RESEARCH ARTICLE

MATHEMATICS ANXIETY OF ELEMENTARY LEVEL PROSPECTIVE TEACHERS: DO MOTIVATION AND BACKGROUND IN MATHEMATICS, MEDIUM OF STUDY, AND AGE IMPACT?

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Abstract

Mathematics teaching and plans to simplify mathematics, even anxiety reduction in the discipline are being widely discussed all over the globe. It is a reality that if the teacher is well-trained, possesses basic minimum skills and has an attitude towards Mathematics, then the learners can grasp the subject matter in its real spirit. This study is an attempt to study the anxiety of prospective teachers in Mathematics. It is also aimed at comparing the students based on their background in Mathematics, age, medium of study, and motivation in Mathematics. A survey has been conducted among 46 students of Diploma in ETE, Jamia Millia Islamia, Delhi using the following tools:
- A data profile, to collect the basic socio-demographic data of the respondents, and
- Mathematics Anxiety Scale; validity and reliability have been rechecked.

The collected data has been analyzed with the help of PASW- Statistics 18th Version and MS-Excel. The results show that medium of study, and age don’t have a role in making variations in the scores on mathematics anxiety. Unlike this result motivation in Mathematics and background in Mathematics do have a mediating role.

Introduction

It is argued that educational opportunity is a necessary condition for student achievement and school success (Schmidt, et al., 2001). Schools as powerful agents of formal education should tailor the opportunities as per the demands of learning community. In order for a learner to have a good content mastery, they have to be provided with multiple opportunities to learn and relearn (Jones & Byrnes, 2006). Similarly, academic improvement is the unavoidable aspect of education and to achieve it the focus needs to be to alter the misconceptions among learners. It is very clear that the attainment of mathematical ability is expected out of basic education and literacy (NCF, 2005). In order to ensure the basic minimum, teachers, the social engineers should have an attitude and aspiration to do and understand the basics of mathematics.

The National Council of Teachers of Mathematics (NCTM, 2000) (in US) posits that the role of conceptual understanding in learning and building mathematical proficiency has been well documented. “Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge” (NCTM; p-20). Students need to learn with understanding not only for gaining procedural fluency, Mathematics equips the child with certain powerful set of tools to understand and change the world (Haylock & Thangata, 2007). Mathematics teaching develops certain form of critical and creative thinking among the learners for establishing competency in mathematical reasoning, argumentation, and problem solving. To make this happen, the basic
minimum requirement is the attitude of teachers, their understandin in Mathematics, and skill to impart the basics.

As a whole, Mathematics is very much misunderstood and the related anxiety is common among learners and even among teachers. Anxiety is a complex emotional response, often unconscious in origin, with fear or dread as its most notable characteristic (Page and Thomas, 1979). If such a form of fear happens or feels in connection with Mathematics, then it can be termed as Mathematics anxiety. Ashcraft and Kirk (2001) revealed that mathematics anxiety affects badly the performance. It leads both to avoidance and to temporary inhibition of working memory. Mathematics anxiety inhibits and blocks the ability of one person in the subject. Haylock (1986) revealed that 26% of pupils aged 10 to 11 years who were regarded as being low achievers in mathematics class were showing an increased level of mathematics anxiety. Ford, et al (2005) also added to the result of Haylock that in 10th year of age some students may feel mathematics anxiety similar to an adult.

What curbs the anxiety in Mathematics?

Motivation in mathematics is proven associated negatively with mathematics anxiety. It is the internal mental state of a person which relates to the initiation, direction, persistence, intensity, and termination of behavior (Landy and Becker, 1987). The present study aims to look at Mathematics anxiety of the pre-service teachers, who would be teaching Mathematics to primary and elementary classes after the completion of their Diploma in elementary teacher education.

2. The Study

Mathematics anxiety is the focal theme of the present study and an attempt will be made to study the relationship of mathematics anxiety with certain related psychological variables. There will be the test on the effectiveness of a pedagogical intervention as well. The study is entitled as “Mathematics anxiety viz-a-viz motivation, performance approach orientation, problem solving and impact of pedagogical intervention: A study among prospective teachers of Delhi.”

