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Effects of the Flipped Classroom Model on Pre-Service Teachers' Performance in Learning Research Ethics Concepts

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Abstract

This study investigated the effect of the flipped classroom (FC) model on pre-service teachers' performance in learning concepts and acquiring high-level cognitive skills in the science and research ethics course. The study employed the pre-experimental research design and was conducted through a single group. 93 pre-service teachers participated in this study. The data collection tools were achievement tests, project summary and research proposals. The implementations was carried out face-to-face and with the Zoom Cloud Meetings. The results revealed that FC model was more effective in learning concepts related to ethics, morality, ethical principles, standards of ethical behavior and unethical behavior than in learning concepts related to science, research and method. In addition, the present study found that the FC model was inadequately or moderately effective in acquiring high-level cognitive skills in the science and research ethics course. On the other hand, there were no statistically significant differences between female and male pre-service teachers' learning levels of science-research-method and ethics concepts. The results further highlighted statistically significant differences between the learning levels of the visual arts pre-service teachers and other pre-service teachers about science and research ethics course concepts.

Keywords: Face to face, Flipped classroom model, Science and research ethics, Undergraduate students.

Article Type:

Research article

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No funds, grants, or other support was received.

Ethics Declaration:

This study followed all the rules stated to be followed within the "Higher Education Institutions Scientific Research and Publication Ethics Directive" scope. None of the actions specified under the title of "Actions Contrary to Scientific Research and Publication Ethics," which is the second part of the directive, were not carried out.

Since the article was prepared before 2020, ethics committee approval was not obtained.

Ters Çevrilmiş Sınıf Modelinin Öğretmen Adaylarının Araştırma Etiği Kavramlarını Öğrenme Performanslarına Etkisi

Öz

Bu çalışmada ters çevrilmiş sınıf modelinin öğretmen adaylarının bilim ve araştırma etiği dersi kapsamındaki kavramları öğrenme ve üst düzey bilişsel beceriler edinme performanslarına etkisi araştırılmıştır. Araştırma tek bir grup üzerinden zayıf deneysel araştırma deseni kullanılarak yürütülmüştür. Bu çalışmaya öğretmen yetiştirme lisans programlarında okuyan 93 öğretmen adayı katılmıştır. Veri toplama araçları başarı testleri, proje özeti ve araştırma önerileriydi. Uygulamalar yüz yüze ve çevrim içi toplantıları ile gerçekleştirilmiştir. Bu çalışmanın sonuçları, ters çevrilmiş sınıf modelinin etik, ahlak, etik ilkeler, etik davranış standartları ve etik olmayan davranışlarla ilgili kavramları öğrenmede bilim, araştırma ve yöntemle ilgili kavramları öğrenmekten daha etkili olduğunu ortaya koymuştur. Ek olarak, bu çalışmada, ters çevrilmiş sınıf modelinin bilim ve araştırma etiği dersinde üst düzey bilişsel beceriler edinmede yetersiz veya orta derecede etkili olduğu tespit edilmiştir. Öte yandan, kadın ve erkek öğretmen adaylarının bilim-araştırma-yöntem kavramlarını öğrenme düzeyleri ile etik kavramlarını öğrenme düzeyleri arasında istatistiksel olarak anlamlı fark bulunmamıştır. Analiz sonuçlarına göre bilim ve araştırma etiği dersi kavramları hakkında görsel sanatlar öğretmen adayları ile diğer branşlardaki öğretmen adaylarının öğrenme düzeyleri arasında istatistiksel olarak anlamlı farklılıklar bulunmuştur.

Anahtar Kelimeler: Bilim ve araştırma etiği, Lisans öğrencileri, Ters sınıf modeli, Yüz yüze.

Introduction

Countries are trying to improve their technologies due to the covid-19 pandemic that affects the whole world and they also integrate developing technology with education systems. Such global pandemics reveal new approaches for teaching and learning and they make some approaches more appealing. The flipped classroom (FC) model is in the focus of researchers during this global pandemic period.

The FC model allows students to access what they can learn through individual studies outside of school. Answers of problematic issues in students' individual learning are sought in synchronous environments. This approach is defined as the displacement of homework and in-class course processing (Verleger & Bishop, 2013). In this model, theoretical knowledge is learned individually, and students can apply what they have learned in the school environment (Zownorega, 2013). Courses are recorded on video and students can access information at any time and place (Talbert, 2012). Students most need teacher help in non-classroom environments because they have to perform difficult tasks outside the classroom (Talbert, 2012). High-level cognitive activities are difficult for students, and these activities are focused within the classroom. In the FC model, learning of content is carried out outside of the classroom using online technologies, while problem solving activities are integrated as a component of the course (Christiansen, 2014; Seery, 2015). FC model is based on learning the subject at home and making its applications in the school environment, and the use of distance education system and tools is important in this model (Bergmann & Sams, 2012).

This teaching model was first used in social sciences such as business, law, sociology, psychology, and philosophy (Lage et al., 2000). Recently, it has been applied in the fields of chemistry (Fautch, 2015; Eichler & Peeples, 2016), medical molecular biology (Kong et al., 2020), physics (Asiksoy & Ozdamli, 2016) and mathematics (Bhagat et al., 2016; Wei et al., 2020). These studies investigated the effect of FC model on math performance of secondary school students (Wei et al., 2020), students' learning success and motivation (Zheng et al., 2020), pre-service teachers' science self-efficacy and attitudes (Gonzalez Gomez et al., 2019), higher education students' creative thinking (Al Zahrani, 2015), students' success, motivation

and self-efficacy (Asiksoy & Ozdamli, 2016) and foreign language students' oral competence (Wu et al., 2017).

The literature on the educational research higlighted that students were the focus of articles related to the FC model (e.g., Al-Zahrani, 2015; Wu et al., 2017). In addition, the researchers carried out studies with higher education students and that control group experimental desings were often used in the studies. On the other hand, the FC model was often used in medical education, (e.g., Cheng et al., 2019; Strelan et al., 2020; Zheng et al., 2020) meta-analysis studies were conducted, and the effect of the model on dependent variables was investigated.

Importance of Research

Education researchers argue that teachers are generally far from educational research and do not benefit as much from current educational research as they should (Costa et al., 2000; Greenwood & Maheadly, 2001; McIntyre, 2005; Vanderlinde & van Braak, 2010). Discussions about the gap between educational research and teacher practice focus in particular on the functionality of educational research and its applicability and advantages for teachers (İlhan et al., 2015). Yıldırım et al. (2014) reported that only 10% of teachers regularly followed educational research, while the teachers who followed it had difficulty understanding the research and could not use it enough in practice. Teachers should be aware of new teaching approaches. They are expected to learn these approaches and apply them in the classroom environment. In addition, they should be able to integrate technology into their teaching. Further, they should be able to guide students in preparing scientific research/project. For these purposes, *'scientific research methods'* course is a compulsory course in teacher training undergraduate programs in Türkiye since 2007. This course aims to provide pre-service teachers with knowledge and skills about the scientific research process. In the following years, the name of this course was changed to *'research methods in education'.* Tosun (2014) reports that this course provides pre-service teachers with skills such as literature review and article writing. In addition, this course reduces the anxiety towards conducting scientific research (Tosun, 2014). Tosun (2022) conducted a bibliometric analysis to reveal the trends of educational research in Türkiye and reported that teachers were among the co-authors in 3.2% of the SSCI-indexed articles analyzed. In recent years, the visibility of teachers in scientific studies such as postgraduate education, guidance in student projects increased. It is important for teachers to learn the basic concepts and principles related to research ethics, as well as to learn the concepts of *'research methods in education'*. Thefore, teacher training undergraduate programs were revised in Türkiye in 2018 and *'science and research ethics'* course was added as a general culture elective course. The content of this course is presented below (Council of Higher Education, 2018):

> Science, nature of science, development of science and scientific research, ethics and ethical theories, research and publication ethics, unethical behavior and ethical violations in the research process, ethical issues related to authorship and copyright, biased publication, editorial, refereeing and ethics, publication ethics and unethical behavior in the publication process, legal legislation and boards related to research and publication ethics, stages to follow when ethical violations are identified, frequent violations of research and publication ethics and methods to prevent them.

