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## Difficulties Encountered by High School Students in Mathematics

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**Abstract:** The aim of this study is to identify whether high school students encounter any difficulties in mathematics and reveal the reasons for such difficulties. The participants of the study, which was a descriptive case study based on qualitative understanding, were a total of 164 students, including 85 students from Anatolian High Schools and 79 students from Science High Schools. Approximately 11% of the participants said they had no difficulties in math, whereas 99% of the students from Anatolian High Schools and 78% of the students from Science High Schools said they had difficulties in mathematic. Their thoughts about the reasons for such difficulties were analyzed by content analysis method considering the type of high school they attended. The findings obtained revealed that the difficulties encountered by the participants in mathematics were teacher-, content- and student-based. Anatolian High School students stated that they intensely faced teacher-based difficulties, whereas Science High School students stated that they faced content-based difficulties. It's expected that the results of this study may contribute to studies to be conducted to increase student success in mathematics education and provide ideas for further studies.

**Keywords:** *Mathematics lesson, difficulties in mathematics, high school student, type of high school.*

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### Introduction

Mathematics has had a critical importance in the scientific and technological development of today's world, but throughout the development process of humanity. For the solution of new problems caused by changes in our lives, there is a greater need more than ever for individuals who value mathematics, who have developed mathematical thinking skills, and who can use mathematics in modeling and problem solving (Ministry of National Education [MoNE], 2018a). With mathematics education, people are growing up as individuals with a high level mental skills, such as logical thinking, creative thinking, problem solving and decision making, can contribute significantly to individual and social development (Krueger & Lindahl, 2001). At this point, the importance of mathematics and certainly of mathematics lessons comes out.

Based on the importance of mathematics, countries compare their students' mathematics achievement and the level of their mathematics education with those of other nations and try to decide what kind of innovations should be done. For this, some international and national evaluations that measure students' mathematics achievements are made. For example, the results of international studies, including Trends in Mathematics and Science Study (TIMSS) and Programme for International Student Assessment (PISA), show that Turkish students' success in mathematics is lower than the average of Organization for Economic Co-operation and Development (OECD) (Beaton et al., 1996; Guzel & Berberoglu, 2010; Mullins et al., 2016; OECD, 2016). In Monitoring and Evaluation of Academic Knowledge study on Turkish eight grade students, about one sixth of them showed a performance below the level of basic mathematics skills (MoNE, 2018b).

In addition, after high school, students need to get a good result in the university entrance exams in order to reach the university education they want. Mathematics is used as a screening tool in such exams conducted in many countries (Martin et al., 2010). This situation increases the importance of mathematics education students receive at high school and before (Beaton et al., 1996). However, in view of the results of university entrance examination, mathematics

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achievement is not at the desired level. The first stage of the two-stage exam is the Basic Proficiency Test that all candidates have to take. There are 40 mathematics questions in that exam. The net average score from mathematics test of approximately two million three hundred thousand candidates who took the exam in 2020 was 5.556. The Field Proficiency Test, which is the second stage, also contains 40 mathematics questions. The net average score from the mathematics test of approximately one million six hundred seventy thousand candidates who took the exam in 2020 was 7.584 (MoNE, 2020). These results indicate that there are some problems in mathematics education.

Mathematics curriculum is prepared by the Ministry of National Education in Turkey. The Ministry of National Education makes arrangements and updates in mathematics curriculum at all levels in the light of developed countries' mathematics curricula and experiences with mathematics education in Turkey (MoNE, 2018a). Currently, two different high school mathematics curricula are in use in Turkey. One is the mathematics curriculum with 216 lesson hours per annum in use at all levels in Science High Schools. Mathematics curriculum for 9th and 10th grades in other high schools, including Anatolian High Schools, is the same as the mathematics curriculum in Science High Schools. 11th and 12th graders can choose one from two different mathematics curricula. One of these is the mathematics curriculum with 216 lesson hours in use at all levels in Science High Schools. The other is the mathematics curriculum with 72 lesson hours per annum prepared for students who don't plan to receive a math-based education in future (MoNE, 2018a).

Current mathematics curriculum is intended to not only improve the students' knowledge of mathematical concepts and operations but also impart skills such as problem solving, reasoning and association to the students (MoNE, 2018a). The Ministry of National Education is responsible for preparing mathematics textbooks according to the curriculum, printing of such textbooks, and distributing them to students free of charge.

