raise awareness about the use of FLM for teachers in the teaching process and students in the learning process. Based on these justifications, this research answered the question "What are the similarities and differences between studies investigating the use of the flipped learning model?" Also, the current study sought to answer the following questions:

1. What were the aims of the studies investigating the use of the FLM?
2. What were the methods of the studies investigating the use of FLM?
3. How were participants selected in studies investigating the use of FLM?
4. What data collection tools did the studies investigating the use of FLM use?
5. How did the studies investigating the use of the FLM conduct the data collection process and data analysis?
6. How did the studies investigating the use of the FLM conduct validity and reliability in studies?
7. What were the results of the studies investigating the use of the FLM?
8. What kind of recommendations were presented in the studies investigating the use of the FLM?

Method

This study adopted a case study based on qualitative research methodology to answer the research questions. Therefore, the authors conducted a systematic review of qualitative and mixed-methods research focusing on the use of FLM. In the literature, the systematic review of qualitative studies is called meta-synthesis. However, the literature has not yet given a name to the systematic review conducted by including mixed method studies. Therefore, the review of qualitative and mixed studies together should either be called meta-synthesis or a different name should be decided (Karakuzu et al., 2023). In this study, we will use the name meta-synthesis. Meta-synthesis, which reveals the similarities and differences of studies conducted in a certain field within a qualitative understanding, involves the evaluation of research findings under certain themes with a critical and holistic approach (Thomas & Harden, 2008). Meta-synthesis studies also provide researchers with important information to draw comprehensive, generalizable, or practically useful conclusions from the data that can be obtained in a single study (Malterud, 2019). Therefore, this study critically examined the similarities and differences of studies focusing on the use of the flipped learning model. Moreover, this study has reached useful conclusions that teachers, students, and researchers can use. Therefore, this study critically examined the similarities and differences of studies focusing on the use of the flipped learning model. Moreover, this study has reached useful conclusions that teachers, students, and researchers can use. As a result, we did not include quantitative studies because studies conducted with quantitative research methods are widely examined in meta-analysis studies and we were concerned that if we included quantitative studies, we might have difficulties in critically evaluating a large number of studies. Another concern was what would be the name of this systematic review if we examined studies conducted with all three methods.

Research Process and Data Collection

Before starting the data collection process, the authors created the research review criteria based on the research questions. This criterion included authors, title of the study, purpose of the research, year of publication,

research method, research design, participants, data collection tool, data analysis, validity-reliability, results, and recommendations (Table 1). We used the meta-synthesis steps suggested by Walsh and Downe (2005) during the data collection process. Figure 1 shows these steps.

Table 1. Example of Matrix Used in the Data Collection Process

Author/ year	Title of the study	The purpose of the research	Research method	Study group	Data collection
Rodríguez et al., 2019	Flipped classroom: Fostering creative skills in undergraduate students of health sciences	This study examines how implementing of flipped classroom methodology fosters the development of creativity and critical thinking skills in undergraduate health science students, assesses the students' opinions on this methodology, and measures its effects on their learning results.	Mixed	Students of health science	Interview

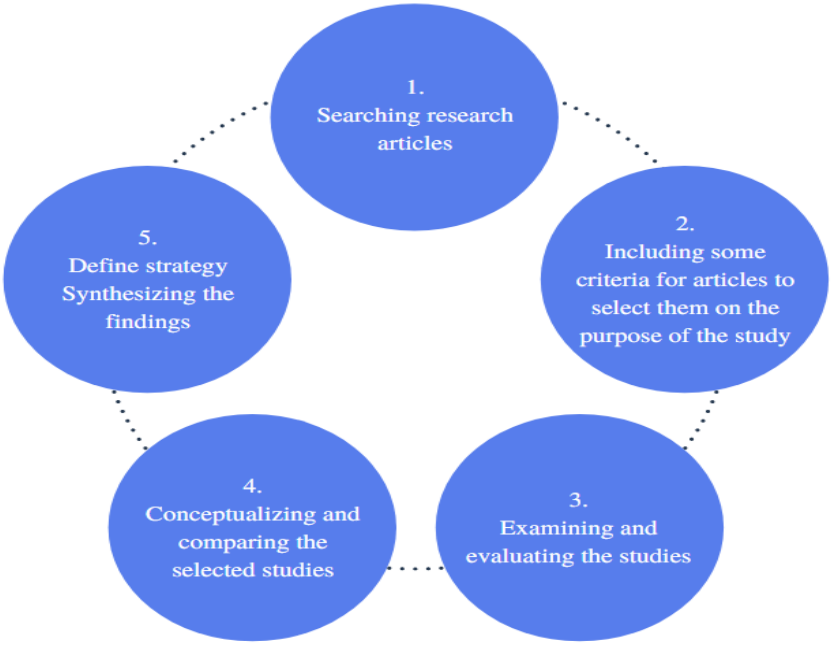

Figure 1. Steps of the Meta-Synthesis Process (Walsh & Downe, 2005)

The data collection process is explained below, on the basis of the steps in Figure 1.

1. Elsevier, SpringerLink, Taylor & Francis, Sage, EBSCO, Wiley, JSTOR, and Scopus databases were searched.
2. While searching, word combinations were formed by adding the keywords "science education", "physics education", "chemistry education", "biology education", "environmental education", and "qualitative research" to the main keywords "flipped learning", "flipped classroom", "flipped learning model", and "inverted learning".
3. Criteria were created to determine the studies to be included in the study and studies were selected within the framework of the criteria. Papers, posters, and outdated publications were not included in

the study. Since research on FLM increased after 2012 (e.g., Bishop & Verlager, 2013), studies published between 2012 and 2021 were included in the study.

4. This study included studies that used qualitative and mixed method researches, investigated student views on flipped learning, and were indexed in Web of Science. The literature emphasizes that approximately ten studies are appropriate for meta-synthesis studies conducted in science-related fields (Bondas & Hall, 2007). In this context, the current study analyzed 13 studies. Table 2 presents information about the studies included in the study.
5. The authors studied on the similarities and differences of the studies and presented the findings under themes and categories.