The current study investigated the effect of the FC model on pre-service teachers' performance in learning concepts and acquiring high-level cognitive skills in the science and research ethics course. The independent variable of this research was FC model. Ethical issues of the scientific research process were fictionalized and presented to pre-service teachers as problem scenarios. Problem scenarios and possible reflections to scenarios were discussed in the synchronous sessions. Pre-service teachers were expected to prepare a research proposal in the present study. In addition, pre-service teachers were expected to define the main components of the project summary. Thus, their performance in acquiring high-level cognitive skills was measured. The following research questions were answered in the study:

- What is the effect of the FC model on pre-service teachers' performance in learning concepts and acquiring high-level cognitive skills in science and research ethics course?
- Is there a significant difference between pre-service teachers' learning levels of science-research-method and ethics according to their gender and undergraduate education programs?

Method

The current study employed the pre-experimental research design among quantitative research approaches. The research was conducted through a single group. This design was preferred due to the lack of a group equivalent to the experimental group (McMillan & Schumacher, 2006).

Sample

Pre-service teachers studying at a state university in Türkiye participated in this study. Non-selective sampling technique was used in the sample selection. The participants were determined according to purposive and convenience sampling techniques from non-selective sampling technique (Fraenkel & Wallen, 2003). The participants were determined according to their proximity to the researcher. In addition, research was conducted with a group rich in information in the context of the purpose of the study. The implementations were carried out in the spring semester of the 2019-2020 and in the autumn semester of the 2020-2021 academic years. 93 pre-service teachers from different teaching programmes participated in this study. Detailed information about the participants was presented in Table 1. 72% of the pre-service teachers were female and 28% were male. In addition, 22.5% of the participant were pre-service guidance and counseling teachers and %21.5 were pre-service Turkish language teaching teachers. Almost all of the participants were second-year undergraduate students (four of the students were third-graders). The research was conducted in the science and research ethics course from general culture elective courses. Participation in the research was voluntary.

Table 1.

Demographics of the sample

		Frequency for 2019-2020 years	Frequency for 2020-2021 years	Total frequency (f)	Total percentage (%)
Gender					
	Female	20	47	67	72.0
	Male	8	18	26	28.0
	Total	28	65	93	100
Teaching programmes					
	Classroom teachers	7	5	12	13.0
	Science teachers	6	---	6	6.5
	Turkish teachers	2	18	20	21.5
	Social studies teachers	9	3	12	13.0
	Elementary mathematic teachers	---	13	13	13.9
	Visual arts teachers	3	6	9	9.6
	Guidance and counseling teachers	1	20	21	22.5
	Total	28	65	93	100

Data Collection Tools

Achievement Tests

Achievement tests consisting of short-answer, true-false, open-ended and multiple-choice questions were used in the present study. Achievement test questions were prepared by the researcher. The questions were categorized by the researcher according to Bloom's revised

taxonomy. Expert opinions were obtained for the content validity and cognitive category levels of the tests. Achievement tests consisted of 21 questions for the midterm exam and 39 questions for the final exam. Midterm exam included 13 multiple-choice, five short-answer and three open-ended questions. Final exam included 26 multiple-choice, six short-answer, five true-false and two open-ended questions. Test questions consisted of the concepts of science, research, method, morality and ethics and the contents of the question, and they are presented in Tables 3, 4 and 5. These questions were in the categories of remembering, understanding and applying according to Bloom's revised taxonomy. No pilot study of the tests was carried out before the implementation. The difficulty and discrimination indixes of the questions included in the achievement test were examined within the scope of the research. In addition, the reliability coefficients of the tests were calculated based on the data collected in the research. This was considered as a limitation of the study.

Project Summary and Research Proposal

Pre-service teachers were given a project summary in this study. Participants were asked to determine *the purpose, method, sample, data collection tools, data analysis, validity and reliability and ethical issues* of the project summary. In addition, pre-service teachers were expected to prepare a research proposal at the end of the semester. Research proposals and project summaries were used as data collection tools in this study. Bloom's revised taxonomy consists of six categories. These are remembering, understanding, applying, analyzing, evaluating, and creating. Skills in the category of analyzing, evaluating and creating require high-level cognitive skills (Brown, 2004). These skills are complex, uncertain, require effort and contain different answers (Resnick, 1987). According to Patterson and Smith (1986, as cited in Wellman, 1997), higher-level cognitive skills do not mean memorizing information and suggesting familiar answers to problems. These skills require the application of knowledge and are necessary in situations of uncertainty, such as in real-life problems (Kitchener & Fischer, 1990). Pre-service teachers were expected to prepare a research proposal in present study. Preparing research proposal is at the creating level according to Bloom's revised taxonomy. Preparing a research proposal requires high-level cognitive skills, as the components must be combined to create a new product. In addition, participants were asked to determine the purpose, method, sample, data collection tools, data analysis, validity and reliability and ethical issues of the project summary. Content analyzing of project summary is at the analyzing level according to Bloom's revised taxonomy. Revealing the components of research requires high-level cognitive skills, as it requires exploring how the components overlap with each other and with all of the research. Research proposals could be prepared individually or as a group. The choice of subjects for research proposals was not restricted to participants. The subject of the research proposal was asked to relate to the education of their field. Project summary is presented below (Project Coordinator: B…A A..U D…A):

> **19th question in the final exam:** A project proposal titled "supporting the measurement and evaluation processes of lecturers in distance education with an online educational portal" was evaluated and it was decided to be supported by The Scientific and Technological Research Council of Turkey (TUBITAK). First, the project team will analyze the needs related to the measurement and evaluation activities carried out in distance education…. Interviews with approximately 200 academic staff will be conducted with semi-structured interview forms. Interviews will be conducted with academic staff from different faculties of universities in the western Black Sea region (Bartın University, Zonguldak Bülent Ecevit University, Karabük University, Bolu Abant Izzet Baysal University and Duzce University). The purpose of the interview was to understand the experience and priorities of academic staff related to measurement and evaluation activities carried out in distance education. An e-learning platform will be created accessible to all stakeholders with the help of the needs analysis findings of the academic staff. Pre-service teachers were expected to answer the following questions with the knowledge and skills they acquired in the science and research ethics course:
>
> 1) What are the purposes of the project?
> 2) What is the method of project?

3) What is the sample of the project?
4) What are the data collection tools of project?
5) What are the data analysis techniques of the project?
6) What are the validity and reliability issues of the project?
7) What might be the the ethical issues of the project?

Implementation

The implementation was carried out for 14 weeks, including 2 hours per week. The first five weeks of the course were conducted face-to-face. The remaining weeks of the course were conducted through distance education, as the COVID-19 pandemic was in a period of rapid spread in Türkiye. The implementation process is presented in Figure 1.