Teaching contents of a curriculum to students includes two stages: the first involves creation of textbooks in accordance with the curriculum. The second stage involves conveying of the lesson by a mathematics teacher to students in accordance with the mathematics curriculum (Ozer & Sezer, 2014). In addition to this, a mathematics teacher is expected to support students academically and emotionally, arouse their interest in mathematics and positively improve their attitude to mathematics (Leon et al., 2018; Opdenakker & Van Damme, 2006; Yu & Singh, 2018). It is known that a mathematics teacher's having good classroom management helps students to pay attention to a math lesson (Wilson et al., 2005). It is also noteworthy that the person who still mainly speaks and is more active in mathematics lessons is the mathematics teacher (Hiebert et al., 2003).

Naturally, the student factor cannot be ignored in the success of an educational activity. Students' own academic self-perceptions, attitudes towards mathematics lesson, math anxiety and whether they have future plans affect their academic performance (Bonne & Johnston, 2016; Kalaycioglu, 2015). It is known that the student's positive academic perception and seeing himself / herself as a good student in mathematics lesson have a positive effect on his/her academic success (Chiu & Xihau, 2008; Dweck, 2000; Ramdass & Zimmerman, 2008).

Apart from the studies that investigated the factors affecting students' success in mathematics lesson, it was also investigated why students do not want to take mathematics lessons and avoid this course unless it is compulsory (Brown et al., 2008; Murray, 2011; Nardi & Steward, 2003). In an Australian study investigating the reasons why students of ages 15-17 did not enroll in a mathematics course other than compulsory high school courses. Students' reasons for declining participation included: mathematics is boring, difficult, not useful, and not well taught (Murray, 2011). British high school students who did not want to take a mathematics course described the mathematics as unnecessary for their future careers, at which they're unlikely to be successful (Brown et al., 2008).

Another British study conducted with 9th graders investigated why students avoid mathematics. When participants' responses in that study were turned into themes, mathematics was described as T. I. R. E. D, which is an abbreviation for Tedium, Isolation, Rote learning, Elitism and Depersonalisation (Nardi & Steward, 2003).

In a study investigating why Turkish secondary school students have difficulty in mathematics, the respondents stated that their mathematics teacher did not teach effectively, use necessary methods and techniques and raise their interest in mathematics. They added that they did not study enough, their basic knowledge about mathematics was limited and they had difficulties because they did not understand the subjects (Yayla & Bangir-Alpan, 2019). In another study, seventh graders saw mathematics as a difficult and boring subject and said mathematics teachers could improve the way they teach lessons and their behaviors towards their students (Memnun & Akkaya, 2010).

Based on the literature review, it is seen that the studies that deal with the problems faced in mathematics by students especially in high school are quite limited. Therefore, the study aimed to reveal the opinions of high school students about whether they encounter difficulties in mathematics and determine the reasons for such difficulties, if they have any.

## Method

### *Research Method*

This study was a case study based on qualitative understanding aiming to identify the difficulties encountered in mathematics by students from Anatolian and Science High Schools and their opinions about the reasons for such difficulties. A case study is a research method that the researcher can use when searching for an answer to a descriptive question (Gay et al., 2009). Bryman (2008) describes a basic case study as a detailed and intense analysis of a certain subject, whereas Miles and Huberman (1994) describe it as an examination of a phenomenon that has taken place in a certain context. This study aimed to describe the difficulties faced by students in mathematics lesson, if any, and their opinions about the reasons for such difficulties, while depicting whether there are differences in their thoughts with respect to the type of high school they attend.

### *Participants*

The participants were students from Anatolian and Science High Schools in a province in the Aegean region. The high schools were selected from various social and economic regions to increase diversity. The study participants were 164 students, including 85 students (51.8%) from Anatolian High Schools and 79 students (48.2%) from Science High Schools. 83 participants (50.6%) were female and 81 participants (49.4%) were male students. The mothers of seventeen (10.4%) and the fathers of twenty-six (15.9%) of the participants are university graduates. Only fifteen students' both parents have university degrees.

According to the high school mathematics curriculum, the students in Anatolian High Schools can continue to receive the mathematics curriculum of Science High Schools after 10th grade if they want to. Students who wish to receive social science-based education can choose basic level mathematics curriculum at 11th and 12th grades. This manifests itself at the grade levels of the students participating in the study. While 48 students from 9th and 10th grades each volunteered to participate in the study, there were 37 participants from 11th grade and only 31 participants from 12th grade.

