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Mathematics education and democracy education

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Democracy is a most accepted form of government system and has a great importance for citizens by allowing them equal and active participation in common life. As its development and characteristics are important for all citizens of a country, each democratic country puts much emphasis on democracy education in its educational curricula. In recent years, some developments about democracy education in national state school in Turkey have been seen and educational goals about teaching democracy have been developed by Ministry of National Education of Turkey. This study aims to show that educational goals of mathematics education are helpful for accomplishment of learning outcomes of democracy education. In the study, it is hypothesised that a well-educated individual having the qualities of mathematics education behaves in accordance with democracy. Based on this hypothesis, goals of mathematics education were determined and researched that students having educational outcomes of these goals also achieve the outcomes of democracy education without taking any formal course in schools. Therefore, a scale about the outcomes of mathematics and democracy education was developed and applied to university students in the department of mathematics education. Findings verified the hypothesis and showed that students having educational outcomes of mathematics education have the qualities of democracy education and can play important roles in positive development process of democracy.

Key words: Democracy, democracy education, mathematics education, educational outcome.

INTRODUCTION

Democracy

Democracy is a widespread form of government in common life and is important for all citizens of a democratic country. Keeping this common system safe and developing it in a positive way matter much to governments and citizens. Democracy is a kind of belief expression. But this expression has to be based on logic (Lindsay, 1973, p. 84). This logic is not a need of commitment to an authority; it is actually a way of meeting the need by creating self-esteem and the power of problem-solving. This makes education essential (Ertürk, 1986, p. 3).

Factors affecting democracy education

There are a number of factors affecting democracy

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education (Mahlomaholo, 2014). Though geography, history, race and age are the unchangeable factors, other factors such as education level and economic status are easiest unchangeable factors among those factors In addition there are also other factors such as religion. (Chan and Wong, 2014), gender, traditions and norms which are accepted as extremely challenging for changing.

Contributions of Mathematics and Mathematics education to individual and social development

In this study, the easiest one "Education level (Dewey, 1966)", specifically mathematics education (Skovsmose, 1998) from the above factors was questioned in detail. Mathematical knowledge is one of the most reliable information of mankind. Though people have differences in religion, race, language and belief, they show a common acceptance on mathematical information. Democracy is an agreement regime. Mathematical knowledge presenting significant contributions to agreement between people has not contradicted with any information yet. With its feature, it supports other disciplines too. Mathematical knowledge gives meaning to the aesthetic side of people (Kelsey, 2013). Therefore, other disciplines use mathematical knowledge for making their information more reliable, concrete and most accepted one. Trust is a very important goal for all societies and governments and at that point mathematical knowledge gains significance in trust. As the mathematical knowledge is a kind of knowledge gained with successively verified knowledge, it creates differences and speediness in individuals' thinking systems (Pinkney and Shaughnessy, 2013). These differences and speediness in thinking enable people perceive behaviours and events easily, make a quick comparison between information and values, and form new information and value judgement (Praetorius et al., 2013). The most important one, that kind of knowledge is instantly accepted by a society or discipline because mathematics is used as a criterion. In science history, any knowledge was not accepted as fast as mathematical knowledge and sometimes some knowledge even created some negative outcomes for its creators or the society. When the knowledge is supported with mathematical knowledge, it is quickly accepted by a large mass. All these features increase expectations towards mathematics and mathematics is seen as a magic wand to overcome almost all problems. People having or desiring to get this knowledge are affected negatively or positively by these expectations. Well-accepted success of mathematics can be named as the mathematics of angels. Maybe mathematics is turned truly into a magic wand when it is broadened to people's deciding processes and desiring to live together. It can also be helpful in determining and solving undesired social events.

Mathematics education and democracy education

Any individual having mathematical knowledge will definitely make contributions to democracy education with acquired skills and values. This study will be based on this hypothesis. Ministry of National Education of Turkish has conducted some research on the development of democracy education and determined relevant goals (MEB, 2004) on this issue. Some of these issues were uncovered by Gürkaynak (1989) in the XIII Education Meeting of Turkish Education Association held between in 30 November - 1 December of 1989. Gürkaynak (1989) said "Democracy is not simply an action and also includes interpersonal communication as it is stated by Plato and Aristo. Then, being simply a mature is not adequate circumstance for democracy. Citizens also need some other skills like involvement, collaboration, agreement and deciding within group."

