# PROSPECTIVE TEACHERS' VIEWS ON THE INTEGRATION OF HISTORY OF MATHEMATICS IN MATHEMATICS COURSES

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**ABSTRACT**

The purpose of this study was to investigate prospective mathematics teachers' attitudes about integrating History of Mathematics in mathematics teaching, their suggestions about the means and methods for integrating History of Mathematics and their expectations about the motivational and conceptual benefits of such an integration. The study also investigated how prospective mathematics teachers changed in terms of their content knowledge and attitudes about integrating History of Mathematics following the instruction that exemplified the use of history of mathematics. The pretest-treatment-posttest quasi experimental design was used. The intervention took place during a "Teaching Methods in Mathematics" course. It contained a number of tasks that required students to participate in activities designed to improve competencies regarding the integration of history of mathematics in mathematics courses. Results indicated an increase in students' attitudes and content knowledge about integrating history of mathematics in mathematics teaching. The increase in students' attitudes was not found to be significant but the increase in the number of strategies students stated for the possible uses of history of mathematics in mathematics classrooms found to be significant. Moreover, the quality of the examples stated for the possible uses of history of mathematics in the classroom found to be significant.

## 1 Introduction

In learning it is important to relate our learning to our real life experiences. In mathematics, students have problems in establishing links between their learning and their experiences. Mathematics is seen as an unquestionable truth which is always there by disregarding the evolution of mathematical ideas. Mathematics teachers have many things to do in assisting students' mathematics learning. They are in an important position in shaping students' ideas, emotions related with mathematics. Teachers' beliefs about mathematics have a significant role in shaping their instructional practice as well as shaping their students' interests, attitudes and achievement (Thompson, 1992). Showing the human side of mathematics to students, how mathematical ideas are evolved, and the struggles in history to create mathematical facts can be integrated in teaching and learning cycle.

The study reported in this paper aims to determine the attitudes of prospective mathematics teachers towards using History of Mathematics in their future teaching experiences. It aims to reveal the change in prospective mathematics teachers' attitudes after an experience in a teaching methods course enriched with materials that cover history of mathematics and its possible uses in the classroom.

## 2 Literature Review

### 2.1. Necessity of Using History of Mathematics in Mathematics Education

There are many arguments about the necessity of using the history of mathematics in the classroom as an integral part of math education. The reasons for such an integration is

discussed around three main points as in Gulikers and Blom (2001). These are conceptual, motivational and multicultural arguments.

Conceptual arguments are combined around the discussion that History of Mathematics (HM) increases students' understanding of concepts (Fried, 2001) and gives insight into concepts, problems, and problem- solving (Fauvel, 1991). The main reason in the use of history in mathematics education is to increase students' conceptual understanding as well as teachers'. The study of the struggles to create mathematical processes and strategies will increase teachers' understanding and doing mathematics besides their teaching repertoire (Ernest, 1998). The conceptual development of mathematical topics may be succeeded by the aid of HM. Freudenthal says that the young learner recapitulates the learning process of mankind in a modified way (Freudenthal, 1981). History of mathematics can suggest a fruitful order of the development of concepts and can also emphasize the sticking points. Moreover, Ernest talk about a parallelism between the historical evolution of mathematical concepts and individual's learning (1998).

Another important point in stating the necessity of using HM in Mathematics Teaching (MT) in terms of conceptual reasons is related with the nature of mathematics. Van Maanen (1997) claims that to step away for a while just as doing mathematics to speaking and talking about mathematics can be succeeded by a look at "old problems" by teachers and students. The myth as mathematics as a perfectly finished body of knowledge will be challenged by this way (Ernest, 1998) besides true understanding of the nature of mathematics.

HM should be integrated in MT because it is a motivating factor in learning and teaching mathematics. Topics that are centred around how HM makes mathematics more interesting, more approachable (Fauvel, 1991) alive and part of human history and culture and how it is helpful in developing a positive attitude toward learning (Liu, 2003) are considered as motivational. The knowledge of historical origins of mathematics will help teachers to learning tasks which will develop students' appreciation of the evolutionary nature of mathematics (Swetz, 1977).

The importance of problem solving and processes also can be shown by the history of mathematics. The history of mathematics will show the problems, obstacles that can be faced in the development of knowledge and in the learning. Mathematics will be more concrete and will have a lively position when the myth as mathematics as a perfectly finished body of knowledge (Ernest, 1998). This idea may trigger students to create something new in mathematics. The history of mathematics will show how mathematics is relevant to every aspect of human life, from religion, politics, government and warfare to art, music, architecture and the wildest dreams of human imagination (Ernest, 1998).

