

## DEVELOPING STUDENTS' COMPETENCY, INTEREST AND SKILLS IN MATHEMATICS WITH MATHEMATICAL BOX

TEACHER	Sudhir Govind Nachane
SCHOOL	Zilha Parisad Higer Primary School, Yashwantnagar, Tahashil – Malshiras, Dist – Solapur, Pin – 413101
PHONE NUMBER	9423-3358-17
E-MAIL	sudhirjee@gmail.com



Shri Sudhir Nachane was interested in mathematics even at a young age. He studied in a government school in a small town of Maharashtra. Even as a child, he would help his classmates with the subject. He completed D.Ed and B.Ed. and joined as an assistant primary teacher in a Zilla Parishad School of Anandnagar. He then completed his B.Sc. in Mathematics from Shivaji University, Kolhapur.

In the first school he taught, he noted that most students were from the scheduled castes and scheduled tribes, with their parents working as laborers. The students were weak in studies, found math hard, rarely attended school, and when they did, they disappeared after the lunch hour, without attending the math classes which was scheduled after lunch. To make the subject attractive for students, Shri Nachane came up with the idea to create some teaching aids to supplement teaching. He made floating picture boards, folding pictures, numerical charts and other such aids. He first used these aids in class to prepare students for the Scholarship Examination, and these found much favor with the students.



Math Box Training

He once came across a Mathematical box made by NCERT and was inspired to teach the subject through play-way methods, learn by doing approach and self-learning process. For these, he needed teaching aids, or teaching learning material (TLM).

Shri Nachane made a list of the Math topics for classes 1 to 7 with special focus on those that the students found difficult. He then conducted a pretest of 20 students from classes 4 and 5 to identify the learning weaknesses. In all, he made around fifty aids for Math and also some for Science.

Similar to the mathematical box prepared by NCERT, Shri Nachane came up with his own version of the Mathematical Box comprising of 30 different educational aids. He was assisted by his colleague Shri B. N. Khadatare, who had some experience in making multipurpose teaching aids. He then used these aids to teach math and managed to capture his students' attention. Slowly and steadily his class witnessed increase in attendance and interest in the subject. Some of the teaching aids include: Flannel Board, Graph Board, Multiplication/Napier strips, Fractional discs, Frame of nails, Magnet Board, Place Value Board, Multiple Hexagon, Spike abacus, Place Value Chips, Volume Box, Decimal Fractional Changes, Number Theory Chart, Electric Circuit, and Two & Three Dimensional Diagrams among others. The wooden box has dimensions of 60 cm x 45 cm x 6 cm. It has compartments of different sizes and the teaching aids are arranged in them. The lid is covered with flannel cloth. There is the Flannel Board inside the lid and a Graph Frame on the outer side.

**Flannel Board.** There is a Flannel Board inside the lid, covered by fitting Flannel Cloth. Geometrical structures and figures made from cardboard can be pinned on it for demonstrating various concepts.



Different parts of the math box

**Number Theory Charts.** They are used to teach Prime numbers, Composite numbers, even and odd numbers, divisibility, and finding LCM & GCD by play-way method.

**Multiplication/Napier Strips.** The plane side of a foot ruler is divided into 10 equal parts with colour. In the same way by taking 30 such rulers and dividing them into 10 parts and then writing numbers i.e. multiplication tables from 1 to 9 on it, one can teach any table from 1 to 9. Tables from 2 to 100 and there onwards can easily be taught with the help of these strips. They can also be used in multiplication.

**Place Value Board.** On the front side of this Board, the lines of one digit, 2 digit, 3 digit numbers are made and the values of digits 0 to 9 are written on it. Nails are used to hang the digits on the board. On removing the number, its place value will appear. The number and its place value are written on different strips, which are fixed with nails on the board. Any numbers, as given by the teacher, can be placed on the board with the help of the nails. Then the value of the same number can be seen from the board.

**Nail frame.** On the back of the board, 900 squares of  $1 \times 1$  are made and these are then fixed with nails. With the help of the rubber band or wool, different geometric patterns can be made. These squares can be used to derive area, volume and perimeter of regular & irregular shapes. Graphs can also be similarly shown.

**Magnet Board.** By setting the magnet on the upper side of nail board, a magnet board is made which is then covered with paper. There are envelopes on which questions are written, and inside there are four options given (on cards). The student has to choose the correct option and place it on the magnet board. If the answer is correct, the card will stick, otherwise it will fall down.

**Place Value Strips.** There are 45 square strips of  $2'' \times 2''$  and 10 strips of  $2'' \times 4''$ ,  $2'' \times 6''$ ,  $2'' \times 8''$ ,  $2'' \times 10''$ ,  $2'' \times 12''$ ,  $2'' \times 14''$ ,  $2'' \times 16''$ ,  $2'' \times 18''$ ,  $2'' \times 20''$ . One square strip is stuck on  $2'' \times 4''$ , two square ones are stuck on  $2'' \times 6''$ , three square ones are stuck on  $2'' \times 8''$ , etc. Likewise 9 square ones were stuck on  $2'' \times 20''$  strip. Numbers are written on them, which indicates the place value. To know the place value of single number, students can expand the number accordingly.

**Graph Board.** On the outer side of the lid, squares are painted in black, which can be used in graphical representation.

**Spike Abacus.** A wooden plank with holes is prepared. In each hole a spike is fixed and in it, the beads are put to be used as abacus. