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MATHEMATICS COURSE NEEDS ASSESSMENT FOR TRIGONOMETRY SUB-LEARNING AREA

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Abstract

The aim of this study was to identify the needs of students about the mathematics course while learning trigonometry sub-learning area in terms of its objectives, content, course book, learning environment, instructional activities, evaluation process and perceptions of teachers about these dimensions. Moreover, this study also concern for whether the students' needs were met after the implementation of the constructivist curriculum. This study is a case study conducted at an Anatolian Teacher High School (ATHS), which is located in the Aegean Region. In this study, 54 students and three teachers were included. For this study, data were collected through student questionnaire and semi-structured interviews. To analyze the data descriptive statistics and descriptive analysis method were used. According to results of the study, trigonometry unit should be connected to daily life and the alleviation of some topics was indicated as needs. It was indicated that teachers were not eager very much to use additional materials for this course except white board, course books and test book. Finally, students needed places like library or computer laboratories which give opportunity to make research.

Keywords: Needs Assessment, Trigonometry.

Introduction

Mathematics education and mathematics achievement have always been on the agenda of the Turkish national education system. Educational changes such as redesigning the curricula as based on constructivist approach in 2005 and after the implementation of elementary curriculum, a new high school curriculum was prepared and implemented in 2009 (MONE, 2013). According to recent accepted regulations by the Board of Education, among all the courses, students who choose science and mathematics or Turkish and mathematics departments take compulsory mathematics lesson (MONE, 2013).

Among the subjects "Trigonometry" is perceived as one of the fundamental subjects in transition to advanced mathematics and its applications. A strong understanding of trigonometry is required in calculus mainly while learning complex numbers, limit, derivative integral and analysis. Moreover, it is one of the contents of secondary mathematics that are taught by linking algebraic techniques, geometrical realities physics, optic, electric, topology and marine and trigonometric relationships (Sarac, 2012). It requires the learner to relate shapes of triangles to numerical relationships to cope with ratios such as sinA=opposite/hypotenuse and to manipulate the symbols involved in such relationships (Blackett and Tall, 1991).

In the study named "Determination of Learning Difficulties in Mathematics" it was found that according to perception of students trigonometry had a difficulty index of 57% (Delice and Aydın, 2015). Despite the fact that, there is determined difficulties about learning trigonometry, research literature in this subject is sparse. The empirical studies on this subject mainly compare an instructional method with lecture-based teaching (Agac, 2009; Emlek, 2007; Tuna, 2011; Yılmaz, Ertem and Güven, 2010). Moreover, there are research studies to evaluate the learning levels of high school students and determine the misconceptions about trigonometry with an achievement test (Kultur, Kaplan and Kaplan, 2008; Orhun, 2004). Yılmaz, Ertem and Güven (2010), searched the effect of dynamic geometry software Cabri on the cognitive learning of 11th grade students while learning Trigonometry and found a significant difference between the experimental and control groups in favor of the experimental group.

In the study of Kultur, Kaplan and Kaplan (2008), it was determined that high school students could not completely learn the basic concepts of trigonometry and how to use the unit circle. Students had difficulty in learning and applying trigonometric equations. In addition to these, students had difficulty in displaying trigonometric functions geometrically. Moreover, they could not fully understand how to interpret the graphs of trigonometric functions. This study revealed the lack of conceptual understanding and conceptual difficulty in the teaching of trigonometry. It can be said that students learn trigonometry not conceptually, but mainly based on memorization to solve problems asked in exams.

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Delice (2003) compared the Turkish and English students aged 16-18 according to their trigonometry performances and found that Turkish students were more successful at the algebraic and operational part of trigonometry and English students were more successful on the applicability of trigonometry in daily life. The reason for this is the emphasis on trigonometry in the curricula of the two countries. For this reason, it can be said that misconceptions can be observed more in the parts of trigonometry which give less emphasis to algebraic or application issues of the Turkish curricula (Delice and Aydın, 2015).

In addition to these, in the study conducted by Weber (2005), students who received lecture based instruction did not appear to develop a firm understanding of trigonometry. For example, many students were unable to justify the reason for the properties of trigonometric functions and they were unable to form reasonable estimates for the outputs of trigonometric functions. Moreover, many of the students involved in the study perceived that the trigonometric functions exist with their geometric models. When asked to approximate sin θ for specific values of θ, many students indicated that the task could only be completed if they were given an appropriately labelled triangle (Weber, 2005).

According to recent accepted regulations by the Board of Education, as stated in Table 1, percentage weight of this trigonometry sub-learning area is 21. Moreover, students are expected to attain 5 gains of trigonometry in 46 hours (MONE, 2013). Students are expected to learn directed angles, trigonometric functions, trigonometric values of sum and difference of two angles and trigonometric equations subjects. At the "directed angles" unit students are expected to explain directional angles and associate radian with degrees which are the units of angle measures. At the "Trigonometric functions" unit students are both expected to form the trigonometric functions with the help of the unit circle, draw their graphs and to form the inverse functions of tangent, sine and cosine. Moreover at the "Trigonometric values of sum and difference of two angles" unit students are expected to find the formulas of trigonometric values of the measures of sum and difference of the two angles. Finally, at the "Trigonometric equations" unit students are expected to find the solution set of trigonometric equations.