Figure 1

Implementation process

Course documents related to science, research, method and nature of science (e.g., term, definition, concept, phenomenon, theory, law, hypothesis, misconceptions) were presented to the participants with *EasyClass program* in the first weeks of the face-to-face course. *EasyClass program* is a free learning management system. Pre-service teachers examined course documents in out-of-school learning environments and learned the concepts in the documents. Pre-service teachers' questions were answered face-to-face in the course. The common misconceptions about the nature of science and the relationship between hypothesis, theory, and law were explained at this stage. Then, course documents related to access to scientific knowledge were presented from the *EasyClass program*. Search engines (e.g., Google, Google

Scholar), indexes (e.g., TR index) and online catolog scans (e.g., national library of Türkiye, online catalog scan at Bartın's university library and national collective catalog scans) were explained to participants in face-to-face course. In addition, how to scan in the thesis center of the Council of Higher Education was explained in practice. Participants were second-year undergraduate students. For this reason, the researcher explained indexes such as Web of Science (WoS), Education Resources Information Center (ERIC) and Australian Education Index (AEI). Course documents related to research problem were presented to the pre-service teachers. Dependent and independent variables were explained to participants in face-to-face course. Sample problem sentences and hypotheses were examined with participants. Additional course documents (e.g., Karasar, 2000; Ertekin et al., 2002; Resnik, 2004; Yıldırım & Şimşek, 2006; Karasar, 2008; Balcı, 2009; Büyüköztürk et al., 2010) were given so that pre-service teachers would be prepared for courses. Pre-service teachers were expected to participate in course discussions. Pre-service teachers were asked to determine the purpose and problems of the research proposals at this stage. The educational contents for the first five weeks and the following weeks are presented in Table 2.

Distance education courses were conducted through the *Zoom Cloud Meetings program*. Course documents were presented through Distance Education Application and Research Center before the synchronous courses. Distance education courses were given to participants as 80 minutes (two course hours) per week. Course video links were shared through Distance Education Application and Research Center for students failed to attend the course. Course documents related to research methods, sampling methods, data collection tools, data analysis methods, validity, realibility and academic reporting were presented to the participants through Distance Education Application and Research Center before the synchronous courses. Pre-service teachers examined course documents in out-of-school learning environments and learned the concepts in the documents. Pre-service teachers' questions were answered in the synchronous courses. Differences between quantitative, qualitative and mixed approaches were explained at this stage. Differences between experimental research designs were explained by examples. In addition, the differences and similarities of the survey, scale and test were explained in the synchronous courses. Pre-service teachers were asked to determine the method, universe, sample, data collection tools, data analysis techniques and validity and reliability of the research proposals at this stage. Pre-service teachers summarized their structured research proposals in synchronous courses to the researcher and they received feedback.

Course documents related to morality, ethics, the principles of scientific ethics and standards of ethical behavior in science were presented in the following weeks. In addition, course documents related to unethical behavior in scientific publications, *i-Thenticate and Turnitin* programs were presented to the participants through Distance Education Application and Research Center before the synchronous courses. Pre-service teachers examined course documents in out-of-school learning environments and learned the concepts in the documents. Pre-service teachers' questions were answered in the synchronous courses. The purposes, functions, advantages and disadvantages of plagiarism detection softwares were explained in practice. Pre-service teachers were informed that this program would be used to determine similarity rates in research proposals. Finally, ethics issues such as research approval, voluntary participation approval, parent permission approval, ethics boards in universities, ethics board approval received from these boards were explained by examples.

Table 2.

Educational content

Weeks	Topics	Educational content
The first	Scientific research and features	Science, research and method Theory, law and hypothesis,

five weeks	Access to scientific knowledge	Search engines (e.g.: Google, Google Scholar), Indexes (e.g.: TR index) Online catolog scans Thesis center of the Council of Higher Education
	Research problem	Dependent and independent variables Sample problem sentences and hypotheses
The next four weeks	Research designs	Quantitative (descriptive, comparative, correlational, survey), qualitative (cultural analysis, phenomenology, case study, grounded theory, concept analysis and historical analysis) and mixed research methods
	Data collection tools	Tests, surveys, interviews, observations and documents
	Sampling methods	Sample, universe, sample size
	Data analysis	Quantitative data analysis methods (descriptive-graphs, frequency, arithmetic mean, median, mode, ranj, standard deviation, variance and normal distribution- and inferential statistics techniques) and qualitative data analysis techniques (descriptive and content analysis)
	Validity and reliability	Validity and reliability
	Academic reporting	Pre-service teachers were asked to determine the method, universe, sample, data collection tools, data analysis techniques and validity and reliability of the research proposals at this stage. Pre-service teachers summarized their structured research proposals in synchronous courses to the researcher and they received feedback.
The last five weeks	Morality and ethics	Morality, ethics
	Standards of ethics behaviour in science	Honesty, attention, openness, freedom, honor share, education, social responsibility, legality, equal opportunity, mutual respect, and efficiency
	Unethical behaviours in scientific publications	Fabrication, falsification, duplication, salamization, plagiarism, paraphrasing, not specifying supporters, and imaginary authorship
	Plagiarism detection softwares	i-Thenticate and Turnitin programs
	Legal legislation and boards related to publication ethics	Research approval, voluntary participation approval, parent permission approval, ethics boards in universities, ethics board approval received from these boards

Further, the ethical issues to be encountered in the scientific research process were fictionalized and discussed with the participants in the synchronous environment. The problem scenarios asked to the pre-service teachers in the synchronous sessions and the possible reflections to answer the problem scenarious are presented below:

Problem Scenarious 1: You must prepare a research proposal within the scope of *Science and Research Ethics* course. You should write the introductory part of your research proposal using different sources. However, you have difficulties in how to cite and reference. How do you resolve this situation?

I use quotation marks for direct cites of up to 40 words.

I give direct cites of more than 40 words in a separate and compressed paragraph.

I cite reasonably from a single source.

I often include indirect cites in the text.

I cite all indirect and direct citations in the text.

I indicate citations' diagnostic information in references.

I write the introductory part of the research proposal by cutting-pasting or copy-pasting from different sources.

I change the statement I got from other sources and write it without citations as if the idea was my own.

Since the document containing the transferred information is a secondary source, I give it as a transmitter.

Problem Scenarious 2: You are investigating the effect of an argumentation-based learning approach on middle school students' science achievement. What ethical issues do you pay attention to for the methodology of the thesis?

Since the research will be conducted with middle school students, I first get approval from the ethics committee.

I get legal permission approval from Turkish Ministry of Education for the application.

Since underage students will participate in the research, I get parental permission.

I conduct the research with volunteer participants.

I get the necessary permissions from the developers for the data collection tools to be used in the research.

I do not receive any identifying information from participants.

In qualitative data analysis, I code for direct statements of participants.

I declare that the data will only be used for research and will not be shared with other people.

Problem Scenarious 3: You want your draft article to be published as soon as possible. What path do you follow in this process?

I submit my article to more than one journal at the same time. Whichever journal accepts my article first, I withdraw my article from the other journal.

I would like to contact the editor and ask him/her to send my article to the referees I know.

I learn from the editor who the reviewers are and contact them.

Data Collection and Analysis

Research data was collected through the *Microsoft Office 365* program. Pre-service teachers received a username and password by the researcher's university to use this program. Participants were given enough time to answer midterm and final exam questions. Midterm and final exams were recorded with the *Zoom Cloud Meetings* program. The researcher explained questions that students did not understand during the exam. Technical support was provided on some issues (such as uploading the answers of open-ended questions into the system). Test questions and options were reflected on the screens of students in different order (mixed) during the exam.