Table 2. Characteristics of Studies Analyzed within the Scope of the Research

Features of Studies		f
Publication year	2016	2
	2017	1
	2018	4
	2019	2
	2020	4
Participants	Secondary school students	1
	High school students	4
	Undergraduate students.	7
	Pre-service teachers	1
Research method	Qualitative research	4
	Mixed method research	9

Data Analysis

The studies were numbered as S1, S2, ... and S13 to facilitate analysis. We have shown which code represents which article in the bibliography. Then, each author read the relevant sections of a study and transferred the data to paper and digital media (Creswell, 2007). Similarly, each author separately analyzed the objectives, data collection, and analysis stages, validity and reliability in studies, conclusions, and recommendations of each study. In the first stage, the authors created their code booklet. Then, the authors came together online to reach a consensus on the codes and finalize the codes. Table 3 shows an example of code generation for the first research question. The codes for the other research questions are presented in the findings section. In the second stage, the codes were grouped under pre-constructed categories from the literature. The names of these categories were: the aims of FLM studies, participants in FLM studies, data collection tools and data analysis, validity and reliability in FLM studies, results of FLM studies, and recommendations for FLM studies (Crabtree & Miller, 1999). In the third stage, the authors created tables for each category and supported these tables with direct quotations in the findings section.

Table 3. Example of Data Analysis

Study	Description in the article	Extracted Tentative codes	Final Codes
S1	This paper examines nursing students' perceptions of the effectiveness of a flipped classroom approach… The study aimed to elicit undergraduate nursing students' responses to a flipped classroom approach in pharmacology lectures…	• Examining students' perceptions of the effectiveness of FLM • Determining students' responses (experiences) to FLM • Testing the effect of FLM on academic performance, motivation, and perceptions.	• Perception • Experience • Academic Performance • Motivation
S2	The current study assesses the impact of a partially flipped course compared to traditional lectures on student academic performance, motivation, and perceptions.		

Validity and Reliability of the Study

This study has taken some measures to increase validity and reliability in line with the views of Thomas and Harden (2008). These measures are explained below.

1. The purpose, research questions, and sub-problems were stated clearly (Credibility and transferability).
2. The authors identified the research data according to specific criteria and explained the identification stages in detail (Credibility and Transferability).
3. The authors examined a sufficient number of studies published in journals indexed in different indexes (Transferability).
4. The authors presented the research data in tables by creating codes and categories (Consistency).
5. The authors coded separately to analyze the study data and reached a consensus. Moreover, the inter-author coding agreement was 95% (Miles & Huberman, 1994). The difference between the authors was whether a study was mixed researches or qualitative research. Regarding this, the authors reached a consensus and decided that the study was conducted with qualitative or mixed method research (Consistency).
6. The authors had enough time for meta-synthesis because the data analysis started in January 2021 and was completed in October 2021 (Credibility).
7. The authors included direct quotations from the studies (Credibility).

Findings

Aims of the FLM Studies Included in Meta-Synthesis

The aims of the studies included in the meta-synthesis within the scope of the research are given in Table 4. When Table 4 is examined, it is seen that a significant part of the studies (S2, S4, S5, S8, S12, and S13) investigate the effect of FLM practices on academic performance. For example, the study coded S2 examined the impact of FLM on academic performance compared to traditional applications. Moreover, three investigations are on student perceptions.

Table 4. Aims of the Studies Included in Meta-Synthesis

Category	Codes	The codes of studies
Aims of the FLM studies	Academic performance	S2, S4, S5, S8, S12, S13
	Perception	S1, S2, S7
	Experience	S1, S11
	Motivation	S2, S13
	Creative and critical thinking skills	S3
	Life skills	S4
	Features and objectives of FLM	S6
	Attitude	S8
	Sources of resistance to FLM	S9
	Science process skills	S10

As seen in Table 4, in S1, nursing students' perceptions of FLM were examined. The aim of this study was expressed as "*This paper examines nursing students' perceptions of the effectiveness of a flipped-classroom approach to increase understanding of pharmacology principles and the application of this knowledge to medication practice. p.79*." S1 and S11 tried to reveal the relationship between student experiences and FLM practices. In this context, the aim of S11 was specified as "*This study aims at studying the mechanism of how they could benefit STEM education and their interactions when used together. p.479*" Furthermore, S3 investigated the impact of FLM on creative and critical thinking skills, and S4 also examined the effect of hybrid FLM applications on the development of students' life skills. Similarly, the effect of an FLM-designed science course on students' science process skills was examined in S10. Regarding the features and purposes of FLM, S6 uttered "*The aim of this study is to contribute to an increased understanding of the flipped classroom movement. p.433*." S8 also investigated the effect of FLM on the attitude toward the chemistry course. S9 aimed to present detailed data on the nature of resistance to FLM pedagogy.

Research Methods of FLM Studies Using FLM

Research methods and designs of studies included in the meta-synthesis within the scope of the research are given in Table 5.

Table 5. Findings Regarding Research Methods

Category	Codes	The codes of studies
Research Methods	Qualitative	S1, S6, S9, S11
	Mixed	S2, S3, S4, S5, S7, S8, S10, S12, S13

As is shown in Table 5, either qualitative or mixed method is used in reviewed studies. In some of the studies, researchers did not explicitly reveal their research methods (i.e. S1, S2.). In this case, we examined the research data and data collection instruments. If the study reported only qualitative data, we coded the method as "qualitative". However, if the research reported both qualitative and quantitative data, we coded the method of this type of study as "mixed". On the other hand, some reviewed studies explicitly wrote their research method. Of this type of study, in S13, the research method is stated as "*This study used an explanatory sequential mixed method design where quantitative data were collected in the first sequence, followed by a secondary qualitative data-collection phase. p.78*." Similarly, in S11, the author declared the method of the research as *"The research follows a qualitative design and individual interviews were conducted on three students and the teacher who conducted the lecture. p.479."*

Participants in Studies Using FLM

Participants of the studies included in the meta-synthesis within the scope of the research are given in Table 6.