### *Data Collection Tool*

The researcher used a data collection tool developed by himself to collect data of the study. This tool consists of two parts. The first part aimed to establish demographic data of the students by asking students questions about their sex, type of high school they attend, their grade level, and educational levels of their parents. The second part consisted of open-ended questions intended to find out the difficulties encountered by the participants in mathematics and their opinions about such difficulties. With the open-ended questions, it was aimed to enable the participants to express their thoughts freely (Creswell, 2007). A data collection tool was drafted and two experts of mathematics education were asked to provide their opinions. The data collection tool, developed using the experts' opinions, was applied on 21 students in a high school other than the high schools selected for the study. As a result of the pilot study, it was seen that the students perceived the demographic questions and the open-ended question in the data collection tool in accordance with their purpose. As a result of the expert opinions and the pilot study, it was decided that the final version of the open-ended question would be "Please write down any difficulties you've encountered in mathematics and your opinions about the reasons for such difficulties."

### *Data Collection*

The research data were collected in the fall term of the academic year 2018 -2019. Data collection procedure was applied during students' elective courses. In each classroom where the data collection tool was applied, students were briefed about the study and it was explained that participation was on a voluntary basis and that the students who did not want to participate in the study did not have to answer the distributed forms. Participants were reminded not to write any personal information such as name or student number on the data collection tool. Finally, it was stated that all the data kept confidential and the researcher would use the study results for scientific work.

### *Data Analysis*

Data collection tools answered by 185 high school students who volunteered to participate in the study were checked by the researcher, and 14 forms with incomplete personal details were first separated from the data set. Then, the answers to the open-ended question in the collected data were examined. During this reading, four forms with open-ended questions left blank and three forms that did not contain an answer related to the question were eliminated. As a result, a total of 164 data collection tools were first numbered from 1 to 164 and demographic data were transferred to the SPSS program. Descriptive statistical analyses were carried out on the demographic data.

Content analysis method was employed to analyze data during the analysis of the open-ended question. The data obtained in the content analysis were categorized to reach sub-themes and themes. During the creation of conceptual categories, first of all, the researcher and an expert experienced in qualitative research prepared a draft about the

conceptual categories by reading the answers to the open-ended question in the data set. Then, by working on both drafts, a consensus was reached on conceptual categories.

Based on the data obtained as a result of the co-work of the expert and the researcher, the themes were named as (1) teacher-based, (2) content-based, and (3) student-based difficulties. The theme of teacher-based-difficulties consisted of the following sub-themes: s/he aims to complete the subject, s/he has rote-learning based educational approach, s/he makes it difficult to learn, his/her classroom management is poor, s/he does not use different methods. The theme of content-based-difficulties consisted of the following sub-themes: too many rules and formulas, requiring memorizing, detailed subjects, a high number of subjects and the level of subjects are above the level of students' knowledge. The theme of student-based- difficulties consisted of the following sub-themes: I don't have enough time for review, I don't like math, my previous knowledge is incomplete, I don't study regularly and I don't believe I will succeed.

#### *Validity and Reliability*

After reaching an agreement on the conceptual categories, the researcher and the expert individually matched the responses in data collection tools with conceptual categories and compared the results. As a result of the first comparison, it was seen that 14 answers were coded in different categories. As a result of re-examining the different results, it was seen that the sentences of these participants were written so that they could be evaluated in more than one category, and a consensus was reached on 9 answers. Since no consensus was reached on 5 answers which were evaluated differently, the reliability coefficient, which was calculated according to Miles and Huberman's (1994) formula " $\text{reliability} = \{\text{number of agreements} / (\text{total number of agreements} + \text{disagreements})\}$ ", was 96.57%.

