Teaching Techniques in Overcoming Mathematics Anxiety
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Abstract (Article Summary)
This paper is a review of research into the nature of math anxiety and teaching techniques used to overcome math anxiety. Math anxiety effects a large percentage of the population and evidence suggests it is primarily influenced by affective factors. It is concluded that teaching techniques with the emphasis on students becoming active learners in mathematics, constructing their own knowledge and having fun is effective in alleviating math anxiety and improving mathematics performance.

What is Maths Anxiety?

Tell most people today that you intend on becoming a maths teacher and their immediate response is like a self-conscious apology, “I was never good at mathematics.” Is this just a symptom of maths anxiety? What is maths anxiety anyway?

Researchers in the field of psychology, have identified two components of general anxiety, namely trait and state anxiety. While trait anxiety refers to an individual’s anxiety proneness, state anxiety is a temporary emotional condition. Among state anxieties, mathematics anxiety is recognised as being situation-specific, it surfaces under mathematically related environments (Baloglu, 1999).

Further research by Xin (1999) found a significant correlation between anxiety toward mathematics and achievement in mathematics among elementary and secondary students with no significant interaction effects due to gender, grade or ethnicity. “There is an increasing recognition that affective factors play a critical role in the teaching and learning of mathematics” (McLeod as cited by Xin, 1999, para. 2).

Since math anxiety is a real psychological anxiety which has a negative effect on mathematics performance, the role of math teachers is therefore to identify which students are prone to math anxiety, using one of many math anxiety surveys, and to use alternative teaching strategies to overcome math anxiety.

Tobias (2004), a leading researcher and author in math anxiety, views math anxiety as causing emotional static in the brain. Every time math anxious students look at some new mathematical material they panic, their understanding and recall abilities are blocked and they are unable to think. People start to doubt that they have what it takes to learn math therefore “their problem is not a failure of intellect but a failure of nerve” (Tobias, 2004, main menu).

The causes of mathematics anxiety in individuals include being told “girls don’t do math”, believing you are either good with words or numbers, lack of discussion and debate in the classroom, pressure to find the one right answer and math being too rigid or dreary (Tobias, 2004). Alternatively, Murr (2001) believes mathematics anxiety comes about because of a sense of urgency in understanding mathematical material and arriving at a solution.

Research by Tobias (2003) and Murr (2001) suggests that self-efficacy, “an individual’s beliefs about their ability to perform tasks successfully” (Krause, Bochner & Duchesne, 2003, pg 75), is a primary factor in causing math anxiety. In the mathematics classroom, students self-efficacy is determined by their skill level and past experiences and
achievements, both positive and negative. Furthermore, Kruse, Bochner & Duchesne (2003) acknowledge that low self-efficacy or negative feelings have a large effect on thoughts, behaviour and motivation and may be associated with anxiety and feelings of helplessness.

*Teaching Techniques in Overcoming Maths Anxiety*

Through the ages math has been perceived as a discipline that few can master but society has shifted from a demand for labourers to a demand for technically skilled employees, such as engineers and computer scientists, and the need for skilled mathematicians is growing (Curtain-Phillips, 2003).

A case study conducted at Danville Community College (Jones, 2001), followed two basic math classes composed of similar students taught in the fall semesters of 1999 and 2000. The research attempted to determine whether clinical psychology theories, such as exploration and modification of dysfunctional perceptions, stress reduction and management and behavioural techniques of reinforcement, would in fact alleviate math anxiety and lead to improved mathematics performance.

The two classes met at the same time of day and used the same text and test resources. Anecdotally, the two classes expressed similar math and test anxiety.

The teaching strategy for the 1999 class was traditional whereby the teacher explained new math concepts then students performed practice questions and memorised the steps and rules required to solve the math problem. For the 2000 class, the teacher consciously tried to reduce math anxiety by creating a positive environment. At the start of each class the teacher would enthusiastically say “Isn’t it great we get to do math today!”

Incentives were used for students to keep reviewing previously learned techniques and homework was left up to the individual, emphasising the need for students to discover their own learning style and determine how much practice they needed.

The teacher used a casual approach to a new topic using some “wondering out loud”, followed by appropriate models for finding a solution and discussing its real world application. The merits of each solution approach were noted and students were challenged to determine which one should be used first.

If students couldn’t recall something they were encouraged to ‘Not panic!’, to stop and think and use self-talk to help them recall or re-create what they were trying to remember. The teacher would also verbally admit when he got lost and would frequently request the classes’ assistance in identifying the error and how to recover.

