European Journal of Educational Research
Volume 8, Issue 1, 337 - 348.
ISSN: 2165-8714
http://www.eu-jer.com/

Investigation of the 5th Grade Students' Engagements in Mathematics Course towards Student Opinions

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Received: November 30, 2018 ▪ Revised: December 28, 2018 ▪ Accepted: January 12, 2019

Abstract: The research was conducted to determine the opinions of students (10-11 years) on their engagement to mathematics course. These students are 5th grade students at a secondary school in Turkey. Qualitative research method was used in the research. At the study, designed as case study, a total of seven secondary school students were participated the research. The study group was constituted with "snowball sampling" technique of purposeful sampling methods. The data was collected by a semi-structured interview form. Sixteen-page interviews obtained from the interviews were transferred to the computer. Data analysis was performed in content analysis. Codes were listed as a result of analysis. Common themes were constituted from the codes. As a result of the research, three themes, (cognitive, social and emotional engagement) eleven sub-themes and eighty nine codes were determined. It was seen that the students' most preferred superficial strategies in terms of cognitive engagement; negative opinions towards group work in terms of social engagement; value given to math course in terms of emotional engagement. Students preferred least getting support sub-theme in terms of cognitive engagement; competitive sub-theme in terms of social engagement; value to the mathematics teacher sub-theme in terms of emotional engagement.

Keywords: *Maths, secondary school, cognitive engagement, social engagement, emotional engagement.*

To cite this article: Deveci, O., & Aldan Karademir, C. (2019). Investigation of the 5th grade students' engagements in mathematics course towards student opinions. *European Journal of Educational Research, 8*(1), 337-348. doi: 10.12973/eu-jer.8.1.337

Introduction

Based on Cavett Robert's words "Life is like a grindstone, and you are the only one to decide whether this grindstone will crumble you up or sharpen you", in order to be successful we must be committed to something and we must fight for it, which means we must engage ourselves. Engagement is a complex structure. Studies investigating students' domain specific engagement are insufficient (Skilling, Bobis, Martin, Anderson & Way, 2016). Education specific engagement is effective in students' present and future educational studies, career plans, critical choices (Wang, Fredricks, Ye & Hofkens, 2016). Engagement is important at this point. Each student can engage differently. The students' thoughts, behaviors and emotions are effective in engagement (Skilling, Bobis, Martin, Anderson & Way, 2016). From a different viewpoint, engagement is indication of the student's struggle to school everything belongs to school and his/her friends (Veiga, Reeve, Wentzel & Robu, 2014). If engagement is the struggle of the student, it may be thought that the student should have a goal worth fighting. When the PISA 2015 results of Turkish students are examined, it is seen that the ratio of the students (22.9%) is under the first level. The first level where "They can answer questions that are presented in a known scope, where the problem is clearly stated and all the information necessary for the solution is given. These students can distinguish the information according to the specific instructions given in the known situations and perform routine procedures. They can carry out operations that are open and can follow a single stimulus" may emphasize a goal for 10-13 years old students to dedicate themselves at the secondary school level (Ministry of National Education, 2016). Students must engage in the mathematics course. This is because their engagement to mathematics is effective on their mathematics achievement (Leis, Schmid & Rimm-Kaufman, 2015). A student's academic success, who is entertained, appreciating, sharing his/her feelings in the social environment, determined to work, in harmony with his/her peers, will be high (Wang & Eccless, 2013).

The specific objectives of the secondary school mathematics curriculum in Turkey that was updated in 2018 are as follows:

- Students will be able to express their thoughts and reasoning in the process of problem solving and will be able to see the deficiencies or gaps in the mathematical reasoning of others.

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- Students will be able to develop their metacognitive knowledge and skills, and will be able to manage their own learning processes consciously.
- They will develop a positive attitude towards mathematics with their experiences in learning mathematics and develop a self-confident approach to mathematical problems.
- They will be able to develop their abilities to be systematic, careful, patient and responsible.
- They will value mathematics knowing that mathematics has a common value to humanity.

A student will successfully complete his/her studies if they are engaged in a mathematical problem willingly without being forced or pressurized. In other words, if students believe that they will succeed, they will push the limits of their cognitive strategies and abilities and will be successful due to their engagement (Warwick, 2008). The students will change their engagement depending on time as they spend time with mathematical problems inside or outside the school (Shearmen, Rylands & Coady, 2012). If the students have difficulty engaging in the mathematics course or engage in a short-term (temporarily), an understanding of permanent and negative mathematics at the secondary school level settles in the students (Lewis, 2013). When the Turkish literature related to the engagement in mathematics course was analyzed, a Turkish translation study of the "Scale of Engagement in Mathematics Course" was found for the secondary school students made by Birgin, Mazman, -Akar, Goksu, Uzun, Gumus and Peker (2017). This study was constituted both to examine the students' engagement in mathematics and also to contribute to the literature.

