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Values in Turkish Middle School Mathematics Textbooks

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Abstract. Mathematics is usually seen as a field in which there is no values. Such a situation causes only a few studies about values teaching to be done in mathematics education. But, mathematics is a field that has various values in it, and that must be considered seriously from this point of view. Values are taught implicitly rather than explicitly in mathematics classes when comparing to others. The same situation can be seen in other lesson textbooks. Thus, in this paper; how much importance do mathematics and its educational values have, are investigated at mathematics textbooks in 6th and 7th primary school graders in Turkey. For this purpose, total eight 6th and 7th grade mathematics textbooks, that were chosen by random approach, are analysed with semantic content analysis. As a result of analysis it has been fixed that rationalism, control and openness values among mathematical values are emphasized more than complementary pairs of formalistic view, theoretical knowledge, instrumental understanding, accessibility and evaluation both in 6th and 7th grades mathematics textbooks.

Key words: mathematical values, mathematics educational values, values, mathematics

1. Introduction

Although cognitive aims, affective factors or aims contain cognitive factors, it is seen that cognitive aims generally take place significantly in cirruculum, textbooks and teachers. This is because;

(a) Affective aims are considered as a mean to reach cognitive aims,
(b) Gaining levels of cognitive aims can be measured more easily (Seah and Bishop, 2000),
(c) According to Southwell, reliability of affective studies has been inquired by academic societies (1995; cited in Bishop et al., 1999),
(d) And development of strategies and activities at affective field occurs more slowly than those of psycho-motor and especially cognitive fields (Main, 1993). Yet, through a man's life, affective factors have developed in same way and they have shown their own effects. So, this kind of negative point of view towards education's affective aspect is inconvenient. In studies about teaching mathematics' affective field,

attitude, belief and motivation dimensions have been usually taken into consideration and its values teaching dimension is neglected (Seah and Bishop, 2000). However, studies about teaching mathematics values stay little and limited. In fact, values is the most important element of raising mathematics learning and teaching qualities (Seah, 2002). At this point, Hill's below citing is important;

> apart from anything else they might learn, students get the message that, in the things which it includes and exludes, the curriculum mirrors the priorities which the community sets on things ... Values education goes on, therefore, even when we are not consciously planning for it. But when its effect is not acknowledged or controlled, the results is often that wrong values for life ara propagated by default (p. 3).

1.1. WHAT ARE VALUES?

Identifying values is hard (Brown, 2001). For this, we need some concepts such as "good" and "bad" (Swadener and Soedjadi, 1988). The word "value" has been used in different meanings. "The value" of unknown in an equation, the "value" of listening a conversation and moral "value" of an individual can be given as an example (Seah and Bishop, 2000). Raths, et al. values have been identified as general guidelines which occured as a result of one's relationship and experience in his/her life (1987; cited in Seah and Bishop, 2000). According to Fraenkel, a value is a concept or an idea that was considered as a important by an individual's life (1977; cited in Swadener and Soedjadi, 1988). Swadener and Soedjadi (1988) – like Fraenkel – identify values as a concept or an idea about value of anything. Frondizi sees values as a personel experiences and psychological phenomenas (1970; cited in Chin and Lin, 2001) and Matthews (2001) sees them as leaders and means of behaviours.

When looking above identifications, it can be described as personel choices considering value or importance of a behaviour or idea, or general aims that are adopted or followed by an individual as a member of a society. Therefore values have reflected concepts or ideas about anything. Values can be categorized into two. These are aesthetic and ethical. Aesthetic values are about beauty concepts. Ethical values are about concepts which can be expressed as good or bad and they are interested especially in good and bad sides of a behaviour. This part of values forms a wholeness with education. They cooperate with education and so they make society formation possible (Swadener and Soedjadi, 1988).

1.2. SIMILARITIES AND DIFFERENCES AMONG VALUE, ATTITUDE AND BELIEF

According to Mcleod, comprehending similarities and differences among affective field concepts; such as attitude, belief and value, become harder (1992; cited in Seah and Bishop, 2000) as there is only a few studies about values (Bishop et al., 1999; Seah and Bishop, 2000). Therefore, terminology used about these concepts becomes complementary (Bishop et al., 1999). Generally, there is a close relation between values and attitudes. Kağıtçıbaşı considers attitudes not only as an emotional or behavioral approach but also considers as integrating of cognition, emotion and behavior inclination (1999; cited in Tavşancıl, 2002). Values have affected emotional components of these elements of attitudes (Tavşancıl, 2002). As for Seligman et al. attitudes are thoughts about a special situation, while values contain more detailed and central fields than those of attitudes (1996; cited in Bishop et al., 1999). And also all of the attitudes has no social side, while values come into existence at two phases as personal and social. Yet, attitudes about social values are social (Tavşancıl, 2002).

Tavşancıl (2002, p. 74) describes belief as a whole cognition of an individual about a topic, while Eren describes it as a permanent emotions net which was constituted by an individual world's one side, his perceptions and his description (2001; cited in Tavşancıl, 2002, p. 74).Thus, values can be seen as a practicing tool of beliefs. That is to say, values are the indications of which how many practices can be done about mathematics teachers' beliefs about their teaching in classroom environment (Clarkson et al., 2000). And also, according to Bishop (2001; cited in Chin and Lin, 2001) beliefs are "the nature of *propositions* about phenomena" (p. 250), while values contain key characteristics below the proposals about human thoughts and behaviours (Chin and Lin, 2001).

Attitudes and beliefs can undergo some changings as a result of people's experiences during their life. Especially, in adolescence period of individuals, these changes take place much. Yet, we cannot tell the same things about values.Values take root within human souls deeper and they are become more integral by human (Seah, 2003). However, beliefs can be categorized into expressions such as right/wrong; for example, "anything is mathematics is right or wrong". Actually, as for Kluckhohn, values are interested in being important of fact or not being important of fact (1962; cited in Seah, 2002). For instance, just like a teacher's taking care about using logical thinking, problem solving or technology in accordance with his/her own teaching techniques or vice versa (Seah, 2002). Differences between values and beliefs are given below at Table I.

Table I. Possible ways of differentiating beliefs from values

	Belief	Value
It is about the degree to which something is	... true	... important
It exists...	... in a context	... in the absence of any context

Source: Seah (2002), Seah and Bishop (2002).