Table 1: Learning Areas, Units and Time Allocation for Trigonometry Sub-Learning Domain

Number	Units/subjects	Number of attainment	Number of course hour	Percentage
11.4.1	Directed angles	1	4	2
11.4.2	Trigonometric functions	2	26	11
11.4.3	Trigonometric values of sum and difference of two angles	1	6	3
11.4.4	Trigonometric equations	1	10	5
Total		5	46	21

Since we are living in an era where new information, opportunities and tools reshape the processes of our outlook in mathematics, our expectations of mathematics and above all, the way we teach mathematics. In today's world, individuals who value mathematics, developed mathematical thinking and modeling, finally who can solve problems are needed more than ever. Hence, a curriculum design should stress good problem solving skills, mathematical thinking power and relationship of mathematical concepts with daily life. A curriculum design mainly includes needs analysis (Morrison, Ross and Kemp, 2004; Posner and Rudnitsky, 2001). Hence, in this study, needs assessment process was applied to identify the gap between the expected and current situation of trigonometry teaching in high school mathematics curriculum.

The definition of need is asserted by Johnson (1990) as a gap or measurable discrepancy between the current state of affairs and a desired future (Ors, 2006). According to this definition, there must be a dissimilarity between the present situation and the preferred situation. Needs assessment is conducted as the primary step to be taken in the design and development of any educational program. According to Altschuld and Witkin (1995), if the program does not meet the needs, the goals, the instructional design or needs may need to be designed again (Ors, 2006). The needs assessment process should be interrelated with course design, materials, teaching/learning, assessment/evaluation processes and should be continuous.

According to Mackay and Mountford (1978) needs of students can be divided into two categories which are learning needs or academic needs and target needs or job needs (Ekici, 2003). Target needs cannot be fulfilled without satisfying learning needs. Needs assessment studies in the literature have mostly focused on identifying the learning and target needs of the students enrolled in language preparatory or undergraduate programs and tourism vocational high schools (Bayyurt and Karataş, 2011; Chen, Chang and Chang, 2016; Ekici, 2003; Erdogan, 2010; Kazar, 2013; Ors, 2006; Wu, 2012). While some of these studies have focused on identifying students' needs to design a specific language program or a formal syllabus (Bayyurt

and Karatas, 2011; Doruk, 2016; Kazar, 2013; Ors, 2006), others evaluated whether the students' needs were met after the implementation of the program (Wu, 2012).

Moreover, different from the needs analysis of language programs, a needs analysis study was conducted by Kahraman (2006) to gather the necessary data for developing a possible astronomy program for elementary and secondary schools in Turkey. According to results, the most important benefit of teaching and learning astronomy was getting information and recognizing the facts about the Earth and the Universe. It was observed that the astronomy subjects listed in the questionnaire was selected with high percentages. Also, it was determined that while learning astronomy subjects learning environment should include visual based materials and teacher-student cooperation. Moreover, in terms of teaching and learning methods, the participants in the study expressed their preferences for experiments and projects that are clear and related to daily life experiences. Besides, performance based evaluation was preferred in the evaluation process.

Furthermore, another needs assessment study was conducted by Erdogan (2010) to make an assessment on the needs of university students who are regarded to be aware of environmental problems and sustainable development concept introduced in an undergraduate course. According to the results of the study, students believed that education was the fundamental stage to constitute awareness for sustainability. Moreover, students indicated the use of discussion and brain storming as the best methods. Finally, the use of instructional media such as computer, projector and video were indicated as essentially important for developing awareness for sustainability.

The Aim and the Research Questions

In this study, the aim was to identify the needs of students and teachers about the mathematics course while learning trigonometry sub-learning area in terms of its objectives, content, course book, learning environment, instructional activities, and evaluation process and whether students' needs were met after the implementation of the constructivist curriculum. The following research question was asked in this study.

The basic research question of the study was formed as:

What were the opinions of students and teachers about the objectives, content, course book, learning environment, instructional activities, and evaluation process of mathematics curriculum? Based upon the basic aim of the study, the following sub-questions were asked in this study:

1. What were the perceptions of students and teachers about the objectives of mathematics curriculum?
2. What were the perceptions of students and teachers about the content of mathematics curriculum?
3. What were the perceptions of students and teachers about the course book of mathematics curriculum?
4. What kind of learning environment did students and teachers prefer when teaching or learning mathematics?
5. What were the perceptions of students and teachers about the instructional activities included in the mathematics curriculum?
6. What were the perceptions of students and teachers about the evaluation process of the mathematics curriculum?

