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Learning History of Mathematics: Perception of Students

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Abstract

The history of mathematics in mathematics education has the potential to make us fuller human being, which is at the heart of the educational tradition. Students of B Ed and M Ed have to study this course in Tribhuvan University. The general objective of incorporating this course is to appreciate the internal dimension and development of mathematics in relation to its multicultural and historical perspectives and develop the critical appreciation to reflect upon the work of different mathematicians who added some knowledge in existing knowledge. The aim of this article is to find out the perception of B. Ed students on learning history of mathematics in the perspective of content and pedagogical knowledge. The paradigm of this research is interpretive and base on grounded theory. Seven students of Butwal Multiple Campus studying on the level B. Ed third year were selected as sample subject and asked to write journal of reflections on the role of knowledge creation in content and pedagogy from the course Math Ed 424. Data were analyzed and the result indicated that history could help increase motivation. Besides this, history of mathematics could help pedagogical knowledge more and content knowledge less. It develops the positive attitude towards learning and helps mathematics to see in concrete form.

Key words: History of mathematics, content knowledge, pedagogical content knowledge

Introduction

Mathematics is a human creation, which has been producing for in excess of 4,000 years. It rose as a reaction to various social and monetary needs of civic establishments, for example, Babylon, Egyptian, Indian, Chinese, Greek, Roman, to give some examples. In prior civic establishments, the answer for numerical kinds of issues lied in experimental examination, though in later periods deductive hypothetical math were applied (Karaduman, 2010). Authentic improvement of mathematics burdens that math as a science has consistently been associated with

monetary and social setting and advancement of society. Current society is like never before subordinate upon innovative changes and periods of its improvement can't be envisioned without arithmetic. On the off chance that we take a gander at the improvement of different sciences, for example, material science, or pure science, we may see that mathematics assumed a significant job in every one of them. Along these lines, we can say that, as comprehension of the world depends on logical speculations, science speaks to a significant piece of human social and logical legacy.

A few researchers perceive just the social side of examining history of mathematics (Gnedenko, 1963). They don't perceive different advantages which we will examine in the blink of an eye, and spot the historical backdrop of mathematics in the authentic science. As they would see it, new information and thoughts don't depend on the past, the past can just forestall progress, and numerous speculations are outdated. This perspective on the historical backdrop of science expresses that an advancement comes just with new thoughts which didn't exist previously, and that the investigation of the past isn't vital in the investigation of mathematics. In the teaching process, special attention should be given to developing positive attitudes of students towards mathematics (Ma & Kishor, 1997, Akinsola & Olowojaiye, 2008, Memnun & Akkaya, 2012). One of the ways to achieve this is to show and convince the students that mathematical knowledge can make their life easier and improve it. But most importantly, a common sense tells us that Mathematics teaching should be organized in the environment in which students will eagerly acquire new knowledge by their own intellectual efforts and abilities. One of the pedagogical tools for achieving these goals is history of Mathematics, and we will now look at how we use this tool in our work. Our conviction is that it is fundamental for a man to recognize what incited the improvement of scientific thoughts, which strategies for study was utilized before and how the issues that were presented were settled. Answers to these issues don't have just social and verifiable centrality, yet are significant for the improvement of contemporary science. Qualities of science of a specific age, yet in addition of contemporary mathematics, can be seen distinctly with regards to scientific accomplishments of the past. One model is the manner by which the fifth Euclid's hypothesize cleared the way to the new non-Euclid's calculations, and they thus shaped the establishment for making more unique scientific developments and aphoristic conclusion frameworks.

Background

ICME-11 (2008) TSG 23 recognized the accompanying potential jobs for the presentation of the historical backdrop of science into mathematics training. It worried to refine mathematics instruction by thinking about it as an authentic, social and social creation, and as a lot of social exercises which are identified with other social exercises. TSG 23 understood that history of arithmetic assists understudies' with understanding the implications of points, values, ideas, techniques, and evidences in various social works on including science. It builds up students' sentiments of citizenship, contextualizing school-based scientific social practices in a historico-basic perspective and keeping up an open demeanor towards the investigation of numerical practices in various international, institutional and sequential settings. Teaching mathematics with no knowledge of the history of mathematics is equivalent to a lawyer being

allowed to practice law having no knowledge of the history of the judicial system, or scientists immersed in science without knowing its history.

