CHAPTER 6

A STUDY OF STUDENTS’ BEHAVIOR FOR INTEGRATION OF HISTORY OF MATHEMATICS WITH ALGEBRA
Students’ beliefs and attitudes towards mathematics teaching and learning play an important role in mathematics education. The learning outcomes of students are strongly related to their beliefs and attitudes towards mathematics\footnote{FuringhettiPehkonen, 2000; Leder, Pehkonen, &Törner, 2002; Pehkonen, 2003; Schoenfeld, 1992; Thompson, 1992}. Any good mathematics teacher would be quick to point out that students’ success or failure in solving a problem often is as much a matter of self-confidence, motivation, perseverance, and many other non-cognitive traits, as the mathematical knowledge they possess. Thus assessing or evaluating students’ mathematical knowledge must be made with the awareness of their beliefs. Systematic inquiry into students’ affective domain has grown a great deal during the last twenty years and many countries have been included in the research. The study described in this chapter aims to find out what kind of beliefs and attitudes towards mathematics students hold. This study is part of our research project.

This chapter included personal ideas, were tested in various classrooms during the 2012-2013. The pre/post student surveys were given to measure any change in attitudes and to give specific feedback on student feelings about using history in Algebra. Statistical analyses show that the pupils who were viewing to the history had a more positive attitude of mathematics than those who were not given the history lessons. There is a general opinion that students should learn through inquiry and through the construction of their own.

Using history of mathematics is essential in active learning processes. By learning activities of students, we mean their investigational work, problem solving, small group work, mutual learning and experiential learning. While solving a certain problem, every student has been proposed to investigate “mathematical situation” of it with persons own priorities for further inquiry of that problem. I consider “situation” as an issue, which is a localized area of inquiry with features that can be modified, but in mathematical sense a certain problem was posed for the first time, who was the author, whether that author proved/solved a problem on person own. The mathematicians were interested in it, a problem was remained unsolved. I would like to consider the possibility of using principles of active learning in teaching mathematics through such historical context. The aim of my research was to exhibit
that students can learn effectively through appropriately designed historical environment.

The researcher himself is an asst. professor of mathematics in a college. He has taught for more than 17 years. On the basis of his observation, he realized the necessity of the work upon the same and following research questions aroused in his mind:

6.1 Research Questions and tools

This study carried out between June 2012 and March 2013 in Indore city of India. Our interest lies in students’ beliefs and behavior towards integration of history of mathematics with algebra. The analysis was performed using a methodology based on the triangulation of information arise from different actions: desk study, assessment of partakers and statistical data analysis.

6.1.1 Research Questions

- How are concepts formed in mathematics?
- Which factors influence or change the meaning of concepts?
- Is there an internal logic and order in the development of mathematical concepts?
- What is the status of mathematics at graduate level?
- What are the problems faced by the students?
- What is the behavior of students towards integration of the history of mathematics with algebra?
- What kind of beliefs and attitudes towards mathematics teaching and learning do students hold?

The researcher felt to know the answers of the above questions, the necessity to work upon this area was realized.

6.1.2 Research participants

For this research work, 580 students were taken as sample of study. Out of which 261 are girls and 319 are boys. The unit of sample had students from Science and
engineering colleges of Indore city. The sample was chosen by random sample method.

Data collection tool was a questionnaire. The data was analyzed by using mean, percentage, standard deviation and t-test.

6.1.3 Tool

Based on the literature, the questionnaire can be considered as a common instrument to study beliefs and attitudes and several researchers use it as a main tool. The Questionnaire consists of two sections. Name, gender, community, category and college name of the student were asked in the section A. Section B of the questionnaire contained 75 statements which are divided into following 11 groups:

i. Beliefs about: mathematics as a subject - 8 statements

ii. Own mathematical abilities – 5 statements

iii. Being Boredom in mathematics – 6 statements

iv. Factors influence or change the meaning of concepts – 8 statements

v. Teaching tools in mathematics -5 statements

vi. Status of mathematics at graduate level – 10 statements

vii. Problems faced by the students – 6 statements

viii. Behavior of students towards integration of the history of mathematics with algebra? – 10 statements

ix. Evaluation of importance of mathematics – 8 statements

x. Evaluation of the teacher – 8 statements

xi. Mathematics and future scope – 2 statements.

For example, statements in the class “new topic in mathematics” were: “the teacher starts by giving us rules”; “we start with a practical problem from a daily life”; “the teacher asks us what we know about the new topic”; “the teacher leaves the textbook to decide what to do”, etc.

Graumann, 1996; Pehkonen, 1994; Pehkonen, 1996; Pehkonen&Lepmann, 1994; Perry, Howard, & Tracey, 1999; Tinklin, 2003; Tsamir&Tirosh, 2002; Vacc& Bright, 1999; Williams, Burden, &Lanvers, 2002
According to the interest the value is given to the statement of the groups, the same are shown below:

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Totally agree</td>
<td>Ta</td>
</tr>
<tr>
<td>Partially agree</td>
<td>Pa</td>
</tr>
<tr>
<td>Uncertain</td>
<td>U</td>
</tr>
<tr>
<td>Partially disagree</td>
<td>Pd</td>
</tr>
<tr>
<td>Totally disagree</td>
<td>Td</td>
</tr>
</tbody>
</table>

Table 7.1 Value according to interest

Here are some additional details about the other tools used for collecting data:

- Written research questionnaires: On several occasions, a written questionnaire was distributed among the members of the whole class in order to determine the prevalence of a certain phenomenon as it appeared in the interviews.

- Regular classroom tests and homework assignments: These tests and assignments reflected the expected requirements of the course and were not specifically designed for the research. However, upon reading the work of the students, it was observed that several phenomena repeatedly appeared.

- Incidental discussions: Some students came to office hours to ask questions. These questions often pointed to a student’s conceptual difficulties and led to a brief impromptu interview on these difficulties.

### 6.2 Hypotheses and Statistical technique

Keeping in mind the nature of the problem descriptive survey method was suited for the study. Five hundred eighty students were asked if they could take fifteen minutes and complete a survey. The undergraduates were first requested to read and sign a consent form (see Appendix A). The signed consent forms were then placed into a packet so the names of each of the students would remain confidential. They were asked to read the directions and answer the questions as honestly as they possibly could. It was brought to their attention again that their answers will be kept completely confidential and their names could not be matched with their answers.
All of the participants were tested under the same basic conditions. They were asked to complete the survey in their regular class rooms. After the students finished and fill out the rest of the survey, they were all thanked for helping us with our research work.

6.2.1 Hypotheses

- The researcher had relatively no idea regarding the outcomes of this research. Thus null hypotheses were designed:
  - H1: There is no significant difference in the behavior of students towards integration of the history of mathematics with algebra.
  - H2: There is no significant lacuna between the present curriculum and work done previously in this field.

6.2.2 Statistical technique

- The statistical techniques have used likely mean, percentage, standard deviation and t-test.

6.3 Data Analysis and Interpretation

Out of 580 students included in the study, 543 completed the questionnaire. Thus, the response rate (93.62 %) was very high. In the following table, the statements are taken from the groups. The columns in the table refer respectively: totally agree (Ta), partially agree (Pa), uncertain (U), partially disagree (Pd), and totally disagree (Td).

The following discussion is not only based on above table but on all the data from the questionnaires. Only a small part of data is presented due to limited space. According to the table above and data, generally there seems to be a small tendency towards more positive beliefs about mathematics amongst students from the survey. Students’ behavior tends to be more fundamental and they are more certain in their statements, especially in relation to the usefulness of the mathematics. Most of the students find that mathematics is a difficult subject and they have to work hard and solve many exercises to be good at mathematics. It appears that when the history integrated with the mathematics, own ability of the students improve to learn mathematics.
There is still a close match of agreement that mathematics is boring. This conclusion is rather striking in the situation where 96.7% of students say that mathematics is important. It means that students have a high motivation to learn but for some reasons they are bored in the mathematics lessons. Indeed, the technology that can help teachers to make mathematics lessons more challenging and fascinating has developed enormously during the last 18 years (1995 to till now) but the phenomenon of “being bored” in mathematics lessons is still quite common amongst the students.

Some interesting results from our study include:

- 89.11% of students agree that mathematics is important and 78.4% acknowledge the usefulness of mathematics in their lives.
- 46.68% claim that mathematics is boring, while 67.32% are sure they need to know mathematics.
- Most students understand that they have to work hard even if they do not enjoy working with mathematics in lessons (72.3%) and it is their responsibility to learn mathematics (88.9%).
- All the students, except one, find it important to know something about numbers and calculations and only two students think it is unimportant to know how to solve practical problems.
- There is still a huge emphasis on “mental calculations” amongst the first year students in upper secondary school as 95.8 % acknowledge that it is important to become good at this.

In this study, the behavior of students towards use of history of mathematics with algebra was to be determined positive. The study is interpreted in terms of percentage.

The data gathered through questionnaire have been analyzed and interpreted from various angles. Mean, standard deviation, t-test and correlation were applied to analyze the collected data. The mean score of students’ behavior towards integration of history of mathematics in mathematics is 315 out of 580. This indicates that students possess only 54.28% positive behavior towards integration of history of mathematic with algebra, which is very satisfactory.
Figure 7.1: Flow of the analysis

Table 7.2 Frequencies.

<table>
<thead>
<tr>
<th>S.No.</th>
<th>Group</th>
<th>(Ta)</th>
<th>(Pa)</th>
<th>(U)</th>
<th>(Fd)</th>
<th>(Id)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Beliefs about mathematics as a subject - 8 statements</td>
<td>67</td>
<td>252</td>
<td>91</td>
<td>59</td>
<td>35</td>
</tr>
<tr>
<td>2</td>
<td>Own mathematical abilities - 5 statements</td>
<td>37</td>
<td>140</td>
<td>70</td>
<td>85</td>
<td>58</td>
</tr>
<tr>
<td>3</td>
<td>Being Boredom in mathematics - 6 statements</td>
<td>23</td>
<td>23</td>
<td>38</td>
<td>96</td>
<td>73</td>
</tr>
<tr>
<td>4</td>
<td>Factors influence or change the meaning of concepts - 8 statements</td>
<td>14</td>
<td>46</td>
<td>51</td>
<td>152</td>
<td>160</td>
</tr>
<tr>
<td>5</td>
<td>Teaching tools in mathematics - 5 statements</td>
<td>16</td>
<td>98</td>
<td>67</td>
<td>165</td>
<td>169</td>
</tr>
<tr>
<td>6</td>
<td>Status of mathematics at graduate level - 10 statements</td>
<td>11</td>
<td>33</td>
<td>48</td>
<td>113</td>
<td>160</td>
</tr>
<tr>
<td>7</td>
<td>Problems faced by the students - 6 statements</td>
<td>192</td>
<td>103</td>
<td>90</td>
<td>57</td>
<td>35</td>
</tr>
<tr>
<td>8</td>
<td>Behavior of students towards integration of the history of mathematics with algebra? - 10 statements</td>
<td>73</td>
<td>98</td>
<td>63</td>
<td>21</td>
<td>60</td>
</tr>
<tr>
<td>9</td>
<td>Evaluation of importance of mathematics - 8 statements</td>
<td>189</td>
<td>241</td>
<td>28</td>
<td>18</td>
<td>7</td>
</tr>
<tr>
<td>10</td>
<td>Evaluation of the teacher - 8 statements</td>
<td>92</td>
<td>111</td>
<td>48</td>
<td>81</td>
<td>37</td>
</tr>
<tr>
<td>11</td>
<td>Mathematics and future scope - 2 statements.</td>
<td>145</td>
<td>131</td>
<td>100</td>
<td>79</td>
<td>57</td>
</tr>
</tbody>
</table>