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# The views of the teacher and students in regards to the use of the history of mathematics in the teaching of fractal subject

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## Abstract

This study aims to determine the views of a mathematics teacher and his students about fractal subject which is processed with the history of mathematics. It was carried out with 35 students enrolled at the 8th grade of a school in Trabzon during the spring term of the 2009-2010 school year. Data collection tools consisted of students' compositions and semi-structured interviews with the students and their teacher. It is understood according to the interviews with the teacher and his students, the course dedicated in the history of mathematics is surprising and useful and the materials are interesting and effective.
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## 1. Introduction

Human type required by the society is changing along with the changing and developing world (Umay, 2001). This change has also showed its effect in the education. Since the adoption of the constructivist approach was adopted in our country, the mathematics curriculum has been renewed constantly. A teaching program that was adopted with by the constructivist approach has been implemented for approximately 5 years. This mathematics curriculum advices that the students should learn through doing-living by emphasizing on the student centered education (Baki & Çabakçor, 2010). However, the negative attitudes of the students towards mathematics, with a sense of not trusting themselves, even, thinking that they are not smart enough to learn mathematics makes student-centered education difficult (Elçi, 2002). At this stage, the use of the history of mathematics can motivate students and at the same time facilitate their understanding of mathematics topics. Additionally, the use of the history of mathematics can provide several benefits for students which can be summarized as follows:

**a)** The history of mathematics is an excellent source which contains interesting problems to improve students' problem solving skills.

**b)** It ensures that students learn more mathematical concepts meaningfully.

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**c)** It assists students to connect mathematics, mathematics applications, and topics of mathematics with other disciplines.

**d)** The history of mathematics allows students to relate mathematics with society (Wilson & Chauvot, 2000).

Hickman and Kapaida (1983) stated that the history of mathematics should be used in mathematics courses, because mathematics is a science that is continually evolving. İdikut (2007) found that courses using the history of mathematics were more succesful than couses that only used teacher guidebooks in her postgraduate thesis. All these studies show that the history of mathematics should be intagrated into classes.

Only man-made objects can be described in Euclidean geometry. However, unlike Euclidean geometry, many structures in nature have an irregular and fragmented apperance such as orbits of the planets, heart, bronchi of lungs, blood vessels, skin, beach strips, etc are composed of fractal structures (Gleick, 2000). The fractal subjects are taken place in the new mathematics curriculum. This study investigate fractal subject, due to inclusion of fractal textbooks to fractal issues and the lack of history of fractals and extinction of a study on the relationship between fractals and its history. Similarly, the recent increase on the researches on the history of mathematics have directed us to associate the history of mathematics with fractals. In this study, the views of a teacher and his students were obtained about the history of mathematics in the teaching of fractal subject and reflections on the classroom environment were given, by using the history of mathematics as a tool.

Koçak (2004) said "Mini-tiny fleas, suck their mothers, their babies in them, or them to their offspring, their ends never come". He stressed with this saying that fractals are a common name of geometric shapes which often resemble themselves or repetitive shapes forever intertwined. Consequently, the problem "what is the historical development of fractals and what are the views of teachers and their students about using the history of mathematics in the teaching of fractal subject?", arises. In the context of this problem, the opinions of teachers and their students were asked about fractal subject regarding the lectures using the history of mathematics.

## 2. Method

This research was carried out by using "case study" method. Since the case study appropriate for the researches conducted individually due to the creation of a possibility to make a research within short amount of time by, as it name indicates, allowing researcher to focus on a special case. Although there is not aimed in such studies, the results of the study may shed light on general (Çepni, 2007).

### 2.1. Participants

The research was conducted with 19 female and 16 male students studying at the 8th grade of a primary school in Trabzon during the spring semester of 2009-2010 school year.