1.3. MATHEMATICS AND VALUES

Modern mathematics has a deductive-axiomatic structure and generally shows a hierachical consruction. So, it is hard to understand a mathematical concept wihout being aware of its preliminary subjects. This deductive-axiomatic structure of mathematics depends on undefined terms, definitions and logical rules (Swadener and Soedjadi, 1988). Absolutist philosophers; who see mathematics from this perspective, appreciate it as an abstract science and also they think that it is interested in generalization, theory and abstractions. So, mathematics is seen as a field which has no social choice and with which only a few people concerns. And mathematics is value-free; that is to say, it is neutral (Ernest, 1991; Bishop, 1998, 2002). In fact, mathematics is loaded with values. It is not neutral. Yet, values are generally taught implicitly rather than explicitly in mathematics. However, values are rarely taken seriously at mathematics educational discussions and mathematics teachers are generally interested in operations that has only one answer. They don't believe values teaching in mathematics lessons (Clarkson et al., 2000). Nowadays, cirruculum programmes are prepared in this way. Programmes prepared usually focus on students'achievements. At cirruculum, although there some expressions about values teaching, we meet a little information about their developments. Teaching values is not like teaching fractions. There is no right answer of teaching values. Even though one can expertise on teaching fractions, one may not always be adequate in teaching values. But, it is an obligation that one has more information about values which play a vital role in mathematics educational development (Bishop et al., 2000).

Values play an important role in students gaining their personal and social identities. Especially, this side of values can be seen at front side in mathematics lessons. Because values affect students' choices about concerning about mathematics or not concerning about it significantly (FitzSimons and Seah, 2001). Sam and Ernest (1997) classify the values about mathematics education into three such as;

(i) Epistemological values: They are the values which are about theoretical side of mathematics learning and teaching such as;

accuracy, systematicness, and rationalism and also characteristics, appreciation and acquiring of mathematical knowledge. For example; accuracy, being analytical, rationalism and problem solving.

(ii) Social and cultural values: They are the values that indicate people's responsibilities about mathematics education for society. Such as; compassion, integrity, moderation and gratitude.

(iii) Personel values: Values that affect person as an individual or a learner. Such as; curiosity, thriftiness, patience, trust and creativity.

Special values decsription about mathematics education is made by Bishop just like below (1996:19; cited in Seah and Bishop, 2000):

> Values in mathematics education are the deep affective qualities which education aims to foster through the school subject of mathematics. They appear to survive longer in people's memories than does conceptual and procedural knowledge, which unless it is regularly used tends to fade (p. 5–6).

Values; like indicated in this definition, is an important affective factor that affects mathematics learning/teaching. According to Cockcroft, negative reflection of values cause mathematics to be loved by children to adults (1982; cited in Bishop, 1999). In fact, values are essential for development of every lesson and they must be taught in every lesson. Yet, like cited above, values are taught in matrhematics lessons implicitly (Bishop et al., 2000; Clarkson et al., 2000, Seah, 2003). Bishop classifies values taught in mathematics lessons into three different types by making them more specialized than that of Sam and Ernest (1997). These are; general educational values, mathematical values and mathematics educational values (1996; cited in Bishop et al., 1999).

(a) General educational values. General educational values are the values which help teachers, schools, culture, society and students to improve. Generally, they contain ethical values such as; good behaviour, integrity, obedience, kindness and modesty (Bishop et al., 1999; FitzSimons et al., 2000). Warning a student who has been cheating during exam can be given as an example for such kind of values (Seah and Bishop, 2000).

(b) Mathematical values. Mathematical values are the values that reflect the nature of mathematical knowledge. They are produced by mathematicians who have grown up in different cultures (Bishop et al., 1999). Proving Pythagorean Theorem in three different ways and their appreciation are an example to mathematical values (Seah and Bishop, 2000). Culture stands as a powerful determiner of mathematical values. Researchs show that basis values of all cultures have not been shared. So, mathematics teachers work in different cultures do

not teach the same values, even if they have taught them the same cirruculum (Bishop et al., 2000). Bishop classifies mathematical values taught in Western culture into three categories as complementary of each others (1988; cited in Seah and Bishop, 2000; Bishop et al., 2000). These are;

(i) Rationalism–objectism: Rationality values indicate the values that people have about mathematics. According to this value, mathematics has the ideas which depend on theory, logic and hypothesis (Bishop et al., 2000). Shortly, rationalism value shows a deductive logic which concerns about only correctness of results and explanations. Objectism value shows; because of its nature, objects and symbols which is an instrument to concretize mathematics that has an abstract language (Bishop et al., 1999; Seah and Bishop, 2000).

(ii) Control – progress: Control value shows that mathematics be applied, not only on phenomena about its nature but also on problems, solutions in social areas (Seah and Bishop, 2000). Mathematics' results have correct answers that can always be controlled (Bishop et al., 1999). However, mathematics with its other aspect is open to progress everytime and it can be used in other fields especially in school lessons, Skolverket cites this side of it too low (2000; cited in Brändström, 2003):

> Mathematics is closely connected with other school subjects. Pupils obtain experiences from the surrounding world and can thus use this as a basis for expanding their mathematical skills (p. 25).

(iii) Openness– mystery: Openness value shows discussing and analyzing mathematical theorems, ideas, results and argumentations. And such a situation leads us to reach corrects and to find new theorems (Seah and Bishop, 2000). Mystery value indicates mathematics own relation, pattern and surprises in its own nature. Such as; dividing every circle's perimeter into its diameter gives the same number (π number) or Pythagorean triangles that have 3, 4, 5 or 5, 12, 13 cm edge lenght gives always a multiple of 60 when they are multiplied with each other. Mathematics has always such kinds of mystery and surprise in itself (Bishop et al., 1999).

Sub-components of mathematical values cited below are fixed by Bishop at Table II;

(c) Mathematics educational values. Teaching mathematics educational values may show differences according to countries, cities, school

Table II. Mathematical values

(1.a) Rationalism: Reason, hypotetical reasoning, logical thinking, explanation, abstractions, theories.
(1.b) Objectivism: Atomism, materialism, determinism, analogical thinking, objectivising, concretising, symbolising.
(2.a) Control: Prediction, knowing, security, mastery over environment, rules, power.
(2.b) Progress: Growth, cumulative development of knowledge, generalisation, questioning, alternativism.
(3.a) Openness: Facts, articulation, demonstration, verification, universality, individual liberty, sharing.
(3.b) Mystery: Abstractness, unclear origins, dehumanised knowledge, wonder, mystique.

