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Management of Mathematics Phobia in a Ninth Standard Student: A Study

Pankaj Singh
Research Scholar (Psychology),
R & D Centre, Bharathiar University, Coimbatore, Tamil Nadu, India
E-mail: ahlawat.pank@gmail.com

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Abstract - **Mathematics Phobia is an irrational fear of Mathematics. Tobias and Weissbrod (1980) used the term 'mathematics anxiety' to describe the panic, helplessness, paralysis, and mental disorganization that arises among some people when they are required to solve a mathematical problem (p. 65). It creates a feeling of tension, apprehension, or fear that interferes with performance in Mathematics and also results in 'Mathematics-Avoidance'. Unfortunately, 'Mathematics-Avoidance' results in less competency, exposure and practice of Mathematics, leaving students more anxious and mathematically, unprepared to achieve.**

Math anxious people do well in other subjects but not in Mathematics, which lowers their self-esteem; as a result they develop negative attitude toward Mathematics, and show less interest in this subject. Anxious students volunteer answers less frequently and have a greater tendency to remain passive in classroom activities. These students avoid Mathematic courses and tend to feel negative towards Mathematics and this also affects student's overall confidence level. However, Behaviour Modification techniques have proven instruments that can reduce various types of anxieties and Super Brain Yoga for improving integration of the brain. Hence this study is undertaken for the Management of Mathematics Phobia.

This is a case study of a student of IX standard, Kendriya Vidalaya, Who was referred by his Mathematics teacher complaining that the student becomes anxious whenever he encounters Mathematic problems. After taking Math autobiography it was revealed that the anxiety began due to an embarrassing event in a Mathematics period when he was in sixth standard. Students score in recent Mathematic exam was noted very low i.e 10/40. His Mathematics Phobia was assessed by using Suri, Monroe and Koc's (2012) short Mathematics Anxiety Rating Scale. Student's hemispheric dominance of the brain was measured by using Taggart and Torrance's Human Information Processing Survey (1984). This student was treated with Behaviour Modification techniques and Super Brain Yoga for five weeks.

Interventions used are: i) Reduction of Rate of Breathing (Ganesan, 2012). ii) Laughter Technique (Ganesan, 2008b). iii) Develpoment of Alternate Emotional Responses to the Threatening Stimulus (Ganesan, 2008a). iv) Super Brain Yoga (Sui, 2005).

The anxiety level and performance in Mathematics exam was reassessed after five weeks. Results showed that Mathematics Phobia was significantly reduced (72 to 14, 58%) and he performed better in the Mathematics exam (10/40 to 28/40, 45%). After reassessing student on Human Information Processing Survey by Taggart and Torrance (1984), it was found that student's dominant information processing mode was 'Integrated' and This shows that Behaviour Modification techniques and Super Brain Yoga are efficient in treating Mathematics Phobia.

Keywords: **Mathematics Phobia, Behaviour Modification, Super Brain Yoga.**

I. INTRODUCTION

Behaviour Modification involves systematic application of learning principles and techniques to assess and improve individual's overt and covert behaviours in order to enhance their daily functioning. Simple or specific phobias have been quite effectively treated with behavior modification. The behaviorists involved in classical conditioning techniques believe that the response of phobic fear is a reflex acquired to non-dangerous stimuli. The normal fear to a dangerous stimulus, such as a poisonous snake, has unfortunately been generalized over to non-poisonous ones as well.

If the person were to be exposed to the non-dangerous stimulus time after time without any harm being experienced, the phobic response would gradually extinguish itself. Also, this assumes that the person does not also experience the dangerous stimulus during that same extended period of time. In other words, one would have to come across only non-poisonous snakes for a prolonged period of time for such extinction to occur. This is not likely to occur naturally, so behavior therapy sets up phobic treatment involving exposure to the phobic stimulus in a safe and controlled setting.

The foundation for Behaviour Modification was laid late in the 19th century in the experimental laboratory of Russian physiologist Ivan P Pavlov which led to conceptualization of classical conditioning. His Noble prize winning research work on dog's digestive system led to the inception of classical conditioning. John B Watson an American psychologist, who coined the term behaviorism in his influential paper in 1916, emphasized that habits are learned due to classical conditioning and also demonstrated it in a classical experiment (Watson & Rayner, 1920).

