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Interdisciplinary Gender Equality Education Integrating Science, Mathematics and Information Technologies and Software Courses: A Sample from Türkiye*

Matematik, Fen Bilgisi ve Bilişim Teknolojileri ve Yazılım Dersleri ile Bütünleştirilmiş Disiplinlerarası Toplumsal Cinsiyet Eşitliği Eğitimi: Türkiye'den Bir Örnek

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ABSTRACT: The general aim of the study was to improve students' awareness of gender equality. An instructional design was developed in which mathematics, science, information technologies and software (ITS) courses were integrated, with the theme of gender equality at the center. The method of the study was determined as a case study. The participants of the study were 21 sixth-grade students at a public school in Turkey. Research data were collected using the "Views Form on Gender Equality" and "Practice Evaluation Form" developed by the researchers. According to the students' views, it was determined that an interdisciplinary education on gender equality had positive effects on improving students' awareness of gender equality. When the students' views about the practice process were examined, it was seen that the positive opinions about the process were high in number, and students presented few negative views.

Keywords: Gender equality, mathematics course, science course, information technologies and software course, sixth-grade students, interdisciplinary approach.

ÖZ: Çalışmanın genel amacı, öğrencilerin toplumsal cinsiyet eşitliği konusunda farkındalıklarını artırmaktır. Matematik, fen bilgisi ve bilişim teknolojileri ile yazılım derslerinin bütünleştirildiği, toplumsal cinsiyet eşitliği temasının merkeze alındığı bir öğretim tasarımı geliştirilmiştir. Araştırmanın yöntemi durum çalışması olarak belirlenmiştir. Araştırmanın katılımcıları Türkiye'de bir devlet okulunda öğrenim gören 21 altıncı sınıf öğrencisidir. Araştırma verileri, araştırmacılar tarafından geliştirilen "Toplumsal Cinsiyet Eşitliğine İlişkin Görüş Formu" ve "Uygulama Değerlendirme Formu" ile toplanmıştır. Öğrenci görüşlerine göre toplumsal cinsiyet eşitliğine yönelik disiplinlerarası bir eğitimin öğrencilerin toplumsal cinsiyet eşitliğine ilişkin farkındalıklarını geliştirmede olumlu etkileri olduğu belirlenmiştir. Öğrencilerin uygulama sürecine ilişkin görüşleri incelendiğinde, sürece ilişkin olumlu görüşlerin fazla olduğu ve öğrencilerin az sayıda olumsuz görüş bildirdiği görülmüştür.

Anahtar kelimeler: Toplumsal cinsiyet eşitliği, matematik dersi, fen bilgisi dersi, bilişim teknolojileri ve yazılım dersi, altıncı sınıf öğrencileri, disiplinlerarası yaklaşım.

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It has been indicated that inequalities increase at both national and international levels due to the differentiation of societies on the basis of qualities such as race, class, gender, and language (Kellogg, 2002). One of these areas of inequality is gender inequality. The concept of sexism is defined as the belief that women and men have different characteristics and that one gender has the right to more power and resources than the other, and it is stated that the attitudes and behaviors created by sexism in children have negative effects on both genders (Schniedewind & Davidson, 2006). In addition, it is emphasized that individuals are also adversely affected by school culture in terms of gender roles (Levine et al., 1995). In this context, gender-based prejudices that some students have negatively affect the other students at school as well. Besides, it is put forward that individuals could make gender discrimination even without noticing while they are avoiding sexist behaviors (Schniedewind & Davidson, 2006). Moreover, it is determined that there are also problems regarding gender inequality in Turkey (Gözütok et al., 2017).

There could be an interpretation regarding the present situation of gender inequality in Turkey when the research and statistical data on this matter were examined. In the Global Gender Gap Report, Turkey is at 130th rank among 153 countries in terms of the gender gap index according to the 2020 ranking (World Economic Forum [WEF], 2019). On the other hand, in the Global Gender Gap Report 2021, Turkey is 133rd among 156 countries (WEF, 2021). When the net schooling rates in higher education in Turkey were analyzed, this rate was 40,6% for men and 46,3% for women (Turkish Statistical Institute [TURKSTAT], 2021a). According to the results of the household labor force survey, in 2019, the employment rate in Turkey was 28.7% for women and 63.1% for men (TURKSTAT, 2021c). When the data for R&D employment were examined, 68,1% of sectoral distribution by gender is men while 31,9% is women (TURKSTAT, 2021b). Turkey is behind EU countries in terms of girls' gross enrollment rates and gender equality index at all levels of education and expected years of education for girls from primary to tertiary education (Maya, 2013). Based on these results, it could be said that there are inequalities regarding gender in areas such as education, employment, and labor in Turkey. These data show the problems related to gender equality, yet producing solutions for them and applying them are also important subjects, in addition to determining the problems. It has been indicated that it is necessary to question the role of education in struggling with social problems and the formation of a more social society reflecting the values regarding personal freedoms (Apple, 2017). In order to solve social problems, the social function of education should be activated (Turhan Türkkan, 2017). In this sense, various studies investigating the perceptions of students and teachers regarding gender equality and examining the effects of curricula for ensuring gender equality were conducted.

In a study at the primary level, it was determined that 7-8-year students have gender stereotypes in toy choice (Bağçeli Kahraman & Başal, 2011). It was put forward in a study on fourth graders that students possess traditional stereotypes and views on women being weaker and more powerless (Yolcu, 2021). In another study with fourth graders, it was also found that students have gender stereotypes towards occupations and households (Yolcu & Sarı, 2018). In a study conducted on the gender perceptions of primary school students between the ages of 7-15, it was determined that the gender perception of children changes according to the age period; however, being a man is

seen as more valuable in every period (Kılıç et al., 2014). Through a study at the middle school level, it was revealed that middle school students do not know gender concepts, and they adopted traditional gender roles (Yeşil & Balcı Karaboğa, 2021). Within another study at the same level, it was put forward that eight graders have views on gender inequality (Kalaycı & Hayırsever, 2014). Besides these studies, during the needs analysis of this study, similar results were found, and it was determined that the awareness of sixth graders towards gender equality is not sufficient, and there is a need to develop this awareness (Turhan Türkkan et al., 2018a, 2018b). In a study conducted at the high school level, it was found that high school students have educational needs on the concept of gender, gender roles and stereotypes, homosexuality, women's participation in decision-making mechanisms, violence against women, and women's participation in working life and income (Acar-Erdol & Gözütok, 2017). Additionally, studies have presented evidence that pre-service teachers hold gender stereotypes and views on gender inequality (Acar-Erdol et al., 2019; Aslan, 2015; Koyuncu Şahin et al., 2018). Moreover, it was seen that similar results were reached through studies with bachelor students as well (Öngen & Aytaç, 2013; Sis-Çelik et al., 2013; Vefikuluçay et al., 2007; Vefikuluçay Yılmaz et al., 2009). Based on these studies in Turkey, it is considered that many students from primary to higher education have stereotypes and negative views on gender equality. In this respect, it can be said that there is a need for a national education on gender equality.

Within the studies at the primary and middle school level, it has been concluded that gender equality education is effective in decreasing students' prejudices towards gender, developing concept knowledge about gender, changing perspectives on gender roles, and raising awareness of gender equality (Akita & Mori, 2022; Brinkman, 2009; Seçgin & Kurnaz, 2015; Yeşil & Balcı Karaboğa, 2021; Yolcu, 2021). Similar results were reached through also studies related to gender equality education with pre-service teachers (Acar-Erdol, 2019; Aydemir, 2019; Esen, 2013; Şener Özel, 2019). Another study conducted with teachers determined that teachers' knowledge about gender differences of students who attended training, their perceptions of justice towards the diversity in the classroom, and their knowledge skills to encourage girls and boys increased (Kollmayer et al., 2020). Besides, it was found that the women's studies course held at the higher education level positively affected the students' views on gender equality (Harris et al., 1999; Stake, 2006; Stake & Hoffmann, 2001; Thomsen et al., 1995). Based on the results of these studies, it is thought that the applied practices have positive effects in terms of gender equality. The studies conducted were carried out mostly with adults. In addition to this, the practices were either developed directly on the subject of gender equality or were associated with courses in social fields such as social studies and life sciences.

When the research conducted within the Turkish educational system was analyzed, it was put forward that the traditional female role approach in society also exists in the education field. Teachers and administrators reinforce this with the language used in-class processes, activities, and course materials - mostly without noticing-and this situation also interrupts women's education in particular, contributing to women's subsidiary position (Polat, 2010). In the studies carried out in this context, it is stated that there are deficiencies regarding gender equality in textbooks and curricula (Çelik et al., 2019; Güney, 2016; Işık Demirhan, 2021; Kalaycı & Hayırsever, 2014;

Karakuş et al., 2018; Kükrer & Kıbrıs, 2017). With respect to this, it becomes clear that there is a need for arrangements regarding gender equality.

In order for individuals to live in an equal world, it is thought that it will be beneficial both individually and socially for individuals to receive gender equality education to produce creative and applicable solutions to these problems and realize the problems related to gender equality. Besides this, this education is mostly given in courses within the social field. There are very few studies handled in numerical courses such as mathematics, science, and ITS. In this sense, the social integration of mathematics, science, and ITS courses will be a unique practice both in terms of practice and in terms of literature.

Mathematics course is considered a tool for dealing with social issues in education (Gutstein, 2007a). Equality and social justice can be taught in mathematics classes to help students interpret and apply mathematical knowledge to answer questions that will potentially strengthen their lives and the society in which they live (Leonard et al., 2010). For this purpose, the events in the world could be approached from a mathematical point of view (Noyes, 2007), and besides caring for numbers, they could be studied with numerical data regarding social topics such as unemployment, racism, and inequality (Miner, 1995). In this context, it is thought that, in general, social topics, in particular gender equality topics, could be handled in mathematics course. Within this scope, when the studies integrating mathematics with social topics were examined, it was determined that there conducted some practices for middle school level (Allen, 2003; Gutstein, 2003; Turhan Türkkan, 2017), for high school level (Brantlinger, 2007; Harper, 2017; McNamee, 2013; Voss, 2015; Wonnacott, 2011), for pre-service teachers (Johnson, 2005; Koestler, 2010) and for teachers (Gonzalez, 2009; Wager, 2008) and these studies have constructed positive effects on individuals regarding social justice and equality. Based on this, it is considered that including topics such as equality, justice, social justice, and gender equality in mathematics course would provide positive outcomes for students.