Bishop (1988), *Source:* Clarkson et al. (2000).

types and grades. For example; choice of problem solving strategies may show differences according to the environment. So, the number of mathematics educational values can increase to that rate. In this paper, five complementary mathematics educational values will be emphasized. The first two of them can be considered as values about pedagogical side of mathematics education and the other three can be considered as values about its cultural side. These are;

(i) Formalistic view– activist view: Formalistic view value shows the deductive and receptive learning values of mathematics, while activist view value shows its intuition and discovery learning; that is to say, its inductive sides.

(ii) Instrumental understanding/learning– relational understanding/learning: Instrumental learning indicates learning rules, operations and formulations in mathematics education and their applications to special questions. Relational learning shows displaying the relationships among concepts and forming appropriate graphics. In fact, these concepts derived by Skemp (Seah and Bishop, 2000) show some similarities with Hiebert and Lefevre's (Star, 2002) "knowledge that rich in relationships" (p. 3) and later McCormick's (1997) conceptual knowledge described as;

> *Conceptual knowledge*,... is concerned with relationships among items of knowledge, such that when students can identify these links we talk of them having conceptual understanding (p. 143).

and application of rules and processes for solving a mathematical problem by Hiebert and Lefevre (1986; cited in Star, 2002)

and lastly procedural knowledge described by Plant (1994; in cited McCormick, 1997) as "know how" (p. 143)

(iii) Relevance – theoretical knowledge: Relevance value shows the importance of mathematical knowledge in solving daily problems. Daily problems and demands show different at societies and cultures. Thus, mathematics can provide special solutions to cultural needs and demands. Mathematical education's theoretical value suggests teachings mathematics at theoretical basis and far from daily events.

(iv) Accessibility –special: These values indicate doing and preparing mathematical activities by either everyone or just by people who has talent in it.

(v) Evaluating – reasoning: Students are asked to realise the steps of knowing, applying routine operations, searching solving problem, reasoning and communicating in order to solve a problem. The first three of this five steps demonstrate using mathematical knowledge about evaluating an unknown answer; while the last two demonstrate the capability of using mathematical knowledge, reasoning more and the ability of spreading the knowledge (Seah and Bishop, 2000).

The most general demonstration of values taught in mathematics lesson is given at Table III below:

Values taught in mathematics lessons and values that people, institutes, and societies have are given at Figure 1 below:

As will be seen from Figure 1, general educational values don't have mathematical and especially mathematics educational values. Some values may appropriate for two or three of these categories. For example; progress and creativity values are both mathematical, mathematics educational and general educational values (Seah and Bishop, 2000).

Textbooks studied at both primary and secondary Turkish public schools can be published at special publishings and also at National Educational Publishing. The appropriatness of these textbooks for cirruculum has been checked by Instruction Council which assigned to National Educational Ministry. The textbooks that get approval from this council can be studied at primary and secondary schools. The choice of these textbooks shows differences according to the teachers have worked there. So, at public schools, textbooks published at different publishings can be taught. And therefore in this research, it has been searched that how much do mathematics educational values take place in mathematics textbooks taught in 2003–2004 educational term at Turkish public middle schools. For this purpose, the answer for questions below have been looked for;

Table III. Values in mathematics education

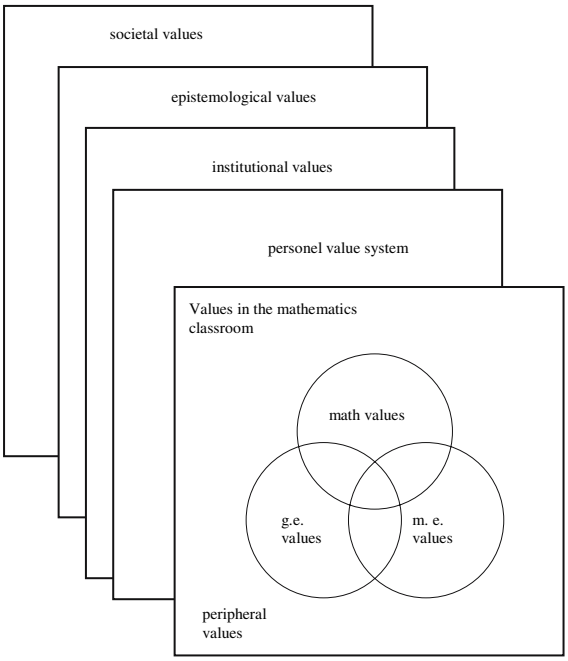
General meanings of 'value'	Mathematical values	Mathematics educational values
To value:	Rationalism	Accuracy
*To command	Objectivism	Clarity
*To praise	Control	Conjecturing
*To heed	Progress	Consistency
*To regard	Mystery	Creativity
	Openness	Effective organization
A value is:		Efficient working
* A standard		Enjoyment
* A thing regarded to have worth		Flexibility
* A principle by which we live/act		Open mindedness
* A standard by which we judge, what is important		Persistence
		Systematic working
* Something we aim for		
* Qualities to which we conform		

Source: Seah et al. (2001).

(1) How much importance has been given to mathematics and its educational values, mathematics textbooks, taught in 6th and 7th grades at Turkish public schools?
(2) Is there any differences between 6th grades mathematics textbooks and those of 7th grades in accordance with having mathematics educational values?

2. Methodology

Compulsory education was increased from 5 to 8 years with an improvement in educational field at 1997 in Turkey. The first 5 years of this period are called as 1st stage of primary school and last 3 years are called as 2nd stage. 7–12 year old students go to 1st stage and 13–15 year-old students go 2nd stage of primary school. This study is limited with searching only the mathematics textbooks studied by 13–14 year-old students. So, three textbooks were chosen by random method for each of mathematics textbooks taught in 6th and 7th grades. However, total eight textbooks have been taken into study by two textbooks published by National Educational Ministry. Each of these books has been named as A6, B6, C6, D6, A7, B7, C7, D7 special codes and during research, these books has been named with these special codes. Here, the number 6 stands for 6th grade



Note. math values : mathematical values
m.e. values : mathematics educational values
g.e. values : general educational values

Figure 1. Relationship of values (*Source:* Seah and Bishop, 2000). Note. math values: mathematical values, m.e. values: mathematics educational values, g.e. values: general educational values.

and the number 7 stands for 7th grade. In searching textbooks, semantic content analysis was used. Semantic content analysis is an operation that finds out the main subject areas in material content, its dimensions and special sub-dimensions about these areas and dimensions (Tavşancıl and Aslan, 2001). In this study, mathematics and its educational values are taken into consideration as general areas and sub-areas which enter to these areas (see Table IV).