3. Major Focus

The present study is designed

1- To study the mathematics anxiety of prospective elementary level teachers of Delhi

2- To compare the mathematics anxiety of prospective elementary level teachers of Delhi viz-a-viz option of Mathematics at higher secondary level

3- To compare the mathematics anxiety of prospective elementary level teachers of Delhi viz-a-viz age

4- To compare the mathematics anxiety of prospective elementary level teachers of Delhi viz-a-viz motivation in Mathematics

across study dealing with mathematics anxiety of prospective teachers, especially in India. Moreover, role of motivation, medium of study and age are not at all studied. These problems and issues are of serious concern and by and large need special focus to improve the level of Mathematics teaching at primary stage.
4. Methodology

Design
The study is designed in survey style and the authors have selected normative survey method to collect the data.

Sampling
Sampling technique was incidental which is one of the non-probability sampling techniques. 46 pre-service teachers were selected Diploma in ETE students from Jamia Millia Islamia.

Measures
The following tools were employed for data collection.
- A Data Blank developed by the authors to collect certain socio-demographic information like age, class, gender, birth order etc.
- Mathematics Anxiety Scale Survey Form developed by Bai, et al. (Revised) (2009): It is a likert type scale with 14 item scores range for 14 to 70. Response categories of the scale are strongly agree, agree, cannot say, disagree and strongly disagree. The Chronbach’s Alpha obtained for the scale is 0.801.
- Modified version of elementary school motivation scale developed by Guay, et al. (2010): It is a nine item scale with five response alternatives namely always no, sometimes no, I don’t know, sometimes yes and always yes. Scores ranges from 9 to 45. The Chronbach’s Alpha obtained for the scale is 0.734.

Procedure of Data Collection
The pre-service students of Diploma in ETE were explained the objectives of the study; and a rapport was thus created. Then they were provided with tests one by one and respective instructions : [i] A data blank, [ii] Mathematics anxiety scale survey form, and [iii] Modified version of elementary school motivation scale. For analysis the participants were further divided into sub-groups based on the objectives of the study.

Statistical Trials
PASW statistics 18th version was used in the calculation of mean, standard deviation, skewness, and independent sample t-test. Similarly a histogram has also been drawn with normal curve on the top.

Delimitation
The sample of the present study is confined to 46 Diploma in ETE students of Jamia Millia Islamia.

5. Analysis of the Results
The construal of the results has been given below.

Table 1
Descriptive Statistical Scores on mathematics anxiety

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Median</th>
<th>Mode</th>
<th>SD</th>
<th>Skewness</th>
<th>Kurtosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mathematics Anxiety</td>
<td>39.3</td>
<td>40</td>
<td>40</td>
<td>9.2</td>
<td>-0.13</td>
<td>-0.51</td>
</tr>
</tbody>
</table>

Table 1 shows that prospective elementary teachers of Delhi have an average mathematics anxiety as per the norms since their mean score is 39.3. The standard deviation obtained is 9.29. Skewness value -0.13 denotes that most of the participants scored at the higher end of the distribution. Histogram of the distribution has been given below.

Figure: 1 Histogram showing the mathematics anxiety

Table 2
Result of independent sample t-test on mathematics anxiety (Age-based)

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>AM</th>
<th>SD</th>
<th>t-value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>20 Years and below</td>
<td>27</td>
<td>38.22</td>
<td>10.63</td>
<td>1.49</td>
<td>P&gt;0.05 (Not significant)</td>
</tr>
<tr>
<td>Above 20 Years</td>
<td>19</td>
<td>43.32</td>
<td>6.52</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The result of the comparison between the mean mathematics anxiety scores based on age of prospective teachers has been given in table 2. The t-value 1.49 denotes that the difference is not statistically significant. It is thus interpreted that age doesn’t have a decisive role in mathematics anxiety of prospective teachers at elementary level. The graph given below shows the mean differences.

