Students Anxiety and Its Causes in Mathematics: A Sequential Explanatory Mixed Method Design

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ABSTRACT

From the last few decades, math anxiety has become the major concern of educationists. Students’ academic achievement especially in mathematics has been considered as a crucial factor in determining the future progress of students. But unfortunately, the participation rate of students in mathematics is decreasing day by day. The main objectives of the study were to assess secondary school students’ anxiety in mathematics and to explore the causes of students’ anxiety in mathematics. A sequential explanatory mixed method research design was used. The data was collected through both quantitative and qualitative methods. A five-point rating scale questionnaire was developed for quantitative data collection. The tool was validated through pilot testing. 100 students participated in pilot testing. Internal consistency of the instrument was assessed by Croanbach’s alpha which was 0.7. The targeted population of the study was both male and female secondary school students from the district Bahawalpur, Punjab. Out of the whole population, 726 male and female students were approached via multi-stage sampling technique. After quantitative data collection data was entered in SPSS version 20 and percentage, frequency distribution and mean score was calculated. Based on the quantitative data results it was observed that secondary school students were numerophobic and had moderately a high level of anxiety in mathematics. On the basis of quantitative results, interviews of secondary school teachers were conducted to explore the causes of students’ anxiety in mathematics. 20 teachers were approached via purposive sampling. The qualitative data revealed that major causes of students’ anxiety in mathematics were lack of practice, lack of previous knowledge, communication gap between student and teacher, and lack of interest in mathematics.

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1. Introduction

Globally, education is considered a significant mechanism to increase the economic development of a nation as the accomplishment does not only depend on a large number population; however, it comes from the existence of proficient human resources. This context highlights that mathematical skills are necessary for successful economic societies (Lipnevich, Gjicali, & Krumm, 2016). Mathematical skills help the countries in technological and scientific development (Enu, Agyman, & Nkum, 2015). Because of its utilization in diverse academic areas like social sciences, arts, basic sciences, and engineering mathematics has become a part of every school curriculum (Patena & Dinglasan, 2013; Phonapichat, Wongwanich, & Sujiva, 2014). In the modern era, Mathematics is considered an essential skill that individuals use all through their lives, such as while they travel, spend money, and keep track of time. Thus, mathematics is a vital proficiency to study at school.

Mathematics as a subject is viewed as a source of producing competitive persons who have a high degree of capabilities for application of knowledge of mathematics in solving problems and making decisions in their routine life (Cooper & Dunne, 1999). The achievement of students in mathematics is largely influenced by psychological factors like anxiety related to mathematics learning (Pajares & Miller, 1994). Therefore, mathematics anxiety has become the major concern of educators for the identification of a student’s achievement (Mohamed & R.A.Tarmizi, 2010). Unluckily, numerous children and youngsters feel tense and nervous while they are doing the math. Individuals having feelings of nervousness when doing mathematical problems might be suffering from “math anxiety.” Math anxiety distresses a lot of individuals or is linked to poor math capability in school as well as in later life (Sokolowski & Ansari, 2017).

Students' anxiety in mathematics has become a common problem in all levels of education including secondary education (Tobias & Weissbrod, 1980). Mathematics anxiety was described by Puteh (2002) as a developmental process that repeats itself based on an assembly of all the information which is obtained by the individual from his or her surroundings. As the accumulation of this information occurs, individuals internalize them and make aware of their belief system about mathematics. An individual with such type of beliefs creates behavioral situations to escape mathematics due to the presence of fear of not being capable of achieving mastery of mathematics. Numerous pupils face the undesirable consequences of anxiety toward mathematics from low achievement in academics, to low self-esteem to resolve practical mathematical problems (Armstrong, 1985; Chinn, 2009). Furthermore, Dodeen, Abdelfatta, and Alshumrani (2014) highlighted that a moderate level of anxiety is beneficial to encourage a learner towards greater mastery, acknowledging if the level of anxiety increased it might promote negative or low performance. Math anxiety is considered the affective variable that influences the academic performance of the students (Ashcraft, 2002). Math anxiety has become the major problem faced by students around the globe. It is the crucial need of time to understand the students' fears in the subject of mathematics and its possible causes. The present study's objectives were:

- To assess the secondary schools' students' anxiety in mathematics.
- To explore the causes of students’ anxiety in mathematics.