The pairs of rationalism–objectism, control–progress and openness–mystery studied under general category of mathematics values have been investigated by the help of the method below:

In rationalism value, logical connectors such as action–reaction, cause and effect have been searched within exercise, problem and example solutions and their numbers cited have been determined. However, examples, exercises and problems which were explained by mathematics deductive logic an abstract language have been evaluated within this category. Graphics, figures etc … that concretize its abstract language have been

Table IV. General categories and sub-categories in semantic content analysis

General categories	Sub–categories
	Rationalism–objectism
Mathematical values	Control–progress
	Opennes–mystery
	Formalistic–activist
Mathematics educational values	Instrumental–relational understanding
	Relevance–theoritical
	Access–special
	Evaluating–reasoning

investigated. Example, exercise and problems; which don't give students any freedom and have imperatives within the scope of a direction, have been considered for control value, while progress value examples, exercises and problems; which give freedom to students, suggest usage of mathematics at other fields and have analogy, model and etc … have been searched. Hard and complicated examples, exercises and problems that display mysteries and surprises of mathematics are investigated within the scope of mystery value, while easy ones that can be done by students are evaluated within the scope of openness value.

For formalistic view among mathematics educational values, the situations; in which teaching has been done by deductive approach – that is to say by teachers and textbooks – have been detected, while for activist view, the situations; in which there are inductive and discovery teaching, have been detected. In relevance value, examples, exercises and problems which emphasize that mathematics is about daily-events are investigated and in theoretical knowledge, the ones; which emphasize that mathematics is only mathematics, are investigated. Subject, explanations, examples, exercises and problems; in which only rules, operations and formulations were used, are studied in instrumental learning and in relational learning, the ones; which demonstrate the relations between concepts, are studied. Also in accessibility value, examples, exercises and problems which can be understood by every student easily are focused on. In evaluation, exercises and problems given at the end of topic are looked at and the questions that require routine operations similar with the topic examples are evaluated. For reasoning value, questions that lead students to think about and different from previous ones are searched.

To test the reliability of the study, textbooks searched have been given to different people and all the results which were held by them are compared. And also, all the sections of textbooks are studied and there is no limitation. In this way, the findings about research problems are aimed to be

Table V. Distribution of topics in mathematics textbooks

Class	Topics
6	Sets, natural numbers, prime numbers and prime factors, fractions, decimal fractions, points, lines, planes, spaces, segments, and rays, angles and triangles, measurements, ratio and proportion.
7	Integer numbers, rational numbers, equation and line graphics, ratio, proportion and percents, angles and polygon, circle and cylinder, statistics and graphics.

exposed clearly. The subjects within 6th and 7th grades mathematics textbooks are given above at Table V:

And also, examples and problems with their solutions and problems without solution, exercises given at the end of topic, problems and project studies have been searched, and the other characteristics that can be searched in textbooks (such as; physical characteristics, its attraction, giving reference and sources and etc ...) have been kept out of research.

3. Findings and Interpretations

In this part, explanations about the situations in which each of mathematics textbooks within the scope of research carried mathematical and mathematics educational values will take place.

3.1. MATHEMATICAL VALUES

The distribution of the numbers of each mathematical values and their complementary pairs in 6th grade textbooks searched according to each subject is given at Table VI:

Rationalism stands for a logic which concerns just correctness and exactness of results and explanations; that is to say a deductive logic. In a content written with this kind of logic, logical connectors; such as, "hence, so, according to, therefore" are usually used. Such logical connectors are used many times; for example, in A6 textbook 49 times, in B6 textbook 23 times, in C6 textbook 25 times and in D6 textbook 13 times about sets topic.

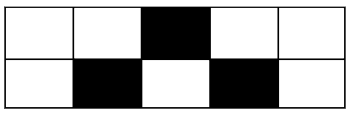
When looking at Table VI, it can be seen that rationalism value (53) is more than objectism (21), openness (89), and mystery value (26) and also that control (46) and progress (44) values are emphasized closely. For the distribution of mathematical values in other subjects, Table VI can be looked at. When generally looking at A6 textbook, objectism value (261)

Table VI. Distribution of mathematical values for each topic in 6. class textbooks

		Mathematical values					
		Complementary value pairs		Complementary value pairs		Complementary value pairs	
Textbook	Topics	Rationalism	Objectism	Control	Progress	Openness	Mystery
A6	Sets	53	21	46	44	89	26
	Natural numbers	51	14	79	9	41	2
	Prime numbers...	14	15	30	24	30	29
	Fractions	45	51	59	22	115	22
	Decimal fractions	11	26	58	62	62	61
	Point, line, ...	14	40	14	18	21	11
	Angle, triangle,...	17	54	11	31	14	31
	Measurements	8	33	61	9	40	65
	Ratio and proportion	2	7	7	–	6	9
	Total	215	261	365	219	418	256
B6	Sets	92	22	53	66	88	27
	Natural numbers	7	9	47	13	68	17
	Prime numbers...	21	6	11	2	27	7
	Fractions	40	15	48	7	51	46
	Decimal fractions	3	12	16	30	33	19
	Point, line,...	20	24	21	9	72	12
	Angle, triangle,...	2	–	19	–	8	–
	Measurements	5	4/10	30/33	3/33	20	25
	Ratio and proportion	20	4	35	14	32	13
	Total	210	96	280	144	399	166
C6	Sets	89	19	65	57	67	10
	Natural numbers	26	6	74	–	87	47
	Prime numbers...	38	15	24	12	37	7
	Fractions	86	9	–	74	68	20
	Decimal fractions	27	45	45	57	57	48
	Point, line,...	26	13/39	16/35	19/35	7/10	3/10
	Angle, triangle,...	12	52	31	13	27	31
	Measurements	18	34	35	15	32	11
	Ratio and proportion	18	–	16	–	8	–
	Total	340	193	306	247	390	177
D6	Sets	83	20	60	53	73	14
	Natural numbers	41	9	12	43	38	23
	Prime numbers...	12	14	19	22	22	32
	Fractions	21	46	16	7	84	123
	Decimal fractions	32	27	36	32	32	38
	Point, line,...	19	–	29	4	15	29
	Angle, triangle,...	8	1	7	32	20	18
	Measurements	15	77	50	26	26	62
	Ratio and proportion	2	–	5	–	7	8
	Total	233	194	224	219	317	347
	General total	998	744	1175	829	1524	946