**Figure: 2 Age-based comparison**

![Age-based comparison graph](image)

**Table 3**

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>AM</th>
<th>SD</th>
<th>t-value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urdu</td>
<td>2</td>
<td>41.8</td>
<td>7.18</td>
<td>1.38</td>
<td>P &gt; 0.05 (Not significant)</td>
</tr>
<tr>
<td>Hindi</td>
<td>2</td>
<td>38.1</td>
<td>10.7</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 3 shows the result of the comparison of mean scores in mathematics anxiety based on medium of study. The t-value 1.38 is proven not significant and is thus interpreted that irrespective of medium of instruction, the prospective teachers at elementary level show average mathematics anxiety. A comparative bar graph is given as figure 3.

**Figure: 3 Medium of study-based comparison**

![Medium of study comparison graph](image)

**Table 4**

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>AM</th>
<th>SD</th>
<th>t-value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opted Mathematics</td>
<td>29</td>
<td>36.14</td>
<td>9.27</td>
<td>4.21</td>
<td>P &lt; 0.01 (Significant)</td>
</tr>
<tr>
<td>at HSS level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not opted</td>
<td>17</td>
<td>46.35</td>
<td>4.78</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Comparison of mean scores according to the status of study of Mathematics at senior secondary level reveals that pre-service teachers who opted Mathematics at intermediate level have less mathematics anxiety than their counterparts. The t-value 4.21 is highly significant at 0.01 level of confidence. Figure 4 makes the comparison clear.

**Figure: 4 Mathematics background-based comparison**

![Mathematics background comparison graph](image)
Table 5
Result of independent sample t-test on mathematics anxiety (Motivation-based)

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>AM</th>
<th>SD</th>
<th>t-value</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low motivation in Mathematics</td>
<td>20</td>
<td>44.10</td>
<td>8.78</td>
<td>2.89</td>
<td>P&lt;0.01 (Significant)</td>
</tr>
<tr>
<td>High motivation in Mathematics</td>
<td>26</td>
<td>36.69</td>
<td>8.49</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The t-value out of independent sample t-test based on motivation in Mathematics revealed that mathematics anxiety is less among prospective teachers those who are having high motivation (t=2.89, P<0.01). It is interpreted that motivation in Mathematics does have an important role in mathematics anxiety. The graphical representation of comparison has been given below as figure 5.

Figure 5
Comparison based on motivation in Mathematics

6. Conclusion
The results show that pre-service teachers of Delhi have an average mathematics anxiety. The comparisons based on background in Mathematics and motivation in Mathematics have got highly significant result. It is quite obvious that pre-service teachers of Delhi who had opted mathematics at higher secondary school level have low anxiety and high motivation in mathematics. It is because of their familiarity in mathematics and their related general awareness.

Because, a limited amount of information can be stored and processed in working memory, a problem solver must be able to efficiently recall domain-specific knowledge structures or information in long-term memory that is relevant to the problem situation, hold it in working memory, and simultaneously work on the solution to the problem (Kalyuga, Ayres, Chandler, & Sweller, 2003). This should be kept in mind by all the Mathematics teachers. Then only they can impart a futuristic Mathematics idea to the learners. While working on a problem, a problem solver also must hold in memory the strategy being applied and keep in mind the interconnections between different parts of the problem; “The extent to which relevant elements interact is a critical feature” (Paas, Renkl, et al., 2003). The idea mentioned here will have a fruitful impact in teaching-learning of Mathematics if the educators really note it down and practice accordingly.

What we have to look further, there should be a clear plan to ensure the basic minimum in pre-service teachers before they plan their own teaching exercise. With a high level of anxiety, how can they teach the younger generation? So the planning should be started from teacher education curriculum itself to save the younger generation from being anxious about the ideas, concepts and exercises of Mathematics. We should plan the curriculum of teacher education incorporating all the related basics of teaching how to learn and how to teach Mathematics without fear and with confidence.

References


