

Postgraduate's Attitudes and Beliefs towards the Use of History of Mathematics

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Abstract: The emphasis on the history of mathematics is able to foster the interest in learning mathematics. History of mathematics provides information and the reasons behind the mathematical formula outcome. This study was to examine the attitudes and beliefs of postgraduates on the use of mathematical history. 67 postgraduate students who are pursuing courses in education field were chosen to be the sample of the study. This study used Attitudes and Beliefs towards the Use of History of Mathematics in Mathematics Education (ABHME) Questionnaire for data collection purpose. The data were analyzed using Statistical Package for Sosial Science Version 21 to produce descriptive statistics. The results showed that postgraduate students have moderate attitudes and belief to integrate history of mathematics. Meanwhile, the study found that the history of mathematics can contribute to others scientific disciplines and positively in the learning of mathematics.

Keywords: Attitudes and beliefs, History of Mathematics, postgraduate students.

I. INTRODUCTION

Mathematics education in Malaysia has gone through various phases in strengthening mathematics starting from preschool until secondary school. The education system focused more on the examination rather than contents knowledge of mathematics. Mathematics should be taught as a dynamic tool to think and not as an operation for learning [1]. Students are taught to emphasize in memorizing learning rather than understanding [2]. In addition, this makes mathematics is considered as a boring subject and unattractive. Thus, it will form negative attitudes among students in accepting mathematics. This attitude is formed from experience and one's perception of a thing or phenomenon [3]. Meanwhile, student's beliefs are closely related to the feelings and opinions of students on mathematics. One aspect highlighted is the belief that students' knowledge and ability to structure learning. Both aspects of this domain are interconnected in measuring the level of mathematics achievement. Student's beliefs play a crucial part as its affect their behavior when they study mathematics and solve mathematical problems. So if students have negative thought about mathematics, it will produce students are that passive and low in critical thinking. This means that attitudes and beliefs are important as it both is part of affective domain in mathematics education [4].

Mathematics is a science that is required in terms of discovery, manufacturing and construction. However mathematical interests were ignored by teachers when they are teaching mathematics. The emphasis on the history of mathematics is very important to prospective teachers and students as it can change their views in mathematics. [5] said that the history can be used as a tool in teaching middle grades mathematics in order to form an understanding of mathematics. This study can be strengthened by [6] proposed that to enhance students' attitudes toward mathematics is to introduce new concepts within a relevant historical context. [7] said that by providing teachers with a new context of mathematics curriculum may allow them to teach in different approach in handling students than before been taught. The history of mathematics is one way to attract students so that they can explore the applications of mathematics. In fact, it can help improve their attitudes

and beliefs as history of mathematics have a lot to offers. Therefore, the purpose of this study was to investigate postgraduate students’ attitudes and beliefs to integrate history of mathematics.

This research differs from previous research as it is focuses on students rather than pre-service mathematics teacher. Postgraduate are chosen as participant in Faculty of Education, UKM. They are no specifics specializations as participants are been choose by convenience sampling. These students also came from different background as some of them are teachers, government officials and fresh graduates. They have one in common profile that is taking mathematics subject. Mathematics subject are requirements for all students in school level. In this case, every postgraduate student has different experience in mathematics. Introducing history of mathematics can open their minds about the roots and needs of mathematics. In UKM, mathematics education has offered a course in History of Mathematics. The purpose of the course is to import knowledge in the history of mathematics and its development as well as introducing them to great mathematicians. Postgraduate students will be taught about the history of mathematics which increase content knowledge of mathematics and improve pedagogical content knowledge can prove to be a worthwhile task [8]. The postgraduate been asked to answer questionnaire based on attitudes and beliefs as to know their perception towards history of mathematics. Therefore, the purpose of this study was to investigate postgraduate students’ attitudes and beliefs to integrate history of mathematics. The objective of this research consists of; a) To identify the level of postgraduate’s attitudes and beliefs towards the use of History of Mathematics. b) To determine the relationship between attitudes and beliefs towards the importance of history of mathematics.

