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Using Flipped Learning to Improve Scientific Research Skills of Teacher Candidates

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Abstract The primary aim of this study was to investigate the effect of a scientific research methods course delivered through flipped learning on teacher candidates' attitudes towards scientific research and the course, and examine the teacher candidates' and instructors' experience in the process. The convergent parallel design was adopted in the study, and the participants were 102 elementary education teacher candidates taking the scientific research methods course at a Turkish university. Throughout the 12-week course, the students were presented the theoretical knowledge, materials and presentations related to the course by means of a distance learning platform, while discussions and activities were held in the classroom environment. All the activities performed and the problems that emerged were discussed among the researchers, and the necessary corrections and modifications were reflected to the classroom and online environments. In the data-gathering process, observations, interviews, reflective diaries and quantitative instruments were employed. The results showed that there were some problems in the implementation of flipped learning, the students developed negative attitudes towards scientific research and the scientific research methods course, and the existing learning culture was an important factor in the effectiveness of flipped-learning practices.

Keywords Flipped Learning, Scientific Research, Scientific Research Methods Course, Attitudes, Mixed Method

1. Introduction

In teacher education programs, various problems are encountered in the acquisition of learning outcomes in scientific research methods classes. Scientific research refers to the process of systematically analysing data gathered for a purpose [1]. Conducting scientific research requires a certain level of expertise, while making meaningful inferences from research entails an established research culture, which is only possible by means of a systematic research training. Research training aims at equipping individuals with the technical competencies for conducting research, and scientific attitudes and behaviours [2]. Karasar [3] highlights the importance of individuals who have research knowledge and culture for the solution of social problems. However, as is indicated in the literature, there are difficulties in developing teachers' and teacher candidates' scientific research skills, and their use of these skills in daily and professional life [4-6]. Moreover, research also shows that teacher candidates develop negative attitudes towards scientific research and the scientific research methods course [7-10]). Technology-assisted distance education models can be employed in developing teacher candidates' scientific research skills and changing their attitudes as positive. One of these models is the flipped-classroom model that is categorised under the blended learning model (see Figure 1).

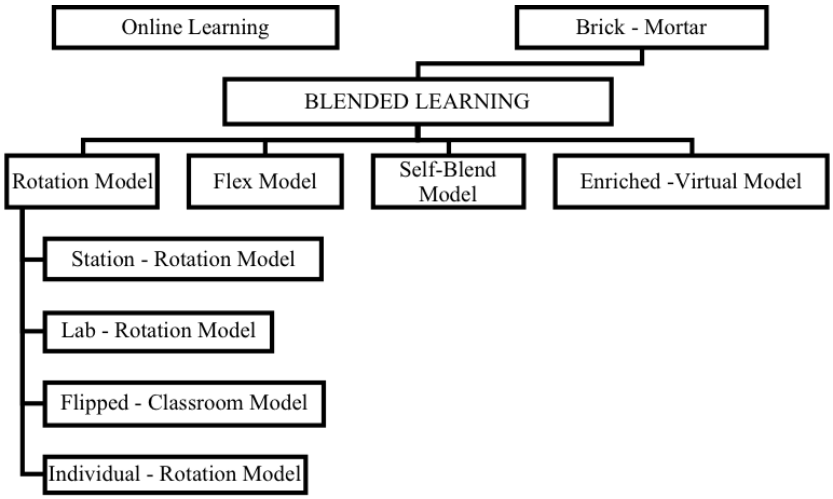
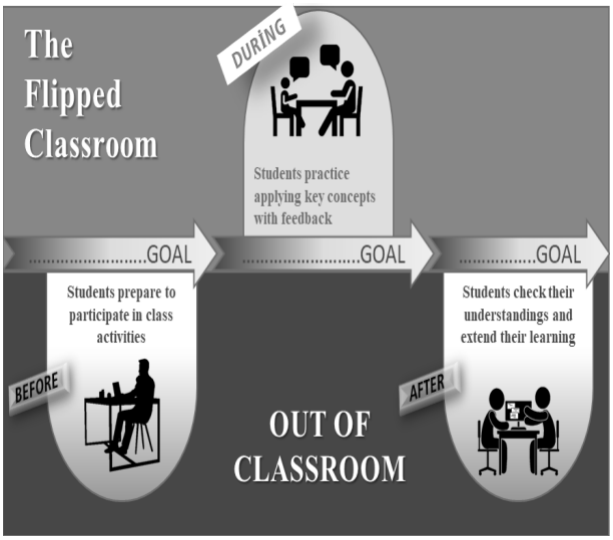


Figure 1. Blended Learning Model [11]

Blended learning that is seen as a model that emerged with developments in distance-education facilities is the blended form of distance education and traditional closed-classroom school model. Advantages such as instructional variety, flexibility and being economical allow blended learning to be widely preferred by practitioners [12-14]. Flipped classroom, a blended learning model, turned the traditional structure of education upside down by moving the learning contents beyond the classroom environment and enabling interaction and practice with the teacher in the classroom [15,16].