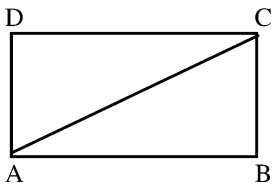
is emphasized more than rationalism value (215), control value (365) is emphasized more than progress value (219) and openness value (418) is emphasized more than mystery value (256). Two examples about rationalism values in A6 textbook are given below:

* The smallest common of the two natural numbers is 72, the biggest common divisior is 3. One of the numbers is 24 and what is the other number? (A6, p.74, prime numbers, rationalism).
* Write the ratio of dark sides of figure below to whole figure (A6, p. 224, ratio and proportion, objectism)



In B6 textbook for example again in sets topic, it is obvious that rationalism value (92) is emphasized more than objectism (22), openness (88) than mystery value (22) and progress value (66) than control value (53). In sets topic, the most emphasized ones are rationalism (92), control (53), progress (66) and openness (88) and in point and line topics, the most emphasized one is objectism value (24) and lastly in fractions topic, mystery (46) is the most emphasized value comparing to others. When looking at B6 textbook at general, it can be seen that, rationalism value (210) is emphasized more than objectism (96), control value (280) than progress value (144) and openness value (399) than mystery value (166). Two of examples in B6 textbook about control–progress values are given below:

* Calculate the areas of two right triangles with their line lenghts (B6, p. 169, measurements topic, control).



(a) $a = 5\,\text{cm}$, $b = 4.6\,\text{cm}$ (b) $a = 0.09\,\text{cm}$, $b = 5.6\,\text{cm}$

Area of right triangle: equals to the areas of ABC and ADC right triangles. Area of one of the triangles equals to the are of the half of rectangular (B6, p. 168, measurements, progess).

For example in C6 textbook and at teaching natural number, it has been seen that rationalism, control and openness values have been used more

than complementary values. It is clear that in sets rationalism value (89), in point, angle, objectism value (52), in natural numbers control (74) and openness values (87), in fractions progress values (74) and in decimal fractions mystery values (48) are used more than others. When we look at C6 textbook in general, it can be seen that rationalism value (340) is emphasized more than objectism value (193), control value (306) is emphasized more than progress value (247), and openness value (390) is emphasized more than mystery value (197). Two examples about openness–mystery values in C6 textbook are given below:

* $K = \{1, 2, 3, .4\}.$, $T = \{2, 4, .a\}.$, $P = \{3, 4, .5\}$. sets are given. Let's write $(K \cap T) - P$ set with listing method and show it with figures ... (C6, p. 29, sets, openness)
* One bag of tea weights 1.8 gr. How many kilos of tea are there in 125 boxes that have 48 bags in each? (C6, p.176, decimal fractions, mystery)

As we look at D6 textbook in general, rationalism (233), control (224) and mystery (347) values are emphasized more than complementary values. Two examples about control–progress values in D6 textbook are given below:

* Find a schemed home plan and detect it. Find its real dimensions according to plan scale (D6, p. 286, ratio and proportion, progress).
* Which of these ratios below forms a proportion? (D6, p. 277, ratio and proportion, control).

(a) $\frac{3}{4}$ and $\frac{15}{20}$, (b) $\frac{8}{12}$ and $\frac{10}{5}$ (c) $\frac{5}{6}$ and $\frac{7}{8}$

When looking at 6th grades textbooks in general, it is obvious that rationalism (998) is conveyed more than objectism (744), control (1175) than progress (829) and openness (1524) is conveyed more than mystery (946). These data indicate that in each of these four textbooks investigated, rationalism, control and openness values have been emphasized more. This situation proves that mathematics textbooks have been prepared in the way that doens't keep students out of textbooks and take care about mathematics' good sides, mysteries and being abstract.

In this part, emphasizing mathematical values in 7th grade mathematics textbooks will be analyzed. For this aim, firstly when we look at logical connectors that are used as indicators of rationalism value, it has been seen that there are logical connectors used; for example, in integer numbers topic, in A7 textbook 34, in B7 48, in C7 27 and in D7 textbook 38.

The numbers of mathematical values that have been conveyed by 7th grade mathematics textbooks are given in Table VII below:

At Table VII, in teaching integer numbers, rational numbers, angles and polygens, circle and cylinder and statistic and graphics topics, rationalism, control and openness values are used more than complementary values. When looking at A7 textbook in general, we can perceive that rationalism

Table VII. Distribution of mathematical values for each topic in 7. class textbooks

		Mathematical values					
		Complementary value pairs		Complementary value pairs		Complementary value pairs	
Textbook	Topics	Rationalism	Objectism	Control	Progress	Openness	Mystery
A7	Integer numbers	29	5	57	54	58	46
	Rational numbers	108	13	61	3	86	61
	Equations and line graphics	6	6	37	4	44	44
	Ratio, proportion and percents	85	43	36	–	49	36
	Angles and polygens	126	93	64	46	71	64
	Circle and cylinder	20	11	29	21	36	20
	Statistic and graphics	36	9	34	12	10	6
	Total	410	180	318	140	354	277
B7	Integer numbers	21	18/97	91/97	5/97	80/97	17/97
	Rational numbers	102	10	81	2	20	82
	Equations and line graphics	33	36	44	62	39	14
	Ratio, proportion and percents	11	52	4	6	35	8
	Angles and polygens	12	1	44	32	25	15
	Circle and cylinder	6	7	11	6	12	8
	Statistic and graphics	6	15	15	5	1	13
	Total	191	139	290	118	212	157
C7	Integer numbers	22	40	34	61	34	45
	Rational numbers	20	21	78	9	24	10
	Equations and line graphics	44	17	16	8	23	28
	Ratio, proportion and percents	54	14	47	18	65	
	Angles and polygens	111	85	38	83	92	91
	Circle and cylinder	51	24	22	13	18	11
	Statistic and graphics	11	30	12	5	14	1
	Total	313	231	247	197	270	186
D7	Integer numbers	4	1	32	65	45	4
	Rational numbers	40	24	59	46	90	15
	Equations and line graphics	120	12	64	23	74	16
	Ratio, proportion and percents	21	29	25	29	16	22
	Angles and polygens	41	35	27	21	37	16
	Circle and cylinder	15	12	33	13	13	7
	Statistic and graphics	5	34	13	4	42	13
	Total	246	147	257	201	307	93
General total		1160	835	1112	656	1143	713

(410) is emphasized more than objectism (180), control (318) than progress (140) and openness (354) is emphasized more than mystery (277). Two examples of rationalism–objectism values in A7 textbook are given below:

* Do the operation of $(-36)-(-9)$. As $(+9)$ is the opposite of (-9) in addition operation, $(-36)+(+9)=-27$ (A7, p. 12, integer numbers, rationalism).
* In Kayseri, the weather temperature is 12 degrees below zero centigrade in the coldest day of winter and is 38 degrees above zero centigrade in the hottest summer day. Express the temperature in the coldest and hottest days with integer numbers (A7, p. 4, integer numbers, objectism).