Methodology

This section includes information about the research goal, model of the study, participants, data collection process and data analysis.

Research Goal

The main aim of this study is to reveal the opinions of 5th grade students (10-11 years) about their engagement in mathematics course. For this purpose, the answers of following questions are sought:

1- What are the opinions of 5th grade students (10-11 years) about their cognitive engagement in mathematics course?

2 - What are the opinions of 5th grade students (10-11 years) about their social engagement in mathematics course?

3. What are the opinions of 5th grade students (10-11 years) about their emotional engagement in mathematics course?

Model of the study

In this study, the opinions of 5th grade students (10-11 years) about their engagement in mathematics course were examined. Qualitative research method was used in the research. Human behavior can only be explored through a flexible and holistic approach. In qualitative approach, the views and experiences of the individuals involved in the research were of great importance and they were preferred because they had the opportunity to obtain in-depth knowledge (Yildirim & Simsek, 2016). The study was carried out with a case study, which is one of the qualitative research designs. The best sources for doing so are Yin's (1994) general text on case study research and Merriam's (1988) book on case studies in education. Both argue that case studies are special kinds of qualitative work that investigates a contextualized contemporary (as opposed to historical) phenomenon within specified boundaries (Hatch, 2002). The case study can be used in different ways in different disciplines. In qualitative research, the case study is related to the in-depth study of the event (Glesne, 2012). According to Yin (2003), a case study design should be considered when: (a) the focus of the study is to answer "how" and "why" questions; (b) you cannot manipulate the behaviour of those involved in the study; (c) you want to cover contextual conditions because you believe they are relevant to the phenomenon under study; or (d) the boundaries are not clear between the phenomenon and context. All factors related to the case are handled with a holistic approach. It focuses on how the relevant factors affect the case and how they are affected (Yildirim & Simsek, 2016). During the study, information such as interviews, observations, documents and different opinions about the situation is obtained. All information accumulated about the situation participates in the case study (Patton, 2014). In this study the main reason to name the qualitative design as case study is, students learning process is handled with as a case, engagement and engagement types ara handled with as all factors of the case.

Participants and Data Collection

In qualitative research, there is no need to work with large groups or to make generalizations which will make random selection meaningful (Glesne, 2012). Researchers choose groups purposefully. It is important to provide richness in terms of knowledge in selected working groups (Patton, 2014). The participants consisted of 7 (3 boys, 4 girls) 5th grade students of a secondary school. This school is a public school and the students are 10-11 years old. Because of the changes in education system in Turkey, named as (4+4+4) 5th grade students are educating at secondary schools' first degree. (4+4+4) system means first part is primary, second part is secondary and the last part is high school. The

participants were constituted with "snowball sampling" technique of purposeful sampling methods. The snowball sampling technique is effective in identifying individuals or cases that may be rich sources of information. It deals with the question "Who do you recommend me to talk to about the subject?" Thus, it enables to reach critical information sources about the subject (Patton, 2014).

Interview technique as data collection technique was used. Qualitative researchers use interviews to uncover the meaning structures that participants use to organize their experiences and make sense of their worlds. These meaning structures are often hidden from direct observation and taken for granted by participants and qualitative interview techniques offer tools for bringing these meanings to the surface (Hatch, 2002). The semi-structured interview form developed by the researchers was used to collect qualitative data. While creating interview questions, first the literature related to the engagement in mathematics course was examined. Subsequently, the 6th (11-12 years) and 7th (12-13 years) graders of the same school were asked to write texts about engagement in mathematics course. The main reason for choosing the 6th (11-12 years) and 7th (12-13 years) graders to write texts about engagement in mathematics course is, because of the exam preparation of 8th (13-14 years) graders. In line with these data, 16 draft interview questions were prepared and pilot interviews were conducted with 10 students (6 boys, 4 girls) after receiving expert opinion. After the pilot interviews, the number of questions was reduced to 6 and interviews approximately 10-12 minutes long were started. Some sample questions in the interview form are as follows:

2- Let's think about mathematics course. Did you use to study the same way in primary school? Is there a change in the way you study? Can you explain?

3 - What do you think about doing mathematics as group work? How do you feel during group work? Can you tell me a moment if you have one?

4-Let's say you had a math lesson today and it was cancelled. How would you feel? What do you do in an empty math class?