II. METHODOLOGY

A quantitative approached was used in this study using questionnaire as a main instrument. The descriptive research was conducted to 67 postgraduate students in Faculty of Education, UKM. The Attitudes and Beliefs Questionnaire towards the use of History of Mathematics in Mathematics Education (ABHME) consists of 35 items which is not separated between constructs of attitudes and beliefs were used. The instruments adapted from [9] investigated attitudes and beliefs as a whole in this instrument as both categorized as affective domain [10]. A 7 point Likert scale was used in collecting the data which ranging from “1” indicates “Strongly Disagree” to “7” indicate “Strongly Agree”. [11] suggested that having more scale points is preferable but there is lesser return after 11 points. A pilot study was conducted to 30 postgraduate students in order to determine the reliability of the instrument and no items was deleted. The Cronbach Alpha value was found to be at 0.70 which is acceptable as in [12] the limit of alpha is 0.6. The distribution of respondents is 12 (17.9%) males and 55 (82.1%) which is shown in Table I. The respondent consist of 28 students from Mathematics, 18 students from Teaching English as Second Language, 14 students from Science and 7 students from Sport Management.

TABLE: I. Demographic Profile

Gender	Frequency	Percentage (%)
Male	12	17.9
Female	55	82.1

III. RESULT

35 items was used in measuring the attitudes and beliefs of postgraduates on the use of mathematical history with 7 point Likert scale. The total score of all responses is equal to 245 and a minimum score of 35. Table II shows the descriptive statistics analysis, the mean of ABHME score was 140.72 and standard deviation of 10.09. The minimum and maximum values of the total responses are 116 and 165.

Table: II Descriptive Statistics of ABHME Responses

Descriptive Statistics	Value
Mean	140.72
Standard Deviation	10.09
Minimum	116
Maximum	165

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To indicate the level of the respondents’ attitudes and belief, the total scores were classified into three categories; it consists of low, moderate and high. Table III shows scoring for the “low” its score is in range of 35 to 105, while “moderate” is in range of 106 to 175 and “high” is in range of 176 to 245.

TABLE: III Classification of ABHME Level

Level	Range Score
Low	35-105
Moderate	106-175
High	176-245

The analysis shows that 67 (100%) of postgraduate students have moderate attitudes and beliefs towards the used of history mathematics by range score that is between 106 and 175. Based on the findings, the moderate level for attitudes and beliefs towards the use of history of ,athematics items can be shown in Table IV. Its represent frequency of responses for the items based on the 7 point Likert scale. Table IV also reported the highest frequency of the responses for each item. The items that respondents prefer to choose for Likert scale points is from 3 to 5. The item that scores the highest number of responses with 25 respondents is Item 29 which is “I do not know the place of the history of mathematics in the elementary mathematics curriculum”. Followed by Item 33 with 23 total numbers of respondents for “Using history-based didactical materials in mathematics lessons causes waste of time”. Item 25 score the lowest number of responses as for “History-based learning activities will not attract students’ interest in classroom setting” with 12 respondents. Second lowest are Item 11 for “I do not have an idea about how to use history-based didactical materials (e.g., pantograph, tangram)”, Item 15 for “History of mathematics is a practical tool for the teaching of mathematics” and Item 27 for “History-based learning activities should be included in the elementary (K6-8) mathematics curriculum” with a total 14 responses.

