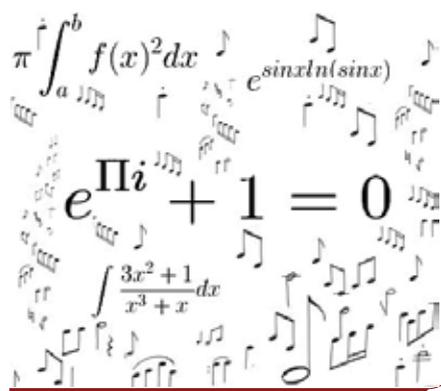


Music as a catalyst to mathematical ability

Vidya Raja

A lot has been written about the relation between mathematics and music. Music training and its impact on the brain—as a catalyst in improving mathematical ability—is intriguing, especially during early childhood. Music is one of the few activities that involves using the whole brain. It is intrinsic to all cultures and can have surprising benefits not only for learning languages, improving memory and focusing attention, but also for physical coordination and development.

The connection between music and mathematics goes back to the days of the ancient Greek philosophers, especially Plato and Aristotle, who deeply researched the bond between the genres. Pythagoras considered music and mathematics to be two sides of the same coin. Music and mathematics have a tremendous correlation.



Music and mathematics have a tremendous correlation

Mathematics is woven into the weft and warp of Carnatic music—from the basic lessons to improvised music or manodharma sangeetam. The mathematical activities that happen during the learning of Indian classical music give rise to endless possibilities of simple arithmetic to higher-level pure mathematics such as calculus

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and hashing algorithms. According to Prof. P. Sambamoorthy, music is an exact science. Mathematical concepts are embedded in every aspect of Carnatic music, beginning from the very scientific classification of the Carnatic raga system, abhyasa ganam, concept of 22 srutis, tala system, and culminating in manodharma sangeetam. A student of mathematics will find herein the practical application of several concepts series, progressions, and formulae of mathematics.

Recent advances in the study of the brain have enabled us to enhance our understanding of the influence of music. Extensive active engagement with music induces cortical re-organisation, producing functional changes in how the brain processes information. If this occurs early in development, the alterations may become hard-wired and produce permanent changes in the way information is processed. Brain cells

communicate with one another by sending signals with the help of chemicals such as serotonin. They travel from cell to cell, creating connections that are strengthened by repeated activation of networks of neurons.

Experience shapes the way circuits are made in the brain. A baby's brain is super-dense and will stay that way throughout the first decade of life. Beginning at about age eleven, a child's brain gets rid of extra connections, gradually making order out of a thick tangle of "wires". The circuitry it ends up with is more powerful and efficient. The brain decides what cells to retain depending on the early experiences. When a connection is used repeatedly, it falls in the permanent list, and the brain retains it. Hence exposure to music listening and learning during early childhood will go a long way in maximising the child's potential. Psychologist Frances Rauscher made the surprising claim that, after listening to Mozart's sonata (C major scale) for two pianos (K448) for 10 minutes, normal students showed significantly better spatial reasoning, that contributes to mathematical skills. Further research has shown that even passive listening to music can have an effect on the brain.

There is more brain activity when one actively participates in singing or playing music. Relating this to



Carnatic music, probably there is scope for us to experiment with the effect of listening to a composition in Sankarabharanam raga and get a parallel effect called the “Sankarabharanam effect”. A lot of research works cited in the Western world show that music training has an effect on cognitive abilities.

Music training has an effect on cognitive abilities

I conducted experimental research with school children in the age group of six to eight years, to study the impact of Carnatic music on mathematical ability. The children were divided into experimental and control groups. The experimental group subjected to Carnatic music intervention showed significant improvement in mathematical ability scores in comparison to the control group that did not receive any music training. In order to implement music education and integrate it with subjects, Howard's Theory of Multiple Intelligence has suggested eight intelligences in children. The musical intelligence present in children can be tapped; the subjects and concepts presented on a musical platter can be easily grasped by students. Similarly, mathematical concepts inherent in musical lessons can be taught without the child actually realising the learning of a difficult concept. Music actually prepares the brain to be receptive to mathematical concepts.

Further, music education at a very young age brings about a sea change in brain structure, thus directly impacting cognitive abilities. It is important to have music as a part of everyday school curriculum, and to expose students to the musical energy



Vidya Raja with school children

that enables positive growth of the mind and enhances cognitive ability and skills. Music should be woven into teaching methodologies of each subject and be taught to educators to make them aware of it. It can easily be integrated with the teaching of subjects in schools, especially at the elementary level. Children are naturally inclined towards music and learn with great interest if taught in tune. It is in the resourcefulness of the teacher to aptly bring in music wherever the subject permits and use musical intelligence to harness the child's capacity to learn the subject effectively.

The teaching of any language offers more scope for the integration of music. Poetry recitations are often rendered in tune to ease memorising, and it suits the tune because of the rhyme. Sanskrit recitation is tuned to Indian classical music. The integration of music in teaching will definitely elevate the status of music too as a subject. Mathematical concepts can be easily demonstrated with music at elementary and middle school levels. Unity amongst teachers from various departments can be inculcated in

school ethics, and an inter-disciplinary approach to teaching a subject can be incorporated.

The “Music for all” idea will help children harness the wide spectrum of benefits of music and will not be restricted to the talented few. The stress on early childhood music education will definitely create a fertile ground for the child to develop cognitive abilities—an important non-musical side effect of music.

Music and cognition—broadcast on
Carnatic Internet Radio



Sangeet Sangyan Episode 2
By Dr. Vidya Raja and Team



**Indian Music Training Improves
Mathematical Ability**

(The author, a musician pursuing her post-doctoral research, is a teacher of music and mathematics, a graded artist of All India Radio, a recipient of the Senior Research Fellowship from the Ministry of Culture, Government of India, and a certified music therapist)