The connection between democracy and mathematics education is not a new topic in the field of mathematics education research (Aguilar and Zavaleta, 2012). In the studies on democracy and mathematics education (Adler, 1988; Bourdieu, 1991; Büyükkaragöz, 1990; Cesar and Torres, 1997; D'Ambrosio, 1990; Dewey, 1966; Goodlad, 1994; Gömleksiz, 1988; Hannaford, 1998; Kasap et al., 2013; Küçükahmet, 1989; Savaş, 2003; Schleicher and Kase, 2000; Skovsmose, 1990; Skovsmose, 1998; Steen, 1999; Şimşek, 2000; Tate, 1996; Valero, 1997; Valero, 1999; Woodrow, 1997; Yıldırım, 1994), the effects of educational context and democracy education on mathematics education are mostly emphasised. There are also some studies proposing that individuals having the power of mathematics can make positive contributions to their society (Gutstein and Peterson, 2005, p.2) and social equality and justice (eMalloy, 2008; Stemhagen, 2014). In this study, it is hypothesised that mathematics education is an adequate prerequisite for democracy education and this ascertain will be tried to be revealed in the study by being different than the other studies. However, it can also be alleged that democracy education is an adequate prerequisite for mathematics education. Therefore, further research can also be conducted for testing this contradictory ascertain.

The aim of the study

The study aims to determine whether the goals of democracy education can be described within the frame of the goals of mathematics education curriculum. Below sub-problem in line with this aim was questioned in this study.

"With which goals of mathematics education can an individual gain some attitudes and skills of democracy education?"

METHODOLOGY

In this section, research design, study participants, instruments, data collection and analysis processes were presented in detail.

Research design

This study hypothesizes that an individual educated in accordance with the educational goals of mathematics education can also accomplish the goals of democracy education. A mixed method, specifically sequential exploratory strategy design, which deals with the problem in detail with two sequential phases, first qualitative and second quantitative (Creswell, 2003) was adopted in this study. In the qualitative phase, the goals of mathematics education and democracy education in the curricula as developed by the Ministry of National education were determined and associated with each other. In the quantitative phase, a form was prepared based on the associations among democracy and mathematics education and presented to the participants of the study.

The participants of the study

100 university students from a faculty of education (Teacher training departments of Primary teacher, Elementary mathematics and Turkish language) and a faculty of science and letters (Department of mathematics) located in East Anatolian Region of Turkey participated in the study. University students were specifically chosen for the study as they are eighteen; which means that they can behave and think freely and have a critical mental capacity of answering the questions.

The participants were determined in three steps. Firstly they were chosen according to the convenience sampling strategy which allows researchers to reach the study group easily in terms of time, money, transportation, etc. (Büyüköztürk et al., 2010). Secondly four groups of university students having different mathematics education levels were chosen from a convenient university. In the determination process of the different departments, the variable of having different levels of mathematics education background was considered and therefore maximum variation sampling which aims to reach different groups for researching different dimensions of the same problem (Büyüköztürk et al., 2010). Thirdly, equal numbers of students from each department (n:25) were randomly invited to participate in the study. Simple random sampling strategy allows participants to have equal chance of being selected for the study (Büyüköztürk et al. 2010)

Instruments

As a data collection instrument, "Democracy Education Scale (DES) was used and the development process of the scale is given below.

Firstly, the fifteen goals of mathematics education (MEB, 2005) were determined and then four of them (explaining mathematical ideas logically, using mathematical language appropriately for sharing, creating self-esteem and attitude towards mathematics, and accepting the power and the network relationships of mathematics) which are related to learning, learning context and learning process were removed from the study. Though there are some indirect democracy studies on above goals, there is less democracy research on the rest eleven goals which are about the outcomes of mathematics education. In this context, a test including eleven open-ended items was formed based on these eleven outcomes. The test was applied to ten teachers from different departments and each item of the test was presented with a five-point Likert scale. The pilot study of DES was conducted with ten people from various areas such as education, law and engineering in order to test the comprehensibility. It was seen that all items were clear for understanding and the test was finished between forty and fifty minutes. Later, the test was applied to 100 students for the main study and the items having less than .300 factor loadings were removed from the test.

