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The Opinions of Middle School Mathematics Teachers on the Integration of Mathematics Course and Social Issues *

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Abstract: The purpose of this study is to examine the opinions of middle school mathematics teachers on the integration of mathematics course and social issues. For this purpose, qualitative research method was used in this study. As for determining the participants of the research, criterion sampling among purposeful sampling methods was used. Being a middle school mathematics teacher as an occupation was considered as a criterion for determining the participants. The participants of the research consist of 13 middle school mathematics teachers in Turkey. So as to collect the research data, the semi-structured interview form created by the researchers was used. The data analysis was performed according to the content analysis, and Nvivo 10 program was used for the analysis. As a result of this study, the themes of the situation and methods of the integration of mathematics course and social issues, the attainment of democratic values in mathematics course and the ways of its attainment, gaining awareness of social justice and equality in mathematics course and the ways of its gaining, the activities performed by teachers for social issues in mathematics course and the teachers' suggestions for the integration of mathematics course and social issues were reached and the results were discussed within this frame.

Keywords: *Mathematics education, social issues, mathematics teachers, teachers' opinions.*

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Introduction

Mathematics education is regarded as a tool for creating solutions for social problems, creating a democracy that is fairer and includes variety from the social aspect, raising awareness of social justice and making the world a better place (Ball, Goffney & Bass, 2005; Gutstein, 2007; Peterson, 2007b; Gonzalez, 2009; Wright, 2017). Mathematics is a part of raising educated citizens, and it is regarded necessary for students to learn the relationship between mathematics and social issues for them to create solutions by understanding inequalities and social problems (Spielman, 2008). When mathematics course is taught in an isolated way from life, students will fail to make sense of the relationship between social realities in the society and mathematics, and they will not realize how to use mathematics in the society when they address mathematics in an abstract context (Peterson, 2007b). Accordingly, it is deemed necessary to include the issues of equality and social justice in mathematics education with the thought that mathematics education plays an important part in the social and economic production of the society (Hart, 2003).

Addressing the issues of social justice and equality in mathematics education ensures seeing different points of view from social and cultural aspects (Koestler, 2010). Furthermore, social justice education gives students opportunities to learn mathematics meaningfully and effectively in a more in-depth way and develop positive attitudes towards mathematics (Leonard, Brooks & Barnes-Johnson, 2010). It is also stated that when social issues are included in mathematics curriculum, the interest and skills of students towards mathematics increase, it contributes to students positively both in understanding mathematical concepts and problem solving, and ensures that they provide suggestions for better social policies by better understanding social issues and the structure of the society (Peterson, 2007b). In this context, social justice education should be included in the mathematics course to help students apply mathematical knowledge by interpreting it to find answers to questions that will strengthen the lives of students and

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the society they live in (Leonard, Brooks & Barnes-Johnson, 2010). Therefore, mathematics education can be integrated with social issues such as equality, social justice and democracy by approaching the events that take place in the world with a mathematical point of view (Noyes, 2007).