The hierarchy between the blended learning model and flipped-classroom model is presented in Figure 1 [11]. One of the elements of this hierarchy, the station model, is about covering at least one of more than one learning module online in a single class, while delivering the rest in a small group or with the teacher. The laboratory rotation model, which is based on students' moving around in a campus, is therefore different from the station model. In individual rotation, every student has an individualised program, and does not necessarily go back to every station or module [17]. In the flipped-classroom model, course contents and explanations are provided in an online environment outside the classroom. The classroom environment is only used for practice and projects under the teacher's guidance, and for high-order learning [15,18-21]. A more flexible form of this model that is based on different learning styles, enriched with purposeful contents and shaped with student experiences has been conceptualised as flipped learning (FL) [22]. FL is a learning model in which learning activities in large classes are extended to personal learning environments, students acquire theoretical knowledge individually or in groups in dynamic and interactive learning platforms under the teacher's guidance, and this knowledge is internalised and turned into practice [22]. In FL, students are provided with more individualised learning environments [23]. In-class instructional activities are moved out of the classroom by means of FL prior to the class. In this way, the class time can be allotted to activities such as research, analysis and discussion. How FL works is represented in Figure 2.



(https://www.goconqr.com/en/learn/flipped-classroom)

Figure 2. Flipped-Learning Classrooms

In FL, the teacher shares written or visual instructional materials (e.g. videos, articles, books, etc.) with his/her students prior to the class. Students make the due preparation before they attend the class. The class time is allotted to practice-based learning activities and higher-order thinking. Students can receive support from the teacher and peers when they need it. Following the class, they keep developing their skills and knowledge through explanations and feedback. In this way, they can deepen their learning during the class [15, 24-27]. The advantages of FL classrooms can be listed as being able to easily organise individualised course contents depending on learning rate and style, students' reaching the contents 24/7, supporting new approaches, and being a technology-friendly approach [28-29]. Flipped Network

[22] mentions four pillars of an FL environment including a flexible environment, a learning culture, an intentional content, and a professional educator. These pillars are explained as follows:

Flexible Environment: FL allows using various learning methods. The educator can re-organise the learning environment physically to ensure adaptation to the subject matter, and promote group or individual work. FL enables students to learn when and where they want.

Learning Culture: Teacher is the primary source of information in the traditional teacher-centred model. FL makes the instruction learner-centred. The time in the classroom environment is spent for examining new ideas and gaining in-depth knowledge. Thus, students play an active role in building knowledge. Similarly, they also take part in evaluating their own learning.

Intentional Content: In FL, the educator tries to maximise the use of student-centred methods and effective learning strategies, and identifies the content based on level and subject.

Professional Educator: In FL, the teacher observes the students during the class time, provides them feedback and evaluate their work. Professional educators are reflective in their practices, and are in contact with colleagues to improve their skills. They adopt constructive criticism in the classroom environment and allow for in-class interaction.

Apart from the four pillars mentioned above, Cheng, Wang, Kinshuk & Chen [30] state that there should be three additional necessities for the use of FL in higher education, and these include progressive activities in which creative ideas are generated as a result of students' social interaction, a view that highlight student experience and new learning platforms in addition to the ones selected by the teacher.

With the spread of the Internet, instructional approaches that can be an alternative to face-to-face or closed-classroom instructional activities have been a research topic in various areas. In this respect, a study on teachers indicates the success of the instruction delivered through the blended learning approach in preparing students for real life [31]. In a study in which the project-based learning approach was implemented through FL, Ruddick [32] found that student achievement showed a significant increase. In a similar vein, there are many studies in the literature that report a positive effect of FL practices on students' achievement and attitudes towards the course [33-37]. Research also focus on evaluating FL and traditional instruction in the context of learning styles [38], student and teacher views on FL [23, 39-42], a long-term curriculum for the development of critical thinking skills [20], ensuring deep learning in large classes [43] and meta-analyses and meta-evaluation studies [44]. The use of informative videos prior to the class is also quite common in the literature on FL [45,46]. The findings of the studies on providing informative videos to students before the class include the development of positive attitudes in students [47-51] and high student achievement [52-56]. Moreover, a variety of studies on knowledge and attitudes related to statistics have also been conducted in the scope of research methodology classes [57-61].

Teachers need to conduct research for their personal and professional development, and also to be able to cope with problems they encounter in daily life. Yet, various problems regarding teacher candidates' attitudes towards scientific research and their acquisition of research skills have been documented in a number of studies [62-67]. In the literature, the scientific research methods course at undergraduate level have been addressed in limited number of studies through variables different from the one in the present study [68-77]. The number of studies in which instructional activities similar to FL (i.e. blended and distance education activities) were used to teach research methods is even more limited in this literature [78-80]. In this regard, the present study aimed at investigating the effect of a scientific research methods course delivered through FL on teacher candidates' attitudes towards scientific research and the course. In addition, the study aimed to examine the FL process by means of the instructor's and teacher candidates' experiences. Accordingly, the following research questions were addressed:

Does the scientific research methods course delivered through flipped learning lead to a significant difference in teacher candidates' attitudes towards (a) scientific research and (b) the course?

How do teacher candidates make sense of their experiences in the scientific research methods course delivered through flipped learning?

2. Method

Convergent parallel design, a form of mixed-method research, was adopted in the study. In convergent parallel design, the qualitative and quantitative stages of a study are conducted simultaneously and equally. Qualitative and quantitative analyses are performed separately, but findings are combined in overall interpretation [81]. By choosing this research design, it was aimed to gather data from multiple sources, and obtain in-depth knowledge. The research process is presented in Figure 3.