Data collection and analysis

DES was applied to students in the four classrooms at the same time in the same day and the participants freely filled the test without giving any personal data. Each test form was numbered from one to one hundred and the test items were ranged from 0 to 5 (i.e. 0=Blank item, 1=Strongly Disagree, 2= Disagree, 3=Neutral, 4= Agree, 5=Strongly Agree) in data entrance process to computer. In the data presentation, each goal of eleven goals of mathematics education was presented in tables. Each goal was accepted as a separate factor and results of factor analyses and the values of Cronbach's Alpha were interpreted. In tables the groups (Yes= Strongly Agree and Agree, No= Strongly Disagree and Disagree, Neutral= Blank item and Neutral) were presented with percentages. The findings of the study was analysed with a descriptive approach from quantitative research methods (Yıldırım and Şimşek, 2005) and each item was descriptively analysed.

FINDINGS

In this section, the findings related to the relationships between the outcomes of mathematics education and the attitudes and skills gained with the democracy education were presented in tables one by one.

The attitudes and skills gained with the democracy education can be achieved by an individual educated in accordance with the first goal of mathematics education, '*The individual will be able to understand mathematical concepts and systems, make relations between them and use these concepts and systems in daily life and other learning fields.*' These were given in Table 1.

As it is seen in Table 1, the participants said 'Yes' the least (45%) to the item 'Does moral questioning' and the most (91%) to the item 'Apply information resources and use them'. Also they were neutral the most (43%) to the item 'Avoid disagreement.' and said 'No' the most (20%) to the item 'Does moral questioning.' According to factor analyses, the item 'Applies information resources and use them' has the least factor loading (,319) and 'Has a culture of discussion and agreement' has the highest factor loading (,733). Cronbach's Alpha coefficient is .893.

The attitudes and skills gained with democracy education can be achieved by an individual educated in accordance with outcomes of the third goal of mathematics education, '*The individual will be able to make inferences about logical induction and deduction*' are given in Table 2.

As it is seen in Table 2, the participants said 'Yes' the least (58%) to the item 'Is devoted to the principles of social pluralism.' and the most (92%) to the item 'Acknowledges and evaluates.' Also they were neutral the most (32%) to the item 'Believes the benefits of democratic principles, institutions and systems.' and said 'No' the most (12%) to the item 'Is devoted to the principles of social pluralism.' According to factor analyses, the item 'Is productive', has the least factor loading (.312) and 'Accepts the values of mutual understanding, collaboration, equality, justice and mutual support' has the highest loading (,733). Cronbach's Alpha coefficient is .831.

The attitudes and skills gained with the democracy education can be achieved by an individual educated in accordance with outcomes of the fourth goal of mathematics education, '*The I ndividual*

Table 1. Factor loadings and percentages with regard to the accomplishment levels of expected attitudes and skills gained with democracy education by an individual having as outcomes the first goal of mathematics education.

An individual who understands mathematical concepts and systems, makes relations between them and uses these concepts and systems in daily life and other learning fields,	Factor loading	Yes	Neutral	No
		%	%	%
Applies information resources and uses them.	,319	91	9	0
Finds constructive, collaborative, nonviolent, attributive and peaceful solutions for social problems.	,664	57	30	13
Is a participant.	,579	74	14	12
Acknowledges and evaluates.	,667	82	9	9
Communicates in multiple ways.	,608	63	29	8
Creates public interest.	,673	49	41	10
Avoids disagreement.	,667	47	43	10
Is linked to law, justice and equality in the differences of the world.	,670	54	35	11
Does moral questioning.	,637	45	35	20
Accepts the values of mutual understanding, collaboration, equality, justice and mutual support.	,677	60	28	12
Has a culture of discussion and agreement.	,733	71	20	9
Thinks critically.	,534	82	13	5
Does collaboration and team work.	,660	75	17	8
Struggles with prejudice and discrimination.	,577	64	26	10
Believes the benefits of democratic principles, institutions and systems.	,731	58	28	14

Table 2. Factor loadings and percentages in terms of the accomplishment levels of expected attitudes and skills gained with democracy education by an individual having as outcomes the third goal of mathematics education.