Quantitative data were analyzed using descriptive statistics techniques. The results were presented with percentage and frequency tables. The researcher examined the difficulty and discrimination indexes of the test items and KR-20 reliability coefficients of tests. Independent samples t-test and one way ANOVA were used to determine whether the participants' learning levels of the concepts of science and research ethics course differed according to gender and undergraduate teaching programmes variables. Research proposals and project summary were rated according to the evaluation criteria in the rating forms. The rating forms included four sections (*introduction, methodology, ethical issues and references*) for the 2019-2020 academic year and eight sections (*purpose, method, sample, data collection tools, data analysis, validity and reliability, ethical issues and references*) for the 2020-2021 academic year. Each evaluation criteria in the rating forms were examined according to categories that were not made, partially

made, adequately made and fully made. The maximum points that could be obtained from the evaluation criteria in the rating forms are presented in Table 6.

Ethics Declaration

This study followed all the rules stated to be followed within the "Higher Education Institutions Scientific Research and Publication Ethics Directive" scope. None of the actions specified under the title of "Actions Contrary to Scientific Research and Publication Ethics," which is the second part of the directive, were not carried out.

Since the article was prepared before 2020, ethics committee approval was not obtained.

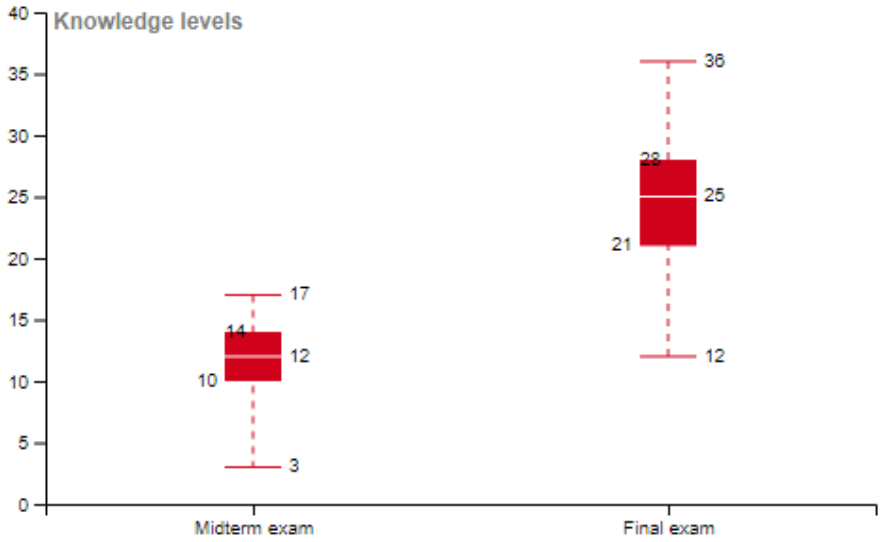
Results

Findings of the Midterm Exam

The science and research ethics course performances of pre-service teachers were revealed in this study with midterm and final exams**.** Participants answered a total of 21 questions in the midterm exam, including 13 multiple-choice, five short-answer and three open-ended. Each correct answer (for short-answer and multiple-choice questions) was rated with 1 point and each wrong answer was rated with 0 points. Descriptive analysis results are presented in Figure 2. The mean of the exam including short-answer and multiple-choice questions was 12.00 and standard deviation was 3.28. The minimum score on this exam was 3.0 and the maximum score was 17.0. Correct answer percentages and difficulty and discrimination indexes for each question are presented in Table 3.

Figure 2

Descriptive statistics for midterm and final exam (for short-answer, true-false and multiple-choice questions)



As shown in Table 3, the percentage of correct answers to the short-answer and multiple-choice questions was between 40.8% and 91.3%. One of the hard questions for pre-service teachers was the thirteenth question *(There is no significant difference between the self-efficacy levels to prepare research proposal of the pre-service teachers participating in the "science and research ethic course" according to their undergraduate programs)*. This question was at the applying level according to Bloom's category. According to 43.0% of participants, the answer to this question was *finding*. In addition, the question answered correctly by most participants was the third question *(Which of the following is not unethical behavior in scientific publications).* This question was at the understanding level according to Bloom's category. 91.3% of participants chose the option of *writing their opinion in accordance with the rules of scientific writing* as the answer to this question. On the other hand, the short-answer questions in this

section were at the remembering level according to Bloom's category. The short-answer questions answered correctly by most pre-service teachers were the fifteenth *(…includes the highest general standards of a society)* and sixteenth *(…are not general standards of behavior, but standards of a particular profession, job, institution, or group in society)* questions. For these questions, the pre-service teachers' answers were *morality* (for fifteenth question) and *ethics* (for sixteenth question). The difficulty indexes of short-answer and multiple-choice questions were in the range of 0.38-0.90. In addition, discrimination indexes were in the range 0.16-0.72. The difficulty indexes of the second, third, fourth and sixth questions were too high and the discrimination index of the fourth question was too low. On the other hand, the average difficulty index was 0.63 and the average discrimination index was 0.44. The reliability coefficient of KR-20 was calculated as r = 0.77.

Table 3.

Correct answer percentage, difficulty and discrimination indexes for short answer and multiple choice questions (N=93)

	Question type	Cognitive process	Content	Frequency of correct answers (f)	Percentage (%)	Difficulty	Discrimination
1	MC	Understanding	Literature review	41	44.0	0.44	0.56
2*	MC	Remembering	Confusius's statement on morality	80	86.0	0.86	0.28
3*	MC	Understanding	Unethical issues	85	91.3	0.90	0.20
4	MC	Understanding	Problem	80	86.0	0.88	0.16
5	MC	Understanding	Method	45	48.3	0.48	0.24
6	MC	Understanding	Research subject	74	79.5	0.82	0.28
7	MC	Applying	The dependent variable	70	75.2	0.70	0.52
8*	MC	Remembering	Plagiarism	51	54.8	0.52	0.64
9	MC	Applying	Discussion	52	55.9	0.50	0.52
10	MC	Understanding	Nature of science	52	55.9	0.64	0.48
11	MC	Applying	Primary sources	53	56.9	0.60	0.72
12	MC	Applying	Hypothesis	46	49.4	0.52	0.48
13	MC	Applying	Finding	40	43.0	0.42	0.44
14	SA	Remembering	Science	55	59.1	0.58	0.28
15*	SA	Remembering	Morality	79	84.9	0.76	0.40
16*	SA	Remembering	Ethics	75	80.6	0.72	0.56
17	SA	Remembering	Phenomenon	63	67.7	0.64	0.64
18	SA	Remembering	Hypothesis	38	40.8	0.38	0.60

Multiple choice=MC; Short answer= SA; *Ethical issues

Three open-ended questions were asked in the midterm exam. The maximum score and descriptive analysis results for each open-ended question are presented in Table 4. Open-ended questions were at the understanding and applying level according to Bloom's category. Pre-service teachers scored high on questions such as *"list the stages of the scientific method"* and *"what are the standards of ethical behavior in science".* Evaluation of the content of the 21 questions for the midterm exam revealed that pre-service teachers' performance related to science and research concepts was lower than their performance related to morality and ethics.

Table 4.