The main purpose of science courses is to raise science-literate individuals. One of the important components of science literacy is the ability to establish the relationship between science and technology, society, and the environment. At this point, it is stated that science courses are taught, putting social issues at the center. Students get an active role and use their scientific knowledge in problem-solving, so they will make progress regarding the nature of science (Pedretti, 1999). As for Tal and Kedmi (2006), when students learn about social issues about science and their reflections on society, they can analyze the incidents, make decisions, and develop attitudes towards this subject. It is indicated that significant research centers such as the National Research Council and Queensland School Curriculum Council emphasize the necessity of enhancing the skills of students regarding their ability to discuss, analyze socio-scientific matters, and make decisions based on knowledge (Topçu et al., 2014). It is thought that teachers who incorporate social justice into their lessons will ideally create a classroom environment that helps students be effective voices for change while supporting students to question the unfair power relations in society (Gutstein, 2007b; Mayberry, 1998; Roth, 2007). At this point, it is considered that including social topics in science course curricula and increasing their awareness in this matter positively effect students' being science literate, which is the main purpose of science courses. History of

science has an important place in teaching scientific literacy (Tokuş, 2018). An individual who is aware of historical developments in science becomes aware of how discoveries and inventions were made, what happened in this process, what conditions were effective, and the efforts made in this way, and in this respect, the history of science is considered a very suitable subject to be used in a science course (Laçin Şimşek, 2009). It can be said that covering the social context in terms of the history of science in the science course is also important in terms of integrating science and social issues.

Rapid changes in technology indisputably bring up concepts such as social justice, equality, and gender equality. There is a technology gap called the digital gap between communities or generations where there are inequalities in access to information technology (Tarman et al., 2015). In situations with a technology gap, since students cannot access information equally, it becomes impossible to expect the same results from students. Hellsten (2007) concluded that the aim of technology is actually to make students one; however, it creates a digital divide these days. The technology could be used to provide social justice education and expand opportunities in this sense, and it is recommended that research be conducted concerning the use of hidden social justice curricula in traditional educational settings (Mitchell, 2015). Hence, it is thought that including concepts such as equality, social justice, and gender equality in ITS course would provide significant contributions to the literature. In addition, one of the aims of ITS curriculum is to *"Develop innovative and original projects for the solution of problems encountered in daily life (problems faced by elderly and disabled individuals, etc.)"* (Ministry of National Education, 2018) and it is thought that ITS curriculum includes the integration of social issues with the subjects in the course.

Considering the multidimensionality of real-life problems such as equality, justice, and social justice, handling these matters in an interdisciplinary approach is crucial in terms of reaching solutions for the problems. When the philosophy and approaches underlying contemporary curricula were counted, it was considered necessary to deal with the subjects within the framework of an interdisciplinary approach and to make connections between courses on real-life subjects (Karakuş et al., 2017). In the interdisciplinary approach, various courses in the curriculum are brought together, and the main point in this approach is that the curriculum developers try to use a series of course-based perspectives (Jacobs, 1989). The interdisciplinary approach is considered the integration and interaction of the issues involved in solving a common problem and involves synthesizing and integrating interrelated disciplines into a coordinated and coherent whole (Munkebye et al., 2020). In an interdisciplinary curriculum, connections between disciplines are strong and evident; issues such as 21st-century skills, global problems, sustainability, and intercultural skills can be addressed with an interdisciplinary approach, and in such a case, the boundaries between disciplines become blurred (Drake & Reid, 2020). Regarding climate change, inequalities in different areas, and social problems that concern the whole world and are among the sustainable development goals, it is necessary to study together across disciplines, develop an interdisciplinary understanding, and even produce solutions to problems with understandings beyond disciplines (İnci & Kaya, 2022). It is stated that there is a need for an interdisciplinary curriculum design that takes science, mathematics, and information technology courses together and reflects the real world

(Millar, 2020). In this respect, it is thought that teaching gender equality and establishing interdisciplinary connections with mathematics, science, and ITS courses will make a contribution. Besides, the integration of these three courses with gender equality topics would give it a different perspective. Moreover, no practice or study towards gender equality integrating mathematics, science, and ITS has been found. In all these respects, it is thought that this study will fill the gap in the literature and make important contributions to the field with new information. Within this context, the main purpose of this study was to develop, apply, and evaluate an instructional design for gender equality education. Based on this main purpose, the study aimed to develop sixth graders' awareness on gender equality. In this sense, answers to the questions below were sought:

1. How does an interdisciplinary teaching on gender equality in the sixth grade of middle school contribute to students' awareness of gender equality?
2. What are the students' views on gender equality education at the sixth-grade level of middle school?

Method

In this section, the dimensions of the research model, participants, application process, data collection, and data analysis are included.

Research Design

The research was conducted through the case study method. A case study is a detailed investigation of an incident or several incidents with any convenient method. The main aim of a case study is to understand every aspect of an incident (Punch, 2005). Case studies could be conducted via quantitative or qualitative approaches. Through qualitative case studies, the factors regarding a case are investigated in a wholistic way and focus on how these factors affect the case in question and how these factors are affected by the case. In addition to this, when the changes and the processes of the case are seen as important, it might be possible to study the cases in the long term (Yıldırım & Şimşek, 2008). In this research, the application of the developed design is considered as a case. In this context, the design development process has been taken into account.

Participants

The participants of the study consisted of 21 students studying in sixth grade through the second semester of the 2018-2019 education year in a state school within a middle-socioeconomic region of Adana province in Turkey. Of the 21 sixth-grade students who made up the participants, 14 were girls, and 7 were boys.

The school where the research was conducted is located in Sarıçam district, in the east of Adana. There are approximately 60 teachers and 800 students at the school. There are 20 classrooms in the school. The region where the school is located is a newly formed region in Adana, and the people living in this region are generally at a middle socio-economic level.

Social issues can be included in teaching processes starting from the elementary school level (McBee, 1996). Dealing with social issues is considered important at the secondary school level (Schniedewind & Davidson, 2006). Students at the elementary school level can understand social issues, which can be included in the period between

the ages of 12-18 (Peterson, 2002). Considering that the issue of gender equality also has a social context, it was thought that a study based on this issue could be conducted at the secondary school level, and therefore, the research was conducted at the sixth-grade level.

Instruction Process

At the beginning of this design, a needs analysis was first made. In line with the needs analysis results, teaching attainments were determined first. Then, these attainments were organized within the framework of relevant disciplines and subjects, and content was formed. In the next stage, the variables, teaching methods, and learning and teaching process activities were arranged. In the last stage, arrangements were made for how teaching would be evaluated. After the theoretical part of the design process was completed, practice started.

The process of instruction lasted for 8 lesson hours in total. The instruction was conducted in April and May of the 2018-2019 education year. In the first instructional process, basic information and concepts were handled within the "Introduction to Gender Equality Topic." Through the second instructional process, the topic "Education and Gender Equality" was taught. The topics included in this course were integrated with the mathematics course. An example of integrating gender equality into the mathematics course can be presented as follows: The "Solves and poses problems that require performing four operations with natural numbers" outcome in the mathematics curriculum is rearranged as "Solves mathematical problems regarding gender discrimination in education" in this practice. In this example, the issue of gender equality in education is integrated with the topic of solving problems with natural numbers in mathematics. In the third instructional process, the topic of "history of science and gender equality" was dealt with and integrated with the history of science topic within the science course. As for the fourth instructional process, "Art, science, literature, social media, and gender equality" was the topic. The topics taught in this course were related to information technologies and software. The activities and used materials are shown in Table 1.

Table 1

The Activities and Used Materials in Instruction

The Activities and Used Materials in Instruction	
Introduction to Gender Equality Topic	• 4 leaf clover event • Video presentations regarding gender equality. • Presentation of the concepts regarding sex, gender, gender equality, gender discrimination, gender stereotypes • Worksheet 1 (Basic concepts) • Evaluation Sheet 1
Education and Gender Equality	• Video about equal opportunity in education • Discussion on the barriers girls face in education • Worksheet 2 (Primary and secondary enrollment rates for various countries – gender equality in mathematics and education) • Worksheet 3 (Solving math problems that involve calculating natural numbers with gender equality situations) • Video presentation and discussion about Malala's life • Evaluation Sheet 2
History of Science and Gender Equality	• Discussion on the concept of "scientist" • Cartoon and discussion about the life of Marie Curie • Video and discussion on the life of Prof. Dr. Dilhan Eryurt • Worksheet 3 (Occupations and gender equality) • Evaluation Sheet 3
Sports, Arts, Literature, Social Media and Gender Equality	• Digital Story Presentation (Stories inspired by the lives of Geeta Phogat and Mary Shelley) • Examining social media posts in terms of gender equality • Evaluation with Kahoot! application (Social media posts involving gender equality/discrimination)

Data Collection and Analysis

The data of the study were collected via the "Opinion Form on Gender Equality" and "Instruction Evaluation Form" developed by the researchers. Both forms were examined by experts studying gender equality. Students put their views on both forms in written form.

Opinion Form on Gender Equality consists of five questions developed by the researchers towards the needs analysis of the study (Turhan Türkkan et al., 2018a). An example case, including gender equality/inequality, was presented in each question. The first case is about gender inequality regarding occupations. The second case is about gender equality in households, the third one is about gender equality in sports, the fourth case is about gender equality in promotion, and the fifth is about gender equality in terms of the right to education. While there is an evident statement of gender discrimination in the first and fourth cases, there aren't any statements of gender discrimination in the second, third, and fifth cases; instead, a hidden situation is present. After each case, a three-choice sub-question was asked of the students. In this direction, the students first marked that they found the situation in the case correct; they were

undecided or did not find it correct. After they stated these opinions, they were asked to express their reasons. Besides asking how they would feel or behave, putting themselves in some individuals' place, they were asked to give the reasons for their views.

As for the Instruction Evaluation Form, there are six questions and three probe questions. These questions were arranged within the scope of their evaluations for the application and were prepared to determine how they found the application, its differences with other courses, the changes in their perspectives on gender equality, their suggestions, and additional opinions.

The inductive analysis method included in content analysis was used to analyze both forms. In this sense, first of all, students' views were transferred to computer. Afterwards, students' views were coded. Themes and sub-themes were formed, bringing the related codes together.