An individual who can make inferences about logical induction and deduction,	Factor loading	Yes	Neutral	No
		%	%	%
Acknowledges and evaluates.	,369	92	7	1
Solves problems.	,544	88	10	2
Reaches the virtue of respect to the society's values, honours, beliefs and freedom.	,602	62	31	7
Is productive.	,312	87	11	2
Is a participant.	,602	79	18	3
Believes the benefits of democratic principles, institutions and systems.	,687	60	32	8
Finds constructive, collaborative, nonviolent, attributive and peaceful solutions for social problems.	,616	73	22	5
Is a peacemaker and facilitator.	,559	64	29	7
Communicates in multiple ways.	,433	82	13	5
Has a culture of discussion and agreement.	,543	81	16	3
Thinks critically.	,554	74	21	5
Accepts the values of mutual understanding, collaboration, equality, justice and mutual support.	,694	68	22	10
Is devoted to the principles of social pluralism.	,614	58	30	12
Respects and tolerates different cultures and their contributions to humanity.	,604	70	21	9

will be able to express his/her mathematical ideas and inferences in the process of solving mathematical problem' are given in Table 3. As it is seen in Table 3, the participants said 'Yes' the least (48%) to the item 'Is devoted to the principles of social pluralism.' and the most (96%) to the item 'Solves problems.' Also they were neutral the most (41%) to the item 'Is devoted to the principles of social

Table 3. Factor loadings and percentages with regard to the accomplishment levels of expected attitudes and skills gained with democracy education by an individual having the fourth goal of mathematics education.

An individual who can express his/her mathematical ideas and inferences in the process of solving mathematical problems,	Factor Loading	Yes	Neutral	No
		%	%	%
Is productive.	,420	92	3	5
Solves problems.	,315	96	3	2
Acknowledges and evaluates.	,472	87	8	5
Finds constructive, collaborative, nonviolent, attributive and peaceful solutions for social problems.	,603	60	28	12
Communicates in multiple ways.	,708	74	13	13
Is a peacemaker and facilitator.	,643	62	24	14
Is an active person.	,613	70	21	9
Accepts democratic leadership.	,706	52	31	17
Accepts the development of humanity as a fundamental principle.	,692	66	25	9
Avoids disagreement.	,745	56	33	11
Reaches the virtue of respect to the society's values, honours, beliefs and freedom.	,762	55	30	15
Is a participant.	,585	77	16	7
Creates public interest.	,522	56	33	11
Is devoted to the principles of social pluralism.	,520	48	41	11
Respects and tolerates different cultures and their contributions to humanity.	,642	61	25	16
Believes the importance of the individual responsibility.	,529	83	10	5
Struggles with prejudice and discrimination.	,596	67	32	11
Does moral questioning.	,507	50	33	16
Is a systematic, careful, patient and responsible person.	,357	78	16	6

pluralism.' and said 'No' the most (17%) to the item 'Accepts democratic leadership.' According to factor analyses, the item 'Solves problems' has the least factor loading (.315) and 'Reaches the virtue of respect to the society's values, honours, beliefs and freedom' has the highest factor loading (.762). Cronbach's Alpha coefficient is .893.

The attitudes and skills gained with the democracy education can be achieved by an individual educated in accordance with outcomes of the sixth goal of mathematics education, '*The individual will be able to use the skills of prediction and mental operation*' are given in Table 4.

As it is seen in Table 4, the participants said 'Yes' the least (43%) to the item 'Does moral questioning' and the most (92%) to the item 'Solves problem.' Also they were neutral the most (37%) to the items 'Is linked to law, justice and equality in the differences of the world, Does moral questioning, Accepts democratic leadership' and said 'No' the most (28%) to the item 'Is linked to law, justice and equality in the differences of the world.' According to factor analyses, the item 'Is productive' has the least factor loading (.348) and 'Accepts the values of mutual understanding, collaboration, equality, justice and mutual support' has the highest loading (.668). Cronbach's Alpha coefficient is .786.

The attitudes and skills gained with the democracy education can be achieved by an individual educated in accordance with outcomes of the seventh goal of mathematics education, '*The individual will be able to create problem solving strategies and use them for solving daily life problems* ' are given in Table 5.

As it is seen in Table 5, the participants said 'Yes' the least (52%) to the item 'Accepts democratic leadership' and the most (89%) to the item 'Is a participant.' Also they were neutral the most (39%) to the item 'Accepts democratic leadership.' and said 'No' the most (10%) to the item 'Believes the benefits of democratic principles, institutions and systems.' According to factor analyses, the item 'Acknowledges and evaluates' has the least factor loading (.345) and 'Is linked to law, justice and equality in the differences of the world' has the highest loading (,702). Cronbach's Alpha coefficient is .846.