Table 6. Findings Regarding Research Groups

Category	Codes	The codes of studies
Participants	Undergraduate students from different majors in education	S2, S7, S9
	High school students	S11, S12
	Secondary school students	S8, S13
	Teachers from science, math, social studies, and Swedish majors	S6
	Undergraduate nursing students	S1
	Undergraduate students in health science	S3
	Pre-service science teachers	S10
	Undergraduate students in human biology	S4
	Undergraduate students in medicine	S5

As is seen in Table 6, three of the studies were conducted with undergraduate students. In addition, studies conducted with undergraduate students from nursing, health science, education, human biology, and medicine were found. For example, S2 explained the participants as;

"*Students came from 28 different majors. For convenience, students' majors were regrouped into four main categories, i.e., Biology/Chemistry, STEM (science, technology, engineering, and math) (i.e., including all STEM majors except for biology, and chemistry-related ones), Non-STEM, and Undeclared. p.124*"

On the other hand, five studies were conducted with teachers (S6), high school (S11 and S12), and middle school students (S8 and S13). In S6, it was explained that the participants of the research were teachers as follows;

"...teachers who were early in joining this movement and who worked actively with the flipped classroom …. To increase the number of respondents, additional participants were sought via tips from the interviewed informants, and two more teachers were contacted in this way. p.433"

In addition, S11 explained high school students were included in the following statement

"20 students who were studying the international British A-Level syllabus were selected. They were all 16–17 years old and studying senior two (equivalent to grade 11) in the same school. p.488".

Data Collection Tools in Studies Using FLM

Data collection tools of studies included in the meta-synthesis within the scope of the research are given in Table 7.

Table 7. Findings Regarding Data Collection Instruments

Category	Codes	The codes of studies
Data Collection Instruments	Semi-structured interview	S4, S5, S6, S8, S10, S11, S13
	Structured interview	S7
	Unstructured observation	S3, S12
	Forms (Personal information form, open-ended question form)	S3, S4
	Survey	S2, S7, S9
	Reflection paper	S9
	Final grades	S4
	Students' products	S3
	Achievement test	S5, S12, S13
	Likert-type questionnaire	S1, S3, S13
	Scientific process skills test and rubric	S10

As can be seen in Table 7, many data collection tools were used in the studies. In this context, semi-structured interviews are the most used data collection tool. The data collection tool is explained in S5 as;

"The interview form was prepared by the researchers to collect data in-depth about the method and was administered to the experimental group of students to examine their perceptions of the flipped classroom... p.857"

The data collection tool used in the two studies was a survey. For example, the use of a survey in S7 is explained as;

"Firstly, the quantitative survey data for relations between personalities, the total satisfaction, and learning styles were collected. p.316."

Another data collection tool used in the three studies was a questionnaire. The use of the questionnaire in S1 is explained as;

"Data were collected using a 10-item questionnaire…. in 2014, the questionnaire was administered both pre- and post-flipping. p.81"

Data Analysis in Studies Using FLM

Data analysis of the studies included within the scope of the research are given in Table 8.

Table 8. Findings Regarding Data Analysis

Category	Sub-Categories	Codes	The codes of studies
Data Analysis	Qualitative analysis	Content analysis	S3, S10, S4, S5, S6, S8, S9, S13
		Descriptive analysis	S1, S2, S7, S11
		Numerical analysis	S10, S13
		Analysis not specified	S12
	Quantitative analysis	Paired samples t-test	S10
		Independent samples t-test	S13, S4
		Mixed ANOVA	S5
		ANCOVA	S12

As seen in Table 8, most of the studies evaluated the data with qualitative analysis. In studies with qualitative analysis, content analysis was most preferred. In these analysis, the opinions of the participants regarding FLM were examined under the themes such as "positive"- "negative", "weak"- "strong", "advantage"- "disadvantage." For example, S5 examined students' perceptions of the FLM under the themes of "positive", "negative" and "would you like to see in other classes". Student B's perception of FLM in the study was reported as *"We spent all of the class time on questions and answers. Learning through discussion is more effective…p.862."* On the other hand, the data were analyzed with descriptive analysis in four of the studies. For example, in S2, the strengths and

weaknesses of flipped learning-based education were examined. The response of a student who emphasized the strengths of FLM in S2 was reported as *"I like the flipped class because I can take however much time, I want to take notes on the videos. p.128."* Two of the studies analyzed the data with numerical analysis. For example, in S10, flipped learning was evaluated under the themes named Video, Google Classroom, and instruction and categories named as contribution to experimentation, limitation of videos in experimentation process, improving scientific process skills, facilitating the interacting, ease of use, and during experimentation. Few investigations have been evaluated with quantitative analysis. As seen in Table 8, t-tests were mainly used in these studies. In these analyzes, the effects of FLM on students' academic achievement, scientific process skills, motivation, and attitudes were investigated. These obtained data were supported by qualitative findings.

Validity and Reliability in Studies Using FLM

The validity and reliability of the studies included in the meta-synthesis within the scope of the research are given in Table 9.