### 2.2. Data collection tools

The data for this study was collected through student compositions and interviews conducted with teachers and students. First, 2 worksheets have been prepared on the fractal subject. The pilot implementation of these worksheets was distributed to 30 students studying the 8th grade in another primary school located in the center of Trabzon. Upon the pilot implementation, the views of teachers and experts were extracted and 2 worksheets were finalized. A semi-structured interview was made with 5 students to determine their opinions. As a matter of ethics, these students were encoded in the form of "S1, S2, S3, S4 and S5". In addition, after the implementation, the students were asked to write their views about the course in the form of a composition. At the end of the study, an interview was conducted with the teacher to evaluate the course.

## 2.3. The implementation of data collecting tools

In this practice, which lasted a total of 4 class hours, a video about fractals was watched by the students. Then, examples of fractals were shown and the historical development of fractals was explained. In addition, the sections of life of Karl Weierstrass and Benoit Mandelbrot, founder of fractal geometry, were presented. A problem solving task in Gleick (2000)'s book "Chaos" and the starting point of the "length of the coastlines of England" was solved with the students. At the end of the course, the worksheets decorated with pictures and information about fractals were applied in pairs.

## 2.4. Data analysis

The recorded interviews were listened to and copies of the interviews were printed. During the analysis of the interviews, instead of using the participants' thoughts verbatim, irrelevant responses of the participants and the expressions and interpretations of researchers were removed, the rest of the information was analyzed according to their similarity. Then, codes and themes were established and the findings were presented in tables. In addition, compositions written by students, as well as interviews with the teacher and students were used in direct quotations.

## 3. Results

This section of research consists of the findings of semi-structured interviews with the students and teacher and the finding of the students compositions.

## 3.1. The findings obtained from the semistructured interviews with students

Table 1 shows the students' response to *"What are the surprising aspects of the mathematics course in relation to the history of mathematics?"*.

Table 1. Suprising aspects of the mathematics course in relation to the history of mathematics

| Theme | Codes | Participants | Supporting Sentence |
|---|---|---|---|
| Recognizing the Aim of the History of Mathematics | The relation of mathematics and nature | S2, S3 | **S3:** We learnt nature has mathematics and also fractal is nature of mathematics. We saw that nature has so many fractal examples in plants such as filix mas. |
| | Learning that mathematics has a history | S3, S4, S5 | **S5:** The biggest difference between this course and other courses is learning the history of mathematics. |
| | Recognized that mathematics is a living science | S1, S2, S5 | **S5:** After this course, I learnt that mathematics has a history of development and change. |

Table 1, indicates students believe that mathematics have examples in nature, and is an interesting and living science. Students' answers are supported in their compositions. One student wrote a compositions as follows: *"We were taking mathematics courses as theoretical issue and their examples. We didn't know the answers to some questions such as; how mathematics existed, where, when and who discovered mathematics etc. We were studying Level Determination Examination (LDE), so we didn't have an answer to any of these questions. With this course, we learnt where mathematics started and how it was discovered. When we learned that mathematics has many examples in nature and it has a long history, we were **surprised.***

Students' answers about "W*hat are the benefits of using the history of mathematics courses?"* are given in Table 2 as follows.

Table 2. The benefits of using history of mathematics in courses

| Theme | Codes | Participants | Supporting Sentence |
|---|---|---|---|
| The Benefits of Using the History of Mathematics in the Curriculum | Providing the emergence of different ideas | S2 | **S2:** Different ideas emerged. |
| | Showing that mathematics is associated with daily life | S3 | **S3:** Yes, I can use the history of mathematics in daily life. Because we are learning history of mathematics. |
| | Helping to understanding mathematical issues | S1, S2 | **S2:** History of mathematics is helping us to better understand concepts. |
| | Demonstrating how mathematics topics are related to our surroundings | S2, S3 | **S2:** After this course, I understood that everything is related to mathematical concepts. |
| | Using students activities in mathematics courses | S2, S4 | **S2:** This coursse consist of a combination of my friend's activities and the history of mathematics. |
| | Learning where and how mathematics concepts originated | S3, S4 | **S4:** We learnt where mathematics originated. I mean, if we learn one concepts origin, we can have deeper understanding and good knowledge of these concepts. |
| | Making mathematics topics' meaningful | S4, S5 | **S5:** After we learnt the history of mathematics we can carry these ideas forwardin this course. |
| | Increasing the interest and attractiveness of mathematics topics | S1, S3, S5 | **S1:** I was very interested in the history of mathematics, British land has infinitive length. |
| | Showing that mathematics doesn't have just calculus | S2, S3, S4 | **S4:** Our old courses were about calculative works such as 2 * 2 = 4. But this course showed us that mathematics is in nature and fractal is a part of this nature . |

