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Students' views about activities developed on the history of Pythagoras theorem

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Abstract

In this study, students' views were taken about history of Pythagoras theorem that contains improved activity which in the history people was thrilled at and there are a lot of their proofs. The study was conducted with 15 students 8th grade at a public elementary school in Trabzon during the spring term of 2009-2010 school year. Case study method was used in this study. Data were taken from observation notes which were written by researchers and semi-structured interviews that were conducted with students. At the end of the study, most students said that they took pleasure in practice and wanted such kind of the lessons. © 2011 Published by Elsevier Ltd.

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1. Introduction

Generally students see mathematics as a difficult lesson consisting of the abstract concepts that are away from life, unattractive equation and formula. Maybe the nobility and beauty of mathematics result from its difficulty. The people who are interested in working on it can discover this beauty. As Poisson stated “*The world is beautiful thanks to just two things: to discover and teach mathematics*”. At this point mathematics instructors should feel this beauty and introduce it to their students (Baki, 2008). For this reason, history of mathematics is benefitted.

The history of mathematics, with its rich content and interdisciplinary that it presents, has been one of the most important methods (Kar & İpek, 2009). According to Swetz (1995), mathematics history makes some subjects to be understood in a more detailed way. Thus, lessons become more interesting and successful. Byers (1982) stated that discovering the history of mathematics will increase students' interest towards learning mathematics. By this way, students can see the enjoyable, exciting and adventurous side of the mathematics (Gulikers & Blom, 2001). Why should teachers use history of mathematics in their lessons? As an answer for this question, most people consider using history of mathematics as concretizing it (Sassano, 1999).

Fauvel (1991) listed the reasons for using history in mathematics education as follows: Mathematics history, **a)** increases students' motivation in mathematics education, **b)** it shows the concrete side of the mathematics, **c)** it provides the opportunity to present the mathematics subjects in order, **d)** it shows the social side of mathematics, **e)** it provides the opportunity to compare past and modern techniques, **f)** it provides the opportunity

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for discoveries, **g**) it helps us to develop a multicultural understanding, **h**) it helps students to understand how concepts develop, **i**) it changes students' perception towards the mathematics, **j**) it makes mathematics less frightening.

According to Zaslavsky (1994), thanks to the content of the history of mathematics, students learn that mathematics emerges from the interests and needs. In the course of history, learning mathematics will vitalize the life inside the historical practices (Carter, 2006). Telling a famous mathematician's life story can attract students' attention to the mathematical subjects. The solutions for the problems in the past may be useful for students' own problems and may give them some opinions. Also, students can compare the old and new problem solving methods (Savizi, 2007). During the history, no other problem has aroused so much curiosity than Pythagoras theorem and no various arguments like this has been done (Şentürk, 1989). In this study, students' views were taken about the improved activities relating to Pythagoras theorem.

2. Method

This research is a special case study in which students' views were taken about Pythagoras theorem's history that contains improved activity which in the history people were thrilled at, and there are a lot of their proofs.

2.1. Participants

The study was conducted with 15 students who were 8th grade at a public elementary school in Trabzon during the spring term of 2009-2010 school year.

2.2. Data collection tools

In this study semi-structured interviews and observations were used as data collection tools. The interview questions were prepared by the researchers and necessary regulations were done by having taken the learned opinions. In order to students' who would take part in the interviews, reflecting the study group well, 5 students were chosen considering their classroom participation. Ethically, these students were coded as "S1, S2, S3, S4 and S5". During the practices, unconfigured observations were done by two of the researchers.

The aim of this study is to introduce students with the different applications of Pythagoras theory which had an important place in ancient civilizations and provide them with different points of view. With this aim, at the beginning of the application, every student was given a life story which was written in the name of the concerned student from the Pythagoras' own, under the name of a letter from the history and a worksheet consisting of three questions was used for students to evaluate the letters. Akdeniz (2008), Swetz (1994), and Şentürk's (1989) studies were benefitted in forming the life story. Besides, 2 worksheets which was integrated with the history of mathematics related to the various ways of proving the Pythagoras theory, were designed by taking learned opinions. In the phase of designing these worksheets, it was benefitted from Çakallı (1997)'s study. While the 1st worksheet consists of the steps having prepared considering Pythagoras' word under the name of "*Let's discover Pythagoras' word*", 2nd worksheet consists of Chinese proof of Pythagoras theorem under the name of "*Pythagoras Theorem in China*". After these two worksheets, the worksheet named as "*It's Time to Think*" was used in order to make students compare what they have learnt through worksheets.