There are debates around the universality of education in schools. It is stated in Matthews (1994) that the public knowledge transmitted in the curriculum is a partisan knowledge; it interests particular groups. Because cultural beliefs affect understanding of what is taught and because teachers need to appreciate the ideas that children bring to their classes, teachers should design multicultural learning environments (Matthews, 1994). History of mathematics helps to develop a multicultural approach in the classroom (Gulikers and Blom, 2001). Mathematics is multicultural in its origins and not just a product of Europe can be shown by working with the history of mathematics (Ernest, 1998).

### 2.1. How History of Mathematics Integrated in Mathematics Education

Many different ways of integration are discussed under two main topics in Fried (2001). These main topics are "strategy of addition" and "strategy of accommodation". "Strategy of addition" involves introducing historical anecdotes, short biographies, isolated problems, or passive strategies for example showing students the pictures of mathematicians. This approach is named as "strategy of addition" because in this way teachers do not alter the current curriculum but only enlarge it. "Strategy of accommodation" changes the way material is presented. Teachers accommodate the curriculum to historical circumstances or to an historical model. This may be exemplified as using an historical development in one's explanation of a technique or idea or organizing subject matter according to historical scheme (Fried, 2001).

The inclusion of a historical dimension in mathematics education provides an opportunity for developing teachers' view of what mathematics is and it allows teachers to have a better understanding of concepts and theories. Firstly, HM changes the teachers' own perception and understanding about mathematics and this will have an affect on how they teach mathematics hence it will influence the way students perceive and understand mathematics (Barbin, 2000).

## 3 Methodology

### 3.1. Sample

The target population is the senior teaching mathematics students in Bogazici University who are enrolled in a "Teaching Methods Course in Mathematics". 14 senior students (6 females, 8 males) take this course.

### 3.2. Design

The design of the study is the pre test – treatment – post test quasi-experimental design. There had been a measurement through a period of four weeks, prior to exposure to the program (phase 1) and after the implementation of the entire program (phase 2).

### 3.3. Variables and Operational Definitions

Attitude towards using HM in MT is one of the dependent variable of this study. It refers to the intention to incorporate HM in MT. It is assessed in terms of History of Mathematics in Mathematics Teaching (HMMT) Attitude Scale. Content knowledge about integrating HM in MT is another dependent variable of this study. It is operationalized in terms of the scores obtained from History of Mathematics with Teaching Strategies (HMTS) Questionnaire. Instructional procedure to improve attitude towards using HM in MT is the independent variable of this study. Further analysis concerning changes in students' attitudes and content knowledge about integrating HM in MT is carried out using data from reports and discussions hold during the instructional period.

### 3.3. Instrumentation

Two instruments are developed for this purpose: History in Mathematics Teaching (HMMT) Attitude Scale and History of Mathematics with Teaching Strategies (HMTS) Questionnaire.

The development of the HMMT attitude scale is based on the semantic differential technique. Weinreich (1968) describes the typical form of a "semantic differential" study as, a group of subjects are presented with a number of pairs of antonymous adjectives, such as good-bad, kind-cruel, wise-foolish, complex- simple, etc and they are required to place every pair of adjective in a scale that has seven places on it. Adjective pairs specific to the concept are chosen in the light of the literature.

An instrument that comprised of 32 items was formed at the beginning. The validity analysis of the instrument is done qualitatively. 11 people studying on different areas on the education evaluated the instrument. They graded the items and stated their ideas about the instrument. They are asked to state eight items that explains the topic worst and the least frequent eight items are excluded from the instrument. The reliability analysis is done after conducting a pilot study. The instrument is applied to 74 mathematics teachers in Istanbul. The alpha is found .947 after reliability analysis with item analysis program.

The second instrument is HMTS Questionnaire. One of the research questions in this study is the knowledge of prospective mathematics teachers about the use of HM in MT. The study questions the different ways of integration of the history of mathematics in mathematics education and the expectations of the prospective mathematics teachers about the benefits of using history of mathematics in mathematics courses. For this purpose HMTS questionnaire is prepared. This questionnaire has two parts: questions on teaching strategies (TS) and TS supportive information list. The validity of the questionnaire is controlled with an expert in this area and 33 strategies are decided to be included in this list.

