THE VIEWS OF STUDENTS AGED 12 ABOUT ACTIVITIES FOR HISTORY OF MATHEMATICS INCLUDED IN MATHEMATICS CURRICULUM

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The mathematics curriculum proposed by The Ministry of National Education, was re-organized within the scope of the study in the experimental group and famous mathematicians and historical anecdotes that played a role in discovery or development of the attainment were given to students as performance projects. The teaching period of 8 attainments were supported with 24 mathematicians and historical anecdotes during 4 weeks. In the study students' opinions were asked, the qualitative data were obtained via semi-structured interview form and descriptively analysed. Students expressed a positive opinion about the contribution of the method used to sentiment and cognitive dimensions.

INTRODUCTION

Mathematical expression and subject in the mathematics textbooks are usually without historical background. Through this kind of mathematics education intended for only right answers in the exams, it is imposible to devolop the mathematical thought. In this aspect, my intention is not to teach the history of mathematics, but to study how we can use historical material in the attainments for meaningful mathematics education. There is no use of history of mathematics in attainment of mathematics curricula in Turkey (TTBK, 2009). In this study attainments were supported by history of mathematics.

In addition to enjoyable examples from the history of mathematics and solving problems in several ways suggested by mathematicians in the different periods, biographies of ancient and modern mathematicians motivate pupils (Gulikers & Blom, 2001; Furinghetti & Radford, 2008). However, the motivation of teachers is important and a historical approach to mathematics enables the attitude of teachers to develop (Kin Ho, 2008). The history is a prerequisite for comprehensive mathematics education (Haverhals & Roscoe, 2010). In this context, I believe that there is a need to raise interest in mathematics and awareness of importance of mathematics for science by using history of mathematics.

MATERIAL AND METHOD

Working group includes 24 sixth grade students, who are 12 girls and 12 boys, from a rural school in 2011-2012 academic year the village in Bolu in Turkey. All students are 12 years old. There was one mathematics teacher at school. The school, where the researcher teachs, was determined as practice school. 13 out of 24 students were interviewed. The interviews were recorded. The duration of interviews varied from 5 to 8 minutes. The interviews lasted one week.

While preparing interview questions, the factors of attitude test applied for preliminary test and postliminary test were used (Nazlıçiçek & Ertkin, 2002). In line with factors of this test, interview form comprising of four questions was prepared. Here are guestions of interview:

- What are the negative things in the class in which the history of mathematics has been used and in the presentation of performance prejects? What are the different and good things in the issues mantioned above?
- Do you think that using the history of mathematics in the class and you presenting this as a performance project have an effect on your learning mathematics or your understanding of mathematics beter?
- It is required to think he mathematics class of the last year. Did you like the mathematics class? Why? Have the activities about the history of mathematics been helpful for your liking mathematics? How?
- Do you think whether the mathematics class in difficult or easy? Has the history of mathematics made the class easier or difficult? Why?

Pilot application of interview questions was carried out with 4 of seventh grade students who had a similar application about history of mathematics in the past academic year. According to feedbacks after the pilot application, interview questions were partly changed.

In Turkey there are five learning areas, which are numbers, geometry, algebra, probability and measurement, in primary school mathematics curriculum. This study covers eight attainments in the learning areas of algebra, numbers, geometry and probability (TTKB, 2009).

Education environment based on attainment was designed under the leadership of the researcher by giving students of working group performance projects about historical development of attainments. In line with the practice, the curriculum suggested by The Ministry of National Education was reorganized with the history of mathematics. Appendix-1 shows a part of reorganized curriculum.

The performance projects were presented as a song and a poem written for a famous mathematician, a drama about discovery or invention of attainment played in classroom and a poster informing about historical development of the subject or mathematician. The contents of the performance projects were evaluated with rubric developed by the researcher. Reinforcement practices were made under the guidance of the researcher within the remaining time allocated for the attainment.

The practice group had four-hour mathematics lessons which were splitted in half on two different days during the week. In the first hour of the lesson, three students presented their performance projects for an attainment and the researcher evaluated them with rubric. In the second hour of the lesson, the problematic situation of the attainment was pointed out and the reasons of the mathematicians to develop or contribute to the subject mentioned in the attainment were discussed. On the second day, the same practice was made and six performance projects were introduced to

class during a week and 24 performance projects about history of mathematics were introduced to class during the four-week practice.

The students were encouraged to benefit from different resources appropriate for their level and a mini-library consisting of mathematics and history of mathematics books was built. Two of students' presentations were explained below as a sample.