Table: IV Mean of ABHME items

Item ABHME	Number of responses (%)						
	1	2	3	4	5	6	7
1. It is difficult to integrate history of mathematics in mathematics education.	13 (19.40)	13 (19.40)	14 (20.90)	12 (17.91)	7 (10.45)	4 (5.97)	4 (5.97)
2. Having knowledge about history of mathematics gives an idea about why humans felt the need for mathematics.	10 (14.93)	15 (22.39)	9 (13.43)	9 (13.43)	18 (26.87)	4 (5.97)	2 (2.99)
3. The use of history of mathematics in mathematics education makes positive contribution to the learning of mathematics by providing a different standpoint and mode of presentation.	9 (13.43)	13 (19.40)	11 (16.42)	13 (19.40)	17 (25.37)	3 (4.48)	1 (1.49)
4. Using history of mathematics in mathematics education causes students to lose their enthusiasm for learning mathematics.	8 (11.94)	13 (19.40)	16 (23.88)	13 (19.40)	11 (16.42)	3 (4.48)	3 (4.48)
5. Noticing that great mathematicians also made mistakes when dealing with mathematics enhances students’ motivation for the learning of mathematics.	20 (29.85)	10 (14.93)	11 (16.42)	10 (14.93)	8 (11.94)	5 (7.46)	3 (4.48)
6. Learning history of mathematics enriches pre-service teachers’ professional repertoire.	9 (13.43)	11 (16.42)	8 (11.94)	15 (22.39)	13 (19.40)	6 (8.96)	5 (7.46)
7. Pre-service teachers must be given courses about how to use history of mathematics in mathematics education.	1 (1.49)	5 (7.46)	8 (11.94)	8 (11.94)	16 (23.88)	12 (17.91)	17 (25.37)
8. History of mathematics enables one to link the mathematical concepts and see	2 (2.99)	2 (2.99)	8 (11.94)	6 (8.96)	16 (23.88)	16 (23.88)	17 (25.37)

the close relationships between them.							
9. History of mathematics helps students comprehend mathematics in depth via introducing alternative approaches and various examples.	18 (26.87)	14 (20.90)	11 (16.42)	8 (11.94)	9 (13.43)	4 (5.97)	3 (4.48)
10. History of mathematics makes students notice that mathematics is a universal product of various cultures.	22 (32.84)	10 (14.93)	10 (14.93)	12 (17.91)	7 (10.45)	4 (5.97)	2 (2.99)
11. I do not have an idea about how to use history-based didactical materials (e.g., pantograph, tangram).	4 (5.97)	5 (7.46)	8 (11.94)	11 (16.42)	13 (19.40)	12 (17.91)	14 (20.90)
12. I do not know how to integrate history of mathematics into mathematics teaching processes.	3 (4.48)	2 (2.99)	7 (10.45)	9 (13.43)	16 (23.88)	11 (16.42)	19 (28.36)
13. Mathematics education integrated with history of mathematics displays a more realistic and comprehensive picture about what mathematics is.	7 (10.45)	11 (16.42)	4 (5.97)	11 (16.42)	19 (28.36)	10 (14.93)	5 (7.46)
14. Real life problems chosen from history of mathematics should be used in mathematics education.	13 (19.40)	6 (8.96)	6 (8.96)	21 (31.34)	14 (20.90)	6 (8.96)	1 (1.49)
15. History of mathematics is a practical tool for the teaching of mathematics.	5 (7.46)	9 (13.43)	9 (13.43)	10 (14.93)	14 (20.90)	12 (17.91)	8 (11.94)
16. History of mathematics should be integrated into mathematics education.	8 (11.94)	10 (14.93)	8 (11.94)	14 (20.90)	15 (22.39)	5 (7.46)	7 (10.45)
17. I do not have enough information about the historical evolutions of the concepts which I will teach in the future.	5 (7.46)	10 (14.93)	21 (31.34)	14 (20.90)	5 (7.46)	7 (10.45)	5 (7.46)
18. Written and visual didactical materials can be developed by using history of mathematics (e.g., worksheets, plays, puzzles, documentaries and cartoons).	3 (4.48)	4 (5.97)	8 (11.94)	10 (14.93)	14 (20.90)	20 (29.85)	8 (11.94)
19. History of mathematics helps grasp the role and importance of mathematics in society.	9 (13.43)	7 (10.45)	19 (28.36)	12 (17.91)	13 (19.40)	6 (8.96)	1 (1.49)
20. Integrating history of mathematics in mathematics lessons increase students' mathematics anxiety.	3 (4.48)	5 (7.46)	16 (23.88)	11 (16.42)	19 (28.36)	9 (13.43)	4 (5.97)
21. Including history of mathematics in mathematics education hinders mathematics teaching.	5 (7.46)	4 (5.97)	12 (17.91)	9 (13.43)	16 (23.88)	10 (14.93)	11 (16.42)
22. History of mathematics enables students to rediscover mathematics by tapping into their own talent and experiences.	7 (10.45)	6 (8.96)	8 (11.94)	18 (26.87)	17 (25.37)	6 (8.96)	5 (7.46)
23. The integration of history of mathematics in elementary (K6-8) mathematics curriculum increases teachers' and students' course load.	17 (25.37)	16 (23.88)	12 (17.91)	12 (17.91)	3 (4.48)	7 (10.45)	0 (0.00)
24. The examination of the original sources of mathematics allows teachers and students to notice the advantages of modern mathematics.	5 (7.46)	3 (4.48)	7 (10.45)	11 (16.42)	18 (26.87)	11 (16.42)	12 (17.91)
25. History-based learning activities will not attract students' interest in classroom setting.	5 (7.46)	4 (5.97)	12 (17.91)	12 (17.91)	10 (14.93)	12 (17.91)	12 (17.91)