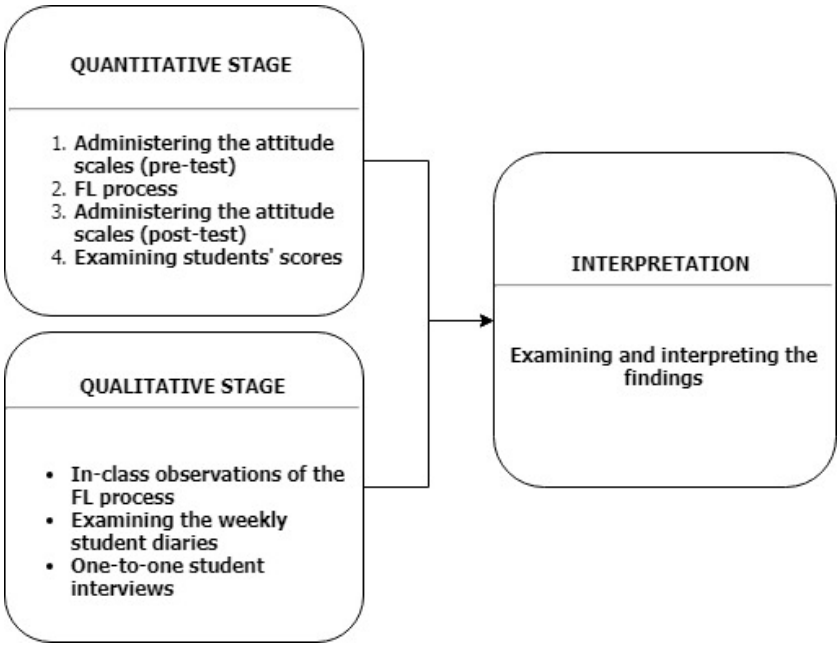


Figure 3. Representation of the Research Process

In the quantitative stage, the attitude scales were administered to examine the change in students' attitudes towards the course and scientific research. As for analysing their course achievement, the weighted means of the learning-research tasks they completed throughout the process, reflective diaries and their end-of-term exam scores were used. The qualitative stage, on the other hand, involved the analysis of in-class observations, weekly student diaries and student interviews. The findings obtained were then interpreted by the researchers.

2.1. Participants and the FL Implementation

This study focused on the compulsory course "Scientific Research Methods" taught in the elementary education undergraduate program in the fall semester of the 2016-2017 academic year, and the students who took this course at the time. The participants received this course in the fifth semester of their undergraduate education. The study was conducted with a total of 102 participants who had not taken a course related to research methods before. The students who participated in the study were informed about the change to be made in the course structure, and their consent was taken. The faculty administration was also informed about the study, and the necessary legal permissions were obtained. In the scope of the study, pre-tests were administered to determine the students' attitudes towards scientific research and the scientific research methods course. All the activities performed and the problems that emerged were discussed among the researchers, and the necessary corrections and modifications were reflected to the classroom and online environments. In the data-gathering process, observations, interviews and reflective diaries were employed in the qualitative dimension. As for the quantitative dimension, the attitude scales about scientific research and the scientific research methods course were used. The quantitative instruments that were implemented in the form of pre- and post-tests aimed at examining the change in the students' attitudes. The evaluation of student achievement contained a process analysing the weighted means of students' reflective diaries, research and learning tasks and their scores in the final exam consisting of multiple-choice questions. The way by which the course was delivered is represented in Figure 4.

In the first two weeks of the semester, the students were informed about the process and the BlackBoard Learning Management System, and practice-oriented activities on how students would use the system were conducted. BlackBoard is an advanced distance learning platform that allows for presenting course content and materials in the electronic environment, and providing feedback and scoring student assignments. Four or five days prior to the class, the students were provided with reading tasks, research tasks, instructional videos and content-based open-ended questions, and asked to fulfil these tasks and upload the assignments to the platform within the specified time. In the class time, discussions were held with regard to that week's topic, and research practices were implemented. Following the class, the students were asked to write and upload reflections related to all aspects of the class including the topic, how it was covered, their performance and the instructor. These steps were routinely followed every week until the end of the semester.