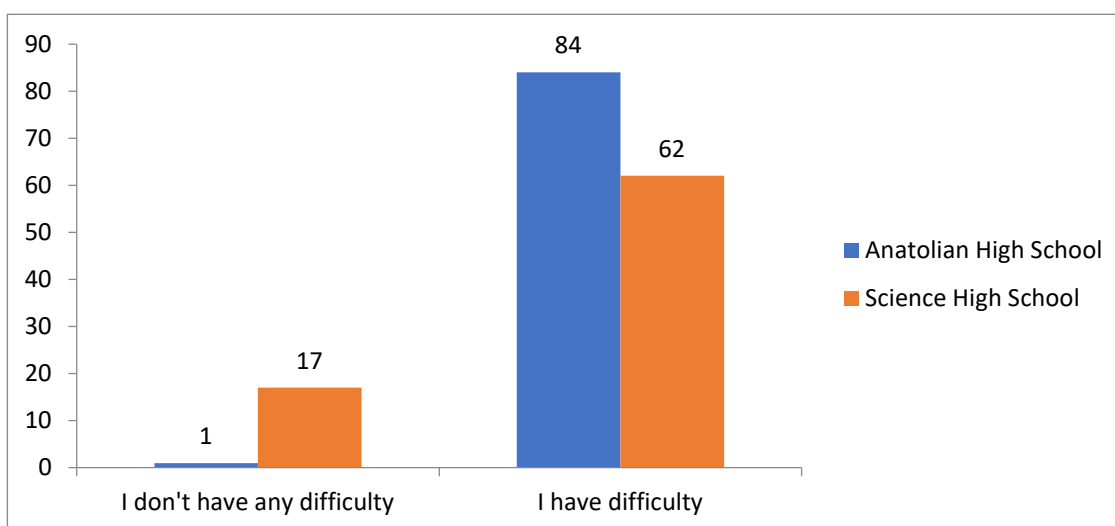
The examples that are thought to represent best each conceptual category obtained as a result of the study are given in the findings section without changing the statements of the students. Thus, the study results' validity was supported by the students' answers in the data collection tool.

#### *Presentation of Data*

For the answers allocated to the respective conceptual categories, frequency tables were made according to the types of high schools attended by the students. Examples of pieces of writing of the students from each conceptual categories were provided by indicating the order number allocated to the data collection tool, the type of high school (A for Anatolian High School, S for Science High School) and gender (F for female, M for male) of the respective student.

### **Findings**

In the study, first, the high school students' opinions about whether they have any difficulties in mathematics were revealed. The data from the participants' opinions were analyzed, and the results are present in Figure 1 below.



*Figure 1. Statistics about the high school students' opinions about whether they have any difficulties in math*

As can be seen from Figure 1, a high number of participants expressed having difficulties in mathematics. A total of 146 participants (89.02%), including 84 (98.82%) Anatolian High School students and 62 (78.48%) Science High School students, expressed having difficulties in mathematics. The number of students who stated that they have no difficulty was 18 (10.98%).

Based on the participants' opinions stating that they have difficulty in mathematics, the reasons for such difficulties were investigated. The three main themes that emerged are; (1) teacher-based, (2) content-based, and (3) student-based difficulties. The distribution of these themes according to the type of high school the students attend is presented in Figure 2.

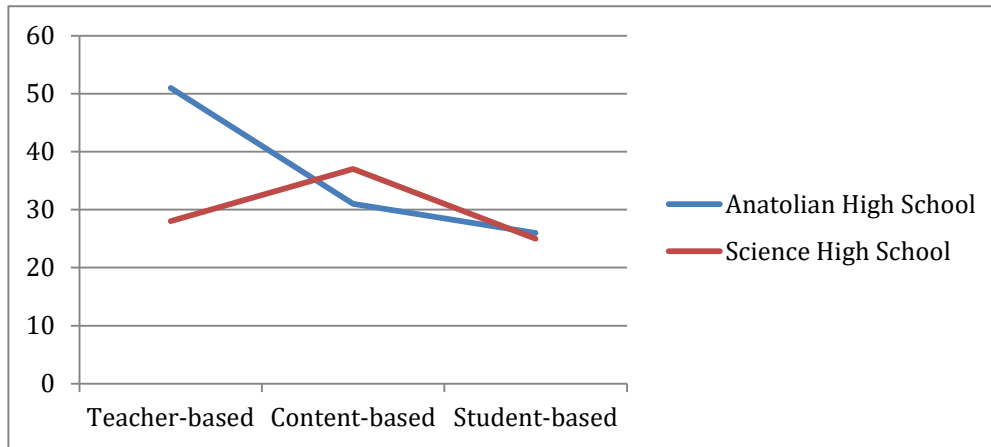


Figure 2. Distribution of the main themes according to the types of high school the participants attend.

When Figure 2 is examined, it is seen that the difficulties faced by the students studying at the Science High School are mostly due to the content-based, while the students studying at the Anatolian High School due to the teacher-based.

The frequencies of the resulting themes and sub-themes based on high school type are presented in Table 1.