Roles of the Researchers

Since the research was carried out within a project, experts in each context of the research worked together. Since this research included the disciplines of mathematics, science, and ITS, an expert from each field took part in it. A mathematics education expert was actively involved in the planning for mathematics subjects, a science education expert was actively involved in the planning for science subjects, and a computer and instructional technologies education expert was actively involved in the planning for ITS education. In order to ensure and control interdisciplinary connections, a curriculum development expert who studies interdisciplinary curriculum development was assigned. In the gender equality dimension of the research, the project manager, who is also a mathematics education and curriculum development expert, actively studied, and this researcher also has scientific research on the teaching of social issues. The mathematics education expert, who is also the first author of the research and the coordinator of this project, also served as a practicing teacher.

Credibility of the Research

Credibility can be achieved by describing in detail the experiences and procedures regarding the process as a researcher (Cope, 2014). In terms of the credibility of the research, it is stated that strategies such as peer examination, long-term interaction, detailed description and reporting, and controlling researcher effects can be used (Patton, 2002). In this respect, the roles of the researchers were explained in detail, detailed information was provided about the process of conducting the research, an effort was made to ensure that the researchers acted objectively in the process, and a long-term interaction was tried to be established with the participants during the implementation process. Besides, peer examination was applied for the reliability of data analysis. With respect to this, the analyses one of the researchers conducted were examined by the other researchers, and the analyses were completed.

Ethical Procedures

Official permission was obtained from the Adana Provincial Directorate of National Education to conduct the research (25/04/2018, E.25867). In addition, written informed consent was obtained from the parents of the participant students.

Findings

The findings of the study were presented under three headings: findings regarding the awareness status of students for gender equality before the instruction, findings regarding the awareness of students for gender equality after the instruction, and findings regarding students' views on the instruction.

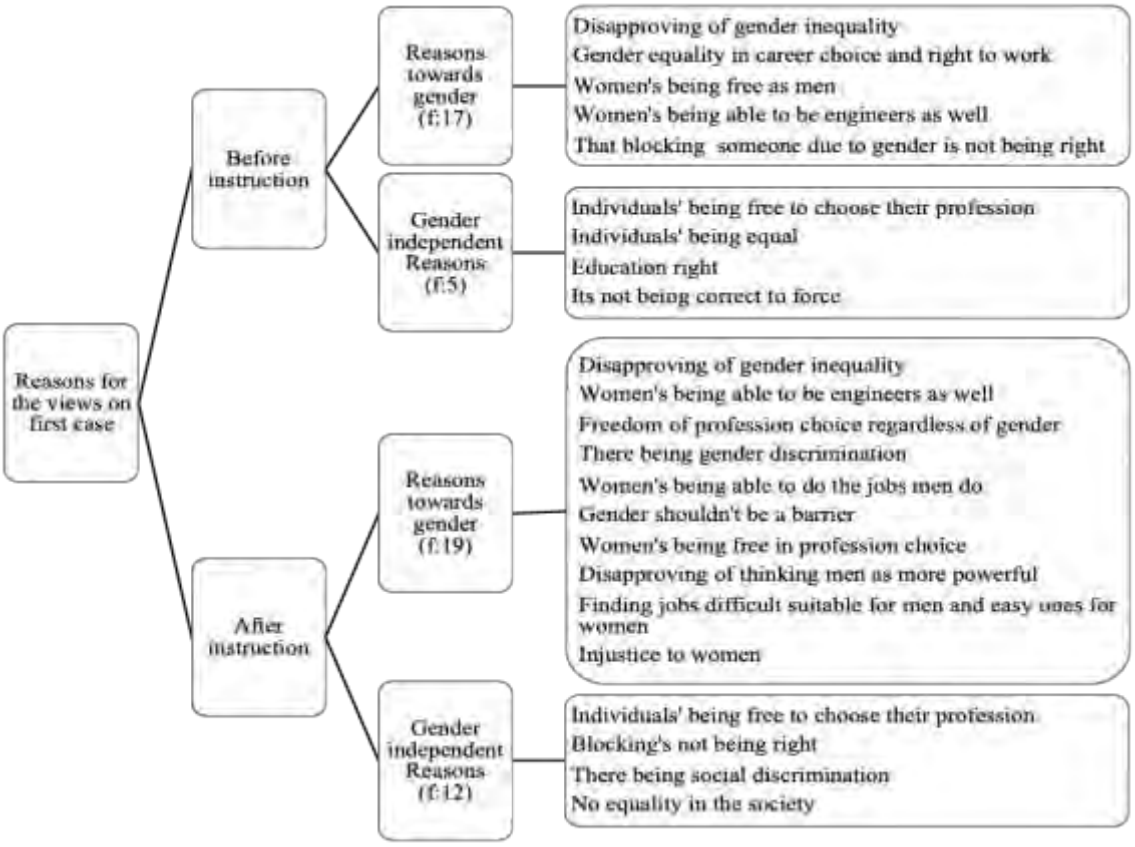
Findings Regarding the Awareness of Students for Gender Equality

Students stated that they did not find the situation correct in the first case, both before and after the instruction. The reasons for students' views on the first case before and after the instruction are presented in Figure 1.

As seen in Figure 1, students presented the reasons for their views on the first case, mostly towards gender, before the instruction. Besides, some students put forward gender-independent reasons as well. Based on this, it could be said that most of the students noticed the gender inequality within the example case in the first question; on the other hand, some students did not notice the inequality. On the other hand, most of the reasons that students presented for their views were related to gender after the instruction. In addition, there were also students who put forward gender-independent reasons. When compared to the situation before the instruction, it was seen that the reasons given by the students for gender increased in number. Based on this, it can be said that the students' awareness of gender enhanced while students questioned the reason for the situation.

Figure 1

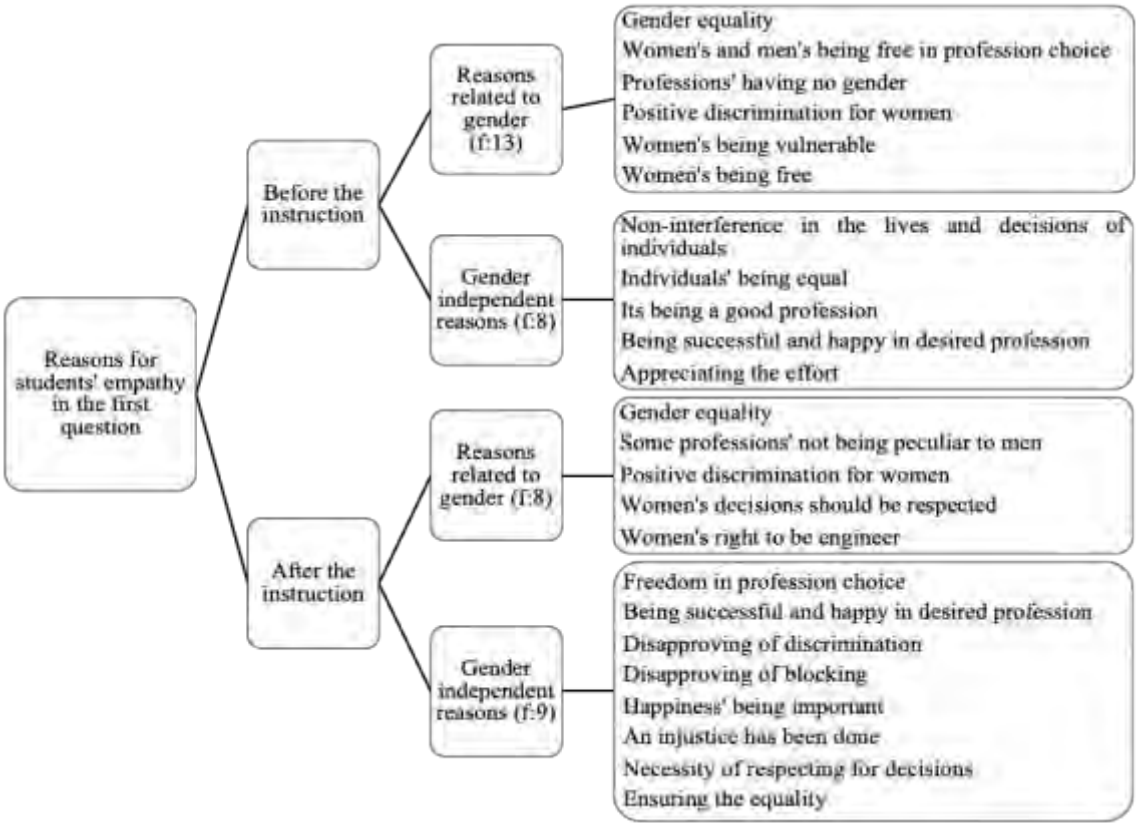
Reasons for Students' Views on the First Case



Before the instruction, in the case of the situation where they put themselves in the place of family, ten students stated that they would allow the girl, six students stated they would support both two children, four students indicated that they should be freed or not intervened and one student told that individual should be asked for his/her wish. On the other hand, after the instruction, in the case when they put themselves in place of family, seven students mentioned that they would let the girl, nine stated that they would support both two children, four students stated they should be freed or not intervened, and one student stated s/he would support girl more. Students' reasons regarding the empathy they showed within the first question were presented in Figure 2.