Similarly, when we look at the mathematical values which B7, C7 and D7 textbooks convey, it is clear that rationalism, control and openness values have been used more than complementary values. These data reveal that 7th grade mathematics textbooks convey the characteristic with 6th grade textbooks. Examples of mathematical values in other 7th grade textbooks are given below:

* The information collected about five monthly thread production, is shown below. Analyze them. Demonstrate the information at the table with statistic and graphics (C7, p. 228, statistic and graphics, objectism).

Thread production (tone)	50	70	80	90	60
Months	January	February	March	April	May

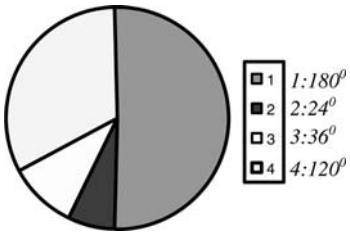
* In a city, some observations about weather condition has been done during November. Data collected from observations are shown at table below. Analyze them.

Weather condition	Sunnny	Foggy	Rainy	Snowy
Numbers of days	10	2	15	3

* Let's show the data given at table with circle graphics: The central angle of a circle is 360° and November has days. The central angle of the circle which refers to one day is $360:30=12^\circ$
  Show sunny days at segment of a circle with $10.12^\circ=120^\circ$
  Show foggy days at segment of circle with $2.12^\circ=24^\circ$
  Show raining days at segment of circle with $15.12^\circ=180^\circ$
  Show snowy days at segment of circle with $3.12^\circ=36^\circ$

Therefore, we draw circle graphics that show weather condition as below (C7, p. 227, statistic and graphics, control):

* Examine the relationship between the terminologies of dividing operation ... (D7, p. 47, rational numbers, mystery)



* Make addition operation below (D7, p. 31, rational numbers, openness):
  (a) $\frac{7}{11}+\frac{6}{11}$ (b) $\frac{17}{20}+\frac{9}{20}$
* In science and astronomy, too big numbers have been shown as multiplying decimal fraction that is characteristic is a one scalar counting number with power of 10 ... (B7, p. 44, rational numbers, progress).
* Make subtraction operation below (B7, p. 33, rational numbers, rationalism)
  (a) $(-\frac{3}{5})-(+\frac{7}{8})$ (b) $(-2\frac{1}{3})-(-4\frac{2}{3})$ ...

3.2. MATHEMATICS EDUCATIONAL VALUES

Mathematics educational values that are conveyed by 6th grade mathematics textbooks are given at Table VIII:

When looking at Table VIII, in teaching sets topic in A6 textbook, we can observe that formalistic view (88) is emphasized more than activist view (23), theoretical value (46) than relevance value (26), instrumental understanding (72) than relational understanding (21), accesssibility value (98) than specialism value (18) and finally evaluation (51) than reasoning value (23). And in the topics of natural numbers, fractions, measurements and ratio and proportion, similiar situation attracts our attention. For the distribution of mathematics educational values within other topics, we can see Table VIII. When looking at A6 textbook in general, it can be said that formalistic view (282) is conveyed is more than activist view (211), theoretical value (623) than relevance value (102), instrumental understanding (486) than relational understanding (143), accesssibility value (546) than specialism value (255) and lastly evaluation (328) than reasoning value (106).

Two examples about formalistic view–activist view values in A6 textbook are given below:

* Fractions; of which denominator cannot be written as 10 or its powers, have period decimal expansion and remainder is different from 0.
  Example: $\frac{4}{10}=0.4$ (A6, p. 118, decimal fractions, formalistic view)

* Stars twinkling at sky are points for us. A pin's tip is a point. A nail's head on which a map hanged is a point. The traces of a piece of chalk on board and traces of a pencil on notebook are points. (A6, p. 146, point, line ..., activist view)

Similarly, in examining B6, C6 and D6 textbooks in general, it has been fixed that formalistic view (228,286,223) is cited is more than activist view (135,150,186), theoretical value (103,632,515) than relevance value (53,105,210), instrumental understanding (85,618,484) than relational understanding (13,101,123), accesssibility value (81,466,318) than specialism value (30,186,62) and lastly evaluation (42, 315, 354) than reasoning value (39,115,129). When considering whole books in general, that similar conclusions got is seen. Total mathematics educational values emphasized in all of the textbooks are:

Formalistic view: 1019 – activist view: 682; theoretical: 1873 – relevance: 470; instrumental understanding: 1673 – relational understanding: 380; accessibility:1411 – specialism: 533; evaluation: 1039 – reasoning: 389.

In fact, these data aren't very surprising. Because in 6th grade textbooks above, it has been fixed that mathematical values; which are far from daily events, has an abstract language and put teacher or textbook instead of student, are dominant. Therefore, it is not surprising that similar mathematical values have been emphasized more in the same textbook while teaching various mathematical topics. Examples from mathematics educational values conveyed by B6, C6 and D6 textbooks are given below:

* In decimal fraction to find out scalar of one number, the number is multiplied by 1/10 if it is at decimal scalar and by 1/100 if it is at percentage scalar. Example: Let's make the solution of 0.3747 decimal fraction ... (C6, p. 159, decimal fractions, formalistic view).
* A bakery sells 4200 loaves of bread in Monday, in Tuesday it sells 857 more loaves of bread than those of Monday and in Wednesday it sells 269 less loaves of bread than that of Tuesday. How many loaves of bread does this bakery sell in three days? (D6, p. 64, natural numbers, relevance).
* Let's divide 348 natural number into 15. From here, we can write the rule below:
  Dividend = divisor $\times$ quotient + remainder (B6, p. 55, natural numbers, activist view).
* Write $B = \{3, 5, 7, 9\}$ set's sub-sets with two elements (B6, p. 16, sets, instrumental understanding).
* Let's pair the elements of $A = \{\Delta, *, O, m, n\}$ set to the elements of counting numbers set one to one.
  $A = \{\Delta, *, O, m, n\}$
  $S = \{1, 2, 3, 4, 5, ...\}$... (B6, p. 11, sets, relational understanding).