Table 1. Distribution of Themes and Sub-themes about the Reasons for the Difficulties Encountered by the Participants in Math by Type of High School

Themes/Sub-themes	Anatolian High School		Science High School		Total	
	f	%	f	%	f	%
<b>Teacher-based- difficulties</b>						
S/he aims to complete the subject	19	17.59	6	6.67	25	12.62
S/he has rote-learning based educational approach	12	11.11	7	7.78	19	9.60
S/he makes it difficult to learn	7	6.48	10	11.11	17	8.59
His/her classroom management is poor	7	6.48	4	4.44	11	5.56
S/he does not use different methods.	6	5.56	1	1.11	7	3.53
<b>Sub total</b>	<b>51</b>	<b>47.22</b>	<b>28</b>	<b>31.11</b>	<b>79</b>	<b>39.90</b>
<b>Content-based-difficulties</b>						
Too many rules and formulas	19	17.59	16	17.78	35	17.68
Detailed subjects	6	5.56	12	13.33	18	9.09
A high number of subjects	4	3.70	6	6.67	10	5.05
The levels of subjects are above the level of students' knowledge	2	1.85	3	3.33	5	2.52
<b>Sub total</b>	<b>31</b>	<b>28.70</b>	<b>37</b>	<b>41.11</b>	<b>34</b>	<b>34.34</b>
<b>Student-based-difficulties</b>						
Doesn't have enough time for review	7	6.48	19	21.11	26	13.13
Doesn't like math	8	7.42	4	4.44	12	6.06
Previous knowledge is incomplete	7	6.48	2	2.22	9	4.55
Doesn't study regularly	2	1.85	-	-	2	1.01
Doesn't believe s/he will succeed	2	1.85	-	-	2	1.01
<b>Sub total</b>	<b>26</b>	<b>24.08</b>	<b>25</b>	<b>27.78</b>	<b>51</b>	<b>25.76</b>
<b>TOTAL</b>	<b>108</b>	<b>54.55</b>	<b>90</b>	<b>45.45</b>	<b>198</b>	<b>100.00</b>

In view of Table 1, it's clear that the difficulties encountered by the participants in mathematics are primarily teacher-based (39.90%), followed by content-based (34.34%) and student-based (25.76%) difficulties. However, Anatolian High School students stated that the difficulties they encounter in mathematics are primarily teacher-based (47.22%), whereas Science High School students emphasized that the difficulties are content-based (41.11%). Student-based-difficulties ranked last by the students from both high schools.

When the sub-themes are listed according to the response frequencies of Anatolian and Science High School students; the answers of Anatolian High School students; "S/he aims to complete the subject", "Too many rules and formulas" and "S/he has rote-learning based educational approach" are in the top three. On the other hand, according to the answers of the Science High School students; "Doesn't have enough time for review", "Too many rules and formulas" and "S/he makes it difficult to learn" sub-themes take the first three places.

"Doesn't have enough time for review" sub-theme according to Science High School students' answers and "S/he aims to complete the subject" and "Too many rules and formulas" sub-themes according to Anatolian High School students' answers are the sub-themes with the highest frequency of 19 each.

The resulting sub-themes are individually addressed and examined below.

#### *Teacher-based-difficulties*

The participants indicated that one of the reasons for difficulties they encounter in mathematics is *teacher-based-difficulties*. This theme consisted of five different sub-themes.

The first sub-theme was referred to as "S/he aims to complete the subject". In this sub-theme, the participants stated that the purpose of their teacher is to complete the subject quickly, rather than providing guidance to them. This was one of the reasons for the difficulties encountered by them in mathematics. A participant (11, A, F) said on this subject *"It's because of our Math teacher. She asks the question and answers it herself. All she wants is to complete the subject quickly. Math is not a course I can learn on my own so when you have no teacher to help you, it gets very difficult to learn."*, and saw her teacher as the reason for the difficulty faced by her, emphasizing that her teacher, who aims to complete the subject quickly, does not provide guidance either. Similarly, another participant (100, S, F) said *"The teacher rushes teaching the subjects unnecessarily, and she goes on to teach a new subject before we fully learn previous subjects. I don't understand if completing the subjects is the only problem."*, and ascribed the difficulty faced by her to the fact that the teacher focuses on completing the subjects, rather than making sure they learn. Another participant (26, A, F) said *"Our teacher rushes teaching to be able to complete the subjects. This is too bad for me. Because if I don't understand [the solution of] that question, I cannot understand any other question related to that subject."*, indicating that the teacher's anxiety about completing the subjects makes it difficult for her to learn.