### 3.4. Treatment Procedure

This intervention takes place during the "Teaching Methods in Mathematics" course. The treatment procedure integrated and applied within the regular course hours. Three objectives are aimed to reach throughout the treatment. These objectives are:

1. Students will show increased support concerning the integration of HM in MT (as assessed by HMMT Attitude Scale).
2. Students will be able to illustrate the various ways of incorporating HM in MT (as assessed by HMTS Questionnaire).
3. Students will be able to identify the possible improvements in their future teaching and benefits of integrating history of mathematics in mathematics teaching (as assessed by HMTS Questionnaire and data from reports and tables produced during the treatment).

The treatment procedure contains a number of tasks that require students to participate in activities designed to improve competencies regarding the integration of history of mathematics in mathematics courses. There are four subsections that constitute the procedure. These subsections are based on i) reading assigned articles, ii) reporting on the discussion board, iii) display of HM on board, iv) discussion and brainstorming.

Reading assigned articles is one of the requirements of the treatment procedure. Students read the assigned articles for four weeks. Articles are chosen on the basis of the criteria stated by Gulikers and Blom (2001). They suggest a method for evaluating the effectiveness of geometry teaching, which uses classroom materials that include history of mathematics as an integral part. "Background information" and "Practical usefulness" are chosen as the basis criteria in the evaluation and selection of the reading materials. In this

study, besides articles related with geometry, articles including piece of information from different areas of mathematics are also included.

One of the aims of the study is to show the usefulness of the historical materials in MT and the varieties in the integration of the HM in MT. Selected articles should be comprehensible. They should give enough "background information" to the readers to prevent any misunderstanding or confusion with the material or develop a negative attitude such that those materials are incomprehensible. The articles that receive 2 points or 3 points (score range 1-3) in terms of this criterion are selected. Since this may be the first time the aimed sample is meeting with a classroom material, the suggestions on teaching and practical usefulness is important. Therefore the articles that receive a minimum of 3 and 4 points (score range 1-4) in terms of "the practical usefulness" are selected.

Reporting on the discussion board is another requirement included in the treatment procedure. Students are expected to submit a report on the discussion board at the end of each week that includes their ideas on the article and use of HM in MT specific to that article. By this way each student is able to read their friends comments on that article. Students are asked to focus on a number of guiding questions in reporting.

Display of History of Mathematics on board is an activity carried on during the treatment. Additional examples on the use of HM on MT displayed each week. Some examples that do not suggest any teaching module but present only excerpts from history like anecdotes, problems or else are also presented on board.

Discussion and brainstorming section included in the treatment procedure as another task. In the final week of the treatment subjects not only share their ideas on the materials they read but also their general ideas about the use of HM on MT.

## 4 Data Analysis and Conclusion

In HMMT Attitude Scale subjects evaluate the given terms on a seven points scale. Data gathered from the subjects is at the interval level. HMMT Attitude Scale is applied to the subjects twice: Before the treatment and at the end of the treatment.

Data gathered in HMTS Questionnaire is at the ordinal level. Subjects are asked to state teaching strategies or instructional procedures that they think they can use HM in MT. They were asked to exemplify each strategy that they had stated. Subjects were given the questionnaire before and after the treatment.

The sample size is 14. Since the number of the sample is small, non-parametric tests are used in data analysis. Wilcoxon test is based on difference in rankings and at least ordinal level of data is required so Wilcoxon test is used for the difference in pre-test and post-test results of both instruments. Apart from the non-parametric tests, some descriptive information was also derived from the data on HMTS questionnaire.

### 4.1. Results

At the beginning of the study there were three objectives aimed to meet. The first two objectives are stated in the form of hypothesis and the results are given after non-parametric statistical analysis related with these hypothesis. The third objective is in the form of research question and results are given after descriptive analysis related with this question.

#### 4.1.1. Non-Parametric Analyses Done on the Hypothesis

The first hypothesis is "Students will show increased support concerning the integration

of HM in MT (as assessed by HMMT Attitude Scale)". The mean of the participants on the HMMT Attitude Scale in the pre-test is found to be 5.99 and the mean of the post-test scores is found to be 6.18 (Table 1). In order to test the significance of this increase Wilcoxon test is administered. The sum of the positive rankings is 70 and the sum of negative rankings is 35. The statistic of interest is Wobs which is simply the smaller of T+ and T-. Critical T value for sample size 14, $\alpha$ = .05 for one tailed test is 25. T value should be equal to or less than the critical value in order to reject the null hypothesis - no difference between the means before after the treatment- The calculated T value = 35 (the sum of negative rankings) is greater then the critical T value null hypothesis is accepted. Therefore, the conclusion is: The increment in the degree of support concerning the integration of History of Mathematics in Mathematics Teaching is not observed to be significant.