Table 9. Findings Regarding Validity and Reliability in Studies

Category	Sub-Categories	Codes	The codes of studies
Validity and Reliability	Credibility	Description/Direct quoting	S1, S2, S3, S6, S7, S10, S12
		Expert control	S13, S8, S10
		Standalone coding	S10
		Maximizing sample size	S11
		Data diversity	S1, S2, S3, S10, S11, S13, S6
		Code names	S1, S2, S3, S8, S12
	Transferability	Explaining researcher role	S8, S12
		Detailing the research process	S1, S2, S3, S11
	Dependability	Audio/Video recording	S6, S8, S13
		Description/Direct quoting	S1, S2, S3, S6, S7, S10, S12
		Detailing the research process	S1, S2, S3, S11
		Standalone coding	S10
	Confirmability	Review	S6
		Detailing the research process	S1, S2, S3, S11
		Expert control	S13, S8
		Subject feedback	S13
	Content Validity	Expert control	S13
		Subject feedback	S13
	Reliability	Cronbach alpha	S10, S13, S2
		Unspecified	S5

Looking at Table 9, we have concluded that most of the studies either did not provide sufficient information or did not make any explanations about the validity and reliability. Among the coding under credibility, explanations were made about the description/direct quote code in half of the studies. For example, in S4, the students' views on their experiences were given as *"I think that you learn more in this kind of activities due to the increased motivation. In addition, thinking by yourself instead of memorizing is more enriching. p.8."* Moreover, data diversity was used to increase reliability in seven studies. For example, in S13, questionnaires and interviews were used as data collection tools for data diversity. Participants' code names were used to hide their identities in five studies (S1, S2, S3, S8, S12). In other studies, no explanation was given about this code. Only two of the studies (S8, S13) mentioned that expert control is sought to increase credibility. For example, S8 provided information about this theme and code *"Three experts in the field of educational technology were contacted via email and asked to review the interview questions for credibility. p. 131."* Finally, information is given in S10 for independent coding and in S11 for maximizing sample size. In the codes under the theme of transferability (researcher role and detailing of the research process), the role of the researcher was mentioned only in two studies. For example, the role of the researcher was specified in the S8 article as *"the researcher documented classroom observations, experiences, thoughts, and*

insights regarding the intervention in a journal daily to on a daily basis in order to enrich the data. p.1." Besides; S1, S2, S3, and S11 explained the research process. The codes under the theme of dependability, as in other themes, sufficient information was not given in the articles examined. The explanations were determined regarding the audio/video code only in three S6, S8, and S13. For example, S13 provided information about dependability *"The interview took approximately 20 mins and was recorded on audiotape, with the students' agreement, and was later transcribed. p.80."*

About the codes for description/direct quoting and detailing the research process, only S10 mentioned stand-alone coding. In terms of confirmability, a sufficient level of explanation was not found in the majority of the articles. Only S6 included information about the confirmability issue *as "The codes were then processed to form the basis for themes. This procedure included a constant check back and forth, checking coding of data as well as emerging categories and themes for consistencies and inconsistencies, as well as keeping the aim in focus. p.436."* In addition, only S13 reported some information regarding the subject feedback *"Besides, some students were also invited to answer the questionnaires before conducting an actual study, aiming to identify their understanding of each item, as well as to gather feedback for the improvement of each item. p.80."* Also, only S13 explained the codes under the theme of content validity (expert control, subject feedback). S13 reported about the expert review code as *"…three experts will be invited to evaluate the questionnaire items by giving a rating for each item as well as comments and suggestions. P.79."* Finally, three articles (S2, S10, and S13) explained the Cronbach alpha code under the reliability theme.

Results Obtained in Studies Using FLM

Within the scope of the research, the results obtained in the studies were analyzed. The results of the analysis are given in Table 10. Table 10 was created by synthesizing the results of the studies included in the meta-synthesis. In this context, there sub-categories are determined and they are named as facilitating learning, gaining skills and competence, and negative opinions.

Table 10. Results of Studies on FLM

Category	Sub-Categories	Codes	The codes of studies	Sample Quotations
Results of FLM studies	Facilitating learning	A better understanding of content	S1, S2, S3, S5, S8, S11, S13	*It was nice to have practice problems on Friday to help enforce what we learned and to go over them [S2]*
		Increasing peer interaction	S5, S6, S7, S11, S13	*A group discussion opens a broad idea through knowledge exchange, we can learn from each other [S13]*
		Come to class ready	S1, S2, S5, S11	*In other courses, I used to come to class unprepared, take notes during the lecture, and study these notes before the exams. Now I have to study every week. [S5]*
		Individual (Autonomous) learning opportunity	S1, S11, S13	*I liked the fact we could go back to lectures, revise, pause, stop, and rewind. [S1]*
		Learning flexibility	S6, S11, S13	*They can watch this in school before they go home, or on their smartphone, it's on YouTube, and they live with it all the time. [S6]*
		Increasing interest and satisfaction in the lesson	S2, S3, S11	*It is very interesting and dynamic. It is a different, fun, and original way to learn. [S3]*
		Taking notes	S1, S2	*I like the flipped class because I can take however much time, I want to take notes on the videos [S2]*
		Instant feedback and active duty	S3, S11	*Practical work is interesting and it enhances active learning [S11]*

	Gaining skills and competence	Learning motivation	S2, S3, S4, S12, S13	*I think that you learn more in this kind of activity due to the increased motivation. [S4]*
		Critical thinking	S1, S3, S4, S13	*I think the workshop activities allowed me to extend my knowledge of the lecture material and apply these concepts to practical situations, and develop critical thinking [S1]*
		Productivity/Original product	S2, S3, S4, S13	*These activities make us think more deeply. It is interesting to exchange opinions and discuss different scenarios in class [S3]*
		Technological competence	S6, S13	*I learn much from YouTube, Khan Academy, or watching BBC News [S13]*
		Self-efficacy and confidence	S13	*I could study more independent outside of the class and this has taught me to be an independent learner, and independent explorer, not only during that class but also today [S13]*
	Negative opinions	Not suitable for learning	S9	*I could not link Flipped Learning with any of my pre-experiences [S19]*

As seen from Table 10, seven studies concluded that the use of FLM resulted in a better understanding of the content. Five studies reported that FLM increased peer interaction. Four studies found that students were able to come to the lesson ready with the use of FLM, and three studies reported that FLM provided students with autonomous learning and flexible learning opportunities. Likewise, S2, S3, and S11 stated that FLM increased interest and satisfaction in the lessons. S1 and S2 emphasized that FLM was effective in taking notes. S3 and S11 found that FLM was effective in taking instant feedback/active tasks.