One of the causes of students’ anxiety in mathematics is a lack of practice. Students show unwillingness to solve mathematics problems. It is generally assumed that students who do not practice enough to solve mathematical issues are more numerophobic. Many students also tend to believe that they will solve the mathematical problem quickly and this misconception creates
nervousness in students (Smith, 2004). Usually, students do not spend enough time practicing mathematical concepts; they do not even realize that they require more time to practice certain mathematical problems.

The other major cause of math anxiety is poor previous knowledge. Students who are slow in learning face numerous problems in the subject of mathematics. They could not recall what they had learned in previous lectures. Such kinds of learners when faced with some problem-solving situations were not able to apply strategies and previous knowledge to solve mathematical problems. Usually, in mathematics, most of the concepts are hierarchical so the learners must improve or modify their previous knowledge about the subject (von Glasersfeld, 1994). Instructors of mathematics highlighted that some students have memory problems that cause math anxiety in students.

Lack of interest also is the main cause of math anxiety. Amelink (2012) concluded that students' lack of interest in mathematics has a great impact on the enrollment in academic programs that requires strong mathematical skills including engineering, technology, and science disciplines. The lower interest of students in mathematics is related to the poor academic performance of the students.

Like lack of practice and poor previous knowledge communication gap is another contributory factor that leads to the poor perspective of students towards mathematics. Instructors play a critical role in the teaching-learning environment. Generally, it is assumed that a teacher should focus on learners' mathematical thinking and promote classroom discussion so the learners can be able to understand the mathematical content. But unfortunately, these practices have not been practiced in mathematical classrooms (Jacobs et al., 2006).

2. Research Methodology

A mixed-method of research was selected for the present study. A sequential explanatory mixed method design was used. Both quantitative and qualitative methods were used for data collection. A self-administered questionnaire on a five-point rating scale was developed to assess the students' anxiety in mathematics. The questionnaire consisted of two portions. The first part consisted of demographic information of the secondary school students. The second part consisted of 20 close-ended questions. 726 male and female students of secondary level from district Bahawalpur, Punjab were approached through a multi-stage sampling technique. After the analysis of quantitative results 20 mathematics teachers of secondary level were selected purposively for the interview. Interview responses were recorded and analyzed to explore the causes of students' anxiety in mathematics.

2.1 Tool validation

A five-point rating scale questionnaire was developed according to the objectives of the study. Tool's face and content validity was assessed by 4 subject specialists. After their suggestion statements were edited and modified. For assessing the reliability of the questionnaire, a pilot study was conducted on a small scale. 100 students were approached for pilot testing. After pilot testing, the collected data was entered in SPSS version 20 and its reliability was assessed by Cronbach's alpha. The tool reliability was 0.7.
A semi-structured interview was conducted to explore the causes of students' anxiety in mathematics. The questions of the interview were developed according to the suggestions of 5 experts in mathematics education.

3. Data Analysis

The quantitative data collected through the questionnaire was entered in SPSS version 20. Percentage, frequency distribution and mean score was calculated. The qualitative data was collected via interviews of teachers. The recorded qualitative data was analyzed by Qualitative content analysis (Creswell, 2009).

3.1 Quantitative Analysis

The quantitative data was collected via a questionnaire presented in the following tables.