The attitudes and skills gained with the democracy education can be achieved by an individual educated in accordance with outcomes of the eighth goal of mathematics education, '*The individual will be able to form models, link the models with oral and mathematical expressions*' are given in Table 6.

As it is seen in Table 6, the participants said 'Yes' the least (48%) to the item 'Accepts democratic leadership' and the most (92%) to the item 'Applies information resources and uses them.' Also they were neutral the most (41%) to the item 'Accepts democratic leadership' and said 'No' the most (12%) to the item 'Avoids disagreement.' According to factor analyses, the item 'Accepts democratic leadership' has the least factor loading (.376) and 'Avoids disagreement' has the highest factor loading (.606). Cronbach's Alpha coefficient is 815.

The attitudes and skills gained with the democracy education can be achieved by an individual educated in accordance with outcomes of the eleventh goal of mathematics education, '*The individual will be able to create and develop intellectual interest*' Are given in Table 7.

As it is seen in Table 7, the participants said 'Yes' the least (53%) to the item 'Does moral questioning' and the most (87%) to the

Table 4. Factor loadings and percentages in terms of the accomplishment levels of expected attitudes and skills gained with democracy education by an individual having the sixth goal of mathematics education.

An individual who can use the skills of prediction and mental operation,	Factor loading	Yes	Neutral	No
		%	%	%
Is productive.	,513	88	7	5
Is an active person.	,417	80	12	8
Accepts the development of humanity as a fundamental principle.	,586	60	28	12
Is linked to law, justice and equality in the differences of the world.	,571	45	37	28
Finds constructive, collaborative, nonviolent, attributive and peaceful solutions for social problems.	,538	52	35	13
Thinks critically.	,656	68	17	15
Is a peacemaker and facilitator.	,613	58	27	15
Does moral questioning.	,668	43	37	20
Avoids disagreement.	,348	49	36	15
Solves problem.	,569	92	4	4
Applies information resources and uses them.	,396	80	12	8
Acknowledges and evaluates.	,627	81	15	4
Accepts democratic leadership.	,479	51	37	12
Communicates in multiple ways.	,578	68	23	9

Table 5. Factor loadings and percentages in terms of the accomplishment levels of expected attitudes and skills gained with democracy education by an individual having the seventh goal of mathematics education.

An individual who can create problem solving strategies and use them for solving daily life problems,	Factor loading	Yes	Neutral	No
		%	%	%
Is a participant.	,380	89	7	4
Believes the importance of the individual responsibility.	,561	80	14	6
Is a peacemaker and facilitator.	,469	80	16	4
Acknowledges and evaluates.	,345	88	9	3
Believes the benefits of democratic principles, institutions and systems.	,598	59	31	10
Accepts the indivisibility of human rights and freedom as a fundamental principle.	,604	66	28	6
Finds constructive, collaborative, nonviolent, attributive and peaceful solutions for social problems.	,538	80	18	2
Is linked to law, justice and equality in the differences of the world.	,702	66	27	7
Thinks critically.	,375	83	12	5
Has a culture of discussion and agreement.	,503	79	16	5
Accepts democratic leadership.	,617	52	39	9
Creates public interest.	,503	61	32	7
Avoids disagreement.	,508	66	27	7
Does moral questioning.	,666	57	36	7
Accepts the development of humanity as a fundamental principle.	,558	73	23	5
Struggles with prejudice and discrimination.	,632	65	27	8
Is an active person.	,399	85	12	3
Is a systematic, careful, patient and responsible person.	,379	88	7	5

items ‘Thinks critically and Communicates in multiple ways.’ Also they were neutral the most (35%) to the item ‘Avoids disagreement’ and said ‘No’ the most (15%) to the item ‘Does moral questioning.’ According to factor analyses, the item ‘Is an active person.’ has the least factor loading (.367) and ‘Is a peacemaker and facilitator’ has the highest loading (,606). Cronbach's Alpha coefficient is .829.

The attitudes and skills gained with the democracy education can be achieved by an individual educated in accordance with

Table 6. Factor loadings and percentages in terms of the accomplishment levels of expected attitudes and skills gained with democracy education by an individual having the eighth goal of mathematics education.