Another sub-theme was referred to as "S/he has rote-learning based educational approach". In this sub-theme, the students indicated that their teachers asked them to memorize the formulas and this had negative effects on their learning of mathematics. On this subject, a participant (36, A, F) said *"While solving math questions, our teacher wants us to know, actually memorize the formulas to be able to solve the questions. So when that happens, we cannot learn fully and we do something by memorizing something. I think it'd be much more logical if the teacher teaches us the logic of the rules instead. Hence, we can be a society that thinks and draws up conclusions, rather than a memorizing society"*, while another participant (127, S, M) similarly said *"If our teacher provides us with an education that will prove to be useful in our lives instead of a rote-learning based math education, math can be more interesting and useful. It's more logical to learn math by experiencing rather than by memorizing"*, by which words he emphasizes the difficulty faced by them and expresses his suggestions for solution.

The third sub-theme was referred to as "S/he makes it difficult to learn mathematics." Because of unclear and confusing delivery of mathematics lesson, students see their teacher as someone who hinders their learning and makes learning difficult for them, let alone being an effective instructor. A participant (56, A, M) said *"I think that there's nothing that cannot be learned in mathematics but teachers make it difficult to learn"*, expressing that the teacher makes it difficult for them to learn, and another participant (103, S, F) expressed the problem causing the difficulty by saying *"I think my problem is that I keep on trying to quickly note down what the teacher has written on the board and try to learn them at the same time. It's not possible to learn mathematics in this way."* Another participant's (111, S, F) words were also quite striking *"You need a good teacher to learn math. If you have one, you'll have no difficulty. But it's a great chance to have a good math teacher. I am one of those who are not that lucky."*

Another sub-theme was "His/her classroom management is poor". In this sub-theme, the students indicated that their teacher's pedagogical knowledge and skills about classroom management are unsatisfactory, which made it difficult for them to learn. On this subject, examples of students' statements were as follows: The participant (1, A, F) said *"There is too much noise in the classroom during a mathematics class. This is not because of the students, the teacher cannot make the students listen to her"*, and another participant (50, A, M) said *"The class is always out of control due to boring and unskilled teachers. I naturally have difficulty in learning."*

The final sub-theme in this theme is the emphasis on difficulties arising from the teachers' failure to use different methods. Examples of the participants' thoughts on this subject include the following: *"The teacher always teaches in a monotonous way using the same book. If we have a lesson with more activities, no one would get bored and there would be no more difficulty in learning"* (156, S, M); *"I think that teachers should develop teaching methods and create activities that will draw the attention of students and make the lesson appealing to students"* (57, A, M); *"I have no problem except teachers who don't know how to teach."* (109, S, F).

### Content-based-difficulties

Another reason for difficulties encountered by the participants in mathematics was *content-based-difficulties*. In this theme, the reasons for difficulties in mathematics indicated by the participants included too many rules and formulas, detailed subjects, a high number of subjects and the levels of subjects above the level of students' knowledge.

The participants stated that they have difficulty in mathematics because mathematics contains too many rules and formulas and that these should be memorized. As an example to this, a participant (68, A, M) said " *There're too many formulas, I cannot keep them in mind*", while another (69, A, M) said " *How can I memorize them all when there are so many rules and so many formulas. It's impossible to learn math*", expressing his despair with these words. Another participant (34, A, F) emphasized the problem of memorizing and effectively expressed her wish for solution of the matter, saying " *Mathematics is not a difficult course, but I do not prefer and do not want to memorize the formulas taught to us and solve the questions. I would like to learn the reasons for the formulas, where they came from, from what perspective or with what kind of idea the person who first found that formula developed it. Even if I understand the origin of some of the formulas, I'm not a genius and I cannot understand all of them on my own. Mathematics is unfortunately taught based on rote-learning and I don't want to learn like that.*"

The participants said that the mathematics subjects are detailed too much and that such detail is unnecessary, which makes learning difficult, as in the following example quotes: " *In the mathematics lesson, we are given many detailed topics that we will probably never use again in our lives. This makes it difficult for me to learn, it literally hurts me.*" (139, S, M), " *The subjects are overly detailed, we are trying to learn much more than what is really useful for us just to be able to go to university, and I hate being forced to do things.*" (4, A, F). They also indicated the high number of mathematics subjects as a reason for difficulties in learning mathematics, saying " *There are too many math subjects. It is impossible to understand, learn and apply all of them in a short time*" (29, A, F) and " *There are so many subject that I can't keep up.*" (30, A, F).