All interviews with the students were carried out in the most appropriate time periods taking necessary permissions. Before starting the interview, it was stated that the names of the students would not be mentioned in the research and that the interviews were not related to their lesson status and that their answers would remain confidential. It is explained that audio recording will be taken in the interviews and the interview notes will be kept to minimize the loss of data. After the process of the study was explained, the students were asked whether they were willing to participate in the research and volunteer students were asked to review and sign the permission form for participation in the research. The interviews lasted for approximately 10 to 12 minutes. Also students' math achievement marks were taken from their teachers and order of Mathematics as favourite course within 5 course was learned from the students to use for discussing the findings.

Data Analysis

In the analysis of the data, content analysis as a kind of qualitative data analysis technique was used. In content analysis, data similar to each other are brought together under certain concepts and themes, organized and interpreted in a way that the reader can understand. Content analysis is carried out on the data obtained by the interview at certain stages. The stages are *the coding of the data, finding the themes, organizing the codes and themes, identifying and interpreting the findings* (Yildirim & Simsek, 2016). The breakdown of the interviews was transferred to the computer and a total of 16-page interview breakdown was obtained. The texts were read with line by line reading technique and analyzed by content analysis. Codes generated from data obtained from manual encodings are listed. It has been examined whether the codes have common points and common themes have been tried to be reached.

Instead of validity and reliability in qualitative researches, credibility, transferability, consistency and conformability that are appropriate to the nature of qualitative research are encountered (Yildirim & Simsek, 2016).

For credibility, among the methods mentioned by Creswell (1998):

- *Diversification - the use of more than one researcher's perspective.*
- *Getting information, ideas and contribution from a colleague.*
- *Participant approval - sharing of interview breakdowns with participants.*
- *Rich and detailed description - ensuring that the reader is included in the research context.*
- *External audit - monitoring of the coding and other steps by a person outside the research process* has been followed (cited in: Glesne, 2012).

Stages followed to ensure transferability:

- *Detailed description - presenting the data in accordance with the concepts and themes without reinterpreting the data.*

- *Purposeful sampling -choosing according to the power of showing the variable that will be included in the research* (Yildirim & Simsek, 2016).

Stages followed to ensure consistency:

- *In the research proposed by Erlandson et al. (1993), a "consistency analysis" was conducted as an evaluation of the activities that were carried out from the outside to the end of the course* (cited in: Yildirim & Simsek, 2016).

Stages followed for confirmability:

- *"Confirmation review" was made in order for the qualitative researcher to explain in a logical way that he was constantly confirming the results he reached recommended by Erlandson et al. (1993)* (cited in: Yildirim & Simsek, 2016).

Considering the steps above, the steps taken to increase the credibility, transferability, consistency and confirmability in the research are as follows:

The opinions of two experts were taken during determining the limits of the research topic and preparation of the semi-structured interview form. After the class level was determined for the research, information was obtained from a mathematics teacher about the suitability of the subject to the class level and the level of reading comprehension and self-expression from two Turkish teachers.

Table 1. Descriptive characteristics of the study group

Student Code	Sex	Most recent math report card note (grading system over 100)	Order of Mathematics as favorite course (Within 5 courses)
S1	Male	82	2nd order
S2	Female	90	2nd order
S3	Female	80	1st order
S4	Male	91	1st order
S5	Female	82	1st order
S6	Female	93	1st order
S7	Male	92	2nd order

Participants were also given "participant consent form" and their written permission was obtained. The steps taken by the researcher were supervised by an expert.

The code, sub-themes and themes organized by the researcher are presented without changing the data. Supervision was also carried out by the expert at this stage. The codes prepared by the researcher were submitted to another independent expert and they were asked to review and re-code.

Compatibility between two encoders is calculated as P = [Na / Na + Nd] x 100 according to Miles and Huberman (1994).

Table 2. Reliability between two encoders

Data Set	Compatibility amount (Na)	Noncompatibility amount (Nd)	Compatibility Percentage (P)
Interview breakdown of S2	24	8	75
Interview breakdown of S5	22	3	88

During the confirmation process, different interview breakdowns were re-coded 2 weeks later by the researcher and the compliance was examined.

Table 3. Inter-coding reliability

Data Set	Compatibility amount (Na)	Noncompatibility amount (Nd)	Compatibility Percentage (P)
Interview breakdown of S1	19	9	67,85
Interview breakdown of S6	15	5	75

The final shape of the study was given after expert opinion. The interview records belonging to the working group were written without changing sentence by sentence and then they were sent to the participants for confirmation. When sharing the findings of the research, direct quotations were frequently included.

Findings / Results

In the research, six questions were asked to determine the opinions of 5th grade students about their engagement in mathematics, and the findings obtained from the students' opinions were grouped under three themes: cognitive engagement, social engagement and emotional engagement.