The Second Hypothesis referred to the degree to which students will be able to illustrate the various ways of incorporating HM in MT (as assessed by HMTS Questionnaire). This hypothesis is assessed in the form of sub-hypothesis. Three sub-hypothesis stated related with this one.

The first one is: There will be significant increase in the number of strategies stated in pre-test and post-test for the possible uses of HM in MT. The total number of teaching strategies all of the students stated was fifty five in the pre-test. The total number of teaching strategies stated in post-test was seventy three. There is an increase in number of strategies stated before and after the treatment. In order to test the significance of this increase Wilcoxon test is administered. Subjects are ranked in terms of the difference in their pre-test and post-test scores. The sum of the positive rankings is 79 and the sum of negative rankings is 25. Critical T value for sample size 14, $\alpha$ = .05 for one tailed test is 25. Since the calculated T value = 25 (the sum of negative rankings) is equal to the critical T value the null hypothesis is rejected. The decision related with this hypothesis is: There is a significant increase in the number of strategies stated in post-test when compared with number of strategies stated in pre-test for the possible use of HM in MT.

The second one is: There will be significant increase in the number of examples for the use of HM in MT stated in pre-test and post-test. The total number of examples written in the pre-test is fifty three and the total number of examples written in the post test was sixty nine. There is an increase in number of examples written before and after the treatment. Wilcoxon test is used in order to test the significance of this increase. Subjects are ranked in terms of the difference in their pre-test and post-test scores. The sum of the positive rankings is 76 and the sum of negative rankings is 28. Critical T value for sample size 14, $\alpha$ = .05 for one tailed test is 25. Since the calculated T value = 28 (the sum of negative rankings) is greater then the critical T value null hypothesis is accepted. The decision related with this hypothesis is: There is not a significant increase in the number of examples stated in pre-test and post-test for the possible use of HM in MT.

The third one is: There will be significant increase in the total quality of the examples stated for the use of HM in MT in post-test compared with the examples states in pre-test. Each example written in pre-test and post-test is evaluated by three different juries and they are graded in terms of their quality.

The statistical analysis is done after quality points are given to examples stated by each subject. The sum of the positive rankings is 85 and the sum of negative rankings is 20. Critical T value for sample size 14, $\alpha$ = .05 for one tailed test is 25. Since the calculated

T value = 20 (the sum of negative rankings) is smaller then the critical T value null hypothesis is rejected. The decision related with this hypothesis is: There is a significant increase in the total quality of the examples stated for the use of HM in MT in the post-test then the examples stated in the pre-test.

#### 4.1.2. Descriptive Analyses Done on the Research Question

The third objective stated in the treatment procedure section related with the intervention is "Students will be able to identify the possible improvements in their future teaching and benefits of integrating HM in MT (as assessed by HMTS Questionnaire and data from reports and table produced during the treatment)". At this section descriptive analyses are done related with this objective.

The positive and negative aspects of the integration of HM in mathematics courses is evaluated at a discussion hold on at the end of the treatment. As positive aspects of using HM in mathematics courses students say that it increases motivation, gives meaning to the learning material, brings variety to the classroom routine. In addition to this, they say that it will sustain better learning, increase students' respect to their teacher and to mathematics. By this integration students may feel closer to the subject, become part of a course, students may become confident in themselves, and they may overcome their math phobia. It relates mathematics with real life, satisfies the learning needs of students in different learning styles. Moreover, different areas like philosophy, history can be integrated into the math courses by this way. Students will have the pleasure of discovery and internal motivation will be sustained. However, they say that it should be a mean to the learning material not an aim of the whole course. As negative aspects of using HM in mathematics courses students say that the lack of time is one of the main problems in the current educational practices. When the level of the material or the example given is not appropriate it may be confusing for students. Teaching mathematics or history can result in a privation dilemma. They emphasized that if it will be the objective of the course it will not be useful for students' learning. The positive and negative aspects are summarized in Table 2.