Mean and standard deviation for open-ended questions in the midterm exam (N=93)

2019-2020 academic years								
	Question type	Cognitive process	Content	N	Mean	SD	Min	Max
19	OE-10 points	Applying	Literature review, Types of information sources	28	4.21	1.25	2.0	7.0
20	OE-7 points	Understanding	Steps of scientific method	28	6.10	1.66	0.0	7.0
21*	OE-7 points	Understanding	Standards of ethical behavior in science	28	6.57	1.25	1.0	7.0
2020-2021 academic years								
	Question type	Cognitive process	Content	N	Mean	SD	Min	Max
19	OE-12 points	Applying	Literature review, Types of information sources	65	5.06	2.52	1.0	11.0
20	OE-9 points	Understanding	Steps of scientific method	65	5.75	3.28	0.0	9.0
21*	OE-7 points	Understanding	Standards of ethical behavior in science	65	4.67	2.59	0.0	7.0

OE=Open-ended; Min=Minimum; Max=Maximum; *Ethical issues

Findings of the Final Exam

Pre-service teachers answered a total of 39 questions in the final exam, including 26 multiple-choice, six short-answer and five true-false and two open-ended. Each correct answer (for short-answer, true-false and multiple-choice questions) was given 1 point and each wrong answer was given 0 point. Descriptive analysis results for final exam are presented in Figure 2. The mean of the exam including short-answer, true-false and multiple-choice questions was 25.01 and a standard deviation was 5.53. The minimum score on this exam was 12.0 and the maximum score was 36.0. Correct answer percentages and difficulty and discrimination indexes for each question are presented in Table 5.

Table 5.

Correct answer percentage, difficulty and discrimination indexes for short answer, true-false and multiple choice questions (N=93)

	Question type	Cognitive process	Content	Frequency of correct answers (f)	Percentage (%)	Difficulty	Discrimination
1	MC	Understanding	Interview	47	50.5	0.50	0.52
2	MC	Understanding	Survey	56	60.2	0.58	0.12
3	MC	Understanding	Survey	71	76.3	0.70	0.52
4	MC	Applying	Universe-Sample	49	52.7	0.52	0.80
5	MC	Applying	Survey research method	38	40.9	0.44	0.24
6	MC	Understanding	Sampling	42	45.2	0.44	0.40
7	MC	Understanding	Qualitative data collection method	44	47.3	0.50	0.52
8	MC	Understanding	Nature of science	42	45.2	0.58	0.68

9	MC	Applying	Hypothesis	50	53.8	0.54	0.52
10	MC	Applying	Findings	54	58.1	0.54	0.44
11*	MC	Remembering	Cited	81	87.1	0.88	0.16
12	MC	Applying	Correlational research method	50	53.8	0.48	0.72
13	MC	Understanding	Research methods	80	86.0	0.84	0.32
14*	TF	Remembering	Ethics	59	63.4	0.60	0.56
15*	TF	Remembering	Morality	72	77.4	0.80	0.40
16*	MC	Understanding	Honesty	89	95.7	0.98	0.04
17*	MC	Understanding	Honesty	84	90.3	0.88	0.16
18*	MC	Understanding	Attention-Error	88	94.6	0.90	0.12
20*	SA	Remembering	Honesty	55	59.1	0.60	0.64
21*	MC	Applying	Open and accessible publications	38	40.9	0.36	0.24
22*	SA	Remembering	Justice	66	71.0	0.66	0.60
23*	SA	Remembering	Freedom	73	78.5	0.70	0.28
24*	MC	Understanding	Education	85	91.4	0.88	0.24
25*	MC	Understanding	Social responsibility	32	34.4	0.42	0.52
26*	MC	Understanding	Legality	79	84.9	0.84	0.24
27*	SA	Remembering	Scientific competence	54	58.1	0.54	0.44
28*	SA	Remembering	Mutual respect	54	58.1	0.56	0.40
29*	MC	Understanding	Productivity	83	89.2	0.82	0.36
30*	MC	Understanding	Fabrication	80	86.0	0.86	0.20
31*	MC	Understanding	Falsification	71	76.3	0.74	0.44
32*	MC	Understanding	Duplication	54	58.1	0.74	0.28
33*	TF	Understanding	Duplication	63	67.7	0.68	0.40
34*	MC	Understanding	Salamization	83	89.2	0.84	0.24
35*	SA	Remembering	Plagiarism	66	71.0	0.70	0.44
36*	TF	Understanding	Paraphrasing	90	96.8	0.96	0.08
37*	TF	Understanding	Institution contribution	60	64.5	0.66	0.12
38*	MC	Understanding	Imaginary authorship	43	46.2	0.44	0.32

Multiple choice=MC; Short answer=SA; True-False=TF; *Ethical issues

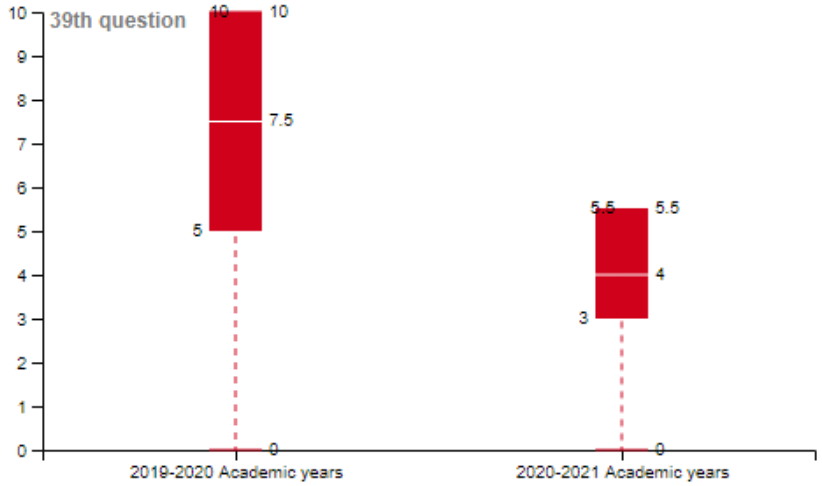
As shown in Table 5, the percentage of correct answers to the short-answer, true-false and multiple-choice questions was between 34.4% and 96.8%. The most difficult question for pre-service teachers in the final exam was the twenty-fifth question (*Which of the following cannot be explained by social responsibility from the standards of ethical in science?)*. This question was at the understanding level according to Bloom's category. In addition, the question answered correctly by most participants (96.8%) was the thirty-sixth question (*Is it unethical behavior to write as if it is your own opinion by changing someone else's ideas or thoughts without specifying the sources used?)*. This question was at the understanding level according to Bloom's category. The difficulty indexes of short-answer, true-false and multiple-choice questions were in the range of 0.36-0.98. In addition, discrimination indexes were in the range 0.04-0.80. The difficulty indexes of the questions 11, 13, 16, 17, 18, 24, 26, 29, 30, 34 and 36 were too high and the discrimination index of the questions 2, 11, 16, 17, 18, 36 and 37 were too low. On the other hand, the average difficulty index was 0.66 and the average discrimination index was 0.37. The reliability coefficient of KR-20 was calculated as $r = 0.84$.

Two open-ended questions were asked in the final exam. The maximum score and descriptive analysis results for 39th question are presented in Figure 3. This question was at the

applying level according to Bloom's category. The average score of the 39th question (*Explain the principle of using the i-Thenticate program in scientific research and for what purpose it is used*) was 7.38 (SD=2.24) for the 2019-2020 academic year (N=28) and 3.59 (SD=2.08) for the 2020-2021 academic year (N=65). Pre-service teachers' answers to the other open-ended question were analyzed with research proposals.