Firstly, a student, who made a presentation about Ali Kuscu in relation to the attainment of "Makes a prediction based on data.", introduced a model explaining the making process of a simple astrolabe to his/her classmates. An instruction explaining the making process of a simple astrolabe was given out. The predictions and deductions, which Ali Kuscu made about sky by using the astrolabe, were discussed. After the presentations about Ulugh Beg and Omar Khayyam, a drama including the characters of Ali Kuscu, Ulugh Beg and Omar Khayyam was played by students studying the same attainment.

Secondly, the term "to construct" was used during the introduction of mathematical objects. Before dealing with the attainments in geometry learning area, it was thought that geometry needed to be constructed and it was decided that one of the performance projects was the birth of geometry. In the drama played by students, one student represented Nile River and Egyptian people, who had submerged soils, determined the boundaries by asking priests for help and after ebbing they redetermined the boundaries with measuring instruments. After those experiences, students' views were asked.

Here, semi-structured interview method was used in order to examine in-depth views of students about using history of mathematics in mathematics education. The purpose of the interview technique is to find out feelings, views and believes of an individual about the study (Çepni, 2010). Semi-structured interview integrates fixed alternative answering into looking in depth in the related area (Büyüköztürk et al. 2010).

The data of the study descriptively analysed. Hence, in the descriptive analysis, the views of individuals interviewed or observed are frequently quoted in order to reflect their views dramatically. The objective of the analysis is to present findings to readers in an organized and interpreted way (Yıldırım & Şimşek, 2001).

The recorded interviews were literally put down on paper. Each answer of each student was separately examined. Data were generally categorized according to the answers at first. After reviewing the categories, sub-categories, which would cover all data, were determined. Some of the categories, which would cover the codes, were combined. Sub-categories covering one another or substituting each other were combined by taking the expert opinion. All answers of the participants, which they gave to the same questions, were included in the analysis. Therefore, there is a difference between frequency and the number of participants (Çepni, 2010).

FINDINGS

Student views about lessons themed history of mathematics in emotional dimension

The perceptive dimension of student views was examined under two titles which were positive and negative. 80 (95%) out of 84 answers in emotional dimension were positive and 4 (5%) were negative. It can be said that the activities themed history of mathematics effect positively students in an emotional dimension because positive answers are more than negative answers. Detailed subtitles of positive answers about the method used were given in Table 1.

Table 1: Positive student views about lessons themed history of mathematics

	Frequency	**Percentage**
To like learning mathematicians' lives	11	14
To be a centre of attraction	1	1
To make models of inventions about attainment	7	9
To like using poem, song and drama	25	31
To learn by having fun	9	11
To think it will benefit future	1	1
To like mathematics more	9	11
To get curious	3	4
To be influenced by a mathematician's life/ to aspire it	6	8
To participate actively in learning process	5	6
To overcome the fear of mathematics	3	4
Total	**80**	**100**

Student Medine underlined that her mathematics awareness in external world developed with the activities.

> Student Medine: Math is also related to play and poems. It spices. Nature is based on math.

Student Eren and Semiha said that they enjoyed at the lessons.

> Student Eren: Lessons are really comic and fun

> Student Semiha: We performed several plays and at the same time covered several subjects. I had a lot of fun.

When positive answers of students were taken into consideration, it can be said that they liked using the forms of poem, song and drama in lessons themed history of mathematics. The students had knowledge of previous studies on the attainment and enjoyed the experience at the mathematics lesson.

The other frequency in emotional dimension is "to like learning mathematicians' lives" with 11 answers (14%). If this dimension is thought to be the second important sub-category, it can be said that the deficiency of mathematical acculturation was filled. Student answers support this finding. Student Seda and Emre expressed their views about the subject as follows:

> Student Seda: While doing projects, we are learning mathematicians' lives. I like this much more. After learning their lives, I liked math more. I enjoyed learning their lives. I think we should do much more things about history of mathematics. We should learn their lives.
>
> Student Emre: We are learning a mathematician's life. We are learning how difficulty they had in finding their math teories and we have fun while learning these things.

When student answers and their percentage were examined, it can be said that students learning how to discover the subject in the attainment and who contributed to the development of this subject with the play-like activities provide positive student views about mathematics by exceeding the traditional mathematics. These findings are parallel with student views in the study which Lit, Siu and Wong (2001) conducted with a similar experimental subject; students said that in this study, they liked the lessons which were entertaining, different, not boring and made understanding easier. In line with the same direction, students in the study about re-invention of geometry, which Gulikers and Blom (2001) carried out, emphasized that they felt more competent in mathematics and said that they overcome their fear of mathematics and learned while having fun.