Mathematics education for social justice is addressed as including the issues of activism and social justice in the mathematics curriculum (Esmonde & Caswell, 2010), and accordingly, it is indicated that it must include mathematical activities for investigating and creating solutions for social problems (Moss, 2014). One of the components of mathematics education for social justice is to use mathematics as a critical tool for social life (Gonzalez, 2009). Therefore, questions on social gender, race and social class have started to be asked and new points of view have started to be included in studies conducted on equality and social justice in mathematics education (Hart, 2003). Social justice education within the scope of mathematics course should include practices that integrate mathematical processes and raising awareness among individuals and social relationships (Tanase & Lucey, 2015). In this context, the concepts of equality and being just are intensively focused on in the mathematics curriculum implemented in the 2017-2018 academic year in Turkey (Ministry of National Education [MNE], 2017), and the importance of understanding the relationship between mathematics and real life has been emphasised. In addition to this, regarding the justice and sharing values, it is stated that the relationship between sharing in the mathematical sense and sharing in social relationships can be emphasised, and as for the equality value, different presentations of the same multiplicity and differences such as comprehension, opinion and view may be addressed as different prospects of the same thing (MNE, 2017). While which of the attainments in the curriculum are associated with these values in question is included in the curriculum, no direct attainment, activity and evaluation activity example are included regarding the attainment of these values. In order for social justice education to be effective within the scope of mathematics course, it is necessary for teachers to consider, participate in and plan the details and complexities specific to concepts such as culture and social justice carefully (Leonard, Brooks & Barnes-Johnson, 2010). Starting from here, teachers should be knowledgeable about this issue with regard to mathematics education for social justice and have the competence necessary to organize activities in which mathematics and social issues are integrated. Nevertheless, no sufficient directions on this subject are included in the curriculum. It is also stated that the ideas of equality and social justice are integrated into mathematics education within the school and society, while connections are built with social, cultural and historical issues in a wider society, and studies that focus on students, teachers and directors at school are required (Hart, 2003). In this context, it is considered that taking the opinions and suggestions of mathematics teachers on integrating social issues such as social justice, equality and democracy with mathematics is important in eliminating the deficiency in this subject and leading the teachers. Accordingly, the general aim of the study was determined as investigating the opinions of middle school mathematics teachers on integrating mathematics course and social issues. While many studies that integrate social justice and equality with mathematics education are encountered abroad (Alexander, 2001; Allen, 2003; Brantlinger, 2007; Gonzalez, 2009; Gutstein, 2003; Harper, 2017; Johnson, 2005; Koestler, 2010; McNamee, 2013; Petric, 2011; Voss, 2015; Wager, 2008; Wonnacott, 2011), upon examining the social sciences literature in Turkey, it is observed that there is almost no academic study on social justice conducted a few years ago (Bali, 2001). Furthermore, no study on integrating mathematics education and social issues was encountered. Accordingly, it is believed that this study is important for the literature in Turkey. It is also thought to be important for teachers who try to integrate social issues with mathematics and also for the researchers who conduct researches about integrating mathematics and social issues in international context.

Methodology

Qualitative research method was used in this study. As for determining the participants of the research, criterion sampling among purposeful sampling methods was used. Being a middle school mathematics teacher as an occupation was considered as a criterion for determining the participants. The participants of the research consist of 13 middle school mathematics teachers working in Adana province in Turkey. The teachers participated to this study voluntarily. Seven of these teachers were male, six were females. The ages of participants range from 27 to 39. The professional seniority of teachers varies between 5 and 16 years. So as to collect the research data, the semi-structured interview form created by the researchers was used. The expert opinion for the interview form was taken and nine questions were included in this form. The data was collected in June of 2014 and at appropriate locations in the schools where the teachers were working. The 5th, 6th, 7th and 8th grades, in which students are trained, are called middle school in Turkey. Students aged 11, 12, 13 and 14 are trained in middle schools in Turkey.

The data analysis was performed according to the content analysis, and Nvivo 10 program was used for the analysis. In this direction, firstly, the texts of the interviews were coded. Then, the related codes were brought together and the themes were generated. Within the reliability studies for the data analysis, both researchers performed analysis separately, and after having completed the analysis, the analyses performed by both researchers were compared, an agreement was reached on incompatible codes and themes, and the data analysis process was concluded. Also, to present the findings, teachers were assigned with different codes such as MT1, MT2, MT3 and so on.

Findings

The findings of the study includes five themes of the integration mathematics course and social issues, gaining democratic values through mathematics, gaining awareness of social justice and equality values through mathematics, teacher's activities for integration mathematics and social issues and suggestions for integration of mathematics and social issues. The codes related to teachers' opinions about integration of mathematics course and social issues are given on Figure 1.