Under the category of gaining skills and competence, S2, S3, S4, S12, and S13 reported that FLM increased motivation. S1, S3, S4, S13 stated FLM increased critical thinking and productivity skills. S6 and S13 reported that FLM increased learners' technological competence. S13 presented the findings that FLM enhanced self-efficacy and confidence. Lastly, as a negative opinion, S9 claimed that FLM was not suitable for learning.

Recommendations in Studies Using FLM

Within the scope of the research, the suggestions made in the articles were analyzed. Results are given in Table 11. When Table 11 was examined, a significant part of the studies suggested that more studies should be conducted on FLM.

Table 11. Recommendations in Studies Using FLM

Category	Codes	The codes of studies
Recommendations	Conducting further studies on different topics and variables	S1, S3, S4, S5, S8, S11, S12, S13
	Increasing sample size	S5, S9, S11, S12
	The effects of videos on different variables could be examined.	S10, S12
	Worksheets should be used in FLM	S11
	Students' pre-motivation and knowledge levels should be determined.	S13
	Long-term follow-up studies can shed further light on this issue.	S5
	The reasons for teachers turn to the model can be investigated.	S6

	Instructors should have specific strategies against the problems they might encounter while teaching lessons by the model.	S7

S3 expressed recommendations as *"…we believe that it has great potential that should be further explored. p.9."* Moreover, four articles suggested conducting studies with larger samples. This suggestion was reported in S5 as *"Future studies could examine the feasibility and effectiveness of this method in larger groups. p.866."* It was also suggested to investigate the effects of the videos used in the lessons taught by FLM on different variables in two studies. This recommendation was specified in S12 as *"Future studies would also be improved by identifying a way to keep track of student video watching and to analyze whether video consumption was correlated with achievement p.780"*

Conclusion and Discussion

The authors concluded that the primary aim of the studies was to investigate the impact of FLM on students' academic performance. Secondly, we concluded that there are studies that aim to investigate students' perceptions and experiences of FLM. The reason why most of the studies investigate the effect of FLM on academic achievement is that the most emphasized domain in schools is the cognitive domain. Additionally, academic achievement is considered the main determinant of future educational and professional success (Flashman, 2012). However, schools are expected to develop students in cognitive, affective, and psychomotor aspects (Demirel et al., 2010). Therefore, this study is important because it increases researchers' awareness that they should also conduct studies on FLM in the affective and psychomotor fields. Similarly, teachers' emphasis on the use of FLM in these two areas in their lessons will improve their students in terms of these skills. Therefore, this study sheds light on teachers in this sense.

This meta-synthesis study argues that it is important for further studies to investigate students' perceptions of their satisfaction with the use of FLM because the literature argues that it is important to determine the perception of satisfaction to expand the use of such models (Cronin & Taylor, 1994). Based on this, student satisfaction is important in the field of educational sciences, as in many fields (Clayson, 2009). Therefore, this study is unique in two respects. First, we recommend teachers determine their students' perceptions of satisfaction with flipped learning. Second, we suggest that the first suggestion is important for the sustainability of FLM.

The current study concluded that FLM studies on science and science-related disciplines were conducted with participants from the upper age group such as university students, pre-service teachers, and in-service teachers. Among the studies we reviewed, studies examining the effect of FLM on science-related issues conducted with participants from the primary school level are limited. Therefore, it is possible to say that there is not enough information in the literature about the effect of FLM on teaching science and science-related subjects to young age groups. There may be different reasons why FLM is not implemented in lower age groups. One of these reasons is teachers' beliefs that FLM will not be effective in younger age groups. Supporting this view, Kahramanoğlu and Şenel (2018) stated that the teachers implementing FLM thought that this model was not suitable for the primary school grade level. Although some teachers thought that FLM was not suitable for younger students, Yang and Chen (2020) claimed that FLM would provide more effective learning than traditional teaching in primary school. This claim is not surprising because many students today have a visual learning style (Rammal, 2006), and watching videos can make them enjoy learning (Yang & Chen, 2020). Additionally, today's K-12 students were born into a world where internet-based learning tools are available (Google, YouTube, and Wikipedia, etc.,). These individuals, called "Digital Natives," have played an average of 10,000 hours of video games and watched 20,000 hours of TV by the time they graduate from college. Computer games, e-mail, internet, mobile phones, and instant messaging applications are an integral part of these students' lives (Prensky, 2005). Therefore, for the reasons mentioned above, this study argues that there should be more studies investigating the use of FLM at the primary education level.

The current study concluded that studies investigating the use of FLM used interviews, observations, and various documents as data collection tools. We concluded that the most frequently used data collection tool was the interview. We also decided that semi-structured interviews were used more than structured and unstructured interviews. We determined that reflection papers, different forms, scales, student products, rubrics, and surveys were used less as data collection tools than interviews. Similarly, Kozikoğlu (2018) concluded that the most

frequently used data collection tools in FLM studies are interviews, achievement tests, and surveys. On the other hand, similar to this study, Uzunboylu and Karagözlü (2017) also stated that observations are the least used data collection tools in flipped learning research.

As an interesting result, we concluded that audiovisual materials were not used as data collection tools in any of the studies. Creswell (2007) categorizes the data collection tools used in qualitative research under four headings: Interviews, observations, documents, and audiovisual materials, and reminds us that each data collection tool has some strengths and weaknesses. In qualitative research, it is recommended to use different data collection tools together to better understand different aspects of the phenomenon (Creswell, 2007). Similarly, it is recommended to use more than one data collection tool in mixed methods research to reflect the pluralistic perspective (Karaca et al., 2022). We concluded that two qualitative data collection tools were used in some of the studies. According to Kozikoğlu (2019), the relatively high number of mixed-method studies on FLM is because they want to use different data collection tools. Based on all these, the authors of this study argue that different data collection tools should be used in FLM studies and that audiovisual tools are more suitable for the nature of FLM.