Table 4. Theme, sub-theme and codes of 5th grade students' engagement in mathematics course

Theme	Sub-theme	Code	f	%
Cognitive Engagement	In-depth Strategies	Resembling/not resembling the previous subject, writing and solving the problem on their own, identifying issues that may arise beforehand, identifying key points	6	34,83
	Superficial Strategies	Reading the notebook, reading the mathematics book, copying the notebook one by one, learning by heart	15	
	Support	Getting help from the teacher, getting help from the family, getting help from the computer	3	
	Practice	Solving test, solving questions from notebook, solving examples from workbook	7	
Social Engagement	Competition	Winning, losing, competing, wanting to group with the hardworking ones, selfishness	5	35,95
	Group Work Positive Perception	Sharing, working together, helping, teaming up	8	
	Group Work Negative Perception	Selfishness, having to teach, dealing with other stuff, boredom, discussion, not listening, not participating in the activity	13	
	Peer Communication	Nice, good, very good	6	
Emotional Engagement	Value Given to Mathematics Course	It is important, it is life, I feel bad, I feel sad, I feel a little upset, studying math, any lesson, being idle	18	29,21
	Value Given to Mathematics Teacher	Good lecturing, good person, valuable, shares information, teacher	8	
Total			89	100

When Table 4 is examined, it is determined that the percentages of "Cognitive Engagement" and "Social Engagement" themes are close to each other among the total of the eighty-nine codes in relation to secondary school students' engagement in mathematics, while the "Emotional Engagement" theme has the lowest percentage.

Cognitive Engagement

The *"Let's think about the mathematics course. Did you use to study the same way in primary school? Is there a change in the way you study? Can you explain?"* question in the interview form is aimed at determining the concept of cognitive engagement in mathematics course of the students. The students' studying strategies for mathematics course are tried to be determined.

Table 5. Theme, sub-theme and codes related to the cognitive engagement of 5th grade students

Theme	Sub-theme	Code	f	%
Cognitive Engagement	In-depth Strategies	Resembling/not resembling the previous subject, writing and solving the problem on their own, identifying issues that may arise beforehand, identifying key points	6	34,83
	Superficial Strategies	Reading the notebook, reading the mathematics book, copying the notebook one by one, learning by heart	15	
	Support	Getting help from the teacher, getting help from the family, getting help from the computer	3	
	Practice	Solving test, solving questions from notebook, solving examples from workbook	7	

Sub-themes for cognitive engagement include in-depth strategies, superficial strategies, support, and practice. In-depth strategies include pieces of cognitive engagement such as detailed thinking, using strategies, organizing, being attentive, self-regulating learning, ways to keep in mind, orientation, planning, observation, and control (Skilling & Styliandes, 2015). High cognitive experiences require deep thinking (Attard, 2012). Therefore, it is thought that codes

of *resembling/not resembling the previous subject, writing and solving the problem on their own, identifying issues that may arise beforehand, identifying key points* can be included in in-depth strategies. Superficial strategies include remembering techniques such as repetition, high-level effort and non-thinking studies (Fielding-Wells & Makar, 2008). Lithner (2000), indicates that in problematic situations undergraduate students tend to rely heavily on their, often mathematically superficial, experiences from school situations. Therefore, it is thought that codes of *reading the notebook, reading the mathematics book, copying the notebook one by one, learning by heart* will be covered by superficial strategies. Students looking at the book, reading the book and the notebook, trying to solve the same question once again in the same way by heart are within the sub-theme with the highest frequency of cognitive engagement in the study. Teacher support, family support and other supportive elements are effective in the student's engagement in mathematics course (Brown, 2008). Therefore, codes of getting help from the teacher, help from the family, and getting help from the computer are discussed in the sub-theme of support in the study. *The codes* such as solving test, solving questions from notebook, solving examples from workbook are included in the sub-theme of practice, which is the step in which the student learns and processes the information.

The theme obtained from this question of the research is identified as "Cognitive Engagement" and sub-themes are defined as "In-depth Strategies, Superficial Strategies, Support and Practice" While the theme of cognitive engagement has generally a percentage of 34,83%, the sub-themes have respectively a share of 6,74%, 16,85%, 3,37%, 7,86%. It was determined that students preferred superficial strategies the most in the theme identified as cognitive engagement.

When the answers of students to the interview question were examined, it was determined that they used "In-depth Strategies" such as "*writing and solving the problem on their own"* (S5, S6), "*resembling/not resembling the previous subject"*(S6), "*identifying issues that may arise beforehand"* (S3), "*identifying key points"*(S1, S2).

S6: For example, I write my own questions about it. I try to solve these questions on my own.

S2: And I try to find some key points.

S6: For example, when when we learn a new topic that is different from the others and see a new question, I first look at my notebook. If it looks like something we solved on the notebook, I try to solve it looking at the old example from the notebook. I found the right answer many times by doing so.