<table>
<thead>
<tr>
<th>Table 1 Personal Information of the Respondents.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Variables</td>
</tr>
<tr>
<td>Gender</td>
</tr>
<tr>
<td>Male</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Age</td>
</tr>
<tr>
<td>12-14</td>
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<tr>
<td>15-17</td>
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<tr>
<td>Grade</td>
</tr>
<tr>
<td>9th</td>
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<td>10th</td>
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<tr>
<td>School</td>
</tr>
<tr>
<td>Public</td>
</tr>
<tr>
<td>Private</td>
</tr>
</tbody>
</table>

Table 1 displays the personal information of the respondents. The final results displayed that 64.6% of the respondents were male and 35.4% of the respondents were female. Table 1 also showed the age of the respondents. The group statistics illuminated that 33.1% of the respondents were from the 12-14 age group and 66.9% were from the 15-17 age group. However, 51.0% of the respondents were from 9th grade and 49.0% were from 10th grade. It also illuminated that 67.2% of the respondents were from the public sector and 32.8% of the respondents were from the private sector.
Table 2 Students’ anxiety in mathematics.

<table>
<thead>
<tr>
<th>Items</th>
<th>SDA</th>
<th>%</th>
<th>DA</th>
<th>%</th>
<th>U</th>
<th>%</th>
<th>A</th>
<th>%</th>
<th>SA</th>
<th>%</th>
<th>Total F</th>
<th>Total %</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Feel uneasy</td>
<td>42</td>
<td>5.8</td>
<td>81</td>
<td>11.2</td>
<td>27</td>
<td>3.7</td>
<td>339</td>
<td>46.7</td>
<td>237</td>
<td>32.6</td>
<td>726</td>
<td>100</td>
<td>3.89</td>
</tr>
<tr>
<td>Low self-esteem</td>
<td>65</td>
<td>9.0</td>
<td>125</td>
<td>17.2</td>
<td>73</td>
<td>10.1</td>
<td>303</td>
<td>41.7</td>
<td>160</td>
<td>22.0</td>
<td>726</td>
<td>100</td>
<td>3.50</td>
</tr>
<tr>
<td>Feel Terrific</td>
<td>169</td>
<td>23.3</td>
<td>261</td>
<td>36.0</td>
<td>77</td>
<td>10.6</td>
<td>123</td>
<td>16.9</td>
<td>96</td>
<td>13.2</td>
<td>726</td>
<td>100</td>
<td>2.60</td>
</tr>
<tr>
<td>Unable to think</td>
<td>44</td>
<td>6.1</td>
<td>175</td>
<td>24.1</td>
<td>58</td>
<td>8.0</td>
<td>269</td>
<td>37.1</td>
<td>179</td>
<td>24.7</td>
<td>726</td>
<td>100</td>
<td>3.51</td>
</tr>
<tr>
<td>Feel tensed</td>
<td>68</td>
<td>9.4</td>
<td>223</td>
<td>30.7</td>
<td>73</td>
<td>10.1</td>
<td>172</td>
<td>23.7</td>
<td>190</td>
<td>26.2</td>
<td>726</td>
<td>100</td>
<td>3.26</td>
</tr>
<tr>
<td>Feel anxious</td>
<td>94</td>
<td>12.9</td>
<td>295</td>
<td>40.6</td>
<td>55</td>
<td>7.6</td>
<td>221</td>
<td>30.4</td>
<td>61</td>
<td>8.4</td>
<td>726</td>
<td>100</td>
<td>2.80</td>
</tr>
<tr>
<td>My mind goes blank</td>
<td>119</td>
<td>16.4</td>
<td>185</td>
<td>25.5</td>
<td>82</td>
<td>11.3</td>
<td>234</td>
<td>32.2</td>
<td>106</td>
<td>14.6</td>
<td>726</td>
<td>100</td>
<td>3.03</td>
</tr>
<tr>
<td>Feel unpleasant</td>
<td>49</td>
<td>6.7</td>
<td>135</td>
<td>18.6</td>
<td>66</td>
<td>9.1</td>
<td>269</td>
<td>37.1</td>
<td>207</td>
<td>28.5</td>
<td>726</td>
<td>100</td>
<td>3.61</td>
</tr>
<tr>
<td><strong>Final Results</strong></td>
<td><strong>89.6</strong></td>
<td><strong>203.9</strong></td>
<td><strong>70.5</strong></td>
<td><strong>265.8</strong></td>
<td><strong>170.2</strong></td>
<td><strong>3.275</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Note: SDA=Strongly Disagree, DA= Disagree, U= Undecided, A=Agree, SA=Strongly Agree