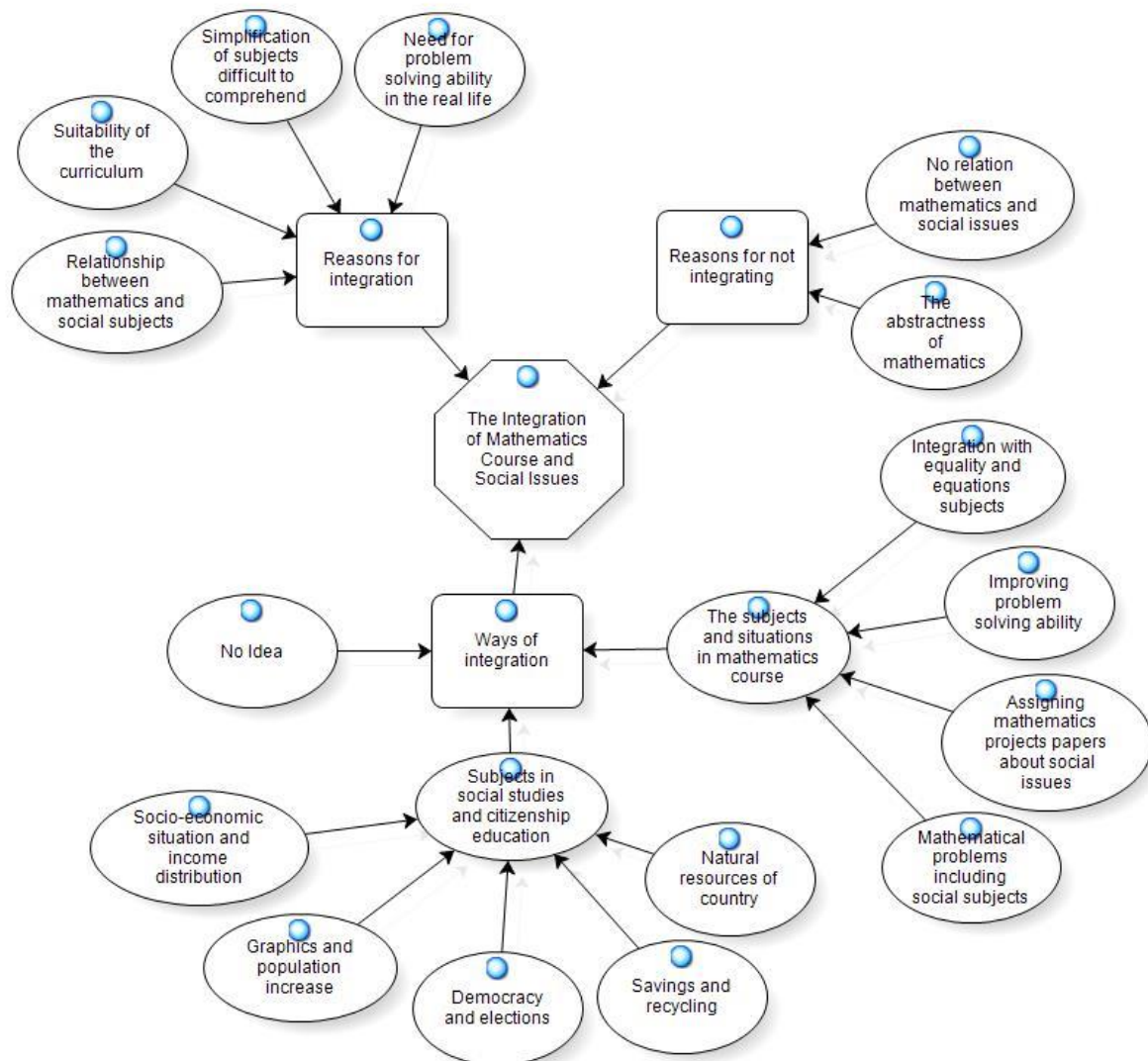


Figure 1. Views about the integration of mathematics and social issues

When teachers' views on integration mathematics course and social issues are examined, nine teachers expressed that mathematics could be integrated into social issues (MT1, MT3, MT5, MT6, MT7, MT8, MT11, MT12, MT13), that three teachers expressed that could not be integrated (MT4, MT9, MT10), and that a teacher expressed that could be partially integrated (MT2). As it can be seen from the Figure 1, this theme includes three sub-themes of reasons for integration, reasons for not integrating and ways of integration. Within the context of the ways of integration, teachers have presented the subjects and situations in mathematics course and subjects in social studies and citizenship education. In this context, MT3 has expressed his opinion as *"Probability and statistics, which is one of these subfields of mathematics, is already used especially in statistics subject in various ways in this respect. Also when we look at the daily life, in the simplest term, for example, in the elections, mathematics is actually used in many areas such as putting forward the socio-economic situations of a society in general, or determining the opinions of any society and the needs of that society, etc. in the survey analyses carried out in the elections."* Nevertheless, two teachers didn't offer any ideas for ways of integration. However, teachers were asked about the reasons of integration and they presented opinions about the need for problem solving ability in real life, the simplification of subjects difficult to comprehend, the suitability of the curriculum and the relationship between mathematics and social subjects. For this context, MT1 expressed his opinions as *"The better problem-solving skills we have, the more easily we can get over these problems. Within this context, I think mathematics and social issues can be associated with each other."* In the context of the reasons for not integrating,

teachers expressed their views that mathematics is not related to social issues and that mathematics is abstract. With regard to this sub-theme, MT10 expressed his opinions as *“It is actually a very abstract concept, I mean I cannot put mathematics into such a social framework, I mean, if it were Turkish you would say it is drama, theatre, cinema, you know you would associate it with something, but I cannot associate mathematics with anything.”*