According to literature, there is not much needs assessment studies conducted to evaluate and design teaching and learning programs in mathematics. To fill this gap, the present study aims to identify the needs of the students and teachers about trigonometry sub-domain of mathematics curriculum. The results of this study may provide information to improve the already existing mathematics curriculum or development of a new curriculum besides providing effective trigonometry teaching process in order to meet the learning and target needs of students.

In addition to these, in this study, students studying in Anatolian Teacher High Schools (ATHS) were included as one of the main data sources. Anatolian Teacher High Schools are one of the educational institutions training teachers which prepare students to higher education institutions aims to provide knowledge, skills and attitudes about teaching profession. It can be said that, besides knowledge and skills, teaching profession requires positive attitudes related to profession (Bozdogan Ates, 2013; Cakmak, 2015). From more than half of the graduates of ATHS were accepted to a university program, a great majority of them entered to a teacher-training programs Gomleksiz and Curo, 2012). Hence, it can be said that majority of these students prefer teaching profession in their career and they are more sensitive to teaching and learning processes than students who continued other types of high schools. Thus, their perceptions about the mathematics curriculum were seen important and included in this study.

METHOD

This study is a case study conducted at the 10th grades of an Anatolian Teacher High School (ATHS), which is located in the Aegean Region, in the spring semester of 2013-2014 education year. "Case study is a specific instance that is designed to illustrate a more general principle and it is the study of an instance in action" (Cohen, Manion and Morrison, 2007). The instance is of a bounded system, for example a child, a clique, a class, a school or a community. It provides a unique example of real people in real situations, enables readers to understand ideas more clearly than simply by presenting them with abstract theories or principles. Hence, a case study can enable readers to understand how ideas and abstract principles can fit together (Cohen et. al., 2007). In case study, there is the uniqueness and complexity in its embeddedness and interaction with its context. In case studies, in order not to permit any distortions direct interpretation of places and events are very important (Stake, 1995).

Case studies use both qualitative and quantitative data (Creswell, 2009). The goal of using qualitative and quantitative research designs together is to draw on the strengths and minimize the weaknesses of both types of research (Creswell, 2012). In this study, quantitative data were used to understand students' ideas and attitudes towards mathematics course, and qualitative part of the study was designed to understand the opinions of teachers on the current curriculum and their suggestions for a better mathematics course. Moreover, written documents were also analyzed to gather information about the content of the course.

Participants of the Study

The main data sources of this study were students at an ATHS and mathematics teachers.

Student Characteristics

In this study, students studying in Anatolian Teacher High Schools (ATHS) were included as one of the main data sources. 54 students filled in a questionnaire while learning the Trigonometry unit. While selecting 54 students, cluster sampling method was used according to principles stated by Cohen et. al. (2007). Out of two classes of Science and Mathematics Department and two classes of Turkish and Mathematics Department, one of them from each department were chosen. 21 of the students were male and 33 of the students were female. Moreover, while 29 students were from Turkish and Mathematics department, 25 students were from Science and Mathematics department.

Teacher Characteristics

One teacher teaching at ATHS and two teachers teaching at both Anatolian High School and ATHS were interviewed. While selecting teachers, convenience-sampling method, which enables the researcher to choose the sample from a group of individuals who are readily available (Cohen et. al., 2007) was employed. As stated in Table 2, while the male teacher had three years' experience, one of the female teachers had nine years' experience and the other female teacher had three years' experience.

Table 2: The Characteristics of Teachers

Code of Expert	*Gender*	*Experience*	*The Faculty Graduated*	*Organization*
T1	Female	3	Education Faculty Science	Anatolian Teacher High School
T2	Female	9	Faculty of Science and Literature	Anatolian High School & Anatolian Teacher High School
T3	Male	3	Faculty of Science and Literature	Anatolian High School & Anatolian Teacher High School

Data Collection Instruments and Procedures

For this study, data were collected through student questionnaire and semi-structured interviews.

Mathematics Course Needs Assessment Student Questionnaire

Student questionnaire was used as data collection tool developed by the researcher in order to identify the ideas of students about mathematics curriculum while learning trigonometry sub-learning domain. The student questionnaire contains background information of students together with questions related to course objectives, course books, content, learning environment, instructional activities and finally the evaluation processes related to the course. In the last part of the questionnaire, the preferences and suggestions of students were asked through an open-ended question. Students were asked to rate 30 items as strongly agree, agree, neither agree nor disagree, disagree or strongly disagree. Table 3 indicated the dimensions of the student questionnaire and related question numbers. The reliability coefficient of the questionnaire were between 0.71 for learning environment dimension and 0.87 for instructional activities dimension.