It was found that students used "Superficial Strategies" such as "*reading the notebook*" (S1, S2, S3, S6, S7), "*reading the mathematics book"* (S1, S3, S4, S5, S7), *"copying the notebook one by one"* (S3,S4, S5, S7), *"learning by heart"* (S1).

S1: In primary school, I used to look from the books. I used to read my Mathematics notebook.

S2: In Mathematics course we. I read my notebook.

S4: I read my notebook for the exam.

S1: I read the books.

S7: He can say try writing the same thing again to the next page. I copy it to an empty paper and do it again. I mean I do it on my notebook.

S1: And then I try reading the digits, like kilometer and then I try to memorize.

It was found that students used "Support" such as "*support from teacher"* (S3), "*support from family"* (S5), "*support from computer"*.

S3: I read the notebook, if there is something I don't understand I ask my teacher because it will be on the exam.

S5: My father studied until 5th grade so he knows our subjects. He is good at math, he writes me questions on some subjects. I solve them, and after that my father checks my answer.

S5: We can enter Eba (a kind of educational portal) and can study better. I study more on the computer.

It was found that students preferred "Practice" such as *"solving test"* (S3, S4, S5, S6, S7) *, "solving questions from notebook"* (S3)*, "solving examples from workbook"* (S5).

S3: I follow my notebook. I solve a test about the subject.

S4: I will solve a test.

S6: I read it thoroughly. I solve tests about the subject.

S7: I solve tests.

S5: I solve questions from the book named as "Tum Dersler" (All Courses). I study one by one from this book. I solve 10 questions in order. I look at the book "Tum Dersler".

In the research, it was seen that students used more than one path at the same time in their opinions regarding their cognitive engagement in a mathematics course. Students use both in-depth and superficial strategies together. However, students are not fully aware of which path will bring them success. Student opinions on the subject:

S6:…… I sometimes achieve success when I do like that. Sometimes I achieve less or no success but may not be as successful as I wish. When I study a lot I can be successful. But sometimes I can be unsuccessful even though I study a lot. When it happens like that I may forget the things I have studied. Maybe it is because I'm forgetting. Maybe sometimes I may be unsuccessful, less successful.

S1: I read my mathematics notebook. I try resolving our examples there. I read the books. I read the key points, teacher. I solve problems.

S7: When I go home, I revise the subject we learned in class. Let's say there is a test exam tomorrow. First of all, I identify the topics that can come up in the exam. Generally, the questions come from the last topic to the first. I know the last topics because we have learned them recently. But I might have forgotten the first ones. That is, I start with the oldest topics first and then move forward... I can write them to an empty paper and resolve them. But I do it in my notebook.

Social Engagement

The "*What do you think about doing mathematics as group work? How do you feel during group work? Can you tell me a moment if you have one?"* question is a question to determine the concept of student's social engagement in mathematics course. Students' opinions about their situation with their classmates in mathematics course were investigated.

Table 6. Theme, sub-theme and codes related to the social engagement of 5th-grade students

Theme	Sub-theme	Code	f	%
Social Engagement	Competition	Winning, losing, competing, wanting to group with the hardworking ones, selfishness	5	35,95
	Group Work Positive Perception	Sharing, working together, helping, teaming up	8	
	Group Work Negative Perception	Selfishness, having to teach, dealing with other stuff, boredom, discussion, not listening, not participating in the activity	13	
	Peer Communication	Nice, good, very good	6	

Sub-themes for social engagement include competition, group work positive perception, group work negative perception, peer communication. The Turkish Language Association defines competition as the contest, rivalry, and race between people who aim for the same purpose. Therefore, codes such as *winning, losing, competing, wanting to group with the hardworking ones, selfishness* are included in the competition sub-theme. Group work positive perception: Because the students have positive perceptions about group work, the codes such as *sharing, working together, helping, teaming* are discussed under this sub-theme. Group work negative perception can be considered to reflect problems of students during group work and negative viewpoints towards group work. *Because codes such as selfishness, having to teach, dealing with other stuff, boredom, discussion, not listening, not participating in the activity* contains negative expressions for group work, they are discussed under this sub-theme. Peer communication is a sub-theme created to indicate the students' thoughts about being together with each other. Therefore, codes such as *nice, good, very good* are discussed under this sub-theme.

The theme obtained from the related question was "Social Engagement" and the sub-themes were "Competition, Group Work Positive Perception, Group Work Negative Perception and Peer Communication". While the theme of social loyalty generally has the highest percentage with a percentage of 35.95%, the sub-themes have respectively 5.61%, 8,98%, 14,60% and 6,74% share. It was determined that the students had the most opinions about the negative perception of group work in the theme determined as social engagement.