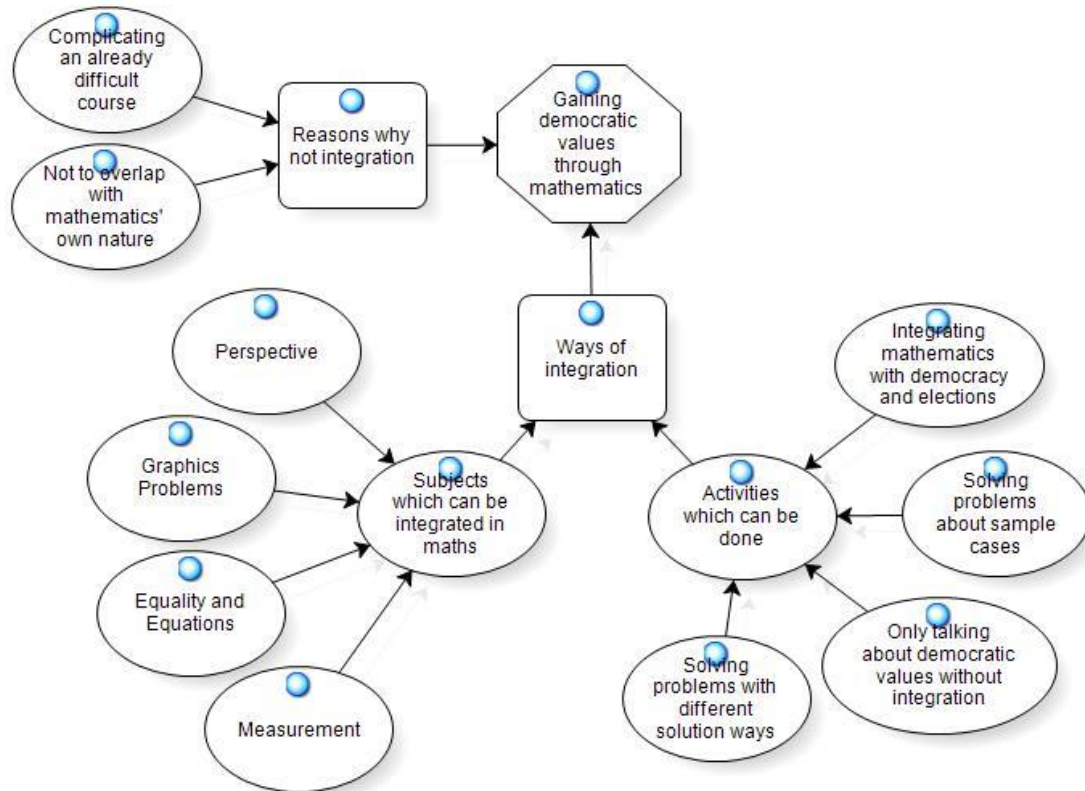


Figure 2. Views about gaining democratic values through mathematics

When the opinions of teachers on gaining democratic values through mathematics are examined, seven teachers expressed that mathematics could be integrated into democratic values (MT1, MT2, MT3, MT6, MT9, MT11, MT12), that four teachers expressed that could not be integrated (MT4, MT7, MT10, MT13) and that two teachers expressed that could be partially integrated (MT5, MT8). As can be seen from Figure 2, this theme includes two sub-themes of reasons why not integration and ways of integration. Within the context of the ways of integration, teachers have presented the subjects which can be integrated in mathematics and activities which can be done. In this direction, MT3 expressed his opinions as *“That there is no such thing as monologism, monoidesim, etc. can be hinted, I mean, regarding this in mathematics, maybe one of the ways of hinting this colorfulness is to plan courses which may reveal different ways of thinking. I mean, besides the fact that any problem has a single solution, it may have more than one solution.”* and suggested an activity about including problems with different solution ways. For mathematical subjects that can be integrated, MT6 stated that *“I think mathematics is a language, a different means of communication, I regard mathematics in such a way. As it is a language in its own field, it definitely has a freedom of its own, and you know, you have said with equality with the social environment, about measuring it as equality, for example, all of these are fair measurements. You know, when we teach a student how to use a meter or like here see the measure of this is that, that is a meter. If the student would have a textile shop in the future, he/she should measure that one meter as one meter, I interpret this as one has to distribute fairly.”* and suggested that democratic values can be gained through subject of measurement. As for the reasons for not being integrated, teachers have presented the reasons that democratic values doesn't overlap with mathematics' own nature and makes difficult mathematics course more complicating. Within this sub-theme, MT7 expressed his opinions as *“Actually, I think that it is related but children experience difficulties in mathematics all by itself, and when such things come together, how can it be, will they have more difficulty when both are together?”* and that he has been hesitant to make the mathematics course difficult for the students even more complicated.