Figure 3

Mean and standard deviation for open-ended question in the final exam (N=93)



Findings for the Project Summary and Research Proposals

Pre-service teachers were given a project summary in the 19th question. Participants were asked to determine *the purpose, method, sample, data collection tools, data analysis, validity and reliability and ethical issues* of the project summary. This question was at the analyzing level according to Bloom's category. The average score of the 19th question was 10.92 (SD=4.62) for 2019-2020 academic year and 15.18 (SD=6.14) for the 2020-2021 academic year (See Table 6).

Table 6.

Mean and standard deviation for research proposal and project summary

2019-2020 Academic years							
Question type	Cognitive process	Content	N	Mean	SD	Min	Max
Project summary-27 points (19th question)	Analyzing	Content analysis of project summary	28	10.92	4.62	0	19
Research proposal							
Introduction-7 points	Creating	Research proposal	28	1.92	1.80	0	5
Methodology-7 points				2.0	2.22	0	7
Ethical issues-10 points				1.35	2.29	0	7
References-1 points				.58	.50	0	1
All of the research proposal-25 points				5.85	6.02	0	18
2020-2021 Academic years							
Question type	Cognitive process	Content	N	Mean	SD	Min	Max
Project summary-40 points (19th question)	Analyzing	Content analysis of project summary	22	15.18	6.14	6	26
Research proposal							
Purpose-5 points	Creating	Research proposal	43	2.88	1.53	0	5
Method-5 points				1.79	1.68	0	5

Sample-5 points	3.11	1.86	0	5
Data collection tools-5 points	2.65	1.32	0	4
Data analysis-5 points	1.62	1.55	0	4
Validity and realibility-3 points	.86	1.03	0	3
Ethical issues-10 points	4.86	2.87	0	7
References-2 points	1.53	.76	0	2
All of the research proposal-40 points	19.32	10.65	0	33

Min=Minimum; Max=Maximum

In addition, pre-service teachers were expected to prepare a research proposal at the end of the semester. Preparing research proposal was at the creating level according to Bloom's revised taxonomy. The research proposals were rated 25 points for the 2019-2020 and 40 points for the 2020-2021 academic years. Research proposals were rated according to the evaluation criteria in the rating forms. The rating forms included four sections (*introduction, methodology, ethical issues and references*) for the 2019-2020 academic year and eight sections (*purpose, method, sample, data collection tools, data analysis, validity and reliability, ethical issues and references*) for the 2020-2021 academic year. All participants prepared research proposals for the 2019-2020 academic year. Preparing a research proposal was left to the students' choice for the 2020-2021 academic year and 22 pre-service teachers did not prepare research proposal. Pre-service teachers who did not prepare a research proposal were expected to determine the *purpose, method, sample, data collection tools, data analysis, validity and reliability and ethical issues* of the project summary. The similarity percentages of the research proposals were examined using *i-Thenticate* program. Descriptive analysis results for research proposals are presented in Table 6. The mean scores of the research proposals were 5.85 (SD=6.02) for the 2019-2020 academic year and 19.32 (SD=10.65) for the 2020-2021 academic year. The results indicated that pre-service teachers acquired high-level cognitive skills at a moderate or inadequately level in the science and research ethics course.

Pre-Service Teachers' Performance According to Gender and Undergraduate Teaching Programmes

The study investigated whether there was a significant difference between the levels of learning the concepts of science-research-method and ethics of the pre-service teachers according to their gender and their undergraduate teaching programmes variables. For this purpose, the questions in the midterm and final exams were divided into two groups as science-research-method questions and ethics questions (for questions in Table 3 and Table 5). The normality of the data was checked according to central tendency measures and kurtosis and skewness coefficients. The results indicated that the mode, median and the mean values of the science-research-method questions and ethics questions were close to each other. Skewness and kurtosis coefficients are given in Table 7. The data for science-research-method questions, ethics questions and overall questions were in a normal distribution range.

Table 7.

Skewness and kurtosis coefficients

	Skewness	Kurtosis
Science-Research-Method	-.273	-.504
Ethics	-.520	-.471
Total	-.393	-.560

The mean score for science-research-method questions was 14.32 (SD = 4.54), while the mean score for ethics questions was 22.29 (SD = 4.31). The independent samples t-test was used to investigate whether there was a statistically significant difference between pre-service teachers' levels of learning about science-research-method and ethics concepts according to their gender. The results highlighted no statistically significant differences between female and

male pre-service teachers' learning levels of science-research-method and ethics concepts (see Table 8).

Table 8.

Independent sample t-test according to gender

		N	M	SD	t	DF	p
Science-Research-Method (Max. 25 points)	Female	67	14.79	4.47	1.591	44.541	.119
	Male	26	13.11	4.58			
Ethics (Max. 30 points)	Female	67	22.64	4.38	1.310	48.922	.196
	Male	26	21.38	4.06			
Total (Max. 55 points)	Female	67	37.43	8.14	1.617	47.789	.112
	Male	26	34.50	7.73			

In addition, a one way ANOVA was used to investigate whether there was a statistically significant difference between pre-service teachers' levels of learning about science-research-method and ethics concepts according to their their undergraduate teaching programmes. The results indicated statistically significant differences in the learning levels of pre-service teachers of the science-research-method and ethics concepts according to their their undergraduate teaching programmes (see Table 9).

Table 9.

ANOVA according to undergraduate teaching programmes

		Sum of squares	df	Mean square	F	p	η2
Science-research-method	Between groups	473.307	6	78.884	4.754	.000*	.249
	Within groups	1427.016	86	16.593			
	Total	1900.323	92				
Ethics	Between groups	664.101	6	110.684	9.108	.000*	.388
	Within groups	1045.060	86	12.152			
	Total	1709.161	92				
Total	Between groups	2139.396	6	356.566	7.882	.000*	.354
	Within groups	3890.668	86	45.240			
	Total	6030.065	92				

According to the Scheffe test results, statistically significant differences were found between the learning levels of the visual arts pre-service teachers (M = 15.33, SD = 2.69) and other pre-service teachers [$F_{(6,86)} = 9.108$; $p < .05$)] about ethics concepts. These differences were in favor of classroom pre-service teachers (M = 26.16, SD = 2.20), science pre-service teachers (M = 23.66, SD = 4.03), Turkish language teaching pre-service teachers (M = 21.85, SD = 3.97), social sciences pre-service teachers (M = 21.41, SD = 3.23), elementary mathematics pre-service teachers (M = 22.76, SD = 3.85) and guidance and counselling pre-service teachers (M = 23.28, SD = 3.59). In addition, statistically significant differences were found between the learning levels of the visual arts pre-service teachers (M = 24.11, SD = 4.01) and other pre-service teachers [$F_{(6,86)} = 7.882$; $p < .05$)] about science and research ethics course concepts. These differences were in favor of classroom pre-service teachers (M = 43.16, SD = 5.52), Turkish language teaching pre-service teachers (M = 36.25, SD = 6.95), elementary mathematics pre-service teachers (M = 38.38, SD = 6.94) and guidance and counselling pre-service teachers (M = 38.95, SD = 6.69). According to the Tamhane test results, statistically significant differences were found between the learning levels of the visual arts pre-service teachers (M = 8.77, SD = 1.64) and other pre-service teachers [$F_{(6,86)} = 4.754$; $p < .05$)] about science-research-method concepts. These differences were in favor of classroom pre-service teachers (M = 17.00, SD = 4.30), Turkish language teaching pre-service teachers (M = 14.40, SD = 3.71), social sciences pre-service teachers (M = 13.08, SD = 3.20), elementary mathematics pre-service teachers (M = 15.61, SD = 3.47) and guidance and counselling pre-service teachers (M = 15.66, SD = 4.35).