It was found that the students used "Competition" expressions in their answers to the interview question such as "*winning"* (S1)*, "losing"* (S6)*, "competing"* (S4). *"wanting to group with the hardworking ones"* (S6, S7).

S1: Uhm... I want our group to win. For example, if I can't solve one of the problems, another person can solve it instead of me. I would like to have hardworking people in my group.

S6: Once we did the group work, we didn't win. I was upset. We weren't lucky that day we couldn't win. Sometimes successful and unsuccessful people are grouped together. In that case, I become unhappy. I get upset about being in the same group with them.

S1: We have to do something in group work and we need to do it in the best way. And we need to do it as a group, we really need to want to be a team.

S7: I wonder who will come next to me. I get excited. Eventually, we're going to work with them. I want to group with good people.

Students' expressions such as "*sharing"* (S1, S6) *"working together"* (S1, S5, S7*),"helping"* (S4)and *"teaming up"* indicate "Group Work Positive Perception".

S1: I think it is a good thing. We can do good things together by sharing the things we know with our friends.

S6: We do group work, it's normal. It is group work, eventually, we can share what we know. with each other

S4: Doing group work is good so that we can help each other. About mathematics I mean. I feel like this when there is a group work.

S7: We learn well by working with everyone.

S1: I think it is a good thing. We can do good things together by sharing the things we know with our friends. We need to do it as a group. We need to really want to be a team.

S5: I feel good in group work. Being with my friends feels good. Because sometimes I may not be able to do it on my own, I have difficulty. But if we are like 4 people, it is better to do it together by taking everyone's opinion.

Students' expressions such as "*selfishness"* (S3, S4, S7)*, "having to teach"* (S4)*, "dealing with other stuff"* (S1)*, "boredom"* (S2)*, "discussion"* (S3, S5, S7*)* "*not listening"* (S1,S2, S3), "*not participating in the activity*" (S6) shows "Group Work Negative Perception". This specified sub-theme has the highest frequency in the theme.

S4: I have to teach something to others.

S1: For example, when three of us are doing something one person is dealing with something else. That person acts like he or she doesn't belong to our group.

S3: We experience problems in group work, one of us wants to do a different operation. We both want to do a different operation. In that case, problems arise in the group. We insist on our own way.

S2: Then we get bored. I haven't experienced it much, but I get angry.

S4: In the group work, some thoughtless people think that they can always get what they say without getting anyone's opinion. When it's like that, group work isn't good. When there are people who insist on their way, problems arise.

S5: We had a group of 4 people. For example, in our group with me, Fatma, Eylul and Baris, we had a little argument when there is a different opinion.

S7: I get unhappy if I can't do it I mean if I'm not the one who solves the question. Everyone was trying to do something else so we couldn't do what I told. But in fact, I was right. But it didn't happen and I was unhappy.

S1: In group work, sometimes people may not listen.

S3: In fact the problem is... Once Baris there was an activity called shoe. And, we showed it to you as well, Baris was saying something else there, and I was thinking some other thing was right. We couldn't agree there. Our opinions didn't match.

A finding from a student who participated in the research was noted. The student used the word *"discussion"* in a positive sense.

S4: Group work is a good thing. Because each person's mathematics achievement is not the same so while everyone is discussing math in this way others can listen and learn too. They can improve their math skills. I fell better in group work.

Students' opinions on "Peer Communication" include expressions such as "*nice"* (S1, S2, S7)*, "good"* (S2, S4) *and "very good"* (S3).

S1: It is nice. we have groups of four people.

S2: We can have fun too. I mean it is nice like that. I can study. I mean together.

S7: I can think well. Studying with everyone. We learn well.

S4: Group work is a good thing. Because math success of everyone is not the same.

S3: Group work is I think very good. I can ask something I'm unable to do to my friends in the group. I feel very well in the group work. I become very happy.

S2: I think it is a good thing. We can do good things with our friends by sharing what we know.

Emotional Engagement

The "*Let's say you had a math lesson today and it was cancelled. How would you feel? What would you do in an idle math class?" and "What emotion would you complete the following phrases with: "For me mathematics course is …….. For me mathematics teacher is……."* questions are a question to determine the concept of student's emotional engagement in mathematics. The aim was to determine the opinions of the students about the teacher and the course.