Table 3: Dimensions of the Student Questionnaire and Question Numbers

Dimensions of Student Questionnaire	*Items*
Objectives	1, 2, 5
Content	4, 6, 7, 8
Course Book	3, 10, 11, 13
Learning Environment	9, 29, 30
Instructional Activities	12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23
Evaluation	24, 25, 26, 27, 28

Teacher Interview Schedule

Teacher interview schedule aimed to gather data about perceptions and opinions of teachers about the mathematics curriculum while teaching trigonometry sub-learning domain. During semi-structured interviews, the researcher focused on particular themes structured beforehand according to the research questions. The interview sessions took almost one hour. All the interviews were conducted by the researcher and were recorded by using digital voice recorder for transcription and analysis. For these interviews, each participant was informed about the purpose of the research.

Data Analysis

To analyze the data collected through the questionnaire, the Statistical Package for the Social Sciences (SPSS 22.0) program was employed. Descriptive statistics including frequencies and percentages were utilized to interpret the findings. The case of this study was analyzed by using descriptive analysis method since the data were analyzed in relation to pre-determined themes. Interview transcriptions were read many times and the most important insights related to the focus of the research questions were highlighted. The answers of three teachers were coded by the researcher and teachers were indicated as T1, T2 and T3. Then, the codes which were meaningful and coherent were categorized under the related themes. The data obtained from interviews were categorized into six themes: (1) Objectives, (2) Content of the Course, (3) Course Book, (4) Learning Environment, (5) Instructional activities, (6) Evaluation Processes.

RESULTS

In order to answer this research questions the perceptions of students were obtained through student questionnaire and the perceptions of teachers were obtained through interviews.

Results Related to First Research Question

The first research question was related to the perceptions of students and teachers about the objectives of mathematics curriculum while learning trigonometry sub-learning domain. The results of the student questionnaire about the objectives of mathematics curriculum were indicated in Table 4.

Table 4: Means, Frequencies and Percentages of Needs Assessment for the Objectives of Mathematics Curriculum

	Strongly Agree		*Agree*		*Neither Agree nor Disagree*		*Disagree*		*Strongly Disagree*		*M*	*SD*
	n	*f*	*n*	*f*	*n*	*F*	*n*	*f*	*n*	*F*		
1. Mathematics is required to be successful in issues of both school and business.	19	35.2	19	35.2	7	13	6	11.1	3	5.6	3.83	1.19
2. Mathematics helps to acquire a better place in society.	16	29.6	15	27.8	8	14.8	10	18.5	5	9.3	3.50	1.34
5. Mathematics teaching should be connected to daily life.	21	38.9	18	33.3	10	18.5	3	5.6	2	3.7	3.98	1.07

According to Table 4, 70.4 % (strongly agree or agree) of students believe that mathematics is required to be successful in issues of both school and business (M=3.83); 57.4 % of students believe that, mathematics helps to acquire a better place in society (M=3.50); and finally 72.2 % of students believe that mathematics teaching should be connected to daily life (M=3.98). According to perception of students, with highest mean score, it can be said that the Mathematics teaching and Trigonometry unit should be connected to daily life.

The Perceptions of Teachers about the Objectives of Mathematics Curriculum

According to perceptions of teachers, all of them stressed the point that this course was highly important in order for students' develop higher order thinking skills like critical thinking, problem solving and making connections with daily life.

T2 stated that:

"Mathematics lesson is important because it improves thinking skills and causation abilities of students. Since every event can be evaluated as a problem in life by learning mathematics students learn to hypothesize, collect data and find the results…"

Results Related to Second Research Question

The second research question was related to the perceptions of students and teachers about the content of mathematics curriculum while learning trigonometry sub-learning domain. The results of the student questionnaire about the content of mathematics curriculum were shown in Table 5.

Table 5: Means, Frequencies and Percentages of Needs Assessment for the Content of Mathematics Curriculum

	Strongly Agree		*Agree*		*Neither Agree nor Disagree*		*Disagree*		*Strongly Disagree*		*M*	*SD*
	N	f	N	f	n	f	n	f	n	f		
4. After checking pre-requisite knowledge, new units should be taught.	39	72.2	12	22.2	1	1.9	2	3.7	-	-	4.63	.71
6. There should be fewer formulas.	24	44.4	17	31.5	10	18.5	3	5.6	-	-	4.15	.92
7. Units should be introduced in conjunction with the previous issues.	19	35.2	18	33.3	9	16.7	4	7.4	4	7.4	3.81	1.21
8. Units should be supported with examples.	36	66.7	14	25.9	2	3.7	2	3.7	-	-	4.56	.74

According to Table 5, almost all students either strongly agreed or agreed that mathematics should be taught after checking the shortcomings related to prior units or the level of pre-requisite knowledge (M=4.63) and units should be supported with examples (M=4.56). Moreover, students stated that fewer formulas should be included (M=4.15) while learning trigonometry. Finally, according to 68.5 % of students, units should be introduced in conjunction with the previous issues (M=3.81). According to perception of students, it can be said that mathematics teaching and Trigonometry unit should be taught after checking students' perquisite knowledge and by connecting it with previous subjects.