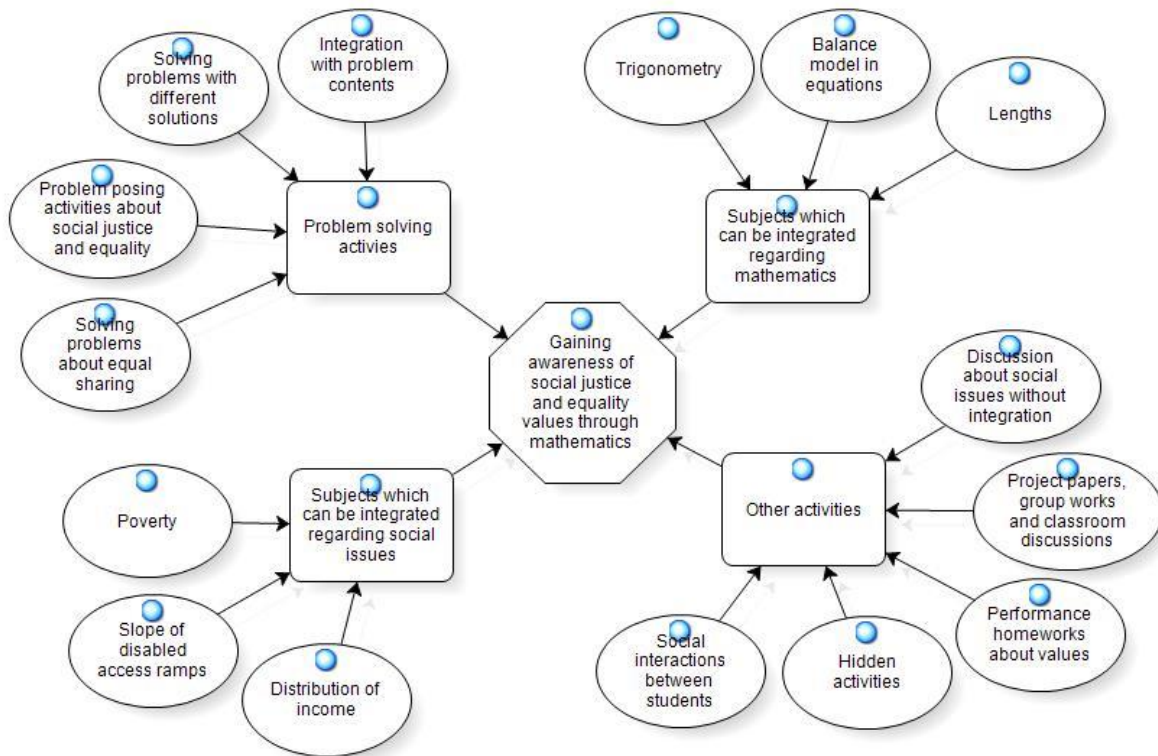


Figure 3. Views about gaining awareness of social justice and equality values through mathematics