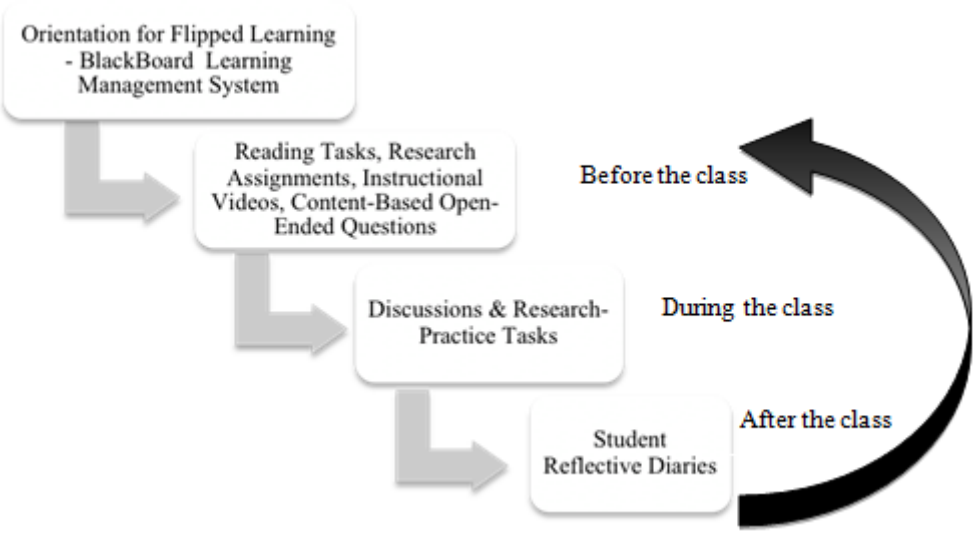


Figure 4. Instructional Process in the FL Class

The requirements of the tasks assigned were clearly defined, and the students were informed about how each task would be evaluated and scored. The weighted means of the scores from reflective diaries, assignments and the end-of-term exam were used to determine the end-of-term achievement score. The 12 assignments assigned to the students throughout the term were evaluated over five points based on the criteria determined, and the students' end-of-term achievement score was calculated by adding 60% of the total scores in the assignments to 40% of the scores in the final exam. Improvements and modifications related to the process were made according to the feedback obtained through reflective student diaries and instructors' observations. For example, when it was noticed that the reading tasks uploaded to the platform were not fulfilled, assignments including open-ended questions were developed as a precaution, and the click-counter of the reading tasks were activated to regularly get information related to participation. In this way, it was aimed to guarantee students' fulfilment of the activities including reading tasks and instructional videos. Additionally, the students' criticisms related to the process were taken into consideration, and improvement were made in the course process accordingly. The whole process such as instructions, assignments, implemented measurement tools, interviews was conducted on students' native language.

2.2. Data Gathering and Analysis

In the present study, all of the researchers worked with the participants as part of the implementation process. One of the researchers was the instructor of the course. The other two researchers took part in following the digital materials and organising the tasks related to the course. In this sense, it can be stated that they were active participants in a way and played a part in organising the activities, but they did not have the exact role of a participant [82]. In qualitative research, researchers who have this role with an "insider" perspective can recast certain changes in the implementation by means of their reflections and observations on the process [83]. It can thus be argued that the observations made throughout the research process were reflected in the decisions taken for re-organising the activities in various ways.

In the data-gathering process, interviews and reflective diaries were employed in the qualitative dimension. The interviews conducted with some of the students whose student diaries were examined constituted one of the qualitative data sources. Such one-to-one interviews allow for in-depth questions, and thus are one of the frequently used methods of data collection in qualitative [84].

In the quantitative dimension, the "Scale of Attitudes Towards Scientific Research" developed by Korkmaz, Şahin and Yeşil [85] and the "Scale of Attitudes Towards the Scientific Research Methods Course" developed by Yaşar [77] were employed. Brief information regarding the quantitative instruments is provided below.

Scale of Attitudes Towards Scientific Research [85]: The scale consisted of 30 items loaded over four factors. The Cronbach Alpha internal consistency coefficients of the factors ranged between .77 and .85. They explained 46.34% of the total variance. The dimensions of the scale included "Reluctance to Help Researchers", "Negative Attitudes Towards Research", "Positive Attitudes Towards Research" and "Positive Attitudes Towards Researchers". Sample items related to the scale are as follows; “I don’t want to contribute to scientific research with the idea that it will not achieve its purpose”, “I am not interested in scientific research because I don’t find realistic”, “I would like to do scientific research if the opportunity is given”, “Scientist is the person who is open to change and self-improvement”.

Scale of Attitudes Towards the Scientific Research Methods Course [77]: The scale consisted of 20 items loaded over four factors. The Cronbach Alpha internal consistency coefficient of the scale was .91, and it explained 39.24% of the total variance. The dimensions of the scale included "Importance of Scientific Research", "Cognitive Self-Confidence", "Interest" and "Daily Life and Professional Relations". Sample items related to the scale are as follows; “I think scientific research methods course is unnecessary”, “I trust myself in preparing a research project in scientific research methods course”, “I am really interested in scientific research methods course”, “I think research-oriented thinking has an important role in my daily life.”

The quantitative instruments that were implemented in the form of pre- and post-tests aimed at examining the change in the students' attitudes. Thematic analysis was employed in the analysis of the qualitative data, whereas descriptive statistics and relational analyses were used for quantitative data.

3. Findings and Interpretation

3.1. Quantitative Findings

The evaluation of student achievement contained a process analysing the weighted means of the students' reflective diaries, research and learning tasks and a final exam consisting of multiple-choice questions. The distribution of the students' mean scores is presented in Figure 5.