The Perceptions of Teachers about the Content of Mathematics Curriculum

According to perceptions of teachers, the content of mathematics curriculum was not appealing to students' age level, it is not interesting and it is not related to daily needs of students. Moreover, students found the units very abstract.

(T2, T3) stated that:

"The content was overloaded with trigonometry, some of the units of trigonometry were not appealing to the interests of students.

(T1) stated that:

"The time allocated for teaching mathematics units appropriate but the units are very abstract for the students."

Furthermore, teachers stated the sequence of the content was not parallel with other disciplines, basically with geometry (T1, T3) as the most stressed negative opinion.

T3 stated that:

"We teach unit circle in mathematics before the students are taught this unit in geometry lesson….. The content is not parallel with geometry lesson so while teaching some units it is hard to teach it to students who does not have necessary knowledge …".

Results Related to Third Research Question

The third research question was related to the perceptions of students and teachers about the course book of mathematics curriculum while learning trigonometry sub-learning domain. The results of the student questionnaire about the course book of mathematics curriculum were presented in Table 6.

Table 6: Means, Frequencies and Percentages of Needs Assessment for the Course Book

	Strongly Agree		Agree		Neither Agree nor Disagree		Disagree		Strongly Disagree		M	SD
	n	F	n	F	n	f	n	f	n	F		
3. Mathematics course book is appropriate to our level of learning.	-	-	8	14.8	15	27.8	12	22.2	19	35.2	2.22	1.09
10. Course book is interesting.	6	11.1	2	3.7	2	3.7	13	24.1	31	57.4	1.87	1.33
11. Course book supports the units learned in class.	-	-	1	1.9	8	14.8	11	20.4	34	63	1.56	.82
13. Exercises in the course book are sufficient.	-	-	7	13	12	22.2	10	18.5	25	46.3	2.02	1.11

Table 6 revealed that 83.4 % (either strongly disagree or disagree) of students believed that course book did not support the subjects taught at class (M=1.56) and 81.5 % of students stated that course books did not attract their attention (M=1.87). Moreover, 64.8 % of students stated that the exercises in the course book were not sufficient (M=2.02) and finally, according to almost 57.4 % of students, course-book was not appropriate to the level of students (M=2.22). According to perception of students, it can be said that the course should be designed in an attractive way that support student learning with exercises appropriate to the levels of students.

The Perceptions of Teachers about the Course Books

Teachers stated that generally they liked the course book when they compare this book with the previous ones. They said that this one was more reader friendly for both students and teachers. Since the course book was the main material of the course, it was highly important resource for teachers. However, all teachers (T1, T2, T3) said that:

"The course book need to be elaborated with more examples and visuals and the problems should be arranged from easy to harder but in the present course book there are either very easy or very harder problems. The level of problems should include moderate hardship."

Moreover, teachers stated that activities of course book can be applied better in schools where students have lower achievement level, while in schools with higher level of student achievement, these activities were stated as easy and not enough for the development of students. Finally, one of the teachers mentioned that instead of using the course book, she used test books from different publishers. By this way, students can learn the solutions of different kinds of problems.

Results Related to Fourth Research Question

The fourth research question was related to the perceptions of students and teachers about the learning environment while students learning trigonometry sub-learning domain. The results of the student questionnaire about the learning environment of 10th grade mathematics curriculum were shown in Table 7.

Table 7: Means, Frequencies and Percentages of Needs Assessment for the Learning Environment

	Strongly Agree		Agree		Neither Agree nor Disagree		Disagree		Strongly Disagree		M	SD
	n	f	N	f	N	f	n	f	n	f		
9. The weekly duration of Mathematics course is sufficient.	17	31.5	21	38.9	8	14.8	2	3.7	6	11.1	3.76	1.26
29. There should be places which gives opportunity to make research like library.	25	46.3	21	38.9	5	9.3	2	3.7	1	1.9	4.24	.91
30. There should be regular subscription to magazines or books about mathematics.	14	25.9	22	40.7	13	24.1	3	5.6	2	3.7	3.80	1.02

It was unearthed in Table 7 that almost 85.2 % of students (strongly agree or agree) believed that there should be places which give opportunity to make research like a library or computer laboratory (M=4.24) and 66.6 % of students believed that a regular subscription to magazines or books about mathematics should be provided. Moreover, 70.4 % of students believed that the weekly duration of Mathematics course was sufficient (M=3.76). According to perception of students, there should be special

places like a library or computer laboratory including up to date magazines and book to deal with or to make research about mathematics.

The Perceptions of Teachers about the Learning Environment

Most of the teachers stated that classroom was the only environment for courses and they did not consider any other place. One of the teachers mentioned that every course needed a separate classroom.