When the opinions of teachers on gaining awareness of social justice and equality values through mathematics are examined, ten teachers stated that awareness of social justice and equality values could be gained through mathematics (MT1, MT2, MT3, MT4, MT5, MT6, MT7, MT8, MT11, MT12), that two teachers stated that could be partially gained (MT9, MT13) and one teacher stated that could not be gained (MT10). As seen in Figure 3, teachers' views on this theme are grouped into four sub-themes as subjects which can be integrated regarding social issues, subjects which can be integrated regarding mathematics, problem solving activities and other activities. In the context of social issues and mathematical subjects that can be related, MT12 said *"Both with the slope subject, and with the trigonometry subject as well, the slope in the construction of the roads for the disabled, studies and activities to make their lives easier by mentioning the disabled people in this subject when the slope subject is being studied can be made."* Within the context of mathematical subjects that can be integrated, MT1 stated that *"When social justice is mentioned, when I think abstractly now, the first thing that comes up to my mind is the "scales model" we use when first teaching the equation concept in the subject of equations... As you already know, when we say justice, the subject of justice, the female sculpture with her eyes closed holding those scales in her hand comes to your mind in our country... I think that maybe by associating, different connections at a more advanced level as from the simple towards the complex one or from the primitive to the developed one can be made."* Within the scope of problem solving activities that can be done, MT2 expressed her opinions as *"In general, in all problems, that we make them pose a problem was present at the end of every subject in the available problems by developing problem-posing skills."* and emphasized the problem posing activities. Within other activities MT5 stated his opinions as *"For example, performance homework can be designed, regarding this subject, regarding these concepts, and values, I mean, there is mathematics in it but not solely mathematics. Actually, there is mathematics again, but performance homework in which these themes can be mainly given can be prepared, project papers can be created, group studies can be done in the classroom, discussions can be made, and this changes the atmosphere of mathematics. The horrific image in the students' eyes would be cleared off, it is possible, I mean, if much effort is exerted, if the teacher wants it, he/she can do it."*

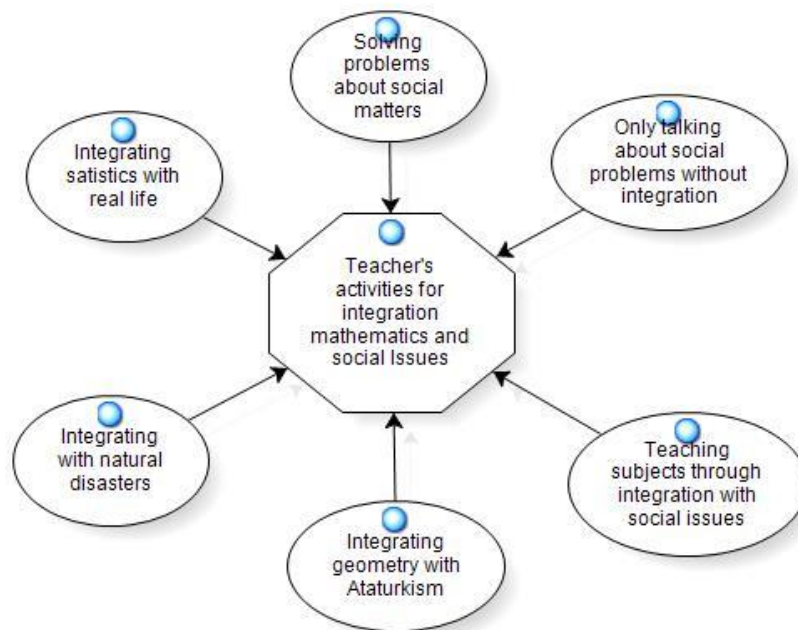


Figure 4. Teacher's activities for integration mathematics and social issues

Teachers were asked whether they integrated mathematics with social issues and that three teachers stated that they integrate (MT1, MT6, MT8), six teachers stated that they occasionally integrate (MT2, MT4, MT5, MT7, MT12, MT13) and four teachers stated that they don't integrate (MT3, MT9, MT10, MT11). Teachers who stated that they integrated and sometimes integrated mathematics with social issues during the lesson were asked about the activities they performed, and the answers received in this context are presented in Figure 4. Within this theme MT5 stated that, "I especially tried to draw students' attention a bit especially in the part of Ataturkism. Here, having the terms related to the subject of geometry attained, by comparing the old and new...", mentioned about Ataturk's Geometry book and expressed about integrating geometry with Ataturkism. In this context, MT13 expressed his opinions as "I mean, there are not many such subjects, actually, there are not many subjects about sociability, and for example, there was a subject about disaster areas. On that subject, for example, I make a social connection, as it is already in our textbook; I make them read those in our textbook. They are called earthquake areas, and some are written as the areas where floods occur, I make children read them from the textbook, for example, such information is present in the textbook." and mentioned about an example in course book.