Table 2 displayed the statistics of students’ anxiety in mathematics. The group statistics of students’ anxiety factor displayed feel uneasy, low self-esteem, feel terrific, unable to think, feel tensed, feel anxious, my mind goes blank and feel unpleasant. The total mean score of feel terrific was relatively low (M= 2.60). While the total mean score of feeling uneasy was moderately high in all sub-factors of anxiety (M= 3.89). The total mean score of the anxiety factor was 3.27 which resulted that secondary school students had anxiety in mathematics.

### 3.2 Qualitative Analysis

Figure 1 presented the responses of teachers’ interviews regarding causes of students’ anxiety in mathematics. Most of the respondents highlighted that students face difficulties in learning mathematics because they prefer to cram the steps of a question and do not practice the solution of questions. They feel reluctant to practice the basic concepts of mathematics. Due to lack of practice, they always forget the necessary steps of solving a question. However, half of the respondents gave the opinion that the other main cause of students’ anxiety in mathematics learning is the lack of previous knowledge of mathematics. Students who were not outstanding in mathematics and had no knowledge about the basic rules of mathematics were more prone to face difficulties in mathematics learning. While less than half of the respondents responded that another main difficulty in learning mathematics is the lack of communication between student and teacher relationships. Students are less confident to ask questions from the teacher in a classroom. Some teachers are so strict that students feel afraid to share their difficulties in any question. They hesitate from asking any questions in a classroom due to the fear of being embarrassed by their class fellows as a result of scolding from the teacher. On the other hand, few teachers highlighted that the other major contributory factor which hinders the student’s capabilities to be effective in mathematics learning is the lack of interest. Students feel that mathematics is just the addition, subtraction, multiplication,
and division of something. It is not more than these parameters.

**4. Conclusion and Discussion**

The first objective of the study was to assess the students’ anxiety in mathematics. The present study concluded that secondary school students were struggling in mathematics and in the light of quantitative analysis, it was observed that students had a moderately high level of math anxiety. The final results highlighted that student who had math anxiety possessed low self-esteem to solve some mathematical problems. As the present study is linked with the study conducted by Escalera, Moreno, Garcia, and Rojas (2016), most of the high school students had math anxiety and they became nervous and lose self-confidence when they were solving some mathematical problem.

The second objective of the study was to explore the causes of students’ anxiety in mathematics. The qualitative results of the study revealed that some of the major causes of students’ anxiety in mathematics are lack of practice, lack of previous knowledge, communication gap, and lack of interest of students in mathematics. Generally, it is assumed that students who did not practice enough were struggling in solving mathematics problems. The study finding is supported by Acharya (2017) who stated that students who did not do the extra effort to practice mathematics had low performance in mathematics. The research study also illuminated that the lack of previous knowledge is a contributing factor in the difficulties faced by the students in learning mathematics. Students who did not develop basic skills of mathematics in their elementary and middle level of education had a low participation rate in mathematics class. It was also observed that those students who had no interest in mathematics were more numerophobic. According to Koller, Baumert, & Schnabel (2001) interest of the learners is the contributory factor that influences the achievement of students in higher secondary schools. The present study also revealed that one of the primary factors that increase students’ anxiety in learning mathematics is the communication gap between students and teachers. Students feel stressed to share their difficulties in academics with their teachers because they hesitate to communicate with their instructor. As indicated by Lee, Sharma, & Aiken (2007) the academic performance of a student is positively influenced by a relationship between student and teacher when it is trustworthy.
References