An individual who can form models, link the models with oral and mathematical expressions,	Factor loading	Yes	Neutral	No
		%	%	%
Is a participant.	,502	86	14	0
Accepts democratic leadership.	,589	48	41	11
Creates public interest.	,537	62	28	10
Solves problem.	,377	91	7	2
Is an active person.	,574	77	17	6
Is a peacemaker and facilitator.	,648	67	25	8
Thinks critically.	,629	87	10	3
Reaches the virtue of respect to the society's values, honours, beliefs and freedom.	,618	60	31	9
Does collaboration and team work.	,514	78	17	2
Applies information resources and uses them.	,376	92	7	1
Accepts the development of humanity as a fundamental principle.	,573	65	28	7
Finds constructive, collaborative, nonviolent, attributive and peaceful solutions for social problems.	,598	71	24	5
Avoids disagreement.	,666	56	32	12

Table 7. Factor loadings and percentages in terms of the accomplishment levels of expected attitudes and skills gained with democracy education by an individual having the eleventh goal of mathematics education.

An individual who can create and develop intellectual interest,	Factor loading	Yes	Neutral	No
		%	%	%
Thinks critically.	,431	87	11	2
Is a participant.	,575	86	10	4
Communicates in multiple ways.	,466	87	10	3
Is an active person.	,367	83	11	6
Accepts democratic leadership.	,489	59	33	8
Accepts the development of humanity as a fundamental principle.	,591	67	27	6
Creates public interest.	,437	61	34	5
Is productive.	,585	74	18	8
Acknowledges and evaluates.	,609	80	13	7
Applies information resources and uses them.	,509	77	17	6
Believes the importance of the individual responsibility.	,482	70	23	11
Is linked to law, justice and equality in the differences of the world.	,517	66	26	4
Avoids disagreement.	,623	54	35	11
Does moral questioning.	,598	53	32	15
Is a peacemaker and facilitator.	,687	68	23	9
Finds constructive, collaborative, nonviolent, attributive and peaceful solutions for social problems.	,477	71	24	5

outcomes of the twelfth goal of mathematics education, '*The individual will be able to comprehend the historical developments of mathematics, its role and value in the development of people's ideas and its significance of the usage in other disciplines*'' are given in Table 8.

As it is seen in Table 8, the participants said 'Yes' the least (38%) to the item 'Accepts democratic leadership.' and the most (86%) to the items 'Is productive and Applies information resources and uses them.' Also they were neutral the most (46%) to the item 'Accepts democratic leadership.' and said 'No' the most (18%) to the item 'Does moral questioning.' According to factor analyses, the item 'Solves problem.' has the least factor loading (.379) and 'Finds constructive, collaborative, nonviolent, attributive and peaceful solutions for social problems.' has the highest factor loading (.646). Cronbach's Alpha coefficient is .836.

The attitudes and skills gained with the democracy education can be achieved by an individual educated in accordance with outcomes of the thirteenth goal of mathematics education, '*The*

Table 8. Factor loadings and percentages in terms of the accomplishment levels of expected attitudes and skills gained with democracy education by an individual having the twelfth goal of mathematics education.

An individual who can comprehend the historical developments of mathematics, its role and value in the development of people's ideas and its significance of the usage in other disciplines,	**Factor loading**	**Yes**	**Neutral**	**No**
		%	**%**	**%**
Is an active person.	,596	63	24	13
Believes the benefits of democratic principles, institutions and systems.	,596	56	28	16
Applies information resources and uses them.	,393	86	13	8
Has a culture of discussion and agreement.	,643	61	30	2
Accepts the development of humanity as a fundamental principle.	,475	70	13	8
Thinks critically.	,515	81	14	5
Solves problem.	,379	85	8	7
Is a participant.	,627	77	13	10
Reaches the virtue of respect to the society's values, honours, beliefs and freedom.	,629	56	33	11
Accepts democratic leadership.	,640	38	46	16
Avoids disagreement.	,593	46	31	13
Is productive.	,443	86	10	4
Finds constructive, collaborative, nonviolent, attributive and peaceful solutions for social problems.	,646	46	37	7
Struggles with prejudice and discrimination.	,523	59	28	13
Does moral questioning.	,520	44	38	18

Table 9. Factor loadings and percentages in terms of the accomplishment levels of expected attitudes and skills gained with democracy education by an individual having the thirteenth goal of mathematics education.