By supporting the above arguments, history of mathematics is one of the subjects in B.Ed and M. Ed level in Nepal. Math Ed 424 is one of the course of second year B.Ed students. This type of subject is not provisioned in humanities and science faculties. The reason one can predict that mathematics teachers should have the knowledge of history of mathematics. In history course of B. Ed level in Nepal, there are seven units. The course is designed by the subject committee of mathematics education. Subject committee would expect from student teachers that they will gain mathematical content knowledge and pedagogical knowledge both although the general objectives are silent to look this course through the lens of pedagogy. However, being an instructor of mathematics education, it is necessary to know the perceptions of our students on acquiring the amount of content knowledge and pedagogical knowledge. This type of research has not seen till now on the course of historical development of mathematics in Nepal. There is a research gap in this sector. It is necessary to find out the students' perception of the students on the role of history of mathematics in the knowledge creation on content and pedagogy.

Research Questions

Glante (2014) carried out the research on the topic entitled "The Use of the History of Mathematics in the Teaching Pre-service Mathematics Teachers". Researcher also follows his research questions to know the perception of students-teachers.

To fulfill the objective of research, researcher had used two questions:

- Was there evidence that using the history of mathematics can strengthen the mathematics content knowledge?
- Was there evidence that using the history of mathematics can strengthen the pedagogical content knowledge?

Methodology

A grounded theory approach was implemented to gather and analyze the data. Grounded theory is an inductive, theory discovery methodology that allows the researcher to develop a theoretical account of the general features of a topic while simultaneously grounding the account in empirical observations or data (Glaser & Strauss, 1967). To find out the perceptions from students' ground, grounded theory qualitative approach in interpretive paradigm was considered as a suitable design of this research. Seven odd roll numbered students majoring mathematics who were studying in B Ed third year were selected randomly. Two research questions were asked to selected students of sample. Data were taken from journal written by the students. Seven students were chosen as participants. They had to write journal of reflection on seven chapters; history of arithmetic, geometry, algebra, trigonometry, calculus and analysis, functions, statistics and probability; on the contribution of the course math Ed 424 in knowledge creation on content and pedagogy. Participants were asked to write their reflection below five hundred words in single space. The participants were not independent to choose topic, researcher divided seven units according to their roll number in ascending order from the given unit of the course to write their reflection. But students were independent to chose the topic under the unit of their part.

The reflections of those students were analyzed to find indications of their acknowledgment of learning mathematics content. The same strategy was used to uncover examples of pedagogical content knowledge.

Finding and Analysis

The reflections from the students written on the contribution of history of geometry on knowledge creation in content and pedagogy were organized and analyzed. Seven students had written reflection journal in seven topics from seven units separately. An analysis of reflection was done by examining the content for phrases and words. For all units it was evident that a majority of the students learnt new content materials than pedagogical content. Here is the table where students reflected their percentage of knowing content and pedagogy from Math Ed 424.

Table 1: Percentage of students indicating new knowledge gained

Units	New mathematics content was learnt	New pedagogical content was learnt	Selected topics
Historical development of arithmetic	72%	28%	The story of zero
Historical development of geometry	64%	36%	History of Pi
Historical development of equation and algebra	55%	45%	History of determinants and matrices
Historical development of trigonometry	70%	30%	Construction of sin table with half-chords
Historical development of calculus and analysis	50%	%0%	Zeno's paradoxes for the develop. of calculus and analysis
Historical development of functions	60%	40%	Letter from Leibniz to Bernoulli on function
Historical development of statistics and probability	80%	20%	Use of probability in real life situations (history)

1. Was there evidence that using the history of mathematics for instruction can strengthen the mathematics content knowledge?

Below I give some representative reflections from journal entries indicating new content was learned:

Student A: I learned the interesting historical story of zero. It has quite a rich and extensive history. The development of zero acted as a sort of springboard for the development of mathematics.

Student B: I learned that Pi is actually taken from the Greek word. It was introduce by the relation of perimeter of circle and its diameter. I learned how Archimedes and others developed each of their respective values of Pi. I was shocked to find out that the constant Pi has been traced all the way back to 1900 BCE by the Babylonians.

Student C: I learnt how Chinese and Japanese mathematicians invented determinants and developed matrices.

Student D: I knew the interesting story of Indian astrologist introduce Sin curve.

Student E: I knew the very interesting paradoxes of Zeno to develop the foundation of calculus and analysis.

Student F: How interesting was the letter from Leibniz to Bernoulli to introduce the terminology of "function"?

Student G: It was also interesting to learn that today probability is involved in insurance (actuarial science), gambling (still), science, genetics, art (color contrast ratio), and music (octaves and scales).

2. Was there evidence that using the history of mathematics for instruction can strengthen the pedagogical content knowledge?

Below I give some representative excerpts from journal entries indicating new pedagogical content was learned:

Student A: This would be wonderful to present to students history of zero and teach arithmetic without having zero other than Hindu Arabic numeral system.