"If I had a separate classroom for mathematics lesson, I could collect all the materials related to subjects there and hang all of them to the walls of class"

All three teachers agreed that four hours a week was adequate for the mathematics lesson in overall. However, they indicated the need of students' to separate more time for themselves to think about the concepts and solving problems by themselves.

Results Related to Fifth Research Question

The fifth research question was related to the perceptions of students and teachers about the instructional activities of the mathematics curriculum. The results of the student questionnaire about the instructional activities of mathematics curriculum were indicated in Table 8.

Table 8: Means, Frequencies and Percentages of Needs Assessment for the Instructional Activities

	Strongly Agree		*Agree*		*Neither Agree nor Disagree*		*Disagree*		*Strongly Disagree*		*M*	*SD*
	n	*f*	*N*	*F*	*n*	*F*	*n*	*f*	*n*	*f*		
12. While learning trigonometry computer assistance is needed.	10	18.5	17	31.5	17	31.5	9	16.7	1	1.9	3.48	1.04
14. I learn best in situations where the teacher explained the subject.	24	44.4	19	35.2	8	14.8	2	3.7	1	1.9	4.17	.95
15. I learn better with projects.	2	3.7	10	18.5	14	25.9	18	33.3	10	18.5	2.56	1.11
16. I learned better with research.	10	18.5	18	33.3	13	24.1	10	18.5	3	5.6	3.41	1.16
17. I learn better by doing activities prepared according to our interests and knowledge levels.	21	38.9	25	46.3	7	13	1	1.9	-	-	4.22	.74
18. I learn better with computer-aided methods.	9	16.7	10	18.5	21	38.9	13	24.1	1	1.9	3.24	1.06
19. I learn better with discussions.	5	9.3	12	22.2	14	25.9	14	25.9	9	16.7	2.81	1.23
20. There should be discussions in which ideas about trigonometry are expressed.	9	16.7	18	33.3	14	25.9	7	13.0	6	11.1	3.31	1.23
21. I learn better with group work.	15	27.8	20	37.0	10	18.5	8	14.8	1	1.9	3.74	1.09
22. I learn trigonometry better with necessary materials, and models.	20	37	17	31.5	12	22.2	5	9.3	-	-	3.96	.99
23. I learn trigonometry better with questions including stories or scenarios.	8	14.8	12	22.2	12	22.2	17	31.5	5	9.3	3.02	1.24

According to Table 8, it was found that 85.2 % of students with highest mean (M=4.22) believed that they learned better by doing activities and exercises prepared according to their interests and knowledge levels; 79.6 % of students stated that they learned best in situations where their teacher explained the subject to them with the second highest mean (M=4.17); 68.5 % of students stated that they learned Trigonometry better with necessary materials, and models (M=3.96). On the other hand, students do not prefer projects (M=2.56); discussions (M=2.81) and questions including stories or scenarios (M=3.02).

The Perceptions of Teachers about the Teaching-Learning Processes of Mathematics Curriculum

In terms of instructional activities of the curriculum, all three teachers stated that they did not follow all the instructional methods which were stated in the mathematics curriculum. They often chose lecturing method because of covering many things in a restricted time. Another reason for choosing lecturing method also stemmed from classroom setting and arrangement of students. They were not appropriate for the activities suggested in the constructivist curriculum. Moreover, teachers indicated that since classrooms were crowded, group activities were not suitable for their classes and for the adolescent students. One teacher stated that:

"maybe it is better to follow group work for the Mathematics lesson in order to help students learn mathematics effectively" (T3) but T1 and T2 stated that "When I asked students to work in groups, there were much noise and chaos in the class..."

Moreover, all teachers informed that although it was stated in the curriculum, they could not implement learner-centered instructional methods and techniques because of students' and parents' being exam oriented, low Mathematics level of some students (hard for discovery method), absence of larger classes, time constraints and too much content to be covered. Finally, all three teachers stated that drama method was not appropriate for the Mathematics course. It can be understood that, teachers mostly being presenter and source of the knowledge and directors of questions to students. Teachers' seeing their roles as being the transmitter of knowledge made students as the receivers of knowledge.

Results Related to Sixth Research Question

The sixth research question was related to the perceptions of students and teachers about the evaluation processes of mathematics curriculum. The results of the student questionnaire about the evaluation processes mathematics curriculum were indicated in Table 9.

Table 9: Means, Frequencies and Percentages of Needs Assessment for the Evaluation Processes of the Mathematics Curriculum

	Strongly Agree		*Agree*		*Neither Agree nor Disagree*		*Disagree*		*Strongly Disagree*		*M*	*SD*
	n	*f*	*N*	*f*	*n*	*f*	*n*	*f*	*N*	*F*		
24. Students should be graded according to written exams.	2	3.7	10	18.5	13	24.1	13	24.1	16	29.6	2.43	1.21
25. Students should be graded according to projects.	-	-	5	9.3	21	38.9	13	24.1	15	27.8	2.30	.98
26. Students should be graded according to classroom observations throughout the semester.	8	14.8	23	42.6	8	14.8	9	16.7	6	11.1	3.33	1.24
27. Students should be graded according to their research abilities.	5	9.3	15	27.8	14	25.9	13	24.1	7	13.0	2.96	1.20
28. Students should be graded according to contributions to group works.	2	3.7	11	20.4	16	29.6	14	25.9	11	20.4	2.61	1.14

It was revealed in Table 9 that 57.4 % of students believed that they should be graded according to classroom observations throughout the semester (M=3.33). On the other hand, students did not want to be graded according to projects (M=2.30) and written exams (M=2. 43).