Figure 2

Reasons for Students' Empathy in the First Question

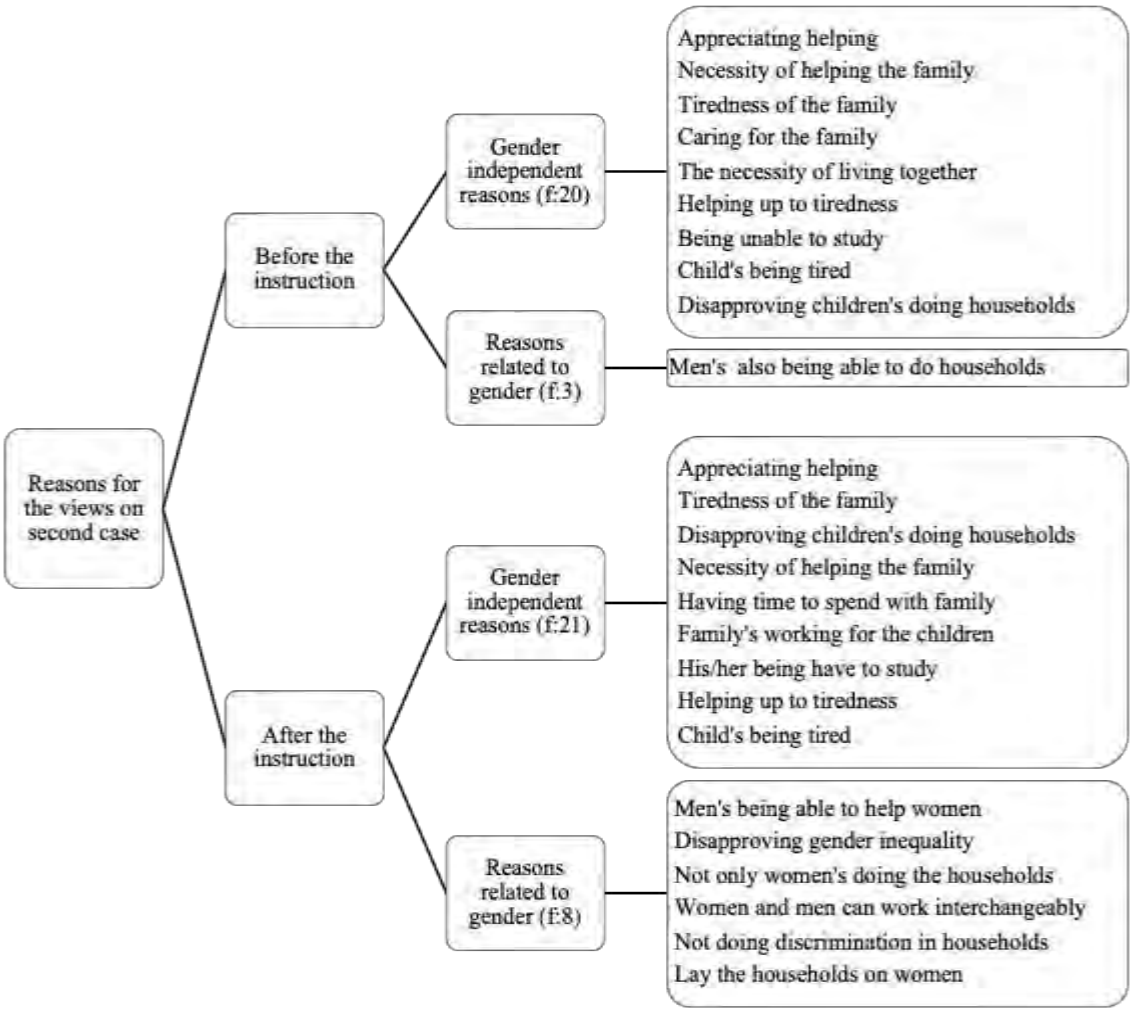


As in Figure 2, the reasons students put forward before the instruction were much more related to gender. Besides, gender-independent reasons were presented as well. In the first question, it was seen that they generally realized the gender inequality in the case. Moreover, it was determined that some students' reasons and rationales were unrelated to gender topics. In this sense, it could be said that some students do not realize gender inequality. After the instruction, while some students presented reasons regarding gender, some of them gave gender-independent reasons.

For the case in the second question, before the instruction, 18 students mentioned they found the behavior right, two students stated that they were undecided, and one student did not find it right. After the instruction, 16 students stated that they found the case in the second question right, three stated they were undecided, and two stated they did not find it right. The reasons for their views are shown in Figure 3.

Figure 3

The Reasons for Students' Views on the Second Question

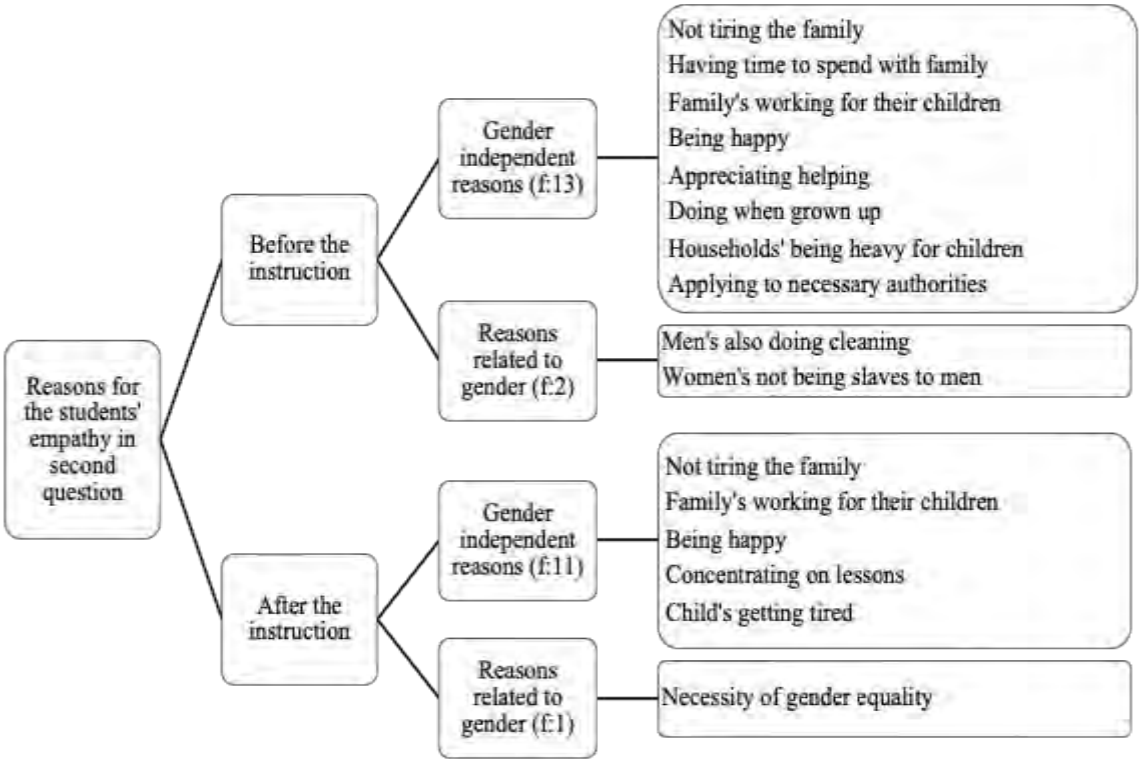


It is seen in Figure 3 that students explained their reasons for views on the second question much more as gender independent before the instruction. Besides, there were few students who came up with reasons related to gender. Based on this, it could be asserted that most of the students did not realize the gender inequality in the case within the second question, while few students realized it before the instruction. After the instruction, most of the reasons students put forward were not related to gender. However, some students presented reasons related to gender as well. Compared to the situation before the instruction, it was seen that the reasons related to gender students mentioned increased in number. It could be said that the students' awareness of gender enhanced while questioning the reasons for the situation.

Before the instruction, 17 students stated that they behaved the same way when they put themselves in Ozan's place; two indicated that they would help with some households, and two said they would not. On the other hand, after the instruction in the situation, they put themselves in Ozan's place; 15 students stated they would behave in the same way, while three students said they would help with some households and three students would not. The reasons students have regarding these views are presented in Figure 4.

Figure 4

Reasons for Empathy of Students within the Second Question

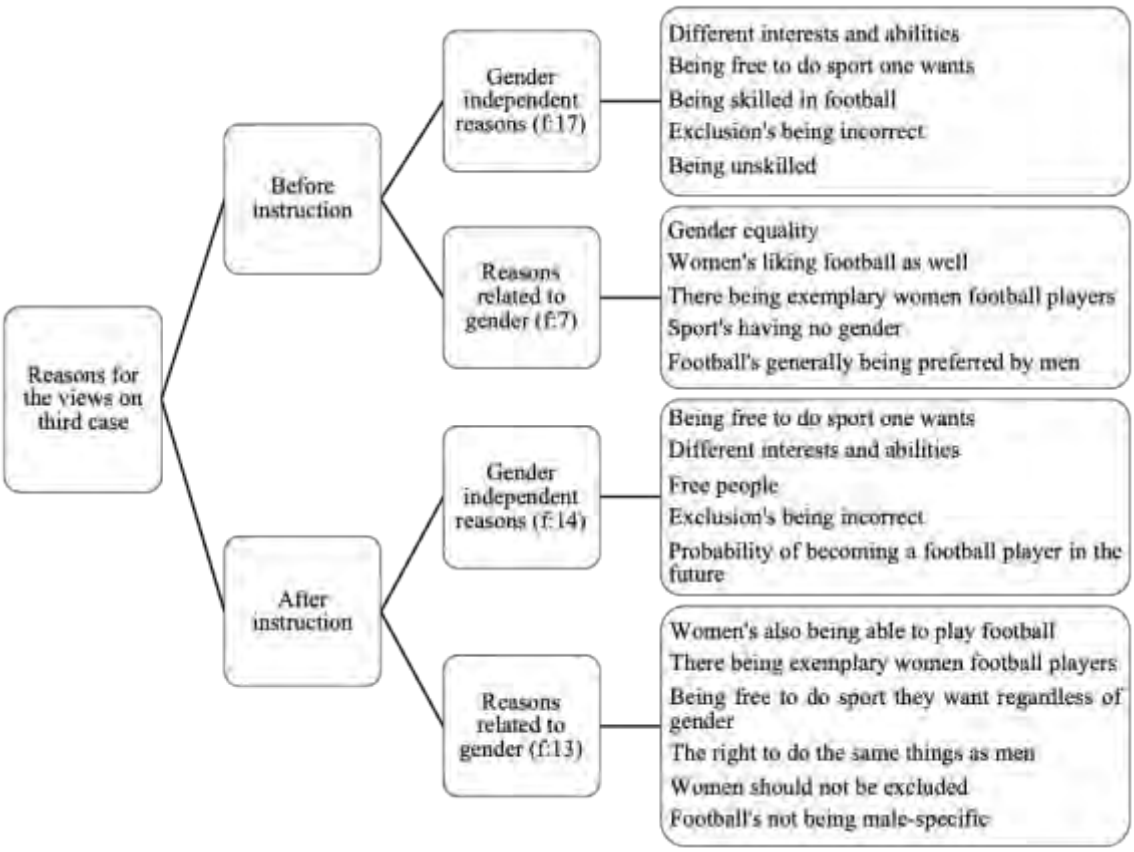


As is seen in Figure 4, most of the reasons students put forward before the instruction were related to gender-independent issues. However, few students explained their reasons as gender-related. In the second question, in general, it was found that most of the reasons and rationales students presented for the situation in the case were not related to gender topic. Based on this, it could be asserted that they did not handle the situation in the case with the gender topic. As for the reasons students brought about after the instruction, most of them were gender independent. However, one student presented a gender-related reason.