The participants were also of the opinion that mathematics subjects' levels are above the level of their mathematics knowledge. On this subject, a participant (54, A, M) said " *I think we are taught math subjects that are too detailed for our age. I think this is the biggest difficulty.*", whereas another said (9, A, F) " *I think there are subjects the level of which is not appropriate to our age and which are difficult to perceive, so that's why we have difficulties.*"

### Student-based- difficulties

The final reason for difficulties faced by the participants in mathematics was *student-based- difficulties*. In this theme, the participants were of the opinion that mathematics requires review the subjects regularly and they don't have enough time for review. On this matter, one participant (91, S, F) said " *We just can't say I've learned math right away and be done with it. It is necessary to digest it, reflect and make an effort on it. To do that, you need to spare time. However, we students are dealing with many other subjects like math. That's why I can't find enough time for math.*", while another (41, A, F) similarly stated " *Math is a very demanding course and it is difficult to meet such demand with my social life. There are a lot of other lessons. I get confused about which one to study by sparing time to it.*"

The participants also said " *I don't like math. I never thought I would be successful in math*" (3, A, F) and " *I don't like math. That's why lessons sound like torture.*" (62, A, M), which reveals that their dislike of mathematics is another reason making it difficult for them to learn mathematics.

Students' readiness to learn is important in the learning process. Problems in pre-learning prevent new learning. This situation emerges in the current study as another reason why students have difficulty in mathematics. The exemplary opinions of the participants regarding the subject are as follows: " *I am the one with the problem. My background knowledge is so poor that I just don't understand.*" (15, A, F) and " *I have many deficiencies in previous math courses, including those in secondary school. I don't have enough time to complete them.*" (75, A, M).

It is a fact that students who have the habit of studying regularly will be successful in the learning process (Kamoru & Ramon, 2017). However, the participants expressed not having the habit of studying regularly as a reason for having difficulties. Regarding this situation, the words of a participant who said (43, A, F) the following can be given as an example: " *The problem I am facing is entirely because of me. I'm struggling because I don't study enough. I know I have to study regularly.*"

Another difficulty faced by the participants is that they do not believe they will succeed. About this, one of the participants (20, A, F) wrote, " *I can not imagine that I will be successful in math. Sometimes I do not even understand what I do not understand. Given our education system, mathematics is a must. This makes me nervous as well as anxious about my future.*", which are quite striking.

## Discussion

The results of the study showed that approximately 20% of the Science High School students stated not having any difficulty in mathematics, whereas almost all Anatolian High School students stated having some difficulty in mathematics. The number of students who stated that they have no difficulty was 18. Thirteen out of 18 students had

both parents who were university graduates and others have one parent with university degree. Rusli found (2017) that parents' education level had positive impact on Turkish students' mathematics achievement. Chiu and Xihau's study (2008) also agree with this finding, which they reported that parents' educational level and the support given by them to their child have positive effects on that student's success in mathematics. It is also known that students at Science High School, which accept students with a national exam, are generally more successful in mathematics than Anatolian High School students.

When the subjects indicated by the students as the difficulties faced by them in mathematics are divided into themes, the problems arising from teachers ranked first (39.90%). Difficulties arising from teachers bring forth teacher's aim to complete the subjects rather than provide guidance to students on learning and his/her teaching math according to a rote-learning based education approach. A typical mathematics lesson involves the following: The teacher briefly describes the new subject to his/her students and solves examples related to that subject and gives homework to his students in which they have to solve similar questions (Stipek et al., 2001), which is a teacher-centered education approach.

Teacher's rote-learning based mathematics education approach is also a result reported by Nardi and Steward's (2003) study. According to the findings of Delil and Ozcan (2019), 49.64% of the mathematics exam questions prepared by teachers of eighth grade were knowledge cognitive level of the TIMSS classification. This can be considered as a result of mathematics teachers' rote-learning based education approach.

Other sub-themes included the fact that the mathematics teacher makes it difficult for students to learn mathematics, poor classroom management and the teacher's failure to use different methods. In agreement with the results of previous literature, these results of the present study indicated that teachers do not teach the lesson in an effective way, do not use appropriate methods and techniques and do not make effort to make mathematics appealing to students (Memnun & Akkaya, 2010; Murray, 2011; Yayla & Bangir-Alpan, 2019). Yackel and Rasmussen (2002) states that if a student does not like the teaching of his/her teacher or perceives his/her teacher academically inadequate, s/he gives up trying to learn the subject. Also, in the current study, some of the participants stated that their mathematics teacher cannot manage the class well and indicated this as a factor that makes it difficult for them to learn mathematics, which is in agreement with the results of Patrick et al. study (2007).