26. History of mathematics assists the change of classroom environment from a place in which knowledge is transferred to a platform in which research is made.	3 (4.48)	3 (4.48)	11 (16.42)	14 (20.90)	19 (28.36)	10 (14.93)	7 (10.45)
27. History-based learning activities should be included in the elementary (K6-8) mathematics curriculum.	6 (8.96)	13 (19.40)	11 (16.42)	14 (20.90)	11 (16.42)	7 (10.45)	5 (7.46)
28. Pre-service mathematics teachers must have knowledge of and ideas about the historical evolution of mathematical concepts.	1 (1.49)	4 (5.97)	5 (7.46)	22 (32.84)	13 (19.40)	9 (13.43)	13 (19.40)
29. I do not know the place of the history of mathematics in the elementary mathematics curriculum.	25 (37.31)	11 (16.42)	12 (17.91)	12 (17.91)	6 (8.96)	0 (0.00)	1 (1.49)
30. History of mathematics provides us to notice the contributions of mathematics to the other scientific disciplines (e.g., physics) and their interrelationship.	1 (1.49)	3 (4.48)	4 (5.97)	12 (17.91)	11 (16.42)	14 (20.90)	22 (32.84)
31. The comparison between the original and modern versions of the way mathematics concepts are handled helps students understand mathematics.	0 (0.00)	4 (5.97)	8 (11.94)	16 (23.88)	21 (31.34)	12 (17.91)	6 (8.96)
32. I do not plan to use the learning activities based on history of mathematics.	3 (4.48)	6 (8.96)	22 (32.84)	14 (20.90)	11 (16.42)	8 (11.94)	3 (4.48)
33. Using history-based didactical materials in mathematics lessons causes waste of time.	6 (8.96)	8 (11.94)	23 (34.33)	20 (29.85)	4 (5.97)	3 (4.48)	3 (4.48)
34. Knowing the historical development of the mathematical topic being studied enables students to learn that topic better.	0 (0.00)	6 (8.96)	8 (11.94)	14 (20.90)	21 (31.34)	9 (13.43)	9 (13.43)
35. It is not important to use history of mathematics in mathematics lessons.	2 (2.99)	3 (4.48)	20 (29.85)	21 (31.34)	11 (16.42)	7 (10.45)	3 (4.48)

IV. DISCUSSION

The findings show that postgraduate students furthering studies in education have a moderate level with average mean for attitudes and beliefs towards using History of Mathematics. The item “I do not know the place of the history of mathematics in the elementary mathematics curriculum” score the highest frequency. As stated before, elementary and secondary curriculum in Malaysia more focuses on concept and solving problems. of mathematics in or outside of school. The mathematics in school itself does not apply the use of history of mathematics in classroom. Due to the fact, there are no places that teach or focus on history of mathematics.