Before the instruction, 20 students for the third question stated that they did not find the situation in the sample case correct, while one student expressed that s/he was undecided. After the instruction, all of the students stated that they did not find it correct. The reasons for this opinion are given in Figure 5.

Figure 5

Reasons for the Views on the Third Case

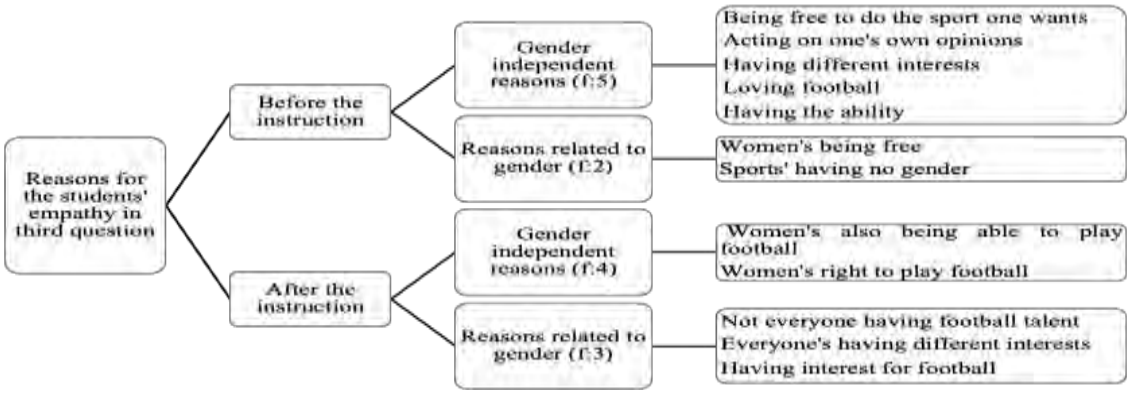


As seen in Figure 5, before the instruction, the students explained the reasons for their opinions on the third question, which was mostly gender independent. Besides, there were also students who related their views to gender topics. Based on this, it can be said that most of the students did not notice the gender inequality in the case of the third question before the instruction, while some students noticed the gender inequality. After the instruction, on the other hand, some of the reasons given by the students were associated with the gender issue, while some were not. Compared to the situation before the instruction, it is seen that the reasons by students related to gender increased in number. In line with this, it could be inferred that their gender equality awareness enhanced while students questioned the reasons for the situation.

Before the instruction, in the case they put themselves in Damla's shoes, eight students expressed that they would play together, six students would support, four students would not be excluded, two students would congratulate, one student would defend, one would want him to teach how to play football, one would not criticize, one would let him alone, one would inform the teacher, one would show empathy and respect. On the other hand, after the instruction, when they put themselves in Damla's place in the case, five students indicated they would respect, four students would not exclude, three students would support, three students would play together, two students would not tease, one student would congratulate, one student would ask her/him to teach him/her, one student would not interfere, and one student would not criticize. The reasons they put forward are presented in Figure 6.

Figure 6

Reasons for the Students' Empathy in the Third Question

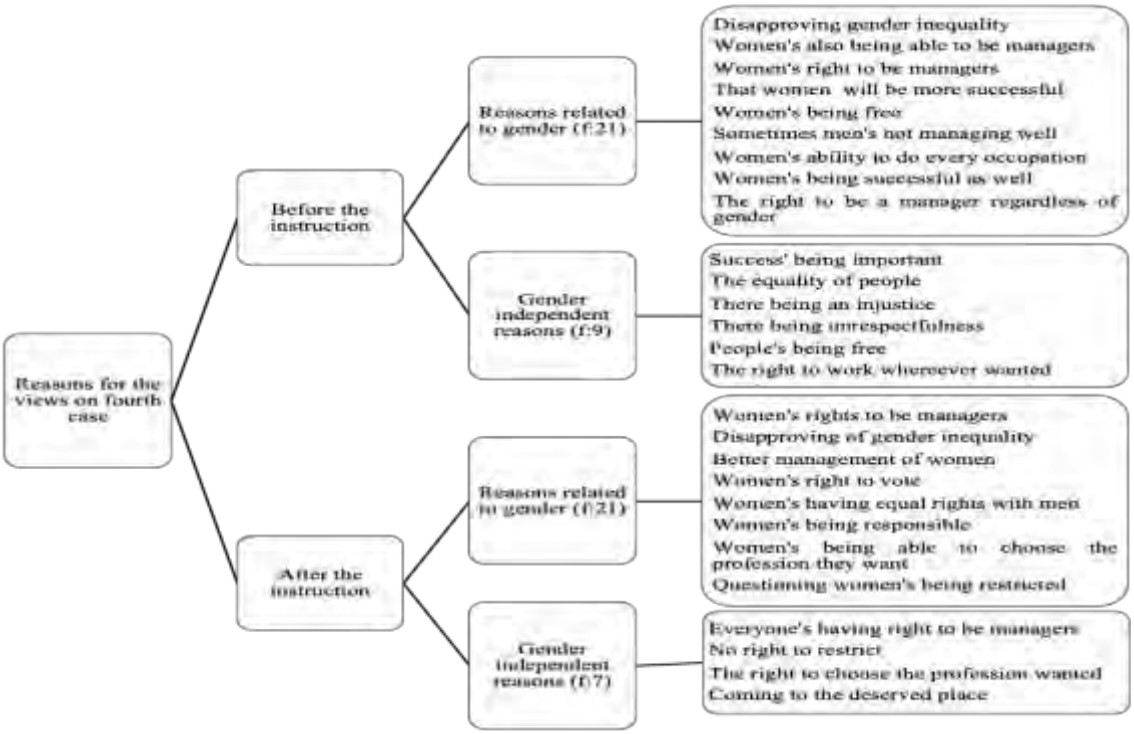


As seen in Figure 6, the reasons given by the students before the instruction were mostly about gender-independent issues. However, there were also students who associated their reasons with gender issues. It could be asserted that students generally did not realize the gender inequality in the case within the third question. In addition to this, it was determined that the reasons and rationales some students came up with related to gender topics. With this respect, it could be said that students did not realize the gender inequality was in the majority. Yet, after the instruction, some of the reasons students were gender independent while some were related to gender.

Before and after the instruction for the fourth question, all of the students stated that they did not find the situation in the case correct. They presented the reasons for their views as in Figure 7.

Figure 7

Reasons for the Views on the Fourth Case

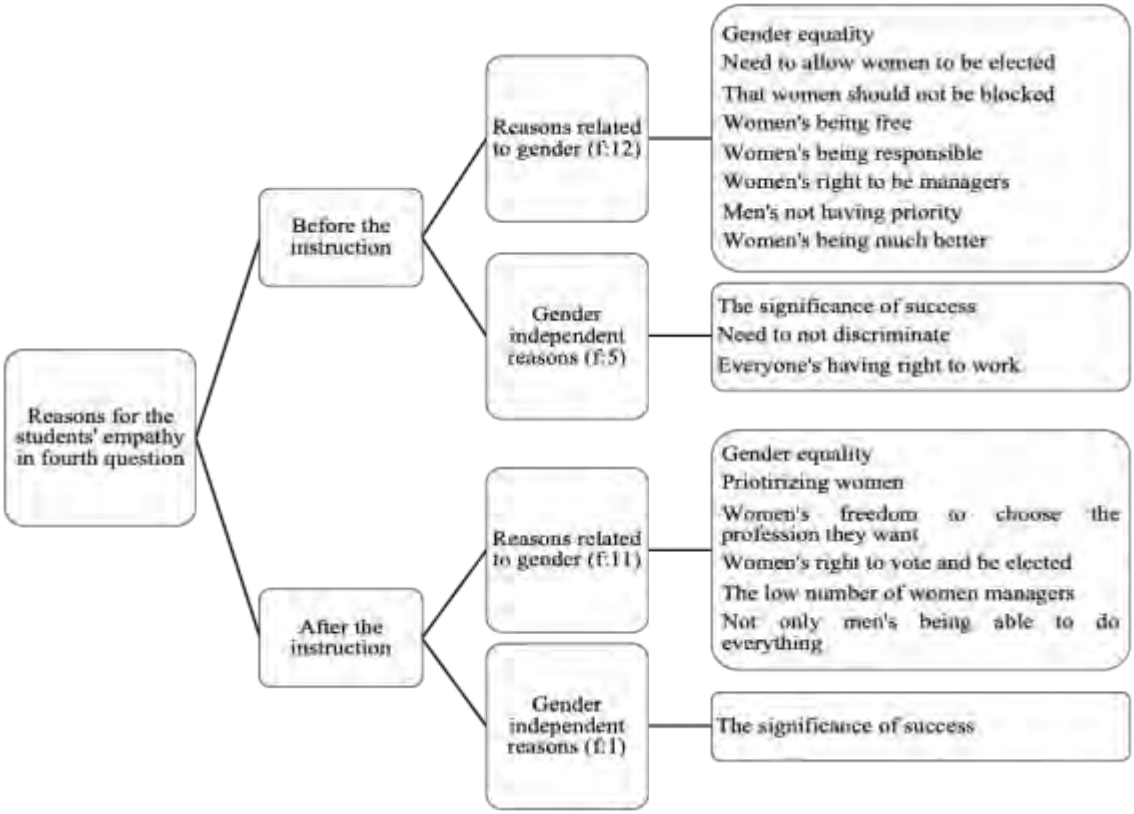


As can be seen in Figure 7, before the instruction, the students mostly associated the reasons they presented for their opinions with gender. Besides, there were students indicating gender independence. Based on this, it could be said that most of the students realized the gender inequality in the case within the fourth question before the instruction, while some did not realize it.

On the other hand, students associated most of their reasons with gender. However, some students presented gender-independent reasons. Compared with the situation before the instruction, it was seen that the reasons given by the students regarding gender did not change in number. Yet, it is thought that the reasons given by students before and after the instruction regarding gender were more numerous. In addition, it was determined that presented gender-independent causes decreased. In line with this, it can be said that students' awareness of gender was at a good level before the instruction, and there was not much change after the instruction. After the instruction, all students stated that they would accept everyone's application regardless of gender if they put themselves in the place of the workplace owner. The reasons they put forward in Figure 8.