Behaviour Modification is based on the learning theories and its basic principle is that when we consistently respond to a stimulus in a particular manner neural network forms and it becomes habit. Habits can be learned and unlearned through Behaviour Modification. Further, in 1950s Joseph Wolpe research work based on Pavlovian conditioning and Sherrington (1947) observation led to inception of Reciprocal Inhibition. He extended the principal of reciprocal inhibition to state that if a response that is incompatible with the learned fear or anxiety can be made to occur to a stimulus that had been conditioned to produce that fear, then that stimulus will cease to elicit the fear reaction. Based on Sherrington (1947) observation that if one group of muscles is stimulated, an antagonistic muscle group will be inhibited, and vice versa, Joseph Wolpe propounded treatment for phobias and irrational fears.

Phobia is an unadaptive habit which is formed due to wrong learning and can be treated by relearning the behaviour to form adaptive habits. Similarly Mathematics-Phobia is treated with Behaviour Modification by relearning and creating alternate responses to the threatening stimulus. Alternate responses are created on the principle of Reciprocal Inhibition where an incompatible response is produced to counter the negative stimulus. Mathematics which has become a threatening stimulus due to various reasons can be de-conditioned by practicing techniques based on reciprocal inhibition.

In Eastern medicine the outer portion of the ear is viewed as a microsystem representing the entire body. According to Dr. Paul Nogier MD, a neurologist, the ear corresponds to an inverted fetus curled in the womb. Points on the ear correspond with specific areas of the body, and the ear lobe corresponds to the head. Consequently, massage of these points can produce therapeutic benefits to the brain. The practice of ear piercing too has its real reasons being the stimulation of the pituitary and pineal glands, due to the effect of the pressure in the ear lobes. Based on this concept Super Brain Yoga was developed by Master Chou Kok Sui which activates our pineal and pituitary gland (Sui, 2005).

Super Brain Yoga is a technique which enhances Alpha waves in the brain and Synchronization of left and right brain hemispheres (Sui, 2005). Increase in Alpha waves in the brain indicates that the body has become relaxed and thus Super Brain Yoga is an effective tool to reduce anxiety. Super Brain Yoga also synchronizes left and right brain hemispheres and integrates the brain. Students having integrated brain are efficient in solving Mathematical problems by using resources of both left and right hemisphere (Oliver, Erin Michelle, 2009). Thus practicing Super Brain Yoga every day helps to alleviate Mathematical Anxiety and also increases scholastic performance of the students in Mathematics exam by enhancing the integration of the brain.

Ganesan (2008, 2012) had studied the efficacy of the above Behaviour Modification techniques and found them effective in reduction of neurotic disorders like phobias. These techniques including Super Brain Yoga were never used before to reduce phobia related to Mathematics. Hence there is a need for systematic evaluation of the efficacy of above mentioned techniques in the Management of Mathemetics-Phobia. This study has been undertaken in this direction with a view to implement these effective techniques.

II.METHODOLOGY

This is a case study of a student of IX standard, Kendriya Vidalaya, Who was referred by his Mathematics teacher complaining that the student becomes anxious whenever he encounters Mathematic problems. After taking Math autobiography it was revealed that the anxiety began due to an embarrassing event in a Mathematics period when he was in sixth standard. Students score in recent Mathematic exam was noted very low i.e 10/40. His Mathematics Phobia was assessed by using Suri, Monroe and Koc's (2012) short Mathematics Anxiety Rating Scale. Student's hemispheric dominance of the brain was measured by using Taggart and Torrance's Human Information Processing Survey (1984). This student was treated with Behaviour Modification techniques and Super Brain Yoga for five weeks.

Interventions: The following interventions were given for five weeks :- i) Reduction of Rate of Breathing (Ganesan, 2012) ii) Development of Alternate Emotional Responses to Threatening Stimulus (Ganesan, 2008a) iii) Laughter Technique (Ganesan, 2008b) iv) Super Brain Yoga (Sui, 2005). They were used to create reciprocal inhibition in the Math anxious student and enhanced integration of the brain. Student had relearned the new behaviour to form adaptive habit towards the Mathematics subject.

III.RESULTS

The student was reassessed after Five weeks. Results showed that Mathematics Phobia was reduced significantly (58%) from 72 to 14, on short Mathematics Anxiety Rating Scale (sMARS) [Table I].

TABLE I MATHEMATICS ANXIETY SCORE BEFORE AND AFTER INTERVENTION

Score Range (0-100)	Before	After five weeks	Reduction
	72	14	58%

Whereas student's academic performance in Mathematics was improved significantly (45%) from 10/40 to 28/40 [Table II].