While we concluded that qualitative and quantitative data analyses were used in mixed method studies, we stated that content analysis, descriptive analysis, and numerical analysis were used in qualitative studies. While descriptive analysis is based on summarizing and interpreting, numerical analysis is based on frequencies and percentages, and content analysis is based on conceptualization and establishing relationships (Yıldırım & Şimşek, 2005). Therefore, content analysis is a higher-level analysis than other types of qualitative analysis. We can say that analyses in-depth are generally carried out in studies. However, we saw that dualist themes and categories such as "positive" - "negative", "weak" - "strong", "advantage" - "disadvantage" were frequently created in the analyses. We argue that we need to go beyond this and use different theoretical perspectives in data analysis. Reaching more analytical generalizations in studies may lead future FLM researchers to provide in-depth perspectives. In this respect, the current study argues that qualitative FLM studies should include analyses that present different perspectives by the interpretive paradigm, and mixed-method FLM studies should include analyses that benefit science and reflect a pluralistic perspective by pragmatism (Karaca et al., 2022).

We have seen that the validity and reliability of the studies examined are generally conducted by the nature of qualitative research. Lincoln and Guba (1985) examine validity-reliability in qualitative research under four headings: credibility, transferability, dependability, and confirmability. Also, some suggestions are made to ensure credibility, transferability, dependability, and confirmability by different researchers (Erlandson et al., 1993; Gagnon, 2010; Lincoln & Guba, 1985; Miles & Huberman, 1994). In this regard; long-term interaction, in-depth data collection, triangulation, expert review, and participant confirmation are suggested to increase the credibility of the research. Describing the entire research process in detail and using purposive sampling are suggested for transferability (Erlandson et al., 1993). Also, making concrete and understandable explanations, preserving raw data, making researcher triangulation, and seeking participant confirmation are suggested to increase dependability. An expert review of the results, an explanation of the role of the researcher, and the characteristics of the participants are offered for confirmability (Gagnon, 2010). When the studies within the scope of the research are examined in terms of validity and reliability, it is seen that the most frequently used procedures to ensure credibility, transferability, dependability, and confirmability are data triangulation, description, and presenting direct quotations, detailing the research process and using code names. Thus, it can be said that the researchers carried out actions to increase the validity and reliability of their research. However, it is seen that the least used procedures in the studies are interacting with the participants for a long time, asking for participants' confirmation of the data and the findings obtained as a result of the analysis of the data, and preserving the raw data. Since these methods are important to increase the credibility and dependability of the research, they should not be ignored in qualitative research. This study claims that validity and reliability studies are necessary to increase the use of FLM.

In the studies, we have seen that FLM achieves the intended goals. According to the results of the studies, FLM improves students' understanding of subject content, ensures that students come to class prepared, and provides flexibility and autonomy in learning. Moreover, FLM enables learners to receive immediate feedback and take an active role, while increasing peer interaction, motivation, interest, and satisfaction. In addition, FLM improves science skills such as critical thinking, productivity/original product development, technological competence, self-efficacy, and confidence. Similarly, Kozikoğlu (2019), in a meta-synthesis study, concluded that FLM

improves students' academic performance, motivation, metacognitive awareness, self-learning skills, attitudes, critical analysis, information literacy, and learning retention. Moreover, other meta-analyses and meta-synthesis studies have also shown that FLM increases achievement (Huber & Werner, 2016; Karagöl & Esen, 2019), engagement (Huber & Werner, 2016), self-efficacy and retention (Huber & Werner, 2016). Apart from meta-analysis and meta-synthesis, it is possible to see similar results in individual studies (Hwang et al., 2021). The positive effects of FLM on students' cognitive and affective development can be explained by its certain features. The first is that FLM offers students the opportunity to learn at their own pace and in their style. One of the famous pioneers of distance education, and the founder of the Kahn Academy, Salman Kahn, drew attention to the possibility of learning at self-pace. Studies are showing that FLM confirms Khan's (2012) claims. For example, according to Almodaires et al. (2019), students' opportunity to rewind, pause, and replay lecture videos helps them learn at their level and understand topics and concepts more effectively. Apart from the opportunity of learning in self-pace, having the chance to practice the new-learned information (Lo et al., 2021), re-visiting the video content in the face-to-face sessions (Şen & Hava, 2020), and allocating more time to think about difficult topics (Yurtseven-Avcı et al. 2022) can be considered as other factors underlying the effectiveness of FLM.

On the other hand, one of the reviewed studies reported negative results regarding FLM. Similarly, a previous meta-synthesis study reported that few studies concluded that FLM was not effective, and this was most likely due to the incompatibility between FLM and traditional learning culture (Youhasan et al., 2021). Another reason for negative opinions and results regarding FLM may be that practitioners cannot apply FLM correctly and effectively. In order not to fall into this situation, it may be beneficial for researchers and practitioners who will utilize FLM in their classes to review the design principles for the flipped classroom developed by Lee and Park (2018). In light of all these, this study argues that there is a need for further studies to explore the positive and negative aspects of FLM. Scientific knowledge needs to have an audience to be used by people. Therefore, this study suggests that further studies that reveal the positive and negative aspects of FLM need to gather supporters to take part in the scientific scene.