The results of the case study into reducing math anxiety were as follows:-

<table>
<thead>
<tr>
<th></th>
<th>Enrolled</th>
<th>U’s: (unsatisfactory)</th>
<th>R’s: (repeat)</th>
<th>S’s: (satisfactory)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fall 99 for 3 cr.</td>
<td>12</td>
<td>17%</td>
<td>42%</td>
<td>42%</td>
</tr>
<tr>
<td>Fall 00 for 5 cr.</td>
<td>19</td>
<td>11%</td>
<td>5%</td>
<td>84%</td>
</tr>
</tbody>
</table>

The above results show that the class of 2000 had a lower percentage of unsatisfactory, a lower percentage of repeats and a much higher percentage of satisfactory grades in
comparison with the 1999 class. Since research has shown that there is a relationship between math anxiety and performance, it is concluded that teaching strategies aimed at reducing math anxiety were successful.

Some criticisms of the above case study would be that the sample groups were not very large, the study should be repeated across grades and there is no measurement of math anxiety before and after the experiment. I am more interested in the students’ feelings about mathematics, in particular whether they felt more confident in their mathematics ability at the end of the course.

Curtain-Phillips (2003) says there needs to be a national call for reform in math teaching. Teachers must find ways to engage students in learning, incorporate more student-directed learning, design activities that make children feel more successful and encourage discussion in the math classroom. Curtain-Phillips, in agreement with the case study, also believes that “math must be seen in a positive light in order to reduce math anxiety” (para. 1).

At the start of each new school year, Curtain-Phillips (2003, para.13) likes to tell her students the story of Albert Einstein to inspire students and give them a sense of a hope for a fresh start regardless of their prior mathematics experiences and anxieties.

“Albert Einstein was a German-American physicist and mathematician, whose major contribution was the Theory of Relativity. Almost every concept of modern physics has been affected by Einstein's theories.

Einstein's teachers thought he was stupid, and he failed math in elementary school. He did not display his talent for mathematics until he was 14, when he taught himself integral calculus and analytical geometry.”

Research by Blessman & Myszczak (2001) into fifth graders understanding of mathematical vocabulary found that math anxiety was one of the contributing causes of poor comprehension. Intervention strategies used to overcome poor mathematical vocabulary included student math journals, student-created math dictionaries, children’s literature to introduce and reinforce mathematical concepts, visual aids and written explanations of open-ended word problems. The results showed an increase in math vocabulary, math performance and communication of mathematical ideas.

Extensive research by Tobias (2004) resulted in her recommendation that students learn to recognize when panic starts. They are taught to divide their exercise book in half and record their feelings and thoughts on the left and their calculations and problem solving steps on the right. This approach gives the student permission to explore their own confusion and writing their thoughts helps break tension and feelings of isolation. Tobias (2004) believes students’ ability to analyse their problems and discover their learning style becomes a source of insight into the math problem itself.

Tobias (2004) also suggests teachers promote math mental health by having students’ write a math autobiography, organising group discussion of difficulties in confronting maths, have one session a week where you discuss ‘left-hand side of page’ comments, slowing down the pace of math sessions and training passive learners to be active and demanding ones.

Curtain-Phillips (2003) believes that a teacher’s attitude or anxiety toward mathematics is often emulated by students, particularly in elementary and middle-school. It is therefore
imperative that mathematics teachers teach with confidence and joy and they can do this by bringing their personalities, interest and strengths into the classroom (para. 16).

“A teacher who enjoys cooking could apply math concepts such as fractions, ratios, proportions, and measurement to kitchen experiences. A teacher who is a strong writer could incorporate writing math poems into the curriculum. Art, science, and history can easily be brought into the mathematics classroom.”

Curtain-Phillips (2003) also suggests that games such as cards, Yahtzee, Battleships and Tangrams, are a good way of introducing many math concepts with the emphasis on having fun while learning. Another of her suggestions for overcoming math anxiety is to include humour in the classroom such as cartoons, used to introduce a math concept. Sources for cartoons include the newspaper, internet and books of math cartoons.

Research into multiple intelligences, the use of drama, cooperative learning, concrete manipulations, real world problem solving and information technology resources also need to be considered when designing teaching techniques in overcoming math anxiety.

**Conclusion**
In conclusion, math anxiety is a very real phobia for many people of all ages, gender and ethnicity. Research has shown that creating a positive environment and attitude toward mathematics and students understanding their own confusions and learning style contributes toward alleviating math anxiety.

Combined with positive reinforcement, students need to be given opportunities for experimenting, exploring, conjecturing, solution inventing and reflecting on work (Curtain-Phillips, 2003, and Martinez, 2003). Therefore, there is no stand-alone teaching technique in overcoming math anxiety but rather a whole range of techniques and strategies.
References