TABLE II ACADEMIC PERFORMANCE IN MATHEMATICS BEFORE AND AFTER INTERVENTION

Score Maximum-40	Before	After five weeks	Gain
	10	28	18 (45%)

Student was assessed on Tagarat and Torrance's Human Information Processing Survey (2012). Results showed that before intervention, the dominant mode of information processing was 'Left' with a score of 16, where Right Hemisphere and Integrated score were 14, 10 respectively. On reassessing the student after intervention, the dominant mode of processing found to be 'Integrated' with a comparatively higher score of 20, whereas Left Hemisphere and Right Hemisphere score were 09 and 11 respectively [Table III].

TABLE III HUMAN INFORMATION PROCESSING SURVEY

	Left Hemisphere	Right Hemisphere	Integrated
Before	16	14	10
After	09	11	20

IV.DISCUSSION AND CONCLUSION

The purpose of the present study was to manage Mathematics Phobia. For the objective assessment of Mathematics Anxiety, a psychometric scale, namely, short Mathematics Anxiety Rating Scale by Suri, Monroe and Koc (2012) was used and to find the dominant information processing mode of the student, Taggart and Torrance's Human Information Processing Survey was used. Behaviour Modification techniques and Super Brain Yoga were used to treat the student. Initially student's recent score in Mathematics exam was collected, which was low, 10/40.

Before giving interventions student was assessed for Mathematics Phobia, where he score 72 and was assessed on Human Information Processing Survey. Student's dominant mode of information processing was found to be 'Left', which implied that student's brain uses logic to perform in Mathematics. Student was given intervention for five weeks with Behaviour Modification techniques, like Reduction of Rate of Breathing, Development of Alternate Emotional Responses to Threatening stimulus, Laughter Technique and Super Brain Yoga.

Reduction of rate of breathing initiates slow breathing or diaphragmatic breathing. According to the University of Texas Counseling and Mental Health Center, "Diaphragmatic breathing allows one to take normal breaths while maximizing the amount of oxygen that goes into the bloodstream. It is a way of interrupting the 'Fight or Flight' response and triggering the body's normal relaxation response". Slow breathing makes the diaphragm to stimulate vagus nerve and it further activates parasympathetic nervous system which alleviates the effect of sympathetic nervous system. Activation of parasympathetic nervous system reduces the effect of anxiety and relaxes the body. So, rate of reduction of breathing produces response which is incompatible to Mathematics Phobia.

Whereas, through Laughter Technique hormone called endorphin is released due exhaustion of abdominal muscles, which helps to alleviate the pain and stress caused due to Mathematics phobia. Finally, by practicing Development of Alternate Response towards Mathematics enables the student to practice six types of emotions after seeing Mathematics as stimulus (a sheet having problems related to addition, subtraction, Multiplication and Division in five digits). The student was first asked to show anger towards the stimulus, and then was asked to laugh at the stimulus followed by singing a song for it, further the student was asked to dance with the stimulus, finally expressed love and worship towards the stimulus. Therefore, by practicing these different emotional responses the conditioned response i.e Mathematics Phobia, becomes neutral. These exercises, through principle of Reciprocal Inhibition, developed alternate emotional responses towards Mathematics Phobia and found to be incompatible with it.

Whereas, Superbrain Yoga is a simple and effective technique to energize and recharge the brain. It is based on the principles of subtle energy and ear acupuncture. It's a scientifically validated method to help super-energize the brain and enhance its sharpness and clarity. Super Brain Yoga is a fast, simple, drug-free method of calming the nervous system through generating Alpha waves in the brain. Alpha waves can be noticed through PET scan of the brain. These waves are usually seen when a person is in a meditative state or completely relaxed.

Super Brain Yoga technique enhanced Alpha waves in the brain and Synchronized left and right brain hemispheres (Sui, 2005). Increase in Alpha waves in the brain indicated that the body has become relaxed and thus countered anxiety caused by Mathematics in the student. In addition Super Brain Yoga also synchronized left and right hemispheres of the brain and made the brain integrated. As, students having integrated brain are efficient in solving Mathematical problems by using resources of both left and right hemisphere (Oliver, Erin Michelle, 2009) thus the

performance of the student increased significantly. Student responded well to these interventions and after five weeks was reassessed on short Mathematics Anxiety Rating Scale. Results showed that Mathematics Phobia was reduced significantly (58%) from 72 to 14 and student's academic performance in Mathematics exam was significantly improved from 10/40 to 28/40 with an increase of 18 i.e 45%.

The student was reassessed after intervention on Taggart and Torrance's Information Processing Survey and the results showed that, student's dominant information processing mode was found to be 'integrated'. The increase in score from 10 to 20 revealed that the student had become more balanced in his approach and together with logic and intuition has a good scope in Mathematics subject.

To conclude, this study has shown that management of Mathematics Phobia with Behaviour Modification techniques and Super Brain Yoga are found to be efficient.

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