An individual who can develop being a systematic, careful, patient and responsible person,	**Factor loading**	**Yes**	**Neutral**	**No**
		%	**%**	**%**
Acknowledges and evaluates.	,517	95	3	2
Does collaboration and team work.	,329	85	10	5
Solves problem.	,555	89	9	2
Has a culture of discussion and agreement.	,662	86	10	4
Believes the importance of the individual responsibility.	,551	91	7	2
Creates public interest.	,516	60	32	8
Is a peacemaker and facilitator.	,683	80	17	3
Communicates in multiple ways.	,604	83	10	7
Is productive.	,326	82	11	7
Respects and tolerates different cultures and their contributions to humanity.	,395	83	11	6
Applies information resources and uses them.	,415	84	15	1
Accepts democratic leadership.	,474	56	30	14
Accepts the indivisibility of human rights and freedom as a fundamental principle.	,563	61	30	9
Accepts the values of mutual understanding, collaboration, equality, justice and mutual support.	,626	79	18	3
Reaches the virtue of respect to the society's values, honours, beliefs and freedom.	,460	83	13	4
Is a systematic, careful, patient and responsible person.	,416	93	5	2

individual will be able to develop being a systematic, careful, patient and responsible person' are given in Table 9.

As it is seen in Table 9, the participants said 'Yes' the least (56%) to the item 'Accepts democratic leadership' and the most (95%) to

Table 10. Factor loadings and percentages in terms of the accomplishment levels of expected attitudes and skills gained with democracy education by an individual having the fourteenth goal of mathematics education.

An individual who can make research, create knowledge and develop power of usage,	Factor loading	Yes	Neutral	No
		%	%	%
Solves problem.	,672	93	2	5
Applies information resources and uses them.	,681	96	2	2
Acknowledges and evaluates.	,462	94	3	3
Is productive.	,458	95	4	1
Accepts the development of humanity as a fundamental principle.	,546	69	20	11
Finds constructive, collaborative, nonviolent, attributive and peaceful solutions for social problems.	,568	71	16	13
Communicates in multiple ways.	,460	77	16	7
Thinks critically.	,614	82	13	5

the item 'Acknowledges and evaluates.' Also they were neutral the most (32%) to the item 'Creates public interest.' and said 'No' the most (14%) to the item 'Accepts democratic leadership.' According to factor analyses, the item 'Is productive.' has the least factor loading (.326) and 'Is a peacemaker and facilitator' has the highest loading (.683). Cronbach's Alpha coefficient is .805.

The attitudes and skills gained with the democracy education can be achieved by an individual educated in accordance with outcomes of the fourteenth goal of mathematics education, '*The individual will be able to make research, create knowledge and develop power of usage*' are given in Table 10.

As it is seen in Table 10, the participants said 'Yes' the least (69%) to the item 'Accepts the development of humanity as a fundamental principle' and the most (96%) to the item 'Applies information resources and uses them.' Also they were neutral the most (20%) to the item 'Accepts the development of humanity as a fundamental principle' and said 'No' the most (13%) to the item 'Finds constructive, collaborative, nonviolent, attributive and peaceful solutions for social problems.' According to factor analyses, the item 'Is productive' has the least factor loading (,458) and 'Applies information resources and uses them.' has the highest factor loading (,681). Cronbach's Alpha coefficient is ,677.

The attitudes and skills gained with the democracy education can be achieved by an individual educated in accordance with outcomes of the fifteenth goal of mathematics education, '*The individual will be able to link mathematics and art, and develop aesthetic feelings*' are given in Table 11.

As is seen in Table 11, the participants said 'Yes' the least (43%) to the item 'Is devoted to the principles of social pluralism' and the most (87%) to the item 'Is productive.' Also they were neutral the most (39%) to the item 'Creates public interest.' and said 'No' the most (20%) to the items 'Is devoted to the principles of social pluralism and Struggles with prejudice and discrimination.' According to factor analyses, the item 'Is productive.' has the least factor loading (,312) and 'Believes the importance of the individual responsibility' has the highest factor loading (,677). Cronbach's Alpha coefficient is .826.