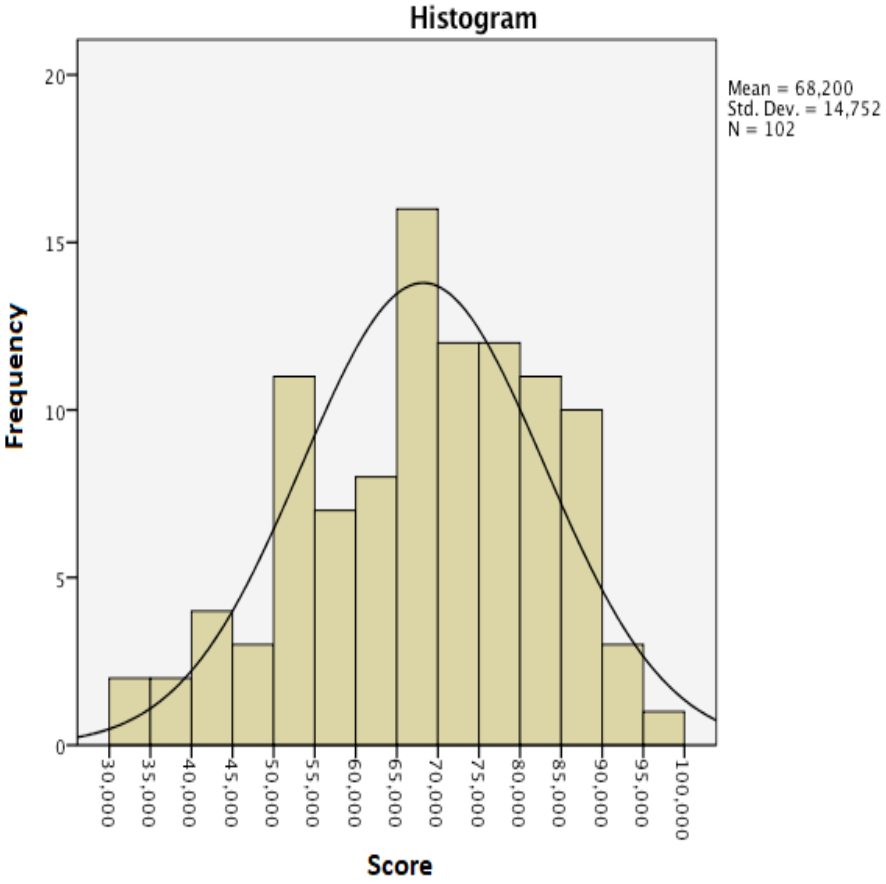


Figure 5. Distribution of Mean Scores

As is seen in Figure 5, the mean of the total group including 102 participants was X= 68.2, the distribution was left-skewed, and 60% of the sample was above the mean. In other words, the participants were successful in the evaluation at the end of the process. In order to reveal the change in the students' attitudes towards scientific research, the data obtained through the scale were subjected to repeated measures variance analysis. The findings related to this analysis are presented in Table 1.

Table 1. Pre-test and Post-test Results in the Scale of Attitudes towards Scientific Research

Pre - Post-Test	N	X	SD	sd	t	p
Dimension 1 Pre-Post (18.42-19.18)	82	-.763	1.36	81	-1.015	.313
Dimension 2 Pre-Post (17.82-18.39)		-.571	.91		-1,139	.258
Dimension 3 Pre-Post (24.32-22.99)		1.331	.88		2.738	.008*
Dimension 4 Pre-Post (25.46-26.06)		.397	.83		.859	.393

*p < .05

Dimension 1 Reluctance to Help Researchers
Dimension 2 Negative Attitudes Towards Research
Dimension 3 Positive Attitudes Towards Research
Dimension 4 Positive Attitudes Towards Researchers

As is seen in Table 1, a significant difference was only found in the dimension "Positive Attitudes Towards Research", but in the negative direction (t(81)=2.738, p< .05). It can thus be said that the students developed negative attitudes towards research at the end of the process. The items in this dimension of the scale included statements measuring the students' willingness to conduct research such as "I enjoy doing scientific research", "I try to solve my problems by using scientific research methods" and "I would like to do scientific research if I get the opportunity" The students who were exposed to an intense process based on practice, experienced scientific research at first hand and had difficulty throughout the process developed an avoidance for conducting scientific research. The findings that will be presented in the qualitative part of this paper also showed that the students realised that conducting scientific research was a difficult process. These factors seem to have led to the development of negative attitudes towards research.

In order to reveal the change in the students' attitudes towards scientific research methods course, the data obtained through the scale were subjected to repeated measures variance analysis. The findings related to this analysis are presented in Table 2.

As can be seen in Table 2, there were significant differences in the dimensions "Importance of Scientific Research", "Cognitive Self-Confidence" and "Interest" in the negative direction (t(81)=2.689, p< .05; t(81)=2.907, p< .05; t(81)=3.343, p< .01). Based on this finding, it can be stated that the students developed negative attitudes towards the scientific research methods course in all dimensions of the scale, except the dimension "Daily Life-Professional Relations" Similar to the previous finding related to scientific research in general, the students' having gone through an intense and tiring process to which they were not accustomed may have been influential in the development of these negative attitudes.

Table 2. Pre-test and Post-test Results in the Scale of Attitudes Towards Scientific Research Methods Course

Pre - Post-Test	N	X	SD	sd	t	p
Dimension 1 Pre-Post (35.06-32.74)	82	2.314	1.11	81	2.689	.009*
Dimension 2 Pre-Post (22.46-19.96)		2.497	1.11		2.907	.005*
Dimension 3 Pre-Post (23.59-20.78)		2.806	1.08		3.343	.001**
Dimension 4 Pre-Post (21.38-20.23)		1.146	.88		1.673	.098

*p < .05; **p< .001

Dimension 1 Importance of Scientific Research
Dimension 2 Cognitive Self-Confidence
Dimension 3 Interest
Dimension 4 Daily Life-Professional Relations"

3.2. Qualitative Findings

The themes and sub-themes related to the qualitative dimension of the study are provided in Figure 6.