Table VIII. Distribution of mathematics educational values for each topic in 6. class textbooks

		Mathematics educational values									
		Complementary value pairs		Complementary value pairs		Complementary value pairs		Complementary value pairs		Complementary value pairs	
Textbook	Topics	Formalistic view	Activist view	Relevance	Theoretical knowledge	Instrumental understanding	Relational understanding	Accessibility	Specialism	Evaluation	Reasoning
A6	Sets	88	23	22	46	72	21	98	18	51	23
	Natural numbers	67	18	14	126	104	12	22	46	32	14
	Prime numbers...	–	47	11	48	20	37	9	47	28	28
	Fractions	51	48	23	107	25	27	76	32	48	30
	Decimal fractions	24	50	9	141	141	12	147	32	75	–
	Point, line,...	7	14	14	1	12	12	6	45	5	1
	Angle, triangle,...	11	–	–	73	16	8	20	3	20	–
	Measurements	30	6	7	52	55	7	8	32	65	9
	Ratio, proportion	4	5	2	29	33	7	60	–	4	1
	Total	282	211	102	623	486	143	546	255	328	106
B6	Sets	93	23	23	40	72	19	95	16	52	25
	Natural numbers	11	23	–	107	76	8	82	26	14	–
	Prime numbers...	8	8	5	19	27	5	18	5	36	28
	Fractions	30	–	2	15	51	3	21	10	14	–
	Decimal fractions	3	41	6	76	76	3	118	–	51	–
	Point, line,...	33	8	7	40	15	38	20	27	9	2
	Angle, triangle,...	5	5	–	10	10	–	39	2	7	–
	Measurements	13	5	1	40	45	7	15	7	41	13
	Ratio, proportion	32	12	9	34	24	11	34	15	38	5
	Total	228	135	53	431	396	94	442	108	262	73

C6	Sets	76	25	15	103	85	13	81	30	42	39
	Natural numbers	63	28	18	67	78	20	62	24	49	34
	Prime numbers...	24	–	14	76	87	8	92	9	44	16
	Fractions	60	23	8	89	81	19	78	19	128	4
	Decimal fractions	13	51	30	189	189	16	57	51	82	–
	Point, line,...	18	17	9	9	7	7	5	5	4	6
	Angle, triangle,...	10	1	–	25	11	6	25	40	11	–
	Measurements	13	5	10	40	45	7	15	7	41	13
	Ratio, proportion	9	–	1	34	35	5	51	1	2	2
	Total	286	150	105	632	618	101	466	186	315	115
D6	Sets	31	88	88	31	54	31	31	31	25	107
	Natural numbers	97	–	13	97	97	–	97	–	97	–
	Prime numbers...	9/	7	11	25	17	5	11	–	25	13
	Fractions	–	32	14	29	48	25	45	12	68	3
	Decimal fractions	2	47	26	61	61	–	19	38	56	–
	Point, line,...	–	4	5	26	10	4	18	8	10	1
	Angle, triangle,...	14	5	–	52	18	3	13	4	4	4
	Measurements	67	–	57	141	141	50	36	–	104	–
	Ratio, proportion	3	3	4	24	38	5	48	–	5	1
	Total	223	186	210	515	484	123	318	62	354	129
General total		1019	682	470	1873	1673	380	1411	533	1039	389

* Draw a quadrilateral and pentagon in your notebooks and name them. And also draw their diagonals. Write the segment lines of newly-formed figures with symbols (D6, p. 196, point, angle,.., evaluation).
* Imagine an apple on a tree as a point and floor as a plane. Express the relation between point and plane when apple is on tree and when apple is on floor (D6, p. 202, point, angle,.., reasoning).
* It is wanted to be made the cubes which has the same dimensions with a tree that is a rectangular prism with the dimensions of 16, 24 and 48 cm. How many cm must a dimension of each cube be? (C6, p. 88, prime numbers ... , specialism).
* Are 6 and 16 numbers prime numbers between each other? (C6, p.85, prime numbers ..., accessibility).

The numbers of mathematics educational values emphasized in 7th grade textbooks are given below at Table IX:

From Table IX, it is possible to see the numbers of mathematics educational values emphasized in each topic within 7th grade textbooks cirruculum. At all of the textbooks examined, it has been seen that formalistic view is emphasized more than activist view, theoretical knowledge than relevance, instrumental understanding than relational understanding, accessibility than specialism and evaluation than reasoning. Total mathematics educational values in all 7th grade textbooks are given below: Formalistic view: 900 – activist view: 330; theoretical: 1380 – relevance: 290; instrumental understanding: 1661 – relational understanding: 415; accessibility: 1060 – specialism: 571; Evaluation: 1242 – Reasoning: 400.

These data convey some similarities with the data about mathematics educational values in 6th grade textbooks cited above. Some of mathematics educational values emphasized in 7th grade textbooks are given below:

* Let's imagine a depositor who desires for building a brick factory at somewhere: before working this depositor must calculate producing bricks more cheaply, making factory work permanently, selling bricks easily, communicational conditions and etc … For this, he thinks about how he can provide the soil in producing bricks. He collects necessary informations by searching the costs of transport, salaries of workmen. He draws a conclusion with expressing these information by numbers. If he can profit according to these conclusions, he decides to build the factory. Statistics means that expressing information (data); which were collected by planned, systematic and careful observations and researches for an aim, by numbers or graphics (C7, p. 221, statistic and graphics, activist view).
* What is mean of 13, 17, 8, 32, 25? (C7, p.235, statistic and graphics, evaluation).

