

## Management of Mathematics Phobia among Ninth Standard Students

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### ABSTRACT

This research is carried out on 60 students of IX Standard, Kendriya Vidyalaya. Students were selected for the therapy on the basis of their SUD score. After taking math autobiography it was revealed that anxiety in mathematics for the students was developed due to various causes and the students were not dyslexic.

Student's average score in the recent mathematics exam was noted. Mathematics anxiety was assessed by using suri, monroe and koc's (2012) short mathematics anxiety rating scale and their hemispheric dominance of the brain was measured by using Taggart and Torrance's Human Information Processing Survey (1984). Students were treated with behaviour modification techniques and super brain yoga for six weeks.

*Interventions used are:*

- I. Reduction of Rate of Breathing (Ganesan, 2012).
- II. Laughter Technique (Ganesan, 2008b).
- III. Development 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 six weeks. Results showed that mathematics anxiety and mathematics SUDs were significantly reduced, which improved the group performance in mathematics exam. This shows that behaviour modification techniques and super brain yoga are efficient in treating mathematics anxiety.

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

**B**ehaviour 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. The principles of Behavior Therapy are taken from the Psychological laboratory

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rather than from the Consulting offices of Clinical psychologists and Psychiatrists. The behavior therapist is identified by his attempts to specify and measures the stimuli that reinforce them. Then he attempts to change this behaviour by direct interventions. Simple or specific phobias have been quite effectively treated with behavior therapy.

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 19<sup>th</sup> 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 Anxieties and irrational fears.

Anxiety 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-Anxiety 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.

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Super Brain Yoga is an ancient Indian yogic technique and is named as "Thoppu Karanam". Thoppu Karanam is a Tamil (a South Indian Language) word, which means to hold the ears. From ancient times this practice has been evident in the Indian Culture, where people practice this in front of the image of the Lord Ganapathy, a symbolic representation of supreme energy in the form of an elephant which actually signifies wisdom. Word 'Ganapathy' is also connected with the brain. Where, "Ga" represents Intelligence, "Na" represents Wisdom and "Pathy" represents Master, ideally meaning the Master of Wisdom and Intelligence. Ganapati, is worshipped as the remover of obstacles, bestower of knowledge and success (Chinmayananda, 1987). It is said that this practice is a request to stimulate the wisdom and intelligence. It is also said that the practice has been evident in the ancient Gurukula Systems, where the seers asked their pupils to practice this technique in order to stimulate and energize the brain and its functions.

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.

Master Choa Kok Sui, has re-invented this practice and named it as "Super Brain Yoga". Super brain 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 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 reduces anxieties. 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 Anxiety. Hence there is a need for systematic evaluation of the efficacy of above mentioned techniques in the Management of

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Mathematics-Anxiety. This study has been undertaken in this direction with a view to implement these effective techniques.

### METHODOLOGY

This research is carried out on 60 students of IX standard, Kendriya Vidyalaya. Students were selected for the therapy on the basis of their SUD score. After taking Math autobiography it was revealed that anxiety in Mathematics for the students was developed due to various causes and the students are not Dyslexic. Their Mathematics Anxiety was assessed by using Suri, Monroe and Koc's (2012) short Mathematics Anxiety Rating Scale. Group's hemispheric dominance of the brain was measured by using Taggart and Torrance's Human Information Processing Survey (1984). Group was treated with Behaviour Modification techniques and Super Brain Yoga for six weeks.

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

### RESULTS

The students were reassessed after six weeks and results showed that the pre-intervention score of the group in Mathematics Anxiety is 68.53, with standard deviation of 9.03, and post intervention score is 51.63, with a standard deviation of 12.15. Mean difference is 16.90 and critical ratio is 9.37. The pre-intervention SUD score of the group is 70.53 with a standard deviation of 13.70, and the post intervention score is 50.98, with a standard deviation of 13.84. Mean difference is 19.55 and Critical Ratio is 9.56.

The pre-intervention scholastic score of the experimental group is 54.20, with a standard deviation of 5.25 and the post intervention score is 72.08, with a standard deviation of 7.61. Mean differences is 17.88 and Critical Ratio is 10.26. The result shows that the levels of Mathematics Anxiety, Mathematics SUDs, and scholastic score of the group before and after intervention differ significantly [Table 1].

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**Table-1: Mathematics Anxiety, Mathematics Suda and Scholastic Score of the Group Before and After Intervention (N = 60)**

Factors	Before Intervention Mean (Sd)	After Intervention Mean (Sd)	Mean Difference	Critical Ratio
Mathematic-Anxiety	68.53 (9.03)	51.63 (12.15)	16.90	9.37**
Mathematics Suda	70.53 (13.70)	50.98 (13.84)	19.55	9.56**
Scholastic Score	54.20 (5.25)	72.08 (7.61)	17.88	10.26**

\*\* p < 0.01

The group was assessed on Tagarat and Torrance's Human Information Processing Survey (1984). Results showed that before intervention, the dominant mode of information processing was 'Right' with a score of 26, where Left Hemisphere and Integrated score were 25, 09 respectively. On reassessing the group after intervention, the dominant mode of processing found to be 'Integrated' with a comparatively higher score of 26, whereas Left Hemisphere and Right Hemisphere score were 16 and 18 respectively [Table 2].