Conclusion and Discussion

The current study investigated the effect of the flipped classroom (FC) model on pre-service teachers' performance in learning concepts and acquiring high-level cognitive skills in the science and research ethics course. The independent variable of this study was the FC model. Dependent variables of present study were the performance levels of pre-service teachers in learning concepts related to science, research and ethics and acquiring high-level cognitive skills. The data collection tools' reliability coefficients were calculated from the data of this study. The average difficulty indexes were 0.63 for the midterm exam and 0.66 for the final exam. In addition, the average discrimination indexes were 0.44 for the midterm exam and 0.37 for the final exam. Further, the reliability coefficients of KR-20 were calculated as $r = 0.77$ for the midterm exam and as $r = 0.84$ for the final exam. The difficulty indexes of the data collection tool items should be in the range of 0.1 and 0.9 (Walsh & Betz, 2000). The average difficulty level for four-option items is 0.62 and the average difficulty level for three-option items is 0.66 (Kaplan & Saccuzzo, 1997). In addition, if the reliability coefficient of the success test is 0.67, it is acceptable (Shum et al., 2006). The results of the present study indicated that the data obtained from the midterm and final exams were reliable.

The present study revealed that at least half of pre-service teachers had difficulties in learning concepts related to methods, hypothesis, findings, survey research method, sampling, qualitative data collection techniques, literature review, types of information sources and nature of science. In addition, the results indicated that at least half of the participants did not learn ethics concepts such as social responsibility, imaginary authorship and open and accessible publications. The mean score for science-research-method questions was 14.32 ($SD = 4.54$), while the mean score for ethics questions was 22.29 ($SD = 4.31$). These results may be interpreted to mean that FC model was more effective in learning concepts related to ethics, morality, ethical principles, standards of ethical behavior and unethical behavior than in learning concepts related to science, research and method. It is thought that the pre-service teacher performance in ethical issues causes from the discussion of scenarios and possible reflections in synchronous courses. Thai et al. (2017) report that the FC model is more effective in improving the learning performance of undergraduate sophomores than blended learning, traditional learning and e-learning setting. Further, Fautch (2015) underpins that FC approach in teaching organic chemistry improves the comprehensiveness of materials and improves students' performance. Students learning with FC approach performed better on the final exam of the statistics course than their peers in the traditional classroom (Peterson, 2016). Bhagat et al. (2016) have found that the FC approach is more effective in students' success in learning trigonometry than the traditional teaching method. A study conducted with English language teaching pre-service teachers in a classroom management course found that with FC approach, students had better learning outcomes than traditional teaching method students (Kurt, 2017). The related literature illustrated that the FC model was effective in improving the learning performance of students compared to the traditional teaching method in statistics, trigonometry, organic chemistry and classroom management courses. On the other hand, Algarni and Lortie-Forgues (2023) conducted a study with 281 middle school students in Saudi Arabia, where mathematics achievement was low. After eight weeks of practice, the researchers reported that while the FC model had a positive effect on students' self-efficacy levels compared to traditional teaching, there was no significant difference in math achievement. Similarly, Clarck (2015) reported that there was no difference between those taught in FC model and traditional teaching environments in terms of academic performance. The current study revealed the effect of the FC model on pre-service teachers' learning performance of science, research, method and ethics concepts, and thus contributed to the educational literature. The limitation of this study was that the research was conducted with a single group.

This study found no statistically significant differences between female and male pre-service teachers' learning levels of science-research-method and ethics concepts. According to the results of the study conducted with engineering students, the researchers reported that the FC model had a significant effect on student grades in favor of female students compared to the traditional teaching method (Chiquito et al., 2019). In additional, researchers found that female

students increased their self-efficacy in producing the desired performance in language learning with the FC model (Namaziandost & Çakmak, 2020).

In addition, the study revealed statistically significant differences between the learning levels of the visual arts pre-service teachers and other pre-service teachers about science and research ethics course concepts. These differences were in favor of other branch pre-service teachers. The related literature is rich with studies focusing on the effect of the FC model on the performances, perceptions and emotions of pre-service teachers from different branches (e.g., science, English language teaching, primary school) (Jeong et al.,, 2018; Akayoğlu, 2021; Barahona et al., 2022). In addition, Fidan (2023) investigated the effect of microlearning-supported FC model on learning performance, motivation and engagement of pre-service teachers. Pre-service teachers studying in three different teaching programs (in the department of Math Teaching, Turkish Language Teaching and Psychologial Counseling and Guidance) participated in the study but no comparisons were made based on teaching programs. The results of the present study will contribute to the relevant literature. The result of the current study may be due to the fact that the gradual development of art education as a discipline or a field of research is slow compared to other fields of education.

Another result of this study was that the FC model was inadequately or moderately effective in acquiring high-level cognitive skills in the science and research ethics course. Preparing research proposal was at the creating level according to Bloom's revised taxonomy. In addition, content analysis of project summary was at the analyzing level according to Bloom's category. The present study found that pre-service teachers were inadequate or moderately adequate in activities that required high-level cognitive skills. Shih and Huang (2019) reported that the control of students over learning in FC facilitated their metacognitive strategies. In addition, Day (2018) found that FC students performed better in correctly answering high-level analytical multiple-choice questions in the anatomy course.

As for the limitations of the present study, this experimental study was carried out with a single group. The researcher recommends to conduct quasi-experimental pretest-posttest design studies with a relatively larger sample. Teachers who follow educational research have difficulty understanding the research and cannot use it enough in their profession (Yıldırım et al., 2014). Future studies can develop a situational judgment test (SJT) to reveal the competencies of pre-service teachers in term of science and research ethics. To overcome such difficulties, the science and research ethics course is conducted interactively with online scenario-based learning activities. After the application, pre-service teachers' competence levels regarding the ethical dimension of scientific research can be examined with SJT.

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Genişletilmiş Özet

Giriş

Tüm dünyayı etkisi altına alan COVID-19 pandemisi nedeniyle ülkeler bir yandan, teknolojilerini geliştirme çabası harcamakta, bir yandan ise gelişen teknoloji ile eğitim sistemlerini entegre etmeye uğraşmaktadırlar. Bu gibi küresel salgın durumları öğretme ve öğrenmeye yönelik yeni yaklaşımların ortaya çıkmasına veya var olan bazı yaklaşımların daha çok tercih edilmesine

olanak sağlar. Bu küresel salgın döneminde de öğretim ve öğrenme sürecinde bir yaklaşım olarak bilinen ters yüz sınıf modeli araştırmacıların ilgi odağı haline gelmiştir.