The total number of teaching strategies indicated in the pre-test is fifty five and it is found to be seventy three in post-test. Twenty five different teaching strategies are stated for the possible use of HM in MT and twenty seven in post-test. In the pre-test, teaching strategies that are stated for four times or more are: Discussion, Cooperative Learning, Guest Lecturer, Integrating Technology, and Role Playing. These strategies in the post-test are: Case Studies, Discussion, Role Playing, Problem Solving, Lecture, Project Based Learning, Differentiated Instruction, Real World References, Discovery Learning, Guest lecturer.

In addition to the increase in the number of strategies indicated in the post-test there is an increase in the number of relevant examples written for the indicated strategies. If the most frequent teaching strategy preferred as teaching strategies stated for five times or more then five times it is "Discussion" for the pre-test whereas they are "Discussion, Problem Solving, Lecture and Real World References" for the post-test. There is a variation in the teaching strategies preferred most frequently for the use of HM in mathematics education in post-test.

### 4.2. Conclusion

The results of the data gathered from the HMMT Attitude Scale indicate that a teaching methods course enriched with materials from history of mathematics for four weeks period make no significant difference in the attitudes of prospective mathematics teachers. The pre-test and post-test results show a direction towards a positive attitude. The mean of the post-test results is higher than the mean of the pre-test. Students' high attitudes towards using history of mathematics in mathematics courses at the beginning of the study were a contributing factor in increasing the efficiency of the study. However, it is hard to increase an attitude that is already high to a higher level. The insignificance of the result may be because of those students' high attitudes at the beginning of the study. As it is indicated in Toeplitz didactic methods can benefit from the study of history of mathematics (1963).

Students participated in this study are aware of the rich repertoire that exists in the history of mathematics and they have a lenient judgment for using it in the mathematics courses. Regarding students' notes on the discussion board, commands in the discussion part and the examples they gave for the use of history of mathematics in mathematics courses in pre-test, the positive attitude towards using history of mathematics was not a result of full awareness of the possible positive outcomes that history can create in students or the variety it can bring into the classroom routine. In the discussion students complained about the lack of courses that they can learn mathematics history. One of the students said that if they knew the material that exists in the history they could develop strategies on how to use those materials in the classroom.

Students' positive attitude for the use of history of mathematics in mathematics courses may be exemplified with students reports submitted to the online discussion board. One of the students used the material suggested in one of the assigned articles during her private tutoring. It was about the geometric solution of quadratic equations. That topic was told in the article "From al Jabr to algebra" by Philip Maher (1998). Her comments on the reading material and her experience with her student are given in the following paragraph.

*" I could not use the material in a classroom setting but I had a chance to use it during my private tutoring. Our topic was factorization and I had just read the article. I told the al-Khwarezmi's method as I remembered to my student. The child used this method in every question and tested its validity. The course was really enjoyable for us. Because my students' attention to the topic increased so much I really could not believe, especially in this topic. Moreover, I realized that his respect to the mathematicians increased. Whenever, he first heard the method he said "how can a man find such a staff?" To the end of the course he tried to discover a new method -tried to solve equations which do not have real roots. We had really a fun course. I felt that my student may be for the first time see the mathematics as an enjoyable toy."*

Another comment on the reading material is about the multicultural aspect that history brings to the classroom. "…*talking about a mathematician who is Muslim and from eastern part of the world would attract students' attention…"* are the words of one of the student submitted his comment on the discussion board about the article about al-Khwarizmi.

## 5 Discussion

If these students participated in the study had a chance to have a longer experience with more examples for the possible uses of history in classroom setting they would have higher positive attitude towards using history of mathematics in their courses for both motivational and conceptual purposes. Even these small experiences had contributed to an increment in their attitude.