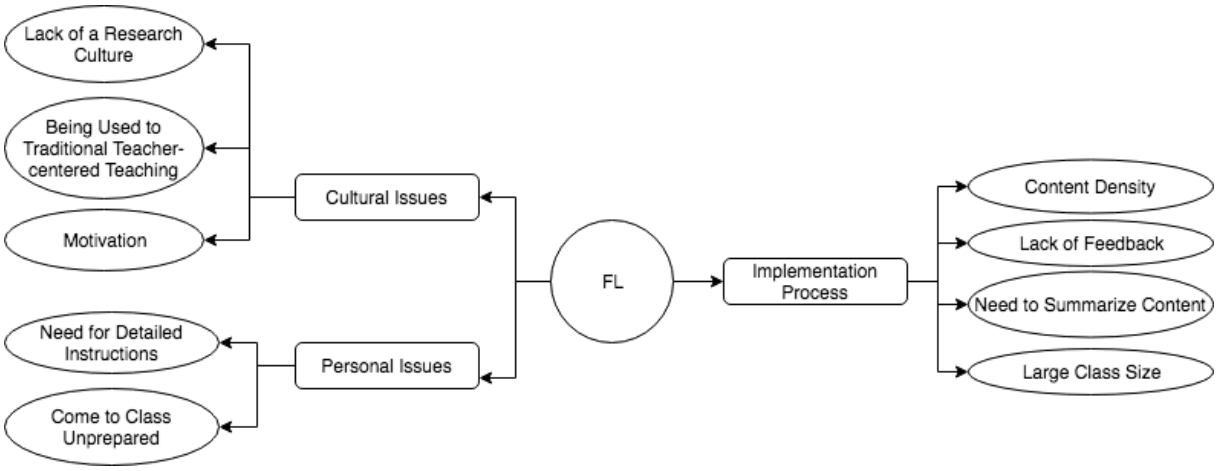


Figure 6. Themes and Sub-Themes Revealed in the Qualitative Analysis

Following the content analysis, three themes including "Cultural Issues", "Personal Issues" and "Implementation Process" were revealed with regard to the course. The themes, cultural and personal issues, touched upon the reasons behind the problems encountered in the classes delivered through flipped learning in terms of cultural and student-related characteristics, while the theme "Implementation Process" contained the students' feedback and suggestions in relation to the problems they experienced in the process.

Cultural Issues

Some of the students were observed to be reluctant to complete the necessary preparations before the class in the scope of FL, and some of them did not simply do it. The interviews, reflective diaries and in-class discussions showed that the tasks assigned to the students required doing some research and took a certain amount of time, and thus caused difficulty for them. These students explained their views that the out-of-class preparations of FL required too much time by referring to other courses they took in previous terms and their past experiences. Examples from the students' views related to the excessive amount of time required by FL tasks outside the classroom are as in the following:

> We have to spare almost several days of the week to this course. Normally, we used to spend only one day for exams. Yet, I need to spend one hour of my time for a proper diary. I deal with research from 5 pm to 11 pm, sometimes even longer than that. It extends to the next day. (Ayşe, Interview)

> We are bored of the assignments taking too much time and doing a lot of research. (Fatma, Diary)

As can be inferred from the quotations above, asking weekly tasks and daily writing from the students who used to work only one day for an exam throughout the whole semester must not have been easy for them. Their tasks merely included answering questions related to a video to be watched and an article to be read, and writing a diary in which what happened in the class that week would be reflected on. In fact, the tasks assigned to the students were planned to take 30 minutes to one hours of the students' time weekly. In spite of this, some of the students' views that FL required too much time for preparation before coming to the class may be due to their writing and research culture, and lack of experience. This can be seen in the views the students expressed in different forms. These students thought that information was provided to them until university, they accepted it as is, and did not have any experience in different learning methods (e.g. FL). In this respect, they stated the following views:

> ... since we desire to access information directly and it is difficult to synthesis and write about such pieces of information, my friends probably have difficulty and don't do the tasks, and I actually hear that they don't want to do. (Ayşe, Interview)

> ... but there was something I noticed then. Until we reached the university level, information was brought to us. We took and accepted it, and continued our education without any critical thinking. A different course and a different method just confused us. (Fatma, Diary)

Some of the students thought that they could not get used to the instructional process conducted by means of FL, and got confused. These students referred to previous learning experiences as the reason behind this confusion. They were used to the following cycle: the instructor teaches the subject matter, they take notes and then they take an exam based on these notes. The students who supported this approach said that courses should be taught by an instructor, and that would be more beneficial for them, stating the following views:

> The way the scientific research methods course [FL] was delivered was the sort that we had never experienced before, so we had difficulty adapting to it. (Ayşe, Diary)

> The other method [i.e. the traditional one] was more

comfortable for us; somebody teaches me and then I take notes and study. (Buse, Interview)

Some of the teacher candidates stated that they viewed the FL practice positively, FL should be a regular practice, it developed different skills in them, but due to previous educational habits and FL requiring extra preparation out of the class, they showed resistance to the FL implementation. Because for years they had been used to the practices in which the teacher was active and the student was passive, the students could not effectively used innovative applications such as FL although it caught their attention. According to these students, whether a system puts more duties and responsibilities on their shoulders was more important than its being good or meaningful. They thought that if a new practice requires additional tasks, the previous practice is better. Examples from the statements of these teacher candidates are as in the following:

Up until now, I have gone through [student-centred] instructional processes that are based on traditional teaching in my whole life. The teacher explains the subject matter, and my friends say, this part is important, this part isn't. Therefore, I and students like me had poor questioning and research skills, and had a tendency to prefer readily available information, which caused us to have difficulty in the course this semester. I wish our education system would work as we experienced in this course, I mean not merely providing information but teach us how to reach and use information. (Ayşe, Diary)

The instruction and system is very good but I think it remains a theory. As far as I gather, the thing you want to do and what we actually do are different. You want something like a student-centred approach in that we do research beforehand and discuss about it during the class, but we haven't experienced such a thing before. (Ahmet, Interview)

Within the process, some of the teacher candidates were observed to ask whether the activities and tasks assigned to them would be included in the end-of-term evaluation of the course. They were also observed to be unwilling to complete the activities and tasks that would not be included in the evaluation. For instance, the click-rate of the additional reading materials uploaded to the platform was only about 15%. This shows that it was only through external stimuli by which the students were motivated, and they thought that an activity without any scores to receive was not necessary. A brief dialogue on this issue is presented from the interviews below:

Buse - You also know well about the students. We don't do it unless we have to. Maybe it can be in the form of a multiple-choice test. Let's say you assign two units, we studied those units, and you can administer a test at the beginning of the class. Those scores can be influential in assessment.