When student views and their percentages about the sub-category were taken into consideration, it can be said that students liked mathematics more with the history of mathematics activities and that they overcome their fear of mathematics. The students expressing no negative opinion about this finding reinforce this notion. With the parallel line, Kin Ho (2008) took student views about lessons where history of mathematics was covered. It was reported that there were positive feelings such as believe, interest, trust and determination in students' views.

There are 4 negative answers of students about activities themed history of mathematics. 2 (50%) out of 4 answers said that performance projects themed history of mathematics were difficult. However, the students said that they had difficulty while preparing the project but after some time they succeded. 1 (25%) out of the negative answers said that s/he did not like the presentations of his/her friends.

Student views about lessons themed history of mathematics in cognitive dimension

The cognition dimension of student views were analysed under two titles which were the effects of lessons themed history of mathematics on learning and the difference of the method used. The effects of the method used on mathematics education were analysed in Table 2 in detail. 19 answers (38%) of students showed that the students understood mathematics better and learned it better with the activities themed history of mathematics. Student Semiha expressed that her perceived success for mathematics increased.

> Student Semiha: This year my math lesson is better than the one in the last year and I increased my grades. I tried to practice some stuffs by learning mathematicians' lives. I started to chew on my lessons more.

Table 2: The effects of lessons themed history of mathematics on mathematics education

	Frequency	**Percentage**
To provide foreknowledge	4	8
To learn/understand better	19	38
To learn mathematicians' lives	9	18
It did not have any effect on my learning	1	2
The lesson got easier	16	32
The lesson got tougher	1	2
Total	**50**	**100**

As seen in Table 2, another important dimension of this sub-category is that the lesson was thought to be easier with the activities including history of mathematics by the students. 16 students (32%) gave this answer. Student Medine, Feyza and Mahmut expressed their feelings.

> Student Medine: The lesson got easier with historians
>
> Student Feyza: History made angles and equation easier
>
> Student Mahmut: The lesson was not tough because I understood beter.

When student answers and their percentages were taken into consideration, it can be said that lessons themed history of mathematics increased the ratio of students' understanding of lessons. Also students saying that history of mathematics made lesson easier by enabling better understanding of mathematics and provided foreknowledge about lesson can be evaluated as a functionality of the method. These findings correspond to the study of Haverhals and Roscoe (2010). These researchers

anticipated that the students' academic success would increase because they faced the problem in person by saying that the method they used was the heart of problem-solving.

Another sub-category of cognitive dimension is different aspects of lessons themed history of mathematics. While 4 (45%) out of 9 students said that they found the method used different and thought the use of poem, song and drama different, 3 (33%) out of 9 students underlined that knowing how the attainment was discovered did not look familiar to them.

> Student Hakan: We were learning different things. For example, I masqueraded as sheep. I performed in Tuba's play. A wolf came in. When she came home in the evening, she realized it. In the morning of the next day she understood it by notching and found numbers.

It is clear that a different method used in mathematics lessons got attention of students and aroused interest in them. In the same direction, Taşkın, Yıldız and Arslan (2010) took postgraduate students' views on their class entitled historical development of mathematical concepts. Participants said that history of mathematics would get attention of students and enable the subjects to be learned in a meaningful way.

DISCUSSION AND IMPLEMENTATIONS

The students who said that they enjoyed participating actively in the process of learning also mentioned that they overcome their fear of mathematics. Students making actively presentations are important for student participation while the history of mathematics is being introduced to class in relation to the attainment.

The biggest reason not to teach history of mathematics in lessons which is propounded by teachers is time shortage. This study is important because it shows that history of mathematics can be introduced to class by being included in major learning areas in primary school mathematics curriculum.

As a result, history of mathematics should be covered in mathematics education environments if it is wished that students' mathematical point of view develops against nature.