* There is eight cars in a car-race and each of them can go about 360 km during race time.
  (a) If another car; that can go 450 km during race time, enters, what will the mean distance of each car be?
  (b) If one car; that can go with about 290 km during race time, doesn't enter the race, what will the mean distance of each of the remaining cars be? (C7, p. 236, statistic and graphics, reasoning).
* If the length of a circle; that is radius length is r; is $Ç/2r = \pi$, it is given with $Ç = 2\pi r$ relation. Let's find out the length of a circle with 3 cm radius length: $Ç = 2\pi r = 2.3$, 14.3=18.84 cm (A7, p. 175, circle, daire and cylinder, formalistic view).
* Find out the area of a circle with 12 cm radius lengths $r = 12$? (A7, p. 179, circle, daire and cylinder, theoretical knowledge).
* $(+\frac{7}{4}) + (+\frac{1}{3}) = (+\frac{21}{12}) + (+\frac{4}{12}) = +\frac{25}{12}$ (B7, p. 27, rational numbers, instrumental understanding).
* Every integer and natural number is a rational number with denominator 1. Natural number is a sub-set of integer numbers set. And integer numbers set sub-set of rational numbers set. Therefore, $N \subset Z \subset Q$ is correct. (B7, p. 23, rational numbers, relational understanding).
* In $\frac{x}{9} = \frac{4}{3}$ operation, $x =$? (D7, p. 102, ratio, proportion and percent, accessibility).
* a and b are directly proportional. If $b = 20$ when $a = 6$, find out b's value when $a = 15$ (D7, p. 102, ratio, proportion and percent, specialism).

4. Results and Discussion

We reached these findings as a result of the research that investigates whether 6th and 7th grades mathematics textbooks convey mathematics and its educational values in Turkish public primary schools:

* It is fixed that 6th and 7th grade mathematics textbooks emphasize rationalism more than objectism, control than progress and openness more than mystery.
* And also it is fixed that 6th and 7th grade mathematics textbooks emphasize formalistic view more than activist view, theoretical knowledge than relevance, instrumental understanding than relational understanding, accessibility than specialism and evaluation than reasoning among mathematics educational values.

The findings of this research show some similarities and differences with the findings of a research that examines whether Seah and Bishop's (2000) Singapore and Victoria mathematics textbooks convey mathematics and its educational values or not. At the result of Seah and Bishop's (2000) research, objectism, control and mystery mathematical values are emphasized more

Table IX. Distribution of mathematics educational values for each topic in 7. class textbooks

		Mathematics educational values									
		Complementary value pairs		Complementary value pairs		Complementary value pairs		Complementary value pairs		Complementary value pairs	
Textbook	Topics	Formalistic view	Activist view	Relevance	Theoretical knowledge	Instrumental understanding	Relational understanding	Accessibility	Specialism	Evaluation	Reasoning
A7	Integer numbers	64	17	5	120	120	–	31	20	42	–
	Rational numbers	23	2	–	3	67	–	9	1	53	8
	Equations and line graphics	14	4	11	33	30	8	24	15	50	9
	Ratio, proportion and percents	46	10	1	85	128	–	99	29	25	–
	Angles and polygens	43	1	–	43	40	3	37	6	92	7
	Circle and cylinder	17	3	1	51	60	12	56	16	32	18
	Statistic and graphics	10	3	1	8	8	4	7	–	1	–
	Total	217	40	19	343	453	27	263	87	295	42
B7	Integer numbers	11	–	5	84	58	9	80	11	33	42
	Rational numbers	43	14	1	38	45	12	37	7	44	11
	Equations and line graphics	69	35	13	78	81	47	98	19	54	12
	Ratio, proportion and percents	15	35	5	18	30	48	60	–	55	–
	Angles and polygens	31	–	–	106	84	23	42	59	33	15
	Circle and cylinder	13	9	7	16	13	8	13	10	11	6
	Statistic and graphics	34	4	6	26	29	9	9	7	14	4
	Total	247	97	37	366	340	156	339	113	244	90

C7	Integer numbers	32	30	11	110	110	–	32	45	79	–
	Rational numbers	50	36	10	20	97	12	83	11	174	11
	Equations and line graphics	40	11	5	37	35	3	19	–	68	15
	Ratio, proportion and percents	25	16	35	27	29	45	76	18	25	16
	Angles and polygens	41	–	1	129	129	23	36	67	31	42
	Circle and cylinder	17	8	2	21	21	7	14	10	22	33
	Statistic and graphics	6	1	3	13	11	29	23	3	11	17
	Total	211	102	55	357	432	119	283	154	410	122
D7	Integer numbers	40	–	29	52	110	23	32	25	28	26
	Rational numbers	35	43	54	54	50	24	33	20	63	37
	Equations and line graphics	82	21	19	90	66	26	55	48	50	36
	Ratio, proportion and percents	27	16	42	22	78	26	30	36	34	26
	Angles and polygens	12	6	1	19	28	9	15	18	55	15
	Circle and cylinder	16	5	9	70	69	–	5	70	44	3
	Statistic and graphics	10	–	25	7	35	5	5	–	19	3
	Total	225	91	179	314	436	113	175	217	293	146
	General total	900	330	290	1380	1661	415	1060	571	1242	400

than rationalism, progress and opennes in both Singapore and Victoria mathematics textbooks, while this research, which was done on 6th and 7th grade mathematics textbooks in Turkey, rationalism, control and openness mathematical values are emphasized more than objectism, progress and mystery mathematical values mutually. It has been also seen that there are huge similarities between these two researches. According to the research of Seah and Bishop, formalistic view, theoretical knowledge, instrumental understanding, specialism, and evaluating with larger emphases than their respective complementary values. In present research, it is just seen that accessibility value is emphasized more than specialism value as a difference.

It has been fixed that mathematics textbooks; which were examined within the scope of this research, are generally far from students' needs, are isolated from real world, and written in abstract and academical style. And also, it has been fixed that textbooks are prepared with the style in which students can only perceive the relations between concepts better. Hiebert and Carpenter (1992) have been also emphasized the importance of this issue by saying;

> Starting from the premise that the development of understanding should be basic goal of mathematics instruction, an obvious implication of our characterizasyon of understanding is that instruction should be designed so that students build connections. How should instruction be designed to accomplish this goal? It seems evident that procedures and concepts should not be taught as isolated bits of information, but it is less clear what connections are most important or what kind of instruction is most effective for promoting these connections ... (p. 81).

Meanwhile, it has been determined that mathematics textbooks, especially while examining evaluation–reasoning pair, contain topic-explanations, examples with solutions and exercises and questions similar to them rather than problems and questions that lead students to think and investigate. In such a situation, it becomes harder that students apply and convey the abilities gained during topic explanations into different environments. In the light of these results, the following can be suggested:

* Writing mathematics textbooks with activist view rather than formalistic view can increase students' participation to lessons.
* Preparing mathematics textbooks as an indicator of the relationships among mathematical concepts can help students to learn mathematics by comprehension.
* In mathematics textbooks, preparing questions and problems at the end of topic; in a way that can encourage students to think and investigate and communicate with real world and expose mathematics relationships with other fields, can establish a basis for students to love mathematics and to study on it.

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