Researcher - So do we need to score everything we do?

Buse - Not much, for instance two points if the total score would be 100 points.

Personal Issues

Some of the students stated that they could not understand how they would complete the learning tasks although they were often informed about the process (i.e. verbally in the class, and with guidelines in the learning management system). Detailed explanations related to each activity were provided to the students by considering their feedback. Even though the students' complaints about the process considerably decreased, the problem was not completely solved. This may be due to the lack of a research culture, being used to traditional teaching, and motivation. The students' views are presented below:

...there must be a task assigned, and I should be working accordingly. Well, I can't think with details. I look at it very straight. What I'm expected to do should be communicated to be in detail. (Sıla, Interview)

I have only recently learned the points to consider in writing the diary [i.e. student diary from the end of the fourth week] (Mehmet, Diary).

The rate of fulfilling the research-learning tasks increased in the course of time, but it did not reach to the desired level. The fact that these tasks were not fully completed caused the students to come to the class without the necessary theoretical knowledge. For this reason, the classroom discussions-activities in FL were not as effective as it was planned in some weeks, the participation was also low, and traditional teaching was adopted in the instruction. This was also associated with the students' motivation, being used to traditional teacher-centred teaching and lack of a research culture. Duygu touched upon this issue in her diary as follows:

Some of the students including myself came to the class without reading the book [i.e. the pdf uploaded to the learning management system]. This caused a problem for covering that week's subject, and our instructor also indicated our indifference to the tasks. He was right because he told us to read the section of the book specifically uploaded to the portal, but we weren't used to this sort of course, we didn't need to log on to the system again after writing our diaries and reports. After a few word, everybody was glancing at each other, and there was a pause. The instructor had also difficulty, and at last he started to teach the subject by leaving constructivist education, he basically turned back to traditional teaching. (Duygu, Diary)

Experimental Procedure

In the FL process, some of the students stated their suggestions in addition to the problems they encountered. These students asserted that the course content was quite

intense, and they had difficulty in learning and implementing this content. They thought that it would be better to carry out the activities after covering the content in the classroom. One of the students stated that following in this regard:

> The course content is too loaded, and there are many concepts that we don't know about. It would be better if we were taught these concepts first and then did the activities. This is because we try to understand these concepts while trying to do the assignments. (Ayşe, Interview)

The students stated that the content of the scientific research methods course was heavily loaded, and most of them had not encountered such content before. Providing the content through presentation in the classroom contradicts with the nature of FL. Yet, certain modification can be made in the content. The students asserted that activities were more effective with the feedback provided with respect to the in-class activities, and they were able to learn through simultaneous interaction. Regarding this issue, one of the students thought that the activities outside the classroom in FL were disadvantageous because she did not have someone to ask a question. As a matter of fact, the learning management system had features that enable students to have discussions and ask questions. However, as some of the students expressed, it was not easy to abandon old habits. Moreover, the class size of 102 students made it difficult to provide feedback to each student. The student views relevant to this issue are as follows:

> For instance, we examined articles in the class, which par is qualitative, which part is quantitative, etc. At least, we can ask you questions there, like have I done this part correct, or how can I do it? Since I was able to learn what was right and wrong, I think I can get a high score. I can't say the same thing for the activities outside the classroom. (Sıla, Interview)

> You need to teach us these concepts. Briefly, or by using slides; with terms that we understand. This is because a concept in the book is explained with an another concept that we don't know about. That's why we have difficulty. It would be easier if we learned the concepts. Sometimes we don't understand what we want to ask. I think there should be some traditional teaching. We could not fully get used to this. (Ayşe, Interview)

> The class is too crowded; it would be more comfortable to interact with less people in research activities. It is not very effective because it is crowded. (Buse, Interview)

The large class size apparently caused problems in conducting the in-class activities and providing sufficient feedback for the activities outside the classroom. Although the course was implemented with the cooperation of three instructors, the problems regarding these issues could not be addressed for every student.

4. Discussion

In this study, the FL approach by which the scientific research methods course was delivered can be said to have led to negative changes in the students' attitudes towards scientific research and the course. Even though this change cannot be directly associated with FL, the busy and challenging process throughout the term may have been influential on the negative attitudes. In the scope of the course, the students went through an intensive process in which they individually experienced the whole process of scientific research from design to discussion. In their diaries and during the interviews, the students stated to notice that conducting scientific research was a difficult task. However, FL, by nature, requires the active participation of students, but in the present study there were problems related to participation due to reasons such as the lack of a research culture, being used to traditional instruction, and motivation-adaptation. In another study in the Turkish context, students were also reported to have difficulties in adapting to FL [86]. This finding overlaps with the findings of the present study. Furthermore, some studies in the literature also show that teacher candidates develop negative attitudes towards scientific research and the scientific research methods course [7-10]. A subject matter and course to which teacher candidates already develop a negative attitude being accompanied by an instructional process that was challenging for the students may have affected the emergence of these negative attitudes. It can thus be argued that the implementation conducted in the present study could not contribute to the solution of the problem concerned.