The Perceptions of Teachers about the Evaluation Processes of the Mathematics Curriculum

The evaluation procedure for Mathematics course was predetermined as three essay type exams and one performance work for all students for each semester and one project work was optional to be completed in a year. Students mostly memorized the formulas about the subjects and if they were asked a differently stated question they would not solve it. Hence, the achievement was quite low in this course. Teachers also mentioned that the anxiety level of students was very high for the Mathematics.

Regarding the types of evaluation procedure, teachers stated that they applied multiple choice test (one exam) and essay type exams (two exams). However, all three teachers stated that they mostly preferred essay type exams since they could understand whether students learned the unit or not through this kind of exams.

T3 stated that:

"When students are evaluated by applying multiple choice tests, we do not know whether they can solve the problems or they find the answers just by chance"

Teachers mentioned that evaluation process was important for the course. Furthermore, teachers indicated that although suggested in the curriculum, they did not apply alternative evaluation procedures such as observation of students' progress, self-evaluation or peer evaluations for this course.

DISCUSSION AND RECOMMENDATIONS

This study explored ATHS students' mathematics course needs through the perception of students and teachers while teaching trigonometry sub-learning domain. According to results of the study, students believed that mathematics is required to be successful in issues of both school and business, helps to acquire a better place in society and finally mathematics teaching and especially Trigonometry unit should be connected to daily life. However, as stated by Gundogdu, Albayrak, Ozan and Celik (2012) that although objectives (such as mathematics is helpful in using mathematics in other courses and daily life, helpful in

being aware of the real life problems, estimate and process by mind, helpful in developing problem solving skills and make use of them in different situations etc.) of mathematics course seen significant there were differences between the importance assigned to them and the realization of the objectives which was indicated as need in this study. In other words, although the objectives of the course was emphasized very important, their realization in mathematics teaching and exams were insufficient.

According to perceptions of students, the level of some content was very heavy for 10th graders and alleviation of some topics was indicated as a need. According to 10th grade Mathematics curriculums of Canada Germany and Turkey, directional angles, trigonometric functions, trigonometric functions in right triangles, graphs of trigonometric functions topics are included similarly in the programs of all three countries. However, Turkey's mathematics curriculum differed from the curriculum of other two countries included additional units as addition and subtraction formulas, conversion and inverse conversion formulas (Guzel, Karatas and Cetinkaya, 2010). Moreover, In England, trigonometry curriculum different from the curriculum of Turkey does not include the subjects of half-angle equations, addition and multiplication formulas, angle measurement units and conversion of one to another unit, specification of trigonometric ratios of a right triangle, conversion and inverse conversion formulas, identification of unit circle, identification of trigonometric functions on unit circle and the usage of trigonometric table (Delice and Aydın, 2015). On the other hand like the curricula of Canada and Germany, mathematics curriculum in England do not direct students memorize the formulas but direct students to make connections between real life and trigonometry hence, include a formula booklet. Hence it was found that many students feel that this course was very unnecessary in their daily lives. For these reasons, high school secondary mathematics curriculum in Turkey should be revised again and some topics of it should be left to university level mathematics courses.

In addition to these, students indicated the need that teachers should check previous knowledge. In other words, it can be said that since mathematics units have linear relationship with each other, if students do not succeed at previous units, then learning a new unit probably will be harder. Besides, spiral programming approach, Tyler's (1949) linear programming approach is dominant in the mathematics curriculum. Mathematics subjects are ordered from easy to difficult, from simple to complex, from known to unknown, from concrete to the abstract, away from the general to the specific and closely regulated (Tyler, 1949).

Furthermore, both students and teachers stated that the questions of the course book either very easy or very hard for students. Teachers stated that they did not implement activities indicated in the course book and also problems in it were indicated as either difficult or easy besides being inadequate and sloppy. Similarly, the study conducted by Gundogdu, Albayrak, Ozan and Celik (2012) indicated that almost one third of the inspectors agreed with the statement that guidebooks prepared for teachers rarely meet the needs of teachers. According to the results of needs assessment, the main focus of students was the university entrance exam and questions related to university exam. Hence, teachers stated that they used test books of different publishers. However, the goal of trigonometry teaching and mathematics courses in general is not only the memorization of procedures and determining reliable methods to elicit correct solutions on paper-and-pencil exercises and exams but rather learning mathematics with understanding (Weber, 2005). Hence, it can be said that the current instruction of trigonometry is not consistent with the goals stated in the curriculum (MONE, 2013).