**Table 2: Human Information Processing Survey of the Group before and After Intervention (N=60).**

	Left Hemisphere	Right Hemisphere	Integrated
Before Intervention	25	26	9
After Intervention	16	18	26

### DISCUSSION

The purpose of the present study was to manage Mathematics Anxiety. 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 group, Taggart and Torrance's Human Information Processing Survey was used. Behaviour Modification techniques and Super Brain Yoga were used to treat the group. The pre-intervention score of the group in Mathematics Anxiety is 68.53, with standard deviation of 9.03. The pre-intervention SUD score of the group is 70.53 with a standard deviation of 13.70 and the pre-intervention scholastic score of the group is 54.20, with a standard deviation of 5.25.

Before intervention, group was assessed on Human Information Processing Survey and the dominant mode of information processing of the group was found to be 'Right'. Group was given intervention for six weeks with Behaviour Modification techniques, like Reduction of Rate of Breathing, Development of Alternate Emotional Responses to Threatening stimulus, Laughter

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Technique and Super Brain Yoga. All interventions are given only after showing the Mathematics Anxiety stimulus which is a sheet of paper having problems related to addition, subtraction, Multiplication and Division in five digits. It is made as Mathematics Anxiety stimulus because Mathematics includes these four aforesaid basic operations and by preparing question on these operations will create anxiety specifically related to Mathematics.

First after showing the stimulus student were asked to practice Rate of Reduction of Breathing Technique. Breathing is of three types; Clavicular breathing, which comes from the shoulder and collar bones, Chest breathing, that comes from the centre of the chest and abdominal breathing which comes from the abdomen. Abdominal breathing, diaphragmatic breathing or slow breathing is breathing that is done by contracting the diaphragm, a muscle located horizontally between the chest cavity and stomach cavity. Air enters the lungs and the belly expands during this type of breathing. Abdominal breathing occurs when breathing rate is reduced to minimal and diaphragm is allowed to move further down enabling lungs to expand fully.

This deep breathing is marked by expansion of the abdomen rather than the chest when breathing. Diaphragmatic breathing is also known scientifically as eupnea, which is a natural and relaxed form of breathing in all mammals. Eupnea occurs in mammals whenever they are in a state of relaxation, i.e. when there is no clear and present danger in their environment. 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. '

'Fight or Flight' mechanism is related to our nervous system. Our body's levels of stress hormones are regulated by the autonomic nervous system (ANS). The ANS has two components that balance each other, the sympathetic nervous system (SNS) and the parasympathetic nervous system (PNS). The Sympathetic Nervous System turns up our nervous system. It helps us handle what we perceive to be emergencies and is in charge of the flight-or-fight response.

Whereas the Parasympathetic Nervous System turns down the nervous system and helps us to be calm. It promotes relaxation, rest, sleep, and drowsiness by slowing our heart rate, slowing our breathing, constricts the pupils of our eyes, increases the production of saliva in our mouth, and so forth. When we consciously reduce the rate of respiration, the parasympathetic nervous system gets activated and calms down the nervous system, including anxiety.

Slow breathing activates parasympathetic nervous system through vagus nerve. Vagus nerve is one among the cranial nerve that comes from the brain and controls the parasympathetic nervous system, which controls our relaxation response. This nerve passes through the diaphragm and during deep breathing, due to the movement of diaphragm, vagus nerve gets stimulated. The stimulation of vagus nerve activates parasympathetic nervous system, which in turn calms down the nervous system and thus anxiety gets controlled.

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Whereas, Laughter Techniques alleviates anxiety through release of certain chemicals in the body due to exhaustion of muscles. Laughter is defined as the act of "making sounds from the throat while breathing out in short bursts or gasps as a way of expressing amusement", according to Encarta Dictionary. Miller, M and Fry, W (2009), theorize that beta-endorphin like compounds released by the hypothalamus activate receptors on the endothelial surface to release nitric oxide, thereby resulting in dilation of vessels. Laughter also leads to reductions of stress hormones such as cortisol and epinephrine. Laughter, when carried out for a while as per the technique, causes exhaustion of the abdominal and facial muscles which results in release of 'Endorphins' and helps to alleviate the pain and anxiety caused due to Mathematics Anxiety.

Finally, by practicing Development of Alternate Response towards Mathematics enables the students to practice six types of emotions after seeing Mathematics stimulus (Mathematics problem sheet). The group 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 group 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 Anxiety, becomes neutral. These exercises, through principle of Reciprocal Inhibition, developed alternate emotional responses towards Mathematics Anxiety and found to be incompatible with it.

Whereas, 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 group. 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 group increased significantly.

Group responded well to these interventions and after six weeks, was reassessed on short Mathematics Anxiety Rating Scale. Results showed that the post-intervention score of the group in Mathematics Anxiety was reduced to is 51. 63, with a standard deviation of 12. 15 and the Critical Ratio was 9.56. Whereas post-intervention SUD score of the group was reduced to 51. 63, with a standard deviation of 12. 15 and the Critical Ratio was 9. 37. The post intervention scholastic score of the group was increased to 72. 08, with a standard deviation of 7. 61 and the Critical Ratio was 10. 26. The results shows that the level of Mathematics Anxiety, Mathematics SUDs, and scholastic score of the group before and after intervention differ significantly [Table-1].

The group 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 the score from 09 to 26 revealed that the group has become

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more balanced in its approach and together with logic and intuition has a good scope in Mathematics subject [Table-2].

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

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