Appendix1: Organized Mathematics Curriculum Based On History of Mathematics

HOURS	LEARNING AREA	SUB-LEARNİNG AREA	ATTAINMENT	STATEMANT	ACTIVITY PROJECT PRESENTATION
2 hours	Probability-Statistics	Central Tendency and Spread	1. Makes a prediction based on data.	[!] The student is made to predict present or future situation. [!] It is emphasized that Omar Khayyam, Ali Kucsu and Ulugh Beg have a relation with astronomy and it is discussed how the student would make a prediction in astronomy studies starting from the data s/he has. [!] The students make their presentations.	Uğur – Khayyam Özlem – Ali K. Büşra – Uluğ B.
2 hours	Probability -Statistics	Identifying Probable Situation	2. Compares basic principles of enumeration and uses them in problems	[!] It is emphasized that basic principles of enumeration include the rules for addition and substraction. [!] It is discussed that reasons why Pascal needed to develop probability and Fermat-Pascal correspondence is mentioned. [!] The students make their presentations.	Betül – Pascal Harun – Cauhy İsa – Fermat
2 hours	Geometry	Angles	3. Defines properties of adjacent, complementary, supplementary and opposite angles.	[!] Adjacent complementary and adjacent supplementary angles are defined. [!] It is emphasized that non-shared edges of adjacent angles form another angle. [!] It is emphasized that a “linear pair” is formed when one edge of two adjacent supplementary angles are common and other edges of them are in the same direction but in the opposite ways. [!] The students make their presentations.	Muhm. – Origin of Geo. Ömer F. – Öklit Cihan – Thales
2 hours	Geometry	Measurement of Angles	4. Estimates measures of complementary, supplementary and opposite angles.	[!] One of the letters “s” or “m” is picked as a mesure of angle and the other one is mentioned. [!] The student is made to realize complementary and supplementary angles in Biruni’s astronomical observations. [!] It is emphasized that its reading way is important while measuring the angle. [!] The students make their presentations. [!] The contributions of Pythagoras and Descartes to geometry are discussed.	Melike – Biruni Ayşe – Pisagor Mehmet – Descart

REFERENCES

Baki, A., & Bütüner, S. Ö. (2010). Matematik Tarihi Etkinlikleri İle Zenginleştirilmiş Sınıf Ortamından Yansımalar. *9. Ulusal Fen Bilimleri ve Matematik Eğitimi Kongresi* (p. 104). İzmir: Dokuz Eylül Üniversitesi.

Boll, M. (2003). *Matematiğin Tarihi.* İstanbul: İletişim Yayıncılık.

Büyüköztürk, Ş., Çakmak, E., Akgün, Ö. E., Karadeniz, Ş., & Demirel, F. (2010). *Bilimsel Araştırma Yöntemleri.* Ankara: Pegem Akademi.

Çepni, S. (2010). *Araştırma ve Proje Çalışmalarına Giriş.* Trabzon: Celebler Matbacılık.

Furinghetti, F., & Radford, L. (2008). Contrasts and Oblique Connections Between Historical Conceptual Developments and Classroom Learning in Mathematics. *Handbook of International Research in Mathematics Education, 2nd Edition, New York* , 626-655.

Gulikers, I., & Blom, K. (2001). A Historical Angle, A Survey Of Recent Literature On The Use And Value Of History In Geometrical Education. *Educational Studies in Mathematics 47* , 223-258.

Haverhals, N., & Roscoe, M. (2010). The History of Mathematics As a Pedagogical Tool: Teaching the İntegral of the Secant Via Mercator' s Projection. *The Montana Mathematics Enthusiast, Vol. 7* , 339-368.

Kin Ho, W. (2008). Using History of Mathematics in the Teaching and Learning of Mathematics in Singapore. *Department of Mathematics and Science Singapore Polytechnic* , 1-38.

Lit, C.-K., Siu, M.-K., & Wong, N.-Y. (2001). The Use Of History in the Teaching of Mathematics: Theory, Practice, and Evaluation of Effectiveness. *Education Journa lEducation Journal The Chinese of Hong Kong* , 17-31.

Nazlıçiçek, N., & Ertkin, E. (2002). İlköğretim Matematik Öğretmenleri için Kısaltılmış Matematik Tutum Ölçeği. *5. Ulusal Fen Bilimleri Ve Matematik Eğitimi Kongresi* (p. 194). Ankara: ODTÜ Yayınları.

NCTM. (1998). *Historical Topics For The Mathematics Classroom.* ABD: NCTM.

Taşkın, D., Yıldız, C., & Selahattin, A. (2010). Lisansüstü Öğrencilerinin Matematiksle Kavramların Tarihsel Gelişimi Dersine Yönelik Düşünceleri. Trabzon: Matematikçiler Derneği 9. Matematik Sempozyumu.

TTKB. (2009). *İlköğretim Matematik Dersi 6-8. Sınıflar Öğretim Programı ve Kılavuzu.* Ankara: MEB Yayınları.

Yıldırım, A., & Şimşek, H. (2011). *Nitel Araştırma Yöntemleri.* Ankara: Seçkin Yayıncılık.