In the meantime, government has introduced a new policy such as implementing Dual Language Programme (DLP) in teaching and learning of Mathematics as to foster students’ interest in mathematics. It is to improve the quality of Science, Technology, Engineering and Mathematics (STEM) for ensuring that the ratio of students who takes science areas increase as stated in [13]. By implementing history of mathematics in classroom can enables improvement in mathematics education because students can realize mathematics plays an important in life [14]. However, teachers have little knowledge from previous education programs about integrating the history of mathematics into their teaching. Therefore, there are major concerns about educating pre service and in service teachers in integrating history of mathematics in classroom [15]. Another constraint is that the history of mathematics courses is not offered in the school level. History of mathematics course only had been offers in selected universities. So it will be difficult for teachers to enroll to that course only for improving their skills.

The “Using history-based didactical materials in mathematics lessons causes waste of time” score the second highest item. This might be because of they have negative attitude of mathematics which turns to be why they dislike mathematics that results in avoidance of using mathematics in life [16]. Furthermore, mathematics is a requirement for passing examination

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or furthering their studies, so students will more focuses on solving problems than to know the roots of mathematics. This action leads to the important of teachers in educating students. The attitudes and beliefs of teachers are the main influence on students' performance and preparation in the classroom [17]. Teachers hold the key in making their students accepting mathematics. The use of history of mathematics can give the chance for students in exposing more about mathematics. Mathematics should be taught as a dynamic tool for think and not as a set of operations.

The “History-based learning activities will not attract students' interest in classroom setting” and “History-based learning activities should be included in the elementary (K6-8) mathematics curriculum” has strong connection as both item score the lowest. Through history, it is a solution to raise students' motivation. As students who think mathematics meaningless yet appreciate the creations of knowledge by mathematician whom have solved a real-life problem in the past [18] can leads to positive attitude towards mathematics. By implementing history-based learning activities might open their mind about the importance history of mathematics as they can learn and see the other sight of mathematics while learning history of mathematics. In addition, many researchers argue that the use of history in mathematics in teaching may lead to more desirable attitudes and achievement in mathematics [19].

Based on the results, it shows that postgraduate may have a difficulties in answering this 35 items as some of them may not use or been taught the history of mathematics in school or faculty. Only 28 postgraduate are from mathematics education that been exposed on using history of mathematics or based on their previous education. In the context of postgraduate, changing their attitudes and beliefs in reforms curriculum by integrating the history of mathematics may be a major concerns as they never had been taught or acknowledge the history of mathematics. However, [20] said that history can help increase motivation and help develop a positive attitude towards learning.

V. CONCLUSION

The study found that attitudes and beliefs for postgraduate student were in moderate level in the use of history of mathematics. It also found that the relationship between attitudes and beliefs towards the importance of history of mathematics can contribute to others scientific disciplines. History of Mathematics shows the finding of new formulas which is important in development to others area of science. It also contributes in positively in the learning of mathematics. It is because the combination of history and concept can helps students in being more understanding in mathematics. Moreover, History of mathematics also importance as its links mathematical concept with the history while knowing the facts. This as well can help them to understand the development of mathematics concept and formulas.

The researchers suggest that further study needs to be done. The further study should concentrate on the perception of undergraduate students whom specialization in mathematics education. As this research is focuses on postgraduate students in any specialization in Faculty of Education UKM. This study also can be conducted to pre-service teachers that teach mathematics. It can be classified according to a survey conducted by previous researchers. The suggestion for pre-service teachers as respondent is because the comparison can be made by evaluating both of the study. Therefore, the actual accuracy of the attitudes and beliefs can be assessed.

In conclusion, History of Mathematics can help students in improving their attitudes and beliefs towards mathematics. Exposure to mathematical history can be started at the school level so that it can foster interest in mathematics. Mathematics is indispensable in this technology area. In addition, mathematics is a crucial subject that is used as a benchmark in determining students' qualifications in furthering their studies. By implementing History of Mathematics in mathematics education may help students in improving their skills and knowledge.

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