Table 7. Theme, sub-theme and codes of 5th-grade students' emotional engagement in mathematics course

Theme	Sub-theme	Code	f	%
Emotional Engagement	Value Given to Mathematics Course	It is important, it is life, I feel bad, I feel sad, I feel a little upset, studying math, any lesson, being idle	18	29,21
	Value Given to Mathematics Teacher	Good lecturing, good person, valuable, shares information, teacher	8	

Sub-themes for emotional engagement are the value given to the mathematics lesson and the value given to the math teacher. Based on the importance and necessity of valuation, sub-themes are defined as the value given to the mathematics lesson and the value given to the mathematics teacher. *It is important, it is life, I feel bad, I feel sad, I feel a little upset, studying math, any lesson, being idle* codes are addressed under this two sub-themes. The greatest share under the theme of emotional engagement is in the value given to the mathematics lesson sub-theme.

The theme obtained from the related question is "*Emotional Engagement" and the sub-themes are "Value Given to Mathematics Course and Value Given to Mathematics Teacher*". The theme of emotional engagement generally has a percentage of 29,21%, whereas the sub-themes have 20,22% and 8,98% respectively.

Expressions given by students to interview questions such as "It is important" (S1, S3, S5, S7), "It is life" (S4, S6), "I feel bad" (S5, S3), "I feel sad" (S4, S6, S7)give opinion about "Value Given to Mathematics Lesson".

S1: It is important. Mathematics course is entertaining, it is exciting.

S3: For me, mathematics course is very important. I want to learn.

S4: Mathematics course is life for me.

S5: Mathematics course is very important for me.

S6: Mathematics course is very special for me. It is a part of my life. Mathematics is life.

S7: Mathematics course is very important for me.

S5: I feel bad. Some people take advantage of the situation when it happens. They make noise and bother us.

S3: I feel bad. Because so far all our mathematics courses were idle or cancelled. We have rehearsals for April 23. Our math classes are cancelled all the time.

S4: I feel sad. As it happens all the time. When something happens, our Math classes get cancelled all the time.

S6: I feel sad. I get upset.

S7: I feel sad.

Expressions such as "*studying math"* (S2, S4, S6)*, "any course"* (S2, S3, S5), *"being idle"* (S7) are related to the value given to the mathematics course.

S2: But I do something else instead. If I have something else to do or some other homework, I mean I try to find something else to do when the class is idle.

S6: I repeat the subject which I have difficulty in understanding. I prepare myself, we do exam together.

S5: I can solve tests. I sometimes solve tests sometimes read books. If there is something I couldn't finish, I try to finish it. I try to solve the test of the subject. But generally, when a class is idle, I solve questions from the book. I study one by one from books.

S7: I study, I read books in general or stay idle. I told the truth.

S3: I solve tests if there is any. If the class is idle, I solve tests if I have from any subject.

S4: I do anything about math. I look at what we did the last again just in case. In the end, that's what we would be doing if the teacher came to the class, I think.

S2: But I do something else, other subjects too. I mean I don't always do math. If the whole lesson is idle, I can read lesson project, we can write something on our notebooks, books with other friends and look at them.

Expressions such as "*good lecturing"* (S1, S2, S5)*, "valuable"* (S5, S6)*, "good person"* (S3)*, "shares information"*(S6)*, "teacher"* (S4) *given by students to interview questions are opinions about "Value Given to Mathematics Teacher"*

S1: I like him/her. My teacher, my teacher, how to say it, explains well He/She makes us play games. Therefore I like him/her.

S2: He/she needs to be able to explain the subject more easily for me, compare everything to something, explain well and love explaining because if he/she doesn't love explaining, he/she can't do it. He/she needs to explain well, the lesson should not be boring. The teacher needs to make us do entertaining activities at the end of the subjects. He/she needs to entertain us. We need entertainment. The teacher needs to do things like that. We like it and also remember it that way. When we don't understand the subject, the teacher needs to be able to explain more easily. He/she needs to understand whether we understand it or not because sometimes we can't say it.

S5: The teacher is also important. A mathematics teacher is very precious to me. Mathematics is in every aspect of our life. It is important for all of us. The teacher should teach us math with fun. The teacher should make different activities more frequently; he/she should entertain us with such activities.

S3: Mathematics teacher is a good person for me.

S4: Mathematics teacher is a teacher for me.

S6: Mathematics teacher is valuable for me. He/she shares everything he/she knows with us.

S7: Mathematics teacher thinks good of me. I think he/she likes me. Eventually, the course is important. And the teacher also is important as the person teaching it.

Discussion and Conclusion

The students' interest in mathematics, their studies and their engagement in mathematics are important in their mathematics learning. The student must believe that he will use mathematics in the future (Skilling & Styliandes, 2015). Some researches state that engagement in mathematics is necessary to learn and keep the information in mind (Ayup, Yunus, Mahmud, Salim & Sulaiman, 2016). There is a positive relationship between engagement and success. A person who does not have sufficient engagement in a field will fail. Engagement is an investment that the student makes psychologically. The fact that he/she tries to learn and does not give up when he/she has difficulty in school indicates engagement. Although engagement in mathematics is an important area of study, there are not sufficient studies carried out (Park, 2005).