We concluded that the studies made suggestions such as conducting more studies on FLM, conducting studies with larger samples, investigating the effects of FLM on different variables, and conducting longer-term studies. We stated that the studies mostly made suggestions regarding the limitations of the research. In scientific research, recommendations can be directed toward the limitations of the research, as well as suggestions for future practitioners and policymakers based on the researcher's findings (Baltacı, 2020). We determined that such recommendations were fewer in number in the studies compared to the recommendations for limitations. In addition, it is a common situation in social science research to present similar recommendations that are not directly related to the research results (Horzum et al., 2016). However, it is seen that the suggestions presented in the analyzed studies are compatible with the research results and are original. Considering that well-crafted recommendations increase the importance of research results (Howes, cf., Baltacı, 2020), it can be said that the recommendations in the analyzed studies are presented by the literature and increase the importance of the research. This study is important because it gives researchers an idea of what kind of study, they should conduct on FLM. In addition, this study is important because it raises awareness for teachers about what they should pay attention to when implementing FLM in their classrooms based on the suggestions in the studies.

In this study, we analyzed 13 studies. Future researchers can increase the number of studies to present different perspectives. In addition, we did not examine quantitative studies in this study. Future researchers can include quantitative studies in their reviews. Additionally, we did not examine a study at the primary school level in this study. Future researchers could include FLM studies at primary school level in their studies.

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GENİŞLETİLMİŞ TÜRKÇE ÖZET

Yapılandırmacı öğrenme yaklaşımında öğrencilerin bilgiyi öğrenip yorumlaması ve karşılaştığı sorunlar karşısında kullanabilmesi önemlidir (Rababah, 2021). Bu kapsamda öğrencilerden karar verme, orijinal fikir üretme gibi becerilere sahip olması beklenmektedir (Banihashem vd., 2021). Bu becerilerin kazandırılabilmesi için de yapılandırmacı öğrenme yaklaşımını temel alan stratejiler kullanılması gerekmektedir. Dolayısıyla dijital öğrenme kaynaklarını ve iletişim araçlarını kullanarak esnek öğrenme (Wanner & Palmer, 2015) ve esnek zaman (Johnson vd., 2012) fırsatı sunan harmanlanmış öğrenme modellerinin kullanımı bu süreçte önem arz etmektedir (van Alten, 2020). Bu modellerden biri olan Ters Yüz Öğrenme Modeli (TYÖM), esnek ve etkili öğrenme ortamları sağlayan dijital araçlar ile birçok öğrenme yaklaşımlarını içermektedir (Andujar vd., 2020; Johnson, 2013). TYÖM'de profesyonel eğitmen tarafından oluşturulan öğretim materyalleri çevrim içi araçlarla öğrencilere gönderilir. Öğrenciler ders zamanına kadar konu ile ilgili temel bilgi ve kavramları öğrenirler. Sınıfta ise öğrencilerin bireysel ve grup çalışmaları yapmasına fırsat verecek etkinliklerle konu özümsenir (Bishop & Verlager, 2013; Flumerfelt & Green, 2013). İlgili alanyazın tarandığında TYÖM'ün etkililiğini inceleyen çalışmaların nicel (Aljaser, 2017; Cobb, 2016), nitel (Ogden, 2015) ya da karma (Love vd., 2014) araştırma yöntemi dikkate alınarak yürütüldüğü görülmektedir. Bununla birlikte alanyazında TYÖM'ün farklı değişkenlere etkisini meta-analiz ile ortaya koyan çalışmalarda artış yaşanmıştır. Farklı kültürleri, öğrenci gruplarını ve yöntemleri içeren TYÖM ile ilgili birçok çalışma yer almasına rağmen bu çalışmaların belli ölçütler çerçevesinde betimlenmesine ve özetlenmesine yönelik yeterli çalışma yer almamaktadır. Son yıllarda TYÖM'ün etkililiğini inceleyen nitel ve karma çalışmalarda da artış olması bu alanda meta-sentez çalışmasının yapılmasını gerekli kılmıştır. Çalık ve Söz Bilir'e (2014) göre üç temel içerik analizi türünden birisi olan meta-sentez, bir konuda yapılmış olan çalışmaların tema veya şablonlar kullanılarak eleştirel bir yaklaşımla bir araya getirilmesi ve değerlendirmesi işlemidir. Böylelikle bir konuyu farklı bakış açıları ile ele alan çalışmaların sonuçlarının nitel olarak incelenip, benzerlik ve farklılıkların ortaya konulması amaçlanır. Ayrıca bir konuda araştırma yapmak isteyen araştırmacıların ilgili bütün çalışmalara ulaşmak zorunda kalmadan konu ile ilgili yapılmış çalışmaları ve yönelimleri görmelerine de yardımcı olur. TYÖM'e yönelik yapılmış çalışmalardan yola çıkarak, bu modelin etkililiğini detaylı bir şekilde inceleyen ve nitel olarak özetleyip betimleyen bir araştırmaya rastlanmamıştır. Dolayısıyla bu konuda yapılacak bir meta-sentez araştırması, TYÖM'e yönelik araştırma yapmayı hedefleyen araştırmacıların yapılan çalışmaların farkına varmalarını ve mevcut durumu değerlendirebilmelerini sağlayacağı düşünülmektedir. Ayrıca bu çalışmada; TYÖM'ün kullanıldığı çalışmaların amaçları, hangi alanlara yönelik çalışmalar yapıldığı, çalışmalarda kullanılan yöntem, desen, veri toplama aracı, örneklem ve izlenen süreçlerin neler olduğu ve hangi sonuçlara ulaşıldığına ilişkin alanyazındaki bilgileri bütünleyici bir yaklaşımla ortaya koymak hedeflenmektedir. Dolayısıyla mevcut çalışma ileride yapılacak çalışmalar için yol gösterici nitelikte olacağından önemlidir. Bu açıklamalar neticesinde mevcut çalışmada, TYÖM ile ilgili nitel ve karma araştırmaları tespit ederek belli ölçütler çerçevesinde bu araştırmaları incelemek ve mevcut durumu sentezlemek amaçlanmıştır. Bu amaç doğrultusunda aşağıda ifade edilen sorulara cevap aranmıştır:

1. TYÖM kullanımını araştıran çalışmaların amaçları nelerdir?
2. TYÖM kullanımını araştıran çalışmaların yöntemleri nelerdir?
3. TYÖM kullanımını araştıran çalışmaların katılımcılarını nasıl seçilmiştir?
4. TYÖM kullanımını araştıran çalışmalarda hangi veri toplama araçları kullanılmıştır?
5. TYÖM kullanımını araştıran çalışmalarda veri toplama süreci ve veri analizi nasıl gerçekleştirilmiştir?
6. TYÖM kullanımını araştıran çalışmaların geçerlik ve güvenirlik çalışmaları nasıl yapılmıştır?
7. TYÖM kullanımını araştıran çalışmaların sonuçları nelerdir?
8. TYÖM kullanımını araştıran çalışmalarda ne gibi öneriler sunulmuştur?