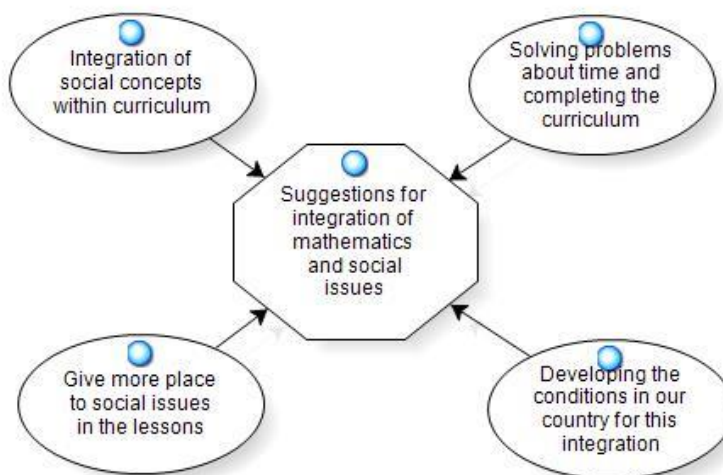


Figure 5. Suggestions for integration of mathematics and social issues

Finally, the teachers asked whether they had suggestions about integrating mathematics with social issues. As it seen in Figure 5, four teachers presented suggestions about integrating mathematics with social issues. MT2 expressed her opinions as "It can have a wider scale, in this subject, it is necessary for us to have a more open scope, I mean I can speak for myself, we can have a more open scope, I mean, we teach in a more unfruitful way, in any way we have a curriculum that we have to catch up with, since either we have an exam to prepare for or we do not find ourselves sufficient, actually

when we take a look at it, we can increase this number in general, or because I can say that I was able to apply this in one or two lessons but I could have been able to apply it in general, I mean it could have increased.” and suggested about developing conditions in our country. Also MT5 stated his views as *“Indeed, actually we have a burden on us, and that is to teach subjects in the given hours, if flexibility is provided to us at that point, I mean, the following can be given in the teacher guidelines, by giving extra hours i.e. extra classes, now elective courses have already appeared at middle schools, students choose mathematics, and we are trying to solve questions under the name of mathematics applications.”* and presented a suggestion about solving problems about time and completing the curriculum.

Conclusion, Discussion and Suggestions

In line with the findings of the study, it was determined that most of the participant teachers thought that they could integrate mathematics course with social issues. Teachers who thought that they could integrate mathematics course with social issues stated the reasons for these opinions as the facts that problem solving is related to real life, social issues and mathematics are correlated, it matches the curriculum, and issues that are hard to understand can be rendered intelligible. Moreover, they stated that this integration could be ensured through equations, graphs, socioeconomic status, population increase, democracy and elections, recycling, natural resources, problem solving and projects. At the same time, teachers who thought that no integration could be ensured stated that they thought in this way because of abstractness of mathematics and there was no relationship between mathematics and social issues. Regarding natural resources, Noyes (2007) stated that integration could be made with mathematics with regard to the unequal distribution of world resources. Beane (1990) stated that the social value dimension of mathematics can be addressed in case the subject of ratio and proportion is addressed in relation to the fact that the effects of bottles that are not suitable for recycling are more expensive on the environment as a waste, in addition to being cheap, in mathematics course. Considering the opinions of teachers and the suggestions in the literature, it is thought that mathematics can be integrated with social issues.

In accordance with another finding of the study, it was observed that half of the teachers thought that democratic values could be gained with mathematics course, while the other part thought that they could be partially gained. Therefore, it was stated that integration could be made with subjects such as perspective, graphs, equations, measurement and selections. Within the scope of the activities for integration, especially problems were mentioned, and it was stated that problems that included cases and problems with different ways of solution could be solved. In addition to this, there are also teachers who state that the issue of democracy can be integrated with mathematics, and only democratic values can be mentioned in the lesson without making an association with mathematics. Teachers who thought that integration could not be ensured stated that mathematics and democratic values could not be integrated since it was not suitable for the nature of mathematics and an already hard lesson could be rendered even more complex. In this respect, Skovsmose and Valero (2001) say that mathematics can be effective in a society's achieving democratic ideals. Woodrow (1997) addresses the ways of introducing democratic values within the scope of mathematics teaching. Starting from these opinions, it is considered that democratic values can be integrated into the mathematics course.