2.3. The implementation of data collecting tools

The application took 4 course hours. Firstly, the letters which were written in the name of students own were handed out, then, they were asked to read the letters and answer the questions about the passage. After the students' comments were got, the worksheet named as "*Let's discover Pythagoras' word*" having been prepared considering "*The area of the square built upon the hypotenuse of a right triangle is equal to the sum of the areas of the squares upon the remaining sides*" was handed out and students were expected to form Pythagoras theorem. After students

formed Pythagoras theorem, the history of Pythagoras was told briefly. Then, 2nd worksheet named as “Pythagoras Proof in China” was handed out in order to enable students to see the proof of Pythagoras that was done in different civilizations. After having studied on these 2 worksheets, students were asked to compare these two proofs by presenting the worksheet named as “It’s Time to Think”.

2.4. Data analysis

In the phase of analyzing the data, firstly the answers given by the participants were tabulated question by question. Next, the data in the table were read again and again by the researchers and draft codes and themes were formed regarding the aim of the study. The answers which can have the same meanings were gathered under a common code. Concurrence was provided by discussing about the codes that researchers could not agree upon. The common codes formed after the discussions are presented with tables. By having described, observation data were directly presented.

3. Results

There are findings obtained from the semi-structured interviews and observations in this part.

3.1. The findings obtained from the semi-structured interviews

The answers that students gave for the question “Although Pythagoras theorem was used before, what do you think about its being named for Pythagoras?” are presented in Table 1. According to it, it can be said that students mostly find the person who has spreaded the Pythagoras theorem important.

Table 1. Students’ views about the name of Pythagoras theorem

Theme	Codes	Participants	Supporting Sentence
The Name of the Theorem	The use of Pythagoras theorem also by various civilizations	S3	S3: I was suprised by its being named as Pythagoras although Chinese also discovered it.
	Thinking that theorem wouldn’t exist unless Pythagoras have found it	S3	S3: Maybe unless Pythagoras have attempted it, such a thing wouldn’t have emerged. It’s just as well that it happened and was called Pythagoras.
	The necessity of the theorem’s having a general name	S5	S5: Indeed, it isn’t very good to name it for his name. All in all, many people, many nations discovered it but it was named for only him. Actually, it would be better if it had a general name.
	Spreading is more significant than discovering it	S1, S2, S3, S4, S5	S1: Someone might have discovered it but as the person who revealed it by having trusted himself has a prior importance, they considered it as Pythagoras.

The students’ answers for the question “What do you think about Pythagoras theorem and the different proofs of Pythagoras theorem?” are presented in Table 2.

Table 2. Students’ views about the different proofs of Pythagoras theorem

Theme	Codes	Participants	Supporting Sentence
Different Proofs of Pythagoras Theorem	Chinese proof is beeing more comprehensible and more realistic	S1	S1: In fact the method Chinese discovered had a more realistic and demonstrative quality.
	Different proofs’ providing various views about Pythagoras theorem	S2	S2: This situation enabled me to look at it from a different aspect.
	Proofs’ being applied and concreting the lesson	S1, S3	S3: This cutting and pasting aspect has drawn my attention since my childhood. It becomes more permenat when it is taught with different materials.
	Students’ demonstration by using the subjects like areas of square and triangle	S1, S2, S4, S5	S4: We have learnt that we get Pythagoras theorem from area of square and triangle. I didn’t know it, I just knew the formula.

Historical Process of Pythagoras Theorem	Several people’s dealing with Pythagoras theorem	S5	S5: At least I have learnt that not only Pythagoras but also many people discovered it.
	The use of a theorem which was discovered years ago, today.	S3	S3: All in all, today we use the thing which Pythagoras did in those days. Of course, it’s a great honour. They suprised me.
	Being learnt the history of Pythagoras theorem.	S1, S3, S5	S1: Of course, the discovery of some formulas, especially when we read Pythagoras’ life, the discovery of Pythagoras theorem suprised me.

When Table 2 is analyzed, it is seen that the students’ answers centered on the discovery of Pythagoras theorem with different ways and the historical process of Pythagoras theorem. Upon investigating the students’ views, it can be said that reaching Pythagoras theorem with the help of area makes the proofs more comprehensible.