Student B: Students could benefit from their methodology of discovering a closer approximation of Pi because these mathematicians had to couple critical analysis with effective problem solving skills in order to find a more efficient means of demonstrating Pi.

Student C: As educators, we must utilize key algebraic properties to show students that though they have reached the correct answer, there are more efficient strategies that they could use to reach the answer.

Student D: I knew to teach approximate value of Sin according to astrologers of India. It will help in pedagogical knowledge.

Student E: I learnt the logic of Zeno and inspire students to draw approximate values by incorporating the knowledge of calculus.

Student F: I knew the real meaning of function in real life situation. It made easy to me to teach the unit "function".

Student G: I learnt where and how probability is used in real life situation and its importance. This knowledge inspired me to teach this unit eagerly.

Discussion and Interpretation

Mathematics is a "social marvel" (Wilder, 1968, p.xi), and that important learning of school mathematics must be encouraged by considering the social hugeness of mathematics, the job of the advancement of numerical ideas and logical idea. Barbin et al. (2000) placed: The conviction that the utilization of history improves the learning of mathematics lays on two suspicions about the way toward learning. The more an understudy is keen on mathematics, the more work will be done; and, the more work that is done the more noteworthy will be the subsequent learning and comprehension (p. 69).

History of mathematics is emphasized worldwide to incorporate the subject for the student teachers. It has given importance such that it helps future mathematics teachers to teach new mathematics content and new pedagogy. Considering these facts, there is a provision of studying Math Ed 424 (History of Mathematics) in B Ed second year in Tribhuwan University. Although there is no any objective and expectation for acquiring pedagogical knowledge from delivering this course to B Ed students, the international trend of this course is to deliver content knowledge and pedagogical content knowledge for such types of courses. Inspiring from the international trend, researcher examined the role of history of mathematics on the part of knowledge creation in new content and pedagogy. From the analysis, it was found that history of mathematics has more contribution in new content knowledge rather than pedagogy. We can deliver interesting pedagogical knowledge through this course and motivate students. The practical use of number to deliver the concept of fraction by Egyptian is very interesting. It can help to estimate the fractional number to the students .Grouping and re-grouping methods used by Egyptians are still useful in mathematics. The contents of Nine Chapters of Mathematics are also helpful for pedagogical knowledge. The list of Fibonacci numbers are helpful to find the coefficients of algebraic binomial expansion. How Friedrich Gauss at the age of 9 found the sum of positive integers from 1 to 100 is interesting to teach students on the topic of the sum of natural numbers. Descarte's contribution to bridge the gulf between arithmetic and algebra is also interesting to teach mathematics. It helps to integrate the branches of mathematics which is the contemporary issue of modern period. The history of projective and descriptive geometry helps teachers to teach these chapters in concrete form. The stories of developing the concepts of curves and curvature by Kepler, Newton and Euler helps students how curves whose curvature variy from point to point is interesting to teach the concept of curve and curvature. The Brachistocrone is very motivating to students to estimate the shortest path. By studying this problem students can apply in their life. The story of classical approach of to computing probability is also interesting to students. Teachers can motivate students and attract them to modern probability theory. In this way there are hundreds of contents for supporting pedagogical knowledge of student-teachers but in this research I found the percentage low in pedagogical support in the comparison of content knowledge. The cause of this type of reflections may be the bi-product of five reasons. The first one: The general objectives of this course is silent in enhancing students' pedagogical knowledge, the second one may be the text books and reference materials are not written properly for developing pedagogical knowledge; the third may be teachers do not teach students pedagogy supporting materials; the fourth reason may be students depend upon the text book of certain writer and so no pedagogical knowledge; the last one may be the researcher's sampling error. Whatever may be the reason, we subject committee members are responsible to obtain the objectives of this course.

For this, first of all, we should add another general objective such that this course will help students to promote pedagogical knowledge. It should be the fact that these types of courses should have contribution in pedagogical knowledge as well as content knowledge and should be in balance because science and humanity faculties have no such types of courses.

Conclusion

Math Ed 424 is very important subject for mathematics education to produce competitive mathematics teachers. This type of course helps to humanize mathematics since mathematics was created by human beings. The social, environmental and economical aspects of human being were solved by mathematics. Mathematics itself was discovered on the way of solving human problems. Knowing the way of discovering mathematics helps students, teachers and also mathematicians to introduce new way of solving mathematical content problems and as well as pedagogy. Keeping this type of course in mathematics education means; mathematics teachers should have the knowledge of new content and pedagogy on historical perspective. So, new content and pedagogy both should be balance in this course. The curriculum designers should have the attention in formulating objectives and syllabus.

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