Figure 8

Reasons for the Students' Empathy in the Fourth Question



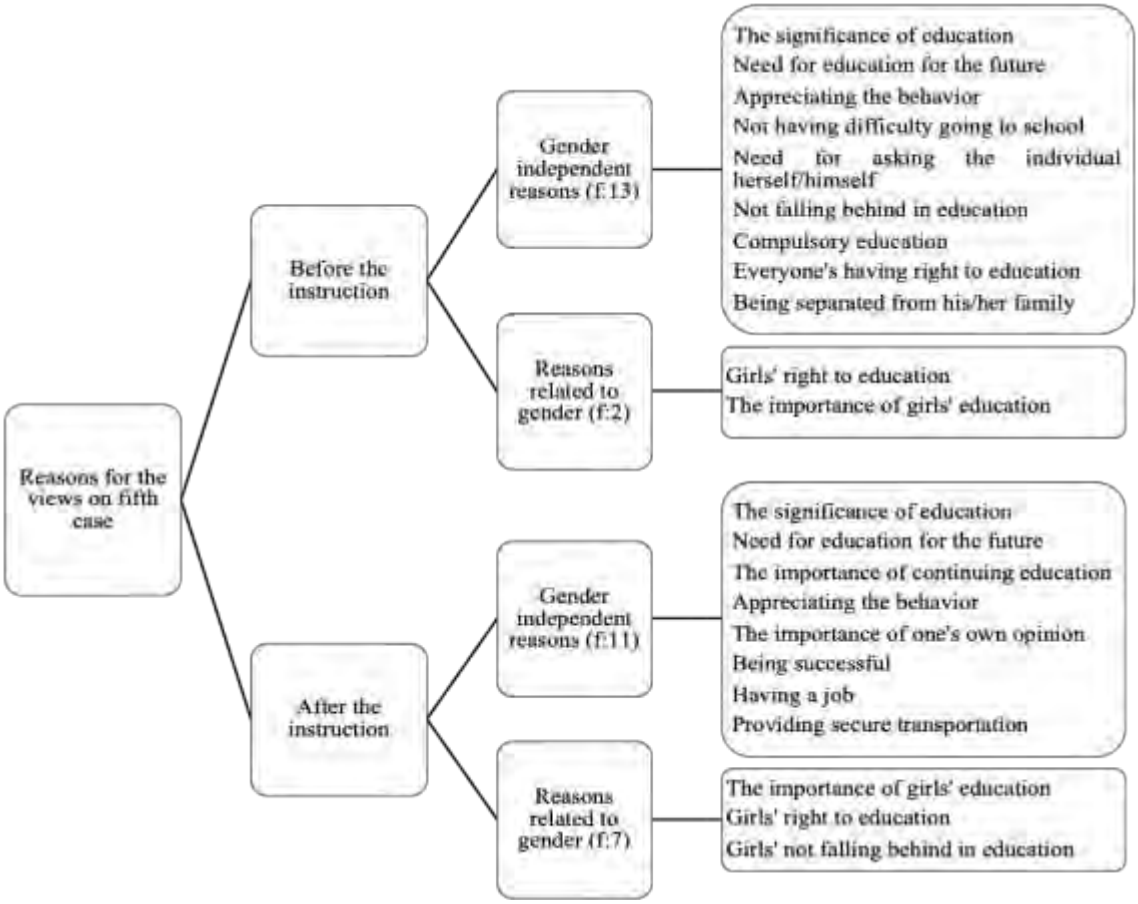
As seen in Figure 8, the reasons given by the students before the instruction were mostly related to the gender issue. However, there were also students who presented their justifications regardless of gender. In the fourth question, it was determined that most of the reasons and justifications presented by the students for the situation in the case were related to the gender issue in general. In addition, it was observed that reasons

and justifications are associated with gender topics as well. Based on this, it could be said that they handled the situation in the case together with the gender topic. However, after the instruction, it was seen that students linked most of their reasons with gender. Moreover, one student presented a gender-independent reason.

Before the instruction, while 19 students stated that they found the sample case in the fifth question correct, one was undecided, and one did not. As for after the instruction, while 20 students found the sample case correct in the fifth question, one student was undecided. They indicated the reasons for these views in Figure 9.

Figure 9

Reasons for the Views on the Fifth Case

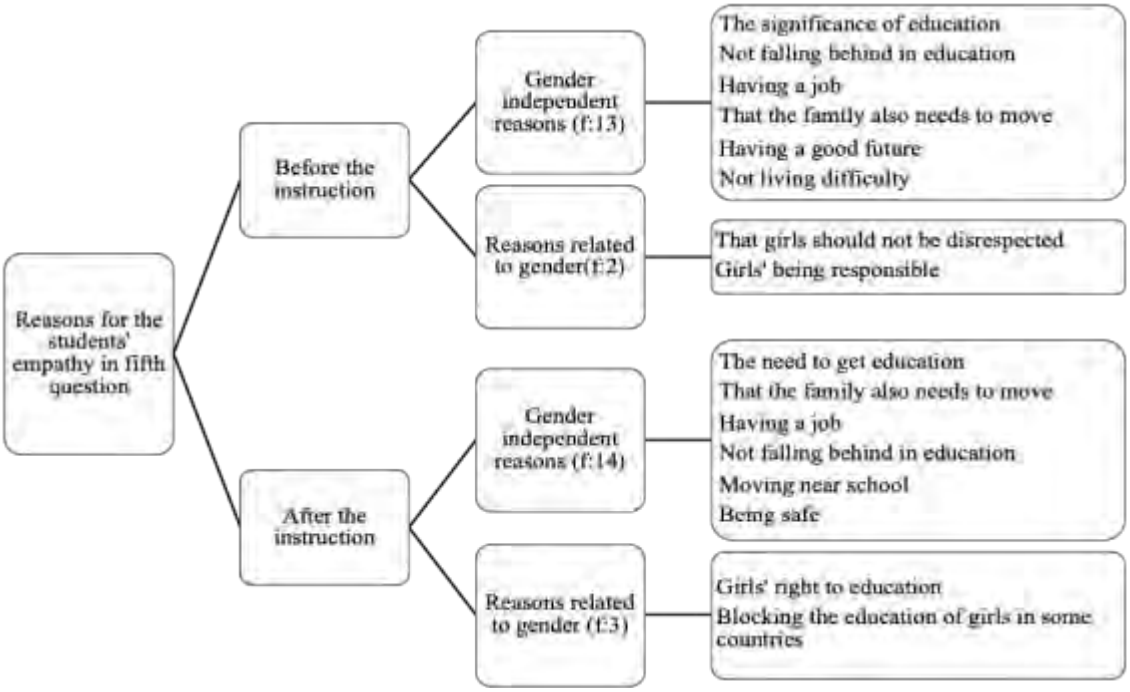


As seen in Figure 9, most of the reasons given by the students before the instruction were about gender-independent issues. However, there were also students who offered reasons about gender. Based on this, it can be said that most of the students did not notice the gender inequality in the case in the fifth question before the instruction, while a small number of students noticed the gender inequality. After the instruction, most of the reasons presented by the students were explained regardless of gender. In addition, it was determined that the reasons associated with the gender issue were also presented. When compared to the situation before the instruction, it was seen that the reasons given by the students for gender increased in number. In line with this, it can be said that students' awareness of gender has improved while questioning the reasons for the situation.

Before the instruction, in the case of the situation, they put themselves in the family's place. 19 students stated that they would behave the same way, one student said the person should be asked first, and one student indicated that the family should go together. On the other hand, after the instruction, when they put themselves in the family's place, 17 students stated that they would act the same way, three students said the family should move together, and one student stated the person should be asked first. The reasons for these views are given in Figure 10.

Figure 10

Reasons for the Students' Empathy in the Fifth Question



As seen in Figure 10, some of the reasons given by the students before the instruction were gender independent, while some of them presented reasons based on gender. In the fifth question, it was determined that most of the reasons and justifications presented by the students for the situation in the case were not related to the gender issue. Based on this, it can be said that most of the students did not deal with the case study on the subject of gender equality. After the instruction, it was determined that most of the students presented reasons regardless of gender. However, it was also observed that there were reasons associated with the gender issue.

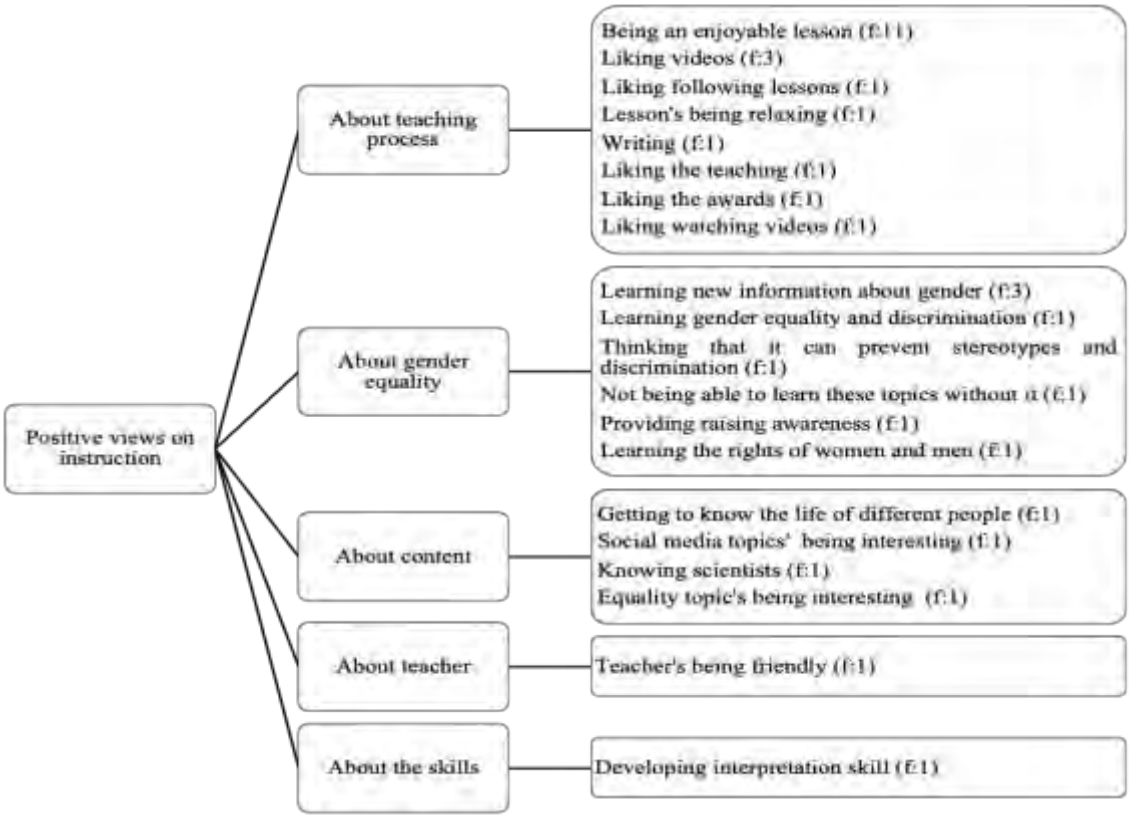
In general, before the instruction, it was seen that the students were aware of gender equality/inequality in some example cases, and in some cases, they were not aware of it. However, it was observed that the reasons and justifications presented for gender equality were less than those presented independently of the issue of gender equality. From this point of view, it could be said that there was a need to improve students' awareness of gender equality before the instruction. In general, when the situation before and after the instruction is compared and the reasons given by the students regarding the case are examined, it can be said that there is an improvement in students' awareness of gender equality after the instruction.