Students' comments during the discussion section indicated that history of mathematics could be used more for motivational than for conceptual purposes. This finding can be explained by using Furinghetti's conceptual framework concerning the use of history of mathematics in mathematics education. In Furinghetti the use of history in mathematics education is discussed under two important objectives. History of mathematics may be used for promoting mathematics or for reflecting on mathematics (1997). The promotion in mathematics is related with the social aspects of mathematics, the image of mathematics. History may be taken as a motivating factor in teaching mathematics, it brings a variation in the classroom routine or it is the human side of mathematics, it can create surprise links with other aspects of students' cultural life. The reflection on mathematics is related with the interior aspects of mathematics, it is more about the true understanding of the nature of mathematics. Most of the students in this study believe in the promotion in mathematics with the use of history of mathematics in mathematics courses. They say that it gains students' attention to the point, the use of history enriches the curriculum however they think that it is not sufficient in helping students learn the topic. It can not be the sole teaching material in the classroom but it can be an enriching material for the classroom. There is a debate as indicated in the Fried (2001). Educators, researchers, mathematicians discuss about the possible uses of history of mathematics in mathematics classroom. In the literature, the history of mathematics is indicated as something "used" rather than something "studied". Besides, some researchers prefer the word "integration" instead of "using". It is seen as only a contributing factor to the course. Similar claims are found in student responses and during discussion. In the discussion the students are asked if they consider math history as an indispensable part of mathematics courses or not for effective mathematics teaching. They are more on the side of the people who see history of mathematics as a contributing factor. One of the students says that importance and value of mathematics history is unquestionable but it is not an indispensable part of the mathematics courses. This idea may be because these students did not study math history from first hand or second hand sources. They have studied on the materials that offer methods for different uses of mathematics history in mathematics courses. They were in a position of a teacher that tries to convey piece of information to the students. Moreover, those materials do not cover all the possible uses of mathematics history in mathematics courses. Only a window is opened to those students they did not see the full picture. This may also be a reason for not seeing mathematics history as an indispensable part of mathematics courses or for evaluating mathematics history as mostly a motivating factor for the courses.

As it is stated above students perceive the use of history of mathematics in mathematics courses as carrying out extracurricular activities in the regular course hours. This idea brought them to complain about time restrictions and overloaded curriculum in the current educational system. They said that they have many things they were supposed to do in the classroom. With such a curriculum load they might not have enough time for extra work

such as enriching material with history. They think that the conceptual development may be accomplished with the aid of history but they consider that way of teaching as a long and time consuming way. Fried (2001) specifies two ways of integration: The strategy of addition and the strategy of accommodation. According to Fried the addition strategy is preferred more than the accommodation strategy. Students in this study also say that the history as an addendum to curricula is a way they can possibly use in their future teaching experiences. Time restriction is also emphasized as a problem in the literature. The reasons for integrating history of mathematics in mathematics education are discussed in Tzanakis and Arcavi (2000). They have stated the common objectives proposed. One of those objectives relates to the lack of time in mathematics teaching. Teachers complain about lack of enough time for mathematics learning. They ask how they are supposed to teach history of mathematics with such time considerations. The argument against this objective is related with how they approach history. Does it enhance learning mathematics or not? Tzanakis and Arcavi claim that historically inspired exercises may stimulate the students' interest and contribute to curricular enhancement alongside the exercises which are more artificially designed.

These students have a lenient judgment for using history in their future teaching experiences. They all have positive attitudes for such an implementation more for motivational purposes. However, they see historical materials somehow not very related with the curriculum and they think the use of such materials does not answer the needs of the students directly. This may change after they experience a realistic teaching experience in a realistic classroom setting. These students discussed hypothetical situation, hypothetical needs of the students. When they become teachers they will see what they need. Their ideas may change in a more positive direction when they see emergency of the need for the improvement in their students' views about mathematics and the need for the real life examples in the classroom.

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## Appendix

**Table1.** The mean of the pre test and post test scores of HMMT attitude scale

| | **N** | **Minimum** | **Maximum** | **Mean** | **SD** |
|---|---|---|---|---|---|
| **Pretest Mean** | 14 | 4,54 | 6,79 | 5,99 | ,718 |
| **Posttest Mean** | 14 | 4,75 | 7,00 | 6,17 | ,665 |

**Table 2.** Negative and positive aspects of using History in Mathematics courses

| **Positive** | **Negative** |
|---|---|
| Source for motivation, gives meaning, brings variety to the class routine and satisfies better learning. Relates mathematics with the real life and different areas, e.g. philosophy, history can be integrated.<br>Students feel closer and a part of the topic, they may overcome math phobia and feel the pleasure of discovery.<br>Result in respect to the teacher- valuing teacher, respect to the mathematics- valuing mathematics<br>Students and teachers may both become confident in themselves<br>Can be appealed for students in different learning style | Time problem (Not enough time).<br>If the example or level is not appropriate it can be confusing.<br>There may be dilemma of privation for teacher and student about the objectives of the course.<br>If history of mathematics is the objective of the course it may not be effective. |