Content-based-difficulties (34.34%), which were indicated as a difficulties encountered in mathematics, ranked second. Sub-themes related to this theme included too many rules and formulas, detailed subjects, a high number of subjects and the level of subjects are above the level of students' knowledge. Similarly, it was reported in the literature that students are of the opinion that there're lots of rules and formulas in mathematics (Yayla & Bangir-Alpan, 2019) and the subjects are difficult and confusing (Memnun & Akkaya, 2010, Murray, 2011). The fact that mathematical concepts are generally abstract. Abstract concepts are more difficult to understand than concrete ones (Borghi et al., 2017). The examples that the mathematics teacher gives to students while explaining abstract concepts are not fully compatible with the subject can cause students not to understand the concepts properly (Lakoff & Nunez, 2000; Willingham, 2010). According to Kloosterman (1996), if a student perceives mathematics as a lesson consisting of only formulas and rules, s/he may choose to memorize the rules. Indeed, some of the participants in this study had a similar perception.

The theme that ranked third was student-based-difficulties with 25.76%. Dagdelen and Unal report (2017) that secondary school students primarily blame themselves for the problem but expect the solution to come from their mathematics teacher.

Among the student-based-difficulties, the students were found to indicate that they don't have enough time to study mathematics, they don't like mathematics and their background knowledge of mathematics is deficient. In a study conducted with mathematics teachers, teachers indicated that the main factor in students' failure in mathematics is that students do not devote enough time to mathematics and do not study regularly (Jameel & Ali, 2016).

In the current study, there were participants who stated not liking mathematics, which is in agreement with international results (Hernandez-Martines & Pampaka, 2017; Murray, 2011). Students with negative attitude towards mathematics who do not like mathematics are known to avoid studying this course (Al Mutawah, 2015). Other than this, students who come to high school with a low level of mathematical knowledge have difficulty in mathematics lessons and fail (Papanastasiou, 2002; Wang & Goldschmidt, 2003). Tabak reports (2019) that most of secondary school students do not know the order of arithmetic operations and perform all calculations from left to right without paying attention to the order of operation.

Students who do not spare enough time to mathematics and whose pre-learning is lacking simply memorize the formulas / rules to use according to the question types without knowing where the formulas given during the math lesson come from or why they are used, which is not a real and permanent learning (Kranendonk, 2010).

### Conclusion

Although mathematics education is very important in shaping of a person's future, when the difficulties faced by high school students in mathematics were examined, it was found that the participants think necessary care is not devoted



to mathematics teaching in Turkey. The number of students who think that mathematics teachers aim to complete the curriculum on time rather than teach mathematics was significantly high. Particularly the students have difficulties in terms of high school mathematics teachers' teaching. They indicated that their mathematics teachers do not promote interest or positive attitude toward mathematics.

The participants thought that mathematics lessons contain too many subjects, rules and formulas, however, they also expressed that they did not regularly review and devote adequate time to mathematics.

These findings also suggest that there is a common perception among students that mathematics lessons are mostly lessons where rules and formulas are taught to solve certain types of questions. This does not conform to the purposes of mathematics curriculum prepared by the Ministry of National Education.

### Suggestions

In the current study, some students ascribed the difficulties they had in mathematics to their teachers. Mathematics teachers can be supported by in-service training and provided with means to improve classroom management, teaching methods, and similar subjects. Such trainings may also include activities which can be implemented to enhance the students' attitudes towards mathematics positively. Apart from this, it will be useful to reflect on what needs to be done to train prospective teachers who are educated in mathematics teaching programs as people who like mathematics and teaching mathematics.

In order to remedy the discrepancies in the learning of topics, the schools should run supplementary help sessions throughout the school year and during the summer. If a teacher thinks that a student is not up to par on a topic being covered in class, that student should immediately be given extra help along with regular classes to ensure that the topic is learned in a timely fashion. Thus snowballing of the gaps in a student's background could be avoided. As a student's mathematical knowledge becomes compatible with his/her grade level academic self-concept and attitude towards mathematics would increase.

Based on high school mathematics teachers' thoughts, a study can be conducted on the difficulties students face in mathematics. Thus, the differences between the opinions of teachers and students on this subject can be investigated. Another study could be done by using mathematics classroom videos about selected mathematics topics, to research mathematics teaching process in Turkey.

Furthermore, by conducting projects with the support of the Ministry of National Education to investigate how to better teach various mathematical subjects to students, it can be determined which methods and examples motivate students to learn mathematics and help them better learn subjects, and implementation of such methods and examples in schools can be facilitated.

### Limitations

This study was limited to students from Anatolian and Science High Schools selected in a province in the Aegean region. There, it cannot be claimed that the results of the study represent the opinions of high school students across Turkey.

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