According to perceptions of students, they needed places like library or computer laboratories which give opportunity to make research. According to results of many studies there is convincing evidence that the quality of the classroom environment in schools has a significant influence on the development and learning of students (Dorman, Adams and Ferguson, 2002; Fraser, 1998; Velayutham and Aldridge, 2013).

According to results of the study, students stated the need that they learned better by activities and exercises prepared according to their interests and knowledge level and in situations where the teacher explained the subject to them. On the other hand, students did not prefer projects and discussions. As it can be seen, students expected their teachers present the knowledge readily and continue their traditional roles. Students accepted the role of being passive listeners not being researchers and discoverers of knowledge. Hence, teachers mostly used lecturing method and question-answer methods for this course.

Teachers were not eager to use additional materials for this course except white board, course books and test book. Similarly, in the study conducted by Kose (2011), the elementary mathematics curriculum did not enable the active participation of students, but resulted in teachers' spend a lot of time to prepare the materials to increase the effectiveness of teaching learning process which make students spectators at this time. However, there are many studies in the literature that active learning including computer aided

teaching, graphic method, dynamic modeling software and cooperative learning contribute to mathematics achievement even learning abstract subjects like trigonometry as stated by students (Agac, 2009; Calıskan, 2009; Emlek, 2007; Ozturk, 2012). In addition to these, Zengin, Furkan and Kutluca (2011) stated that the use of computers and mathematical software could help in understanding the mathematical concepts and relate them to the daily lives of students since they allow students to manipulate pictures and relate its dynamically changing state to the corresponding numerical concepts. Similarly, in the study of Temli Durmuş (2016) mathematics teachers indicated the importance of materials in helping the students to make abstract terms concrete. Hence, they improve students' understanding.

Furthermore, in the study teacher stated their unwillingness that when they were asked to work in groups, there were much noise and chaos in the class. However, as stated by Felder and Brent (2007) there are many advantages of applying group work or cooperative learning. As they indicated, instead of simply watching and listening, students learn more by doing something actively. In addition to these, cooperation enhances learning of both mathematically poor students and strong students. While mathematically strong students by explaining and clarifying mathematical subjects to mathematically poor students often find gaps in their own understanding and fill them in; mathematically poor students who are likely to give up if they get stuck when working individually, keep going when working in groups.

Moreover, in this study, all three teachers stated that drama method was not appropriate for the Mathematics course. On the other hand, the study conducted by Ornek (2007) determined the effects of role playing (dramatization) when teaching trigonometry. The findings indicated the positive effect of dramatization both on mathematics achievement and on the attitudes towards mathematics when teaching trigonometry to eight grade students.

It was determined that students did not want to be evaluated according to midterm and final exam results they wanted to be graded according to teachers' observations during the semester. However, teachers stated that they preferred written exams in order to identify that whether students understood the concepts or not. Furthermore, teachers stated their indisposition about applying alternative evaluation approaches as self-evaluation or peer evaluations for this course. It can be said that existing evaluation procedures only assesses the cognitive products of the course however, the evaluation of affective and psychomotor properties of students can be stated as an important need.

Recommendations of the Study

In this study, some suggestions have been made to come over the difficulties that emerge during teaching and learning process of trigonometry. In this study, only the opinions of students and teachers about the mathematics curriculum were included which constitute the stakeholders, who are directly related to teaching and learning process. However, for a further study, the opinions of administrators, inspectors, program developers, mathematicians from universities and parents can be included and their opinions can be gathered about different levels of mathematics curriculum.

The organization of appropriate learning environments are very important in order to achieve the aims of mathematics curriculum. Since, teachers are active in the design of learning environments, as also stated by Ornstein and Hunkins (1998), materials used for instruction are not pre-determined lists. Hence, a separate mathematics classes should be equipped with mathematical books, magazines, mathematical and technological materials and finally, mathematics manipulation software in accordance with the needs and interests of students.

Based on the results of this study, teachers are suggested to create an educational atmosphere where students are actively engaged in learning, teachers and the students cooperate, interesting and effective materials are included and finally alternative evaluation strategies are included teaching learning processes when necessary.

Finally, it is suggested according to the results of this study, beside teaching trigonometry as formulas and rules, conceptual understanding including geometrical representations should also be emphasized. Teachers should visualize the trigonometry concept as much as possible and increase the motivation of the students by talking about the reflection of trigonometry in our daily lives and the history of trigonometry.

All in all, this needs assessment study was conducted as the starting point for curriculum development since it provides an accurate profile of a target group. The needs assessment process as a continuous procedure which reviews students' needs, wants, and lacks. In the light of these research results, program developers could revise the mathematics curriculum in line with the goals of Ministry of Education.

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