Eğitim araştırmacıları, öğretmenlerin genellikle eğitim araştırmalarından uzak olduklarını ve mevcut eğitim araştırmalarından gerektiği kadar yararlanamadıklarını tartışmaktadırlar (Costa, Marques ve Kempa, 2000; Greenwood ve Maheadly, 2001; McIntyre, 2005; Vanderlinde ve van Braak, 2010). Eğitim araştırmaları ile öğretmen uygulamaları arasındaki boşluğa ilişkin tartışmalar, özellikle eğitim araştırmalarının işlevselliği ve öğretmenler tarafından uygulanabilirliği üzerine odaklanmaktadır (İlhan vd., 2015). Yıldırım vd., (2014) öğretmenlerin sadece %10'unun düzenli olarak eğitim araştırmalarını takip ettiğini, takip eden öğretmenlerin ise araştırmaları anlamakta zorlandıklarını ve mesleklerinde yeterince kullanamadıklarını bildirmişlerdir. Öğretmenler yeni öğretim yaklaşımlarının farkında olmalıdır. Bu yaklaşımları öğrenmeleri ve sınıf ortamında uygulamaları beklenir. Ayrıca, teknolojiyi öğretim yaklaşımlarına entegre edebilmelidirler. Öte yandan, öğrencilere bilimsel araştırma/proje hazırlamada rehberlik edebilmelidirler. Bu amaçla Türkiye'de 2007 yılından bu yana öğretmen yetiştirme lisans programlarında 'Bilimsel Araştırma Yöntemleri' dersi zorunlu bir ders olarak okutulmaktadır. Bu ders, öğretmen adaylarına bilimsel araştırma süreci hakkında bilgi ve beceri kazandırmayı amaçlamaktadır. İlerleyen yıllarda bu dersin adı 'Eğitimde Araştırma Yöntemleri' olarak değiştirilmiştir. Tosun (2014), bu dersin öğretmen adaylarına literatür taraması ve makale yazma gibi beceriler kazandırdığını bildirmiştir. Ayrıca bu ders bilimsel araştırma yapma kaygısını azaltmıştır (Tosun, 2014). Tosun (2022), Türkiye'deki eğitim araştırmalarının eğilimlerini ortaya çıkarmak için yaptığı bibliyometrik analiz çalışmasında, analiz ettiği SSCI indeksli makalelerin %3,2'sinde öğretmenlerin ortak yazarlar arasında yer aldığını bildirmiştir. Son yıllarda lisansüstü eğitim, öğrenci projelerinde rehberlik gibi bilimsel çalışmalarda öğretmenlerin görünürlüğü artmıştır. Öğretmenlerin 'eğitimde araştırma yöntemleri' dersi kapsamındaki kavramları öğrenmelerin yanı sıra araştırma etiği ile ilgili temel kavram ve ilkeleri öğrenmeleri de önemlidir. Bu nedenle 2018 yılında Türkiye'de öğretmen yetiştirme lisans programları revize edilmiş ve genel kültür seçmeli dersi olarak 'Bilim ve Araştırma Etiği' dersi ilave edilmiştir.

Bu çalışmada ters yüz sınıf modelinin öğretmen adaylarının bilim ve araştırma etiği dersi kavramlarını öğrenme ve üst düzey bilişsel beceriler edinme performanslarına etkisi araştırılmıştır. Bu araştırmanın bağımsız değişkeni ters yüz sınıf modelidir. Bilimsel araştırma sürecinin etik konuları kurgulanmış ve öğretmen adaylarına problem senaryoları olarak sunulmuştur. Eşzamanlı oturumlarda problem senaryoları ve senaryolara olası refleksler tartışılmıştır. Bu çalışmada öğretmen adaylarından bir araştırma önerisi hazırlamaları beklenmiştir. Ayrıca, öğretmen adaylarından proje özetinin ana bileşenlerini tanımlamaları beklenmiştir. Böylece üst düzey bilişsel beceriler edinmedeki performansları ölçülmüştür. Çalışmada aşağıdaki araştırma sorularına cevap aranmıştır:

- Ters yüz sınıf modelinin öğretmen adaylarının bilim ve araştırma etiği dersi kavramlarını öğrenme ve üst düzey bilişsel beceriler kazanma performanslarına etkisi nedir?
- Öğretmen adaylarının bilim-araştırma-yöntem ve etik kavramlarını öğrenme düzeyleri arasında cinsiyet ve öğrenim görülen lisans programlarına göre anlamlı bir fark var mıdır?

Yöntem

Bu çalışmada nicel araştırma yaklaşımlarından zayıf araştırma deseni kullanılmıştır. Araştırma tek bir grup üzerinden yürütülmüştür. Deney grubuna eşdeğer bir grubun olmaması nedeniyle bu desen tercih edilmiştir (McMillan & Schumacher, 2006).

Sonuç ve Tartışma

Bu çalışmada kullanılan veri toplama araçlarının güvenirlik katsayıları çalışmada toplanan verilerden hesaplanmıştır. Ortalama güçlük indeksi ara sınav için 0.63, final sınavı için 0.66

olarak belirlenmiştir. Ayrıca ortalama ayırt edicilik indeksi ara sınav için 0.44, final sınavı için 0.37 olarak belirlenmiştir. Diğer taraftan KR-20 güvenirlik katsayıları ara sınav için r=0.77, final sınavı için r=0.84 olarak hesaplanmıştır. Veri toplama aracı maddelerinin zorluk indeksleri 0.1 ile 0.9 aralığında olmalıdır (Walsh & Betz, 2000). Dört seçenekli öğeler için ortalama zorluk seviyesi 0.62 ve üç seçenekli öğeler için ortalama zorluk seviyesi 0.66'dır (Kaplan & Saccuzzo, 1997). Ayrıca başarı testinin güvenirlik katsayısı 0.67 ise kabul edilebilir (Shum vd., 2006). Mevcut çalışma sonuçlarına göre ara sınav ve final sınavından elde edilen verilerin oldukça güvenilir olduğu söylenebilir.

Bu çalışma, öğretmen adaylarının en az yarısının yöntemler, hipotezler, bulgular, tarama araştırma yöntemi, örnekleme, nitel veri toplama teknikleri, literatür taraması, bilgi kaynakları türleri ve bilimin doğası ile ilgili kavramları öğrenmede güçlük çektiğini ortaya koymuştur. Ayrıca katılımcıların en az yarısının sosyal sorumluluk, hayali yazarlık, açıklık ve ulaşılabilir yayınlar gibi etik kavramları öğrenemediği tespit edilmiştir. Öte yandan bilim-araştırma-yöntem soruları için puan ortalaması 14.32 (SS = 4,54), etik soruları için puan ortalaması 22.29 (SS = 4.31) olarak belirlenmiştir. Bu sonuçlara göre ters yüz sınıf modelinin etik, ahlak, etik ilkeler, etik davranış standartları ve etik olmayan davranışlarla ilgili kavramları öğrenmede bilim, araştırma ve yöntemle ilgili kavramları öğrenmekten daha etkili olduğu söylenebilir. Öğretmen adaylarının etik konulardaki performansında senkron derslerde senaryoların ve olası reflekslerin tartışılmasının etkili olduğu düşünülmektedir.

Bu çalışmada kadın ve erkek öğretmen adaylarının bilim-araştırma-yöntem kavramlarını öğrenme düzeyleri ile etik kavramlarını öğrenme düzeyleri arasında istatistiksel olarak anlamlı farklılık bulunmamıştır. Ayrıca çalışma, görsel sanatlar öğretmen adayları ve diğer branşlardaki öğretmen adayları arasında bilim ve araştırma etiği dersi kavramlarını öğrenme performansları arasında diğer branş öğretmen adaylarının lehine istatistiksel olarak anlamlı farklılıkların olduğunu ortaya koymuştur. Bloom'un gözden geçirilmiş taksonomisine göre araştırma önerisi hazırlama yaratma düzeyinde beceri kazanmayı gerektirir. Ayrıca proje özetinin içerik analizi Bloom'un kategorisine göre analiz düzeyinde beceri kazanmayı gerektirir. Bu çalışmanın bir başka sonucu, ters yüz sınıf modelinin bilim ve araştırma etiği dersinde üst düzey bilişsel becerilerin kazanılmasında yetersiz veya orta derecede etkili olduğudur.