The evaluation of student achievement was performed through a process analysing the weighted means of the students' reflective diaries in 12 weeks, research and learning tasks and a final exam. Since the study did not include a control group, it should be stated that there was no reference point to evaluate student achievement based on the effectiveness of applications. In the descriptive statistics related to achievement scores, the distribution was left-skewed (i.e. the high score frequency was higher), 60% of the sample was above the mean ($X=68.20$), and thus, the participant group could be described as successful in terms of statistics. Accordingly, although the students developed negative attitudes towards scientific research and the scientific research methods course, they can be said to be successful in achieving the cognitive outcomes of the course.

During the interviews and in their diaries, the students stated that the course content was loaded and they had difficulty in mastering this content. The content of the scientific research methods course can be slightly reduced. In this way, students would go through a more effective

process by reducing the information overload that they are exposed to. Besides, the students asserted that in-class activities were more effective in terms of the feedback provided, and they were able to learn better through simultaneous interaction. It cannot be denied that out-of-class activities have a disadvantages with regard to feedback when compared to in-class ones. The class size might have been an issue for the instructors not having provided sufficient feedback to the assignments that the students uploaded to the platform. This particular problem can be solved by reducing the class size and increasing the interaction among students. Although there were adequate features allowing for discussion in the platform used throughout the process, the students did not use these features. During the process, the students stated that they got confused because of the new form of instruction, and that the instructors' teaching the content in class would be more beneficial. This feedback, which was received from the students in spite of instructional videos, reading-research tasks and assignments provided every week, was interpreted as their not being used to traditional teaching, not being able to internalise different methods in which they are more active, and not wanting to make an effort for the class activities. In other words, the students' existing learning culture was influential in the current situation. Porcaro [87] points out that the existing culture may affect students' ways of interacting with other shareholders in constructive learning environments. Learning culture is a construct that is formed institutionally and shaped by individual experience [88]. Reeves, Harmon and Jones [89] state that instructional traditions and the learning culture are vitally important in computer-based instructional activities in addition to factors such as teachers' professional characteristics, school location, technological facilities and support mechanism. In this respect, Wright and Lander [90] reported that South East Asian students showed less participation to activities compared to their Australian peers due to their cultural orientation in constructive group work. In another study, it was found that constructive learning activities did not work out in the Chinese culture as it should have [91]. Similarly, Lo and Hew [92] state that problems such as not getting used to the new research culture and not fulfilling the pre-class activities arise in FL. Nederveld and Berge [93] emphasise that the culture of responsibility along with preliminary preparation and technology access are important for FL to be conducted properly. Consequently, it can be argued that the learning culture of the institutions where FL is to be implemented should be taken into consideration among other characteristics.

In this study, students have developed negative attitude towards both scientific research and scientific research methods course. A control group was not included due to ethical issue because there was no way to make up for the FL-based class in the control group. Therefore, it would not be reasonable to make judgements about the effectiveness of FL based on the findings of this study. Yet, the findings regarding the effectiveness of FL are similar to those reported in the literature [94-96]. In-depth knowledge can be obtained through research designs with a control group in further studies.

In the study, it is thought that students' habits towards traditional learning approaches have impeding effect on the effectiveness of a new learning approach such as FL. There are various variables which lead to this negative effect of the new method on students. In addition to the students' problem of adaptation to the new method, it is thought that giving more assignment and responsibilities to students has negative effect on students. Similar to this view, Tune, Sturek and Basile (2013) [97] determined that the additional workload required by the FL leads to negative effects on students' view. Additionally, Strayer (2007) [98] mentions the negative effects of the use of technology as the first resource in the process of teaching a new knowledge. In accordance with this opinion, in this study students give negative feedback in respect of using technology as a first resource.

It is thought that the students describe the content and duties as too intense (in fact it is not) and that they do not want to take on more duties and responsibilities are related to the existing learning culture. The idea is also supported by student interviews.

5. Suggestions for Practice

Suggestions for a better FL process are offered based on the researchers' experience and the students' feedback throughout the research process. First of all, the scientific research methods course is heavily loaded in terms of theoretical knowledge. FL might not be the ideal option for acquiring knowledge in the Turkish context and culture. For this reason, theoretical knowledge can be reduced, if possible. In this way, students could go through a more effective process by reducing the overload that they are exposed to.

Secondly, more systematic feedback can be provided to prevent misconceptions in the FL process. In this approach in which the acquisition of theoretical knowledge is left to students' control, they should be observed more often. Similarly, the theoretical knowledge related to the class being summarised by the instructor at the beginning and end of the class can be effective in both preventing misconceptions and solving the problem of knowledge acquisition. These also overlap with the students' feedback. Thirdly, students need to much informing about the distance learning platform to be used in FL. Further orientation can be beneficial in this regard. Fourthly, the large class size can negatively affect in-class and out-of-class learning activities in FL. This is observed in conducting the in-class activities, and providing sufficient feedback for the activities outside the classroom. Although

the course was implemented with the cooperation of three instructors, this problem could not be solved in the process. This particular problem can be solved by reducing the class size, or by increasing the interaction among students through a platform they can use for this purpose. However, the extent to which such an interactive platform would be used by students is a matter of discussion. Lastly, it was found in the study that the students needed detailed instructions related to the learning tasks assigned to them. Therefore, students should be provided with detailed (and if possible, written) instructions regarding what they are expected to do in the process.

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