Table 2 concludes that the history of mathematics provides conceptual learning, increasing the awareness of mathematics courses and showing that mathematics is more than just calculating. In this state one student's composition showed that *"This course provided a much **deeper understanding** than another courses. While using the history of mathematics course provided our general knowledge increased and focused on mathematical concepts. When we saw Turkish scientists' inventions, our **desire to learn increased**.*" The students' compositions and their semi-structured answers support the positive aspects of the history of mathematics.

Table 3 showed the students' answers to "*What do you think about the materials used in this study?*".

Table 3. Students' views about using materials

| Theme | Codes | Participants | Supporting Sentence |
|---|---|---|---|
| Properties of Using History of Mathematics' Materials | Providing fluency to cource | S1 | **S1:** If we learned all courses like this, the topic of mathematics will be more practical and will given us a faster learning process. These topics provide us with a deeper understanding of mathematics. |
| | Making active student learning | S4 | **S4:** The worksheets, given from teachers, have direct students' answers. This provides student centered learning. |
| | Including history of mathematics | S4 | **S4:** Our materials are visual and they are related with history of mathematics. |
| | Containing useful information | S5 | **S5:** It was good, useful and effective. |
| | Showing that mathematics is a part of nature | S5 | **S5:** The materials and history of mathematics were useful to learning. |
| | Structuring of interest | S2, S3 | **S3:** Materials are very interesting and engaging. |
| | Facilitating the understanding | S1, S3, S5 | **S5:** In this manner, the course is very professional and provided easy learning for us. |

Table 3 is showing that students are satisfied with the use of materials. One students' composition is related to the history of mathematics and materials. It says "*This course, unlike other courses, is using materials and situations to **take our attention** to mathematical concepts that's why the history of mathematics is so interesting. Furthermore supporting learning with materials and using worksheets helped to us to better **understand the mathematics' topic**.*"

*3.2. The findings obtained from the semistructured interview with teacher*

Following this course, the class' teacher was interwieved and enquired about her general assessment of the course. The teacher answers are as follows *"Actually I never used the history of mathematics in my courses. After observing this course, I noticed that this method provided the students with a deep understanding of how topics can turn to story, capturing the students attention. Examples such as the length of the coastline of Britan were very useful. But, while using the history of mathematics, we must establish a good balance because the training curriculum and* **preperation of the LDE exam** *for students and using history of mathematics will be difficult."*

## 4. Discussion

In this study, it is found that students have positive attitudes toward the course using the history of mathematics. Several studies have reached findings resembling this conclusion (Jankvist, 2009; Karakuş, 2009). In addition, teacher's positive thoughts regarding with using the history of mathematics in the course are similar to the findings of the study of Philippou and Christou (1998). It is believed that, the use of materials, and videos summarizing the historical development of fractal have an impact on the positive statements of students and teachers on the history of mathematics.

## 5. Conclusion and Recommendation

In this study, the impact of the course associated with the history of mathematics and the students' impressions were investigated and it is concluded that students have positive attitudes toward this course. Similarly, the teacher has also carried the same excitement and curiosity. Separately, it is understood that based on interviews with the teacher and students, the course in the history of mathematics is surprising as well as useful and the materials are interesting and effective. Therefore, it is recommended that similar studies can be carried out for other subjects of mathematics and in-service courses should be given to teachers regarding the topic with "How do teachers use the history of mathematics in lessons?" Finally, with respect to the interviews with the teacher and students, the involved time and placement exam LDE can be a problem in the use of the history of mathematics in courses.

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