RESULTS, DISCUSSION AND SUGGESTIONS

The first goal of mathematics education 'The individual will be able to understand mathematical concepts and systems, make relations between them and use these concepts and systems in daily life and other learning fields.' achieved fifteen educational outcomes of democracy education. The second goal, 'The individual will be able to make inferences about logical induction and deduction' achieved fourteen educational outcomes of democracy education. The third goal, 'The individual will be able to express his/her mathematical ideas and inferences in the process of solving mathematical problems' achieved nineteen educational outcomes of democracy education. The third goal, 'The individual will be able to use the skills of prediction and mental operation' achieved fourteen educational outcomes of democracy education. The fourth goal, 'The individual will be able to create problem solving strategies and use them for solving daily life problems' achieved eighteen educational outcomes of democracy education. The fifth goal, 'The individual will be able to form models, link the models with oral and mathematical expressions' achieved thirteen educational outcomes of democracy education. The sixth goal, 'The individual will be able to create and develop intellectual interest' achieved sixteen educational outcomes of democracy education. The seventh goal, 'The individual will be able to comprehend the historical developments of mathematics, its role and value in the development of people's ideas and its significance of the usage in other disciplines' achieved fifteen educational outcomes of democracy education. The eight goal, 'The individual will be able to develop being a systematic, careful, patient and responsible person' achieved sixteen educational outcomes of democracy education. The ninth goal, 'The individual will be able to make research, create knowledge and develop power of usage.' achieved eight and the tenth goal 'The individual will be able to link mathematics and art, and develop aesthetic feelings' achieved seventeen educational outcomes of democracy education.

In addition, findings of each item in the tables can be reviewed one by one. As the focus of this study is not interpretation of statistical knowledge reached with the separate analyses of these items, it will be adequate to give the minimum 'Yes' rate (38%) and 'No' rate (16%) for the aim of the study. This finding shows that the

Table 11. Factor loadings and percentages in terms of the accomplishment levels of expected attitudes and skills gained with democracy education by an individual having the fifteenth goal of mathematics education.

An individual who can link mathematics and art, and develop aesthetic feelings,	Factor loading	Yes	Neutral	No
		%	%	%
Is productive.	,312	87	9	4
Believes the importance of the individual responsibility.	,677	65	24	11
Thinks critically.	,395	77	16	7
Avoids disagreement.	,537	56	28	16
Does collaboration and team work.	,640	61	24	15
Is devoted to the principles of social pluralism.	,361	43	37	20
Respects and tolerates different cultures and their contributions to humanity.	,420	80	16	4
Creates public interest.	,418	51	39	10
Is a peacemaker and facilitator.	,517	66	36	8
Is a participant.	,613	80	13	7
Is an active person.	,560	70	22	8
Does moral questioning.	,574	46	37	17
Has a culture of discussion and agreement.	,582	73	20	7
Believes the benefits of democratic principles, institutions and systems.	,555	56	33	11
Is linked to law, justice and equality in the differences of the world.	,484	65	22	13
Finds constructive, collaborative, nonviolent, attributive and peaceful solutions for social problems.	,608	70	23	7
Struggles with prejudice and discrimination.	,448	44	36	20

minimum ‘Yes’ rate of the items is higher than the ‘No’ rate. The findings also indicate that an individual educated in accordance with the goals of mathematics education can acquire the attitudes and skills of democracy education. This finding is in parallel to a number of studies’ findings. Valero (1997) found that if people educated with the goal of mathematics education including teaching democracy, they can solve the problems with mathematical knowledge when they meet two different ideologies. Valero (1999) also found that mathematics education in school has an effective role in the reinforcement for democratic social relationships. In parallel to research findings, Goodlad (1994) found that mathematics forms the spirit of democracy and moral values in shaping democracy. In addition, Hannaford (1998) found that mathematics should be taught as a tool for helping problem solving and then given within a universal logic in accordance with the goal of problem solving in all areas ranging from daily life issues to political ones. Cesar and Torres (1997) said mathematical knowledge is a path to the meaning of knowledge, and Steen (1999) said mathematics is a new social literacy for understanding democracy in society. Gutstein and Peterson (2005) found that the students who are aware of the power of mathematics can understand their own power in forming a democratic society and they can take active roles in society. In addition, Malloy (2008) found that the students can use their skills for social equality and justice by using mathematics after they learn how to adapt mathematics for other cases. Considering above issues and the findings of the study, if we desire a constant positively changing democracy, we should educate individuals in society having the outcomes of mathematics education. As a last, further qualitative and quantitative research is needed on this issue especially the contents presented in tables in the findings. Such studies can be helpful for the authorities who are in charge of deciding and giving ways to education.

Conflict of Interests

The author has not declared any conflict of interests

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