The findings obtained from the study in which secondary school students' engagement in mathematics were examined according to the student views: Engagement in mathematics has been identified as three sub-themes (cognitive engagement, social engagement, and emotional engagement). When the percentages of the three sub-themes within the theme were examined, it was determined that the percentages of the sub-themes cognitive (34,83%) and social (35,95%) were close to each other, and the least share was emotional engagement (29,21%).

In the study, it was observed that students preferred superficial strategies in mathematics lesson in the theme of cognitive engagement. This finding is in line with the research of Fielding Wells and Makar (2008). The reason why students prefer this way may be because of the similarity in the mathematics course achievement assessment exam questions. The students do not want to learn different types of questions, but the type of questions in hand, the ones good for the exam. Based on the opinions of the students in the theme of cognitive engagement in mathematics lesson, the least preferred sub-theme is supported. Hesitating from the teacher or education levels of people in the family may be effective in students' least preference to get support. Parallelism was determined with the study of Ayup, Yunus, Mahmud, Salim and Sulaiman (2016). In addition, students' grades were taken from mathematics teachers with regard to the students participating in the research. It can be thought that there is a connection between the answers of the students to the interview questions and the grades of the mathematics lesson. This situation is also mentioned by Park (2005). Because students with high grades gave statements indicating that they used in-depth strategies in the cognitive engagement sub-dimension. And also Lithner (2003) indicates that their strategies are rarely grounded in relevant mathematical concepts and in the few cases where the students' reasoning is grounded in consistent mathematics it is still dominated by the individuals memory images and familiar routines. According to Lithner's findings (2003), concern is the possibility or risk that this kind of behaviour also is common among upper secondary school students. If this is the case, it might be one important cause to the problems with the mathematics education at upper secondary school in Sweden.

The biggest share under the theme of social engagement is in the negative perception of the group work. It is seen that students are happy to be together in their opinions but they are also aware of the negative experiences they have. In other words, students both want to work together and feel discomfort from each other. The lowest share of social engagement in mathematics is the sub-theme of competition. It can be said that students are happy to be together, have problems from time to time, but are not in a serious competition with each other. Students do not hold each other responsible for the defeat. A similar situation was determined in a study carried out by Skilling and Styliandes (2015).

In the research, the students were asked "*Can you order your favorite lessons?"* and students were seen to place math lessons in the first orders. From this point of view, it can be said that students care about mathematics lesson. Eighteen of the twenty-six codes identified in the theme of emotional engagement are in the sub-theme of value given to the mathematics course. However, when the answers of the students are examined, it is determined that very few said that I would definitely do something about mathematics to the question *what would you do if the mathematics course is idle?* . When the opinions of the students given under the theme of value given to the mathematics teacher are examined, it can be said that the students have positive feelings towards the mathematics teacher but they have expectations from a teacher. In parallel with the present research, students' mathematics engagement levels were determined by various variables in the study conducted by Shearmen, Rylands and Coady (2012). The reason why the students get higher frequency in the sub-theme of value given to mathematics teacher in the sub-theme of value given to mathematics course may be because the students are more concerned with learning mathematics.

In this study conducted with the 5th-grade students of the secondary school, engagement in mathematics course was grouped under three themes: cognitive, social and emotional. The three identified themes are related to each other. Because if a student does not have positive emotions towards the course and the teacher, he/she may have difficulty in being motivated and learning activities. According to Tossavainen and Juvonen's research (2015), that reports a large survey from Finnish students' motivation in mathematics at secondary schools, motivation in mathematics is often concerned with abroader focus on mathematical views and beliefs. This difficulty of the student prevents the acquisition of achievements aimed by the program in his cognitive understanding. Also Tossavainen and Juvonen's study (2015), states that students motivation levels are high at fifth grade, but starts to decrease at sixth grade. Decreases on the motivation of students can effect the engagement of students. Because of this, engagement of secondary school students differs year by year. Research findings of Skilling and Styliandes (2015) are in parallel with the findings. The student who does not have sufficient knowledge about the subject, who is not interested in the course and the environment and who has negative attitudes cannot take part in the group studies or is not desired by the group. From this point of view, three themes are closely related.

Based on the findings, the following suggestions can be made:

- Students' cognitive, social and emotional development can be followed separately and students with special problems can be taken into consideration.
- Students can keep reflective mathematics diaries within mathematics course because during informal conversations students stated that writing reflective diaries engage them to the courses.
- The study can be applied on students who are studying at different grade levels.
- In-service trainings can be given to mathematics teachers to develop their engagement in mathematics.

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