Findings Regarding the Views of Students Towards the Instruction

Students' opinions on instruction were presented under six themes: positive views, negative views on instruction, views on the differences of instruction from other courses, changes in perspective, what was learned at the end of the instructional process, and suggestions for the instructional process. The positive views of the students about the instruction are given in Figure 11.

Figure 11

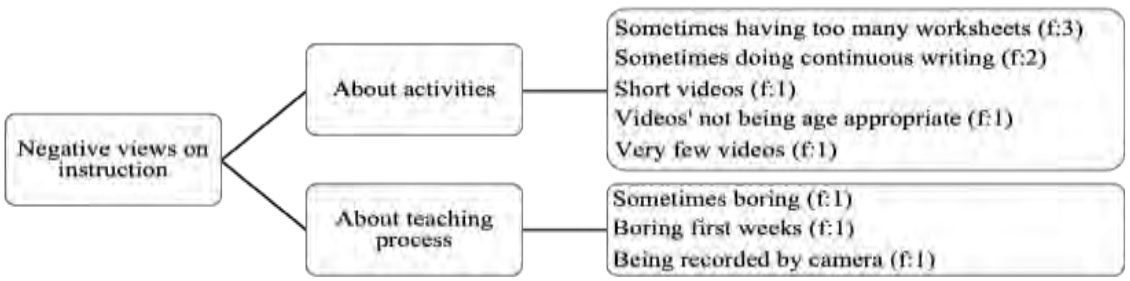
The Positive Views of Students on Instruction



As seen in Figure 11, the students' positive views on instruction were gathered under five themes, which were about the teaching process, gender equality, content, teacher, and skills. Students put forward some views as it being an enjoyable lesson, learning new information about gender topics and learning gender equality and discrimination. The negative views of students on instruction are shown in Figure 12.

Figure 12

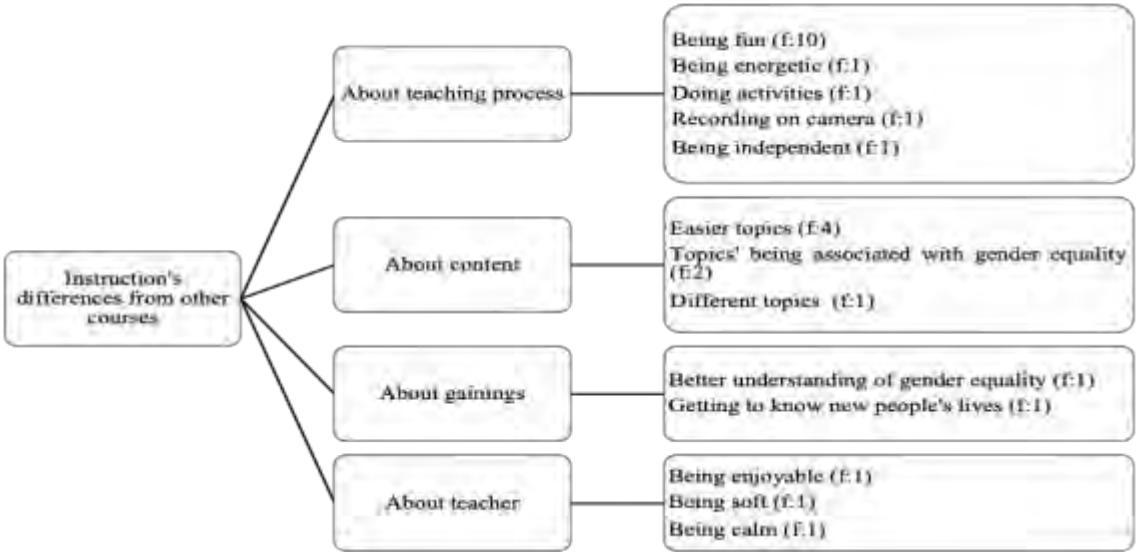
The Negative Views of Students on Instruction



It is observed in Figure 12 that students' negative views on instruction were placed under two themes: activities and the teaching process. Students mostly mentioned sometimes having too many worksheets and sometimes doing continuous writing. Students' views about the instructions' differences from the other courses are presented in Figure 13.

Figure 13

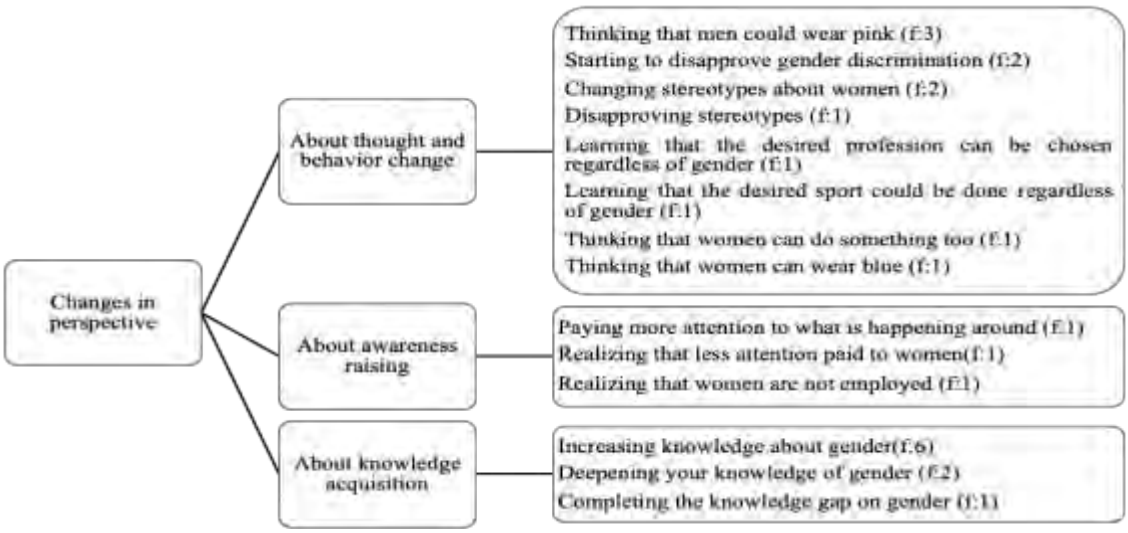
The Views of Students on the Instruction's Differences from Other Courses



Four students stated that the instruction did not differ from other courses. As shown in Figure 13, students' views on the instruction differences from other courses were grouped under four sub-themes: About teaching process, content, gainings, and teacher. The students mostly mentioned that the lesson was fun, the topics were easier, and the topics were associated with gender equality. Changes in students' perspectives are presented in Figure 14.

Figure 14

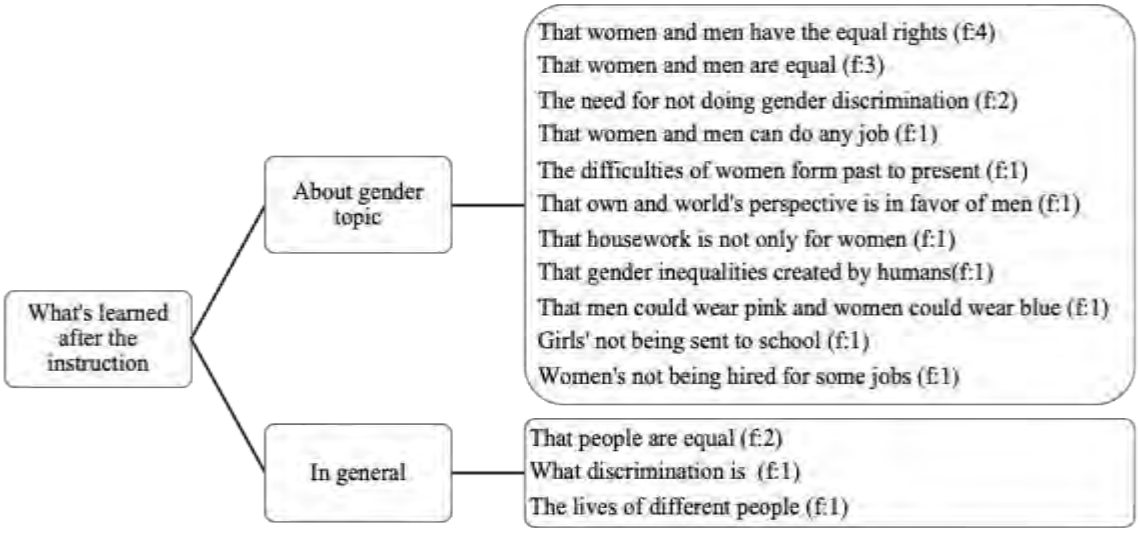
Changes in Students' Perspective



Four students stated that there was no change in their point of view, and they thought similarly before the instruction as well. As can be seen in Figure 14, it was grouped under three sub-themes: about thought and behavior change, awareness raising, and knowledge acquisition. In this context, it was mostly mentioned about the increase in knowledge about gender, thinking that men could wear pink, starting to disapprove of gender discrimination, changing stereotypes about women, and deepening of knowledge about gender. Student views on what was learned at the end of the instructional process are presented in Figure 15.