It was determined that most of the teachers thought that the issues of social justice and equality could be integrated with mathematics course. They determined that trigonometry, equations and equilibrium model, lengths were the subjects that could be associated in the context of mathematics course, while these were the issues of poverty, wheelchair ramps and income distribution in the context of social issues. It was determined that opinions were provided more on problem solving activities for integrating the issues of social justice and equality with mathematics course, and activities for problem posing, solving problems that include different ways of solving and placing social issues in the content of the problem could be performed in this direction. Furthermore, activities were provided for the project, performance task, and social interaction between students, group works, classroom discussion, hidden activities and discussing without integrating with mathematics. With regard to integrating the issues of social justice and equality in mathematics course, Peterson (2007a) stated that problem posing studies take an important place in social justice education performed within the scope of mathematics education, while Gutstein (2003) also similarly suggested that problem posing studies are conducted in order for students to understand these issues in the education aimed at the issues of social justice, equality and living conditions. Regarding the problem solving and problem posing studies, there are expressions in mathematics practices course curriculum like that: “Students will essentially solve and pose problems in mathematics practices. While problems can be totally abstract mathematical games, they can be realistic problems selected from other areas such as social sciences and science or daily life issues” (MNE, 2013, p.2). Again, the relationship between an individual's own personal values and mathematics is mentioned in the mathematics course in the mathematics curriculum, and introducing values such as justice, sharing, equality, freedom, respect, responsibility and savings is mentioned (MNE, 2017). Accordingly, it is considered that the issues of social justice and equality can be integrated into the mathematics course, while activities especially such as problem solving and problem posing can be performed for this integration.

In addition to their opinions on integration, the teachers were also asked whether they integrated social issues with mathematics course, and in this direction, it was determined that most of them partially integrated them; some of them

did not, while a smaller part integrated social issues with mathematics course. Therefore, it can be said that while the opinions of teachers on integration are positive, a very small part performs activities for integration in the practice dimension. Within the scope of practices in the lesson, it was determined that they performed activities for problem solving related to social issues, associating real life with statistics, associating geometry and the subject of Atatürkism, and associating with natural disasters. Regarding the subject of statistics, Noyes (2007) stated that activities could be performed in mathematics course on using statistics for better understanding the unequal distribution of the world's resources. Starting from here, it can be said that integration can be performed through various subjects and activities. In addition to this, teachers made suggestions on integrating with the social concepts in the curriculum, including social issues more in the lessons, regulating the country's conditions for integration, and creating solutions for the problem of completing the curriculum regarding integrating mathematics course with social issues. With regard to integrating mathematics and social issues, teachers believe that the practices they perform and suggestions they provide are limited. In addition to the opinions and suggestions of teachers, it is stated in the literature that numerical data in issues such as unemployment and racism can be included in the mathematics course, in addition to dealing with numbers with regard to sports and weather forecast (Miner, 1995). Furthermore, the subject of percentages is regarded as an important subject for the information about what is going on around the world, and integration can be made with the subject of percentages when addressing the issues of welfare, power, gender, race, ethnic origin and discrimination in this context (Peterson, 2007c). This study was performed based on the opinions of teachers. In this context, it is deemed necessary for students to perform practice-based studies to realize the role of mathematics in a democratic society (Tanase & Lucey, 2015). Moreover, teachers and researchers are advised to perform practices and studies on the issue of social justice within the scope of mathematics teaching (Hart, 2003; Gutstein, 2007; Gonzalez, 2009; Gutstein et al., 2005). Starting from this, it is deemed necessary to perform practices by taking into consideration the subjects and activities presented by teachers and included in the literature and evaluating the results of practices by extending the research.

In brief, it can be said that, most of the teachers thought that it can be possible to integrate mathematics with social issues, to gain democratic values and awareness to social justice and equality in mathematics. The teachers discussed the matters that can be appropriate for integrating mathematics and social issues. They also discussed the matters and activities that can be appropriate for gaining democratic values in mathematics. Besides, they discussed the matters, the problem solving activities and classroom activities that can be appropriate for gaining awareness to social justice and equality in mathematics. It is found that the practices about integrating mathematics with social issues are limited. It is determined that the teachers came up with limited number of suggestions about integrating mathematics with social issues. In this context, it is thought that the teachers' competencies in this subject should be questioned and investigated. In accordance with these results obtained, various suggestions were developed regarding integration of mathematics course and social issues. The suggestions are presented are given below:

- Giving much more integrations about social issues and making arrangements within mathematics curriculum; providing instructive guidance in the curriculum for teachers and adding arrangements to the curriculum for motivating teachers
- Solving the problem about completing the curriculum
- Carrying out ethnographical studies about integrating mathematics and social issues in order to analyze the current phenomena in detail

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