Bu araştırmada nitel araştırma yönteminin bir deseni olan durum çalışması deseni kullanılmıştır. Bu amaçla, TYÖM'ü kullanmış nitel araştırma yöntemi ile yürütülen araştırmaların içerik analizi meta sentez yoluyla yapılmıştır. Veri toplama sürecine başlamadan önce araştırma soruları doğrultusunda bir araştırma matrisi oluşturulmuştur. Bu matriste, yazar, çalışmanın başlığı, araştırmanın amacı, yayın yılı, araştırma yöntemi, araştırma deseni, çalışma grubu ve veri toplama aracı yer almıştır. Veri toplama sürecinde Walsh ve Downe (2005) tarafından belirlenen meta-sentez işlem basamakları kullanılmıştır. Verilerin ön analizlerinde, veri

yüklemesini önlemek için analize dâhil edilen çalışmalar Ç1, Ç2, Ç3… şeklinde numaralandırılmıştır. Daha sonra her çalışmanın ilgili bölümleri okunarak veriler kâğıda ve dijital ortama aktarılmıştır (Creswell, 2007). Kodlama aşamasında bu veriler araştırma problemlerine göre analiz edilmiş ve kodlar oluşturulmuştur. Daha sonra ortaya çıkan bu kodlar temalar altında toplanmıştır (Crabtree ve Miller, 1999). Meta-senteze dâhil edilen çalışmalar dört araştırmacı tarafından analiz edilmiştir.

Araştırma verilerinin analizi, TYÖM'ün öğrencilerin akademik performansı üzerindeki etkisinin araştırılmasının, incelenen çalışmaların en belirgin amacı olduğunu ortaya koymuştur. Daha sonra yapılan çalışmalarda öğrencilerin TYÖM ile ilgili algı ve deneyimlerinin araştırılması hedeflenmiştir. Okulların öğrencileri bilişsel, duyuşsal ve psikomotor yönlerden geliştirmesi beklenmektedir. Ancak bunlar arasında okullarda en çok üzerinde durulan bilişsel alandır. TYÖM araştırmaları daha çok üniversite öğrencileri ve öğretmen adayları gibi üst yaş gruplarından katılımcılarla gerçekleştirilmiştir. İlköğretim düzeyindeki katılımcılarla yapılan bir çalışma bulunmamaktadır. TYÖM araştırmalarında görüşmeler, gözlemler ve çeşitli belgeler en çok kullanılan veri toplama araçlarıdır. TYÖM araştırmalarında arzu edilen hedeflere genellikle ulaşılmıştır. Araştırmaların sonuçlarına göre TYÖM'ün, öğrencilerin konu içeriğini anlamalarını geliştirdiği, öğrencilerin derse hazırlıklı gelmelerini sağladığı, öğrenmede esneklik ve özerklik sağladığı, öğrenenlerin anında geri bildirim almasını ve öğrenme süreçlerinde aktif rol almasını sağladığı, akran etkileşimini geliştirdiği, öğrencilerin motivasyonunu ve istekliliğin artırma noktasında etkili olduğu bulunmuştur.

Günümüzün K-12 öğrencileri, Google, YouTube ve Wikipedia gibi internet tabanlı öğrenme araçlarının mevcut olduğu bir dünyaya doğdu. "Dijital Yerliler" olarak adlandırılan bu kişiler, üniversiteden mezun olana kadar ortalama 10.000 saat video oyunu oynamış, 20.000 saat TV izlemiş olacaklardır. Bilgisayar oyunları, e-posta, internet, cep telefonları ve anlık mesajlaşma uygulamaları yaygınlaşmıştır ve bu öğrencilerin hayatlarının ayrılmaz parçaları olmuştur (Prensky, 2005). Kullanıcıların memnuniyet algıları üzerine yapılan araştırmalar, bir ürün veya uygulama için algıların ve olumlu deneyimlerin belirlenmesinin önemini göstermiştir (Cronin & Taylor, 1994). Birçok alanda olduğu gibi eğitim bağlamında da öğrenci memnuniyeti önemlidir (Clayson, 2009). Bu nedenle öğrencilerin TYÖM'e yönelik algı ve deneyimlerinin belirlenmesi sürdürülebilirlik açısından önemlidir. TYÖM'nin sürdürülebilirliğinin sağlanabilmesi için öğrencilerin TYÖM'e yönelik algı ve deneyimleri belirlenmelidir. Ayrıca TYÖM'nin kullanıldığı araştırmalarda veriler analiz edilirken aynı bulguları tekrar etmemek adına farklı teorik bakış açıları kullanarak analitik genellemeler yapmak, gelecekteki araştırmaları mevcut olanlardan farklılaştırabilir. Geçerlik güvenirlik önlemleri TYÖM araştırmalarında araştırmanın inandırıcılığını ve güvenirliğini artırmada önemli olduğu için göz ardı edilmemelidir. Ters yüz edilmiş sınıf için farklı araştırmacılar tarafından (Örn. Lee & Park, 2018) geliştirilen tasarım ilkelerinin sınıflarında TYÖM kullanacak araştırmacı ve uygulayıcılar tarafından öğrenilmesi faydalı olabilir.