Figure 15

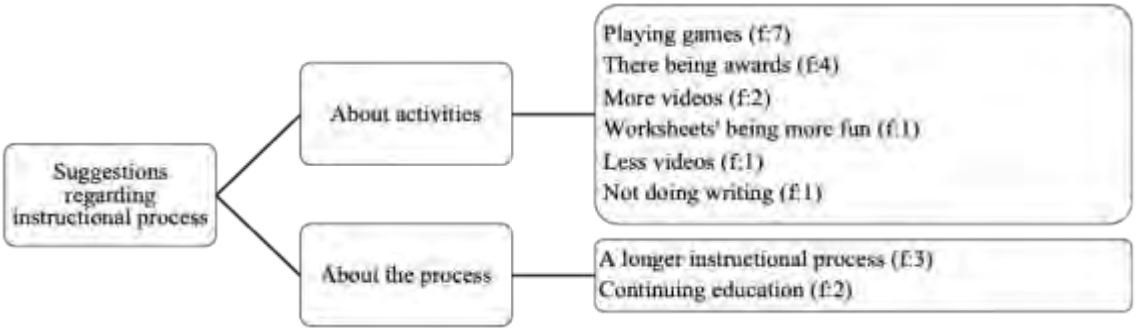
What's Learned After the Instruction



As a result of the instructional process, one student mentioned that they were already familiar with these topics, while two others provided very general responses, stating that they had learned everything. As seen in Figure 15, what was learned at the end of the instruction was gathered under two sub-themes about gender topics and in general. Within this context, they stated that they mostly learned that women and men have equal rights, that women and men are equal, that there should be no gender discrimination, and that people are equal. The suggestions made by the students regarding the instructional process are given in Figure 16.

Figure 16

Suggestions regarding the Instructional Process



As seen in Figure 16, students' suggestions regarding the instructional process were grouped under two sub-themes: about activities and the process. Students mostly indicated that games could be included, awards could be offered, and continuing education should be offered.

Results and Discussion

Before the instruction, when the awareness of the students in the sixth grade of middle school was examined, it was found that the students noticed gender inequality in the cases where there was a clear discourse of gender discrimination when the reasons for their opinions were examined, it was determined that they presented reasons independent of gender. In case studies involving implicit cases of gender equality/inequality, a small number of students did not realize gender equality/inequality; when the reasons for their opinions were examined, it was determined that they mostly presented gender-independent reasons. In line with the answers to the second, third, and fifth questions, it can be said that they did not notice the situation regarding gender equality/inequality; however, in the first and fourth questions, they noticed the gender inequality in the case. In the cases in these questions, it is clear that injustice was done to individuals due to gender stereotypes, but in the cases given in the second and fifth questions, there were situations involving equality, contrary to injustice. As for the case in the third question, there was exclusion instead of injustice. For this reason, they may have associated the students' explanations for the first and fourth questions more with the subject of gender. In addition, when the answers given to the questions were examined, it was determined that while the most reasons for the gender issue were given in the fourth question, in the third question, the least number of reasons for the gender issue were given. Based on this, it can be said that there were deficiencies in gender equality before the instruction and training were needed on this subject. Similar results were obtained with the needs analysis research conducted for this study (Turhan Türkkan et al., 2018a). In similar studies conducted in Turkey, it has been determined that primary and middle school students have stereotypes and negative opinions about gender equality (Turhan Türkkan et al., 2018a; 2018b; Bağçeli Kahraman & Başal, 2011; Kalaycı & Hayırsever, 2014; Kılıç et al., 2014; Yeşil & Balcı Karaboğa, 2021; Yolcu, 2021; Yolcu & Sarı, 2018). As a matter of fact, in different studies on this subject at the middle school level, it is stated that there is a need for education on gender equality (Acar-Erdol & Gözütok, 2017). In line with this, it can be said that it would be beneficial to improve the students' awareness regarding gender equality in the classroom where the instruction was conducted.

In order to determine how interdisciplinary teaching on gender equality in the sixth grade of middle school contributed to students' awareness of gender equality, the reasons given by the students before and after the instruction were examined. In the first, second, third, and fifth questions, it was seen that the reasons given by the students related to gender increased in number compared to the situation before the instruction. Based on this, it could be said that students' awareness of gender has improved while questioning the reasons for the situation. However, in the fourth question, it was seen that the reasons given by the students related to gender did not change in number compared to the situation before the instruction. In the context of the fourth question, it could be inferred that the students' awareness of gender was at a good level before the

instruction while questioning the reasons for the situation, and there was not much change after the instruction. However, in general terms, it can be said that the instruction increased students' awareness of gender equality. In studies conducted at primary and middle school levels, it has been concluded that gender equality education is effective in reducing students' prejudices towards gender, developing concept knowledge about gender, changing their perspectives on gender roles, and raising awareness of gender equality (Akita & Mori, 2022; Brinkman, 2009; Seçgin & Kurnaz, 2015; Yeşil & Balcı Karaboğa, 2021; Yolcu, 2021). In this respect, it could be said that gender equality education positively effects the individual and social context.

When the students' views on the instructional process were analyzed, it was seen that the number of positive opinions about the process was high, and they also presented negative opinions, even a few. However, it has been determined that the instruction differs from other courses, especially in terms of teaching, creating positive changes in the students' perspective, and increasing their learning about the subject. The subject of gender equality must come to the fore in the opinions expressed by the students, and this situation gives rise to the idea that it increases students' awareness of the subject. In this context, it confronts us as an important outcome for students to gain knowledge and awareness about gender equality and to create positive thinking and behavior changes. Based on this, it could be indicated that instruction positively effected students. When the studies on gender equality education and practices are examined, it is seen that education for gender equality creates a positive change in gender attitudes from traditional to egalitarian attitudes (Özcan, 2012), improves gender perception (Altınova & Adıgüzel, 2013), and increases gender sensitivity. (Esen, 2013), improves gender attitudes and raises awareness (Seçgin & Kurnaz, 2015). As seen from the results of these studies, gender equality education positively effects individuals. However, it was determined that some arrangements should be made for the worksheets and videos on the negative opinions of the students and their suggestions to improve the instruction. With respect to this, it can be said that it would be beneficial to improve the teaching activities carried out.

A significant result of this study is also that it is possible to integrate the topic of gender equality with mathematics, science, and ITS courses. From this point of view, it can be said that numerical courses can be a tool for raising awareness about gender equality. Although no study directly integrates gender equality with mathematics courses, when the results of studies that associate mathematics courses with social issues are examined, it has been determined that students have achieved positive outcomes on issues such as equality and social justice (Allen, 2003; Brantlinger, 2007; Gutstein, 2003; Harper, 2017; Johnson, 2005; Koestler, 2010; McNamee, 2013; Turhan Türkkan, 2017; Voss, 2015; Wonnacott, 2011). a study incorporating technology for social justice education concluded that technology can effectively support educational initiatives and actions related to social justice (Mitchell, 2015). Based on this, it is considered that social issues could be included not only in social field courses but also in numerical field courses, and they could be conducted through interdisciplinary instruction.

Considering the positive effects of gender equality education on students, suggestions for practice and future studies were created. These recommendations are presented below:

- As gender equality education increases students' awareness of gender equality, this instructional practice could be extended to the whole country and included in courses' curricula in an interdisciplinary way.
- This study was conducted with middle school sixth-grade students. Similar studies can be carried out at primary education and high school levels.
- This study was carried out for mathematics, science, and ITS courses. In this context, other studies can focus on the integration of different courses.
- This study was carried out with a qualitative method. In other studies, will be conducted in this context, quantitative tools such as scales and tests can be used.
- The case study design was used in this study and was limited to the effects of the instruction on students. In the studies to be carried out in the same context, more detailed studies can be conducted using designs such as action research, ethnography, etc.
- Only students are included as data sources in this study. Stakeholders such as teachers, administrators, and parents can also be included in the studies to be carried out.

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Statement of Responsibility

The authors assume full responsibility for the study. In the research, Buket Turhan Türkkan took part in the research design, literature review, implementation, data collection, data analysis and reporting stages. Nihan Arslan Namlı and Betül Karaduman took part in the literature review, implementation, data collection, data analysis and reporting stages of the research. Memet Karakuş took part in the research design, implementation, data analysis and reporting stages of the research. All authors participated in critical review.

Conflicts of Interest

The authors do not have a conflict of interest with any institution or person.

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Appendix: Views Form on Gender Equality

1) Ayşe and Ali are seventh grader twins. Both wants to be computer engineers after graduated from high school. However, her family doesn't want Ayşe to be an engineer. They do not find it right for women to be engineer so they hinder Ayşe. On the contrary, his family supports Ali's wish for being an engineer as he is a male. In this case, regarding family's thoughts and behaviors;

a) I find it right.

b) I do not find it right

c) I am undecided

Because;……

……

What would you do if you were in the family's place? Why?

……

……

2) Ozan is a 15-year-old boy. Ozan's mother and father are teachers. Ozan's parents are usually very tired when they come home. For this reason, Ozan helps his family in preparing the meal, setting the table and washing the dishes in order to prevent his parents from getting tired more. He helps his family as much as he can in house cleaning on weekends. In this case, about Ozan's helping his family in households;

a) I find it right.

b) I do not find it right.

c) I am undecided.

Because;……

……

What would you do if you were in Ozan's place? Why?

……

……

3) Damla is a middle school sixth grade girl who loves football very much. As she likes to play football, she plays during breaks and in her spare time. However, her girlfriends in the class criticize Damla's playing football and exclude her. In this case, regarding the behavior of Damla's girlfriends towards Damla;

a) I find it right.

b) I do not find it right.

c) I am undecided.

Because;……

……

What would you do if you were Damla's girlfriends? Why?

……

……

4) Fatma is a very successful employee at her job. Fatma is 32 years old and has two children. Fatma successfully manages her home life and business life, and does her stuff at work without slacking off. A manager will be determined at Fatma's workplace this

month. Along with Fatma, two female employees and four male employees applied to become managers. However, the owner of the workplace where they work did not accept the applications of female employees, stating that women could not be managers, and only accepted applications from male employees. In this case, regarding the thoughts and behaviors of the owner of the workplace;

a) I find it right.

b) I do not find it right.

c) I am undecided.

Because;……
……

What would you do if you were the owner of the workplace? Why?
……
……

5) Aslı is a 16-year-old girl who continues her high school education. The village where Aslı lives is far from the nearest town where there is a high school, and in winter the roads are very dangerous due to snow. Aslı's family supports the education of girls. However, they think that Aslı is having difficulties because her high school is far away. Her family, thinking that Aslı would not fall behind in education, bought a house in the district where the high school is located and decided to live with her grandmother there. In this case, this decision of Aslı's family;

a) I find it right.

b) I do not find it right.

c) I am undecided.

Because;……
……

What would you do if you were in Aslı's family's place? Why?

……
……