Students’ answers for the question “Which parts did you like and did you have difficulties during the application? Why?” are presented in Table 3.

Table 3. Students’ views about the parts they liked and they had difficulty in the lesson

Theme	Codes	Participants	Supporting Sentence
What is Liked about the Materials	Thinking activities as enjoyable like games	S2, S4	S2: The activities were like the dramatization of proof.
	Writing a letter about Pythagoras life for students	S1, S3, S4	S1: Also, after I read Pythagoras letter, it really attracted my interest your handing out the letter.
	Activities are being effective and interesting	S1, S3, S4	S3: Your activities are very catchy. The whole lesson we learnt draw my interest. It was a nice lesson.
	Cut up activities and course’s being applied	S1, S2, S4, S5	S4: It is good for activities to be practical.
The Favorable Things about the Content	Learning the history of Pythagoras theorem	S2	S2: I found it sympathetic that it it has got a history.
	Learning how to demonstrate the proof of the theorem	S5	S5: I have understood the proof of Pythagoras theorem.
	Learning a famous mathematician’s life	S4	S4: We have learnt the life of a person whose name we knew before.
	The activities done being related with history	S2, S3	S2: It wasn’t boring; we both practiced it and related it to history.
	Matematicians’ increasing the interest	S2, S4	S2: I read the scientists who are interested in mathematician. Maybe I will be one of them.
Time	Lack of time	S1, S2	S1: It would be better if we had more time.
Direction	Some of the directions’ not being clear enough.	S3, S4	S3: There wasn’t any part I had difficulty but I had a bit difficulty in reading the directions one by one and where to paste them.

When Table 3 is analysed, it can be seen that the students’ positive answers are related to material and content, and students negative answers are related to time and direction. Besides, it was determined that students liked doing practice in the lesson and receiving a letter addressed themselves and what they disliked was that some of the directions weren’t clear and the time was limited.

The answers students gave for the question “What are the things that made this practice different from the previous mathematics lessons, for you?” are presented in Table 4.

Table 4. Students views about the lesson process which was integrated with the history of mathematics

Theme	Codes	Participants	Supporting Sentence
Views about the Lesson Process	Relating all lessons with history	S4	S4: I think that in all courses such histories should be instructed.
	History’s motivating to students towards the lesson	S5	S5: My friends who don’t like mathematics may like mathematics by this way.
	Students’ participating the lesson more actively	S2, S3, S4, S5	S4: In the previous lessons, we just read and passed it. The teacher gave instruction about only that subject, but she / he didn’t give any information about the history.
Views about the Materials	The use of different materials other than blackboard and chalk	S3	S3: We don’t use such materials in our lessons. I wish every subject was taught by this way, it was really good.
	Giving historical information about Pythagoras theorem	S5	S5: The lesson was good. It was good to learn that different people dealt with Pythagoras theorem.

When Table 4 is analysed, it is seen that students' answers were related to the period of lesson and materials. It was determined that most students think that teaching a lesson with the historical process of the mathematics enables students to attend the lessons more actively.

3.2. The findings obtained from the observations

When we evaluate the lesson generally, students' attendance to the lesson was very good. There was a good communication with the students. It was observed that the letters which came at the beginning of the lesson is a good motivation tool for drawing students' attention to the subject. It increased the students' interest to be more active during the lesson and theorize by themselves. It was also observed that students' self-confidence increase as a result of realizing the historical proofs. Some of the students mentioned that they should learn history, they might be able to do such discoveries one day, too.

4. Conclusion and recommendation

It made this theorem concrete with students to show different proofs of Pythagoras theorem with the prepared activities. Additionally, Pythagoras theorem's being named after Pythagoras within the historical process, students' learning famous mathematicians' life stories and students' realizing the historical proofs with the help of activities increased the students' self-confidence and interest towards the lesson. The findings obtained from the interviews such as “*Proofs' being applied and concretizing the lesson*”, “*Students' attendance to lesson in a more active way*” and classroom observations confirm these ideas. Considering these results, it is suggested for teachers to use mathematics history (talking about the mathematicians' life stories etc.) now and then in teaching mathematical subjects and concepts. Thereby, the instruction of mathematical subjects and concepts can become more meaningful and permanent for students. Lastly, it was observed that students liked the materials that were used during the lessons, but they had difficulty in doing the activities in time. Consequently, it is necessary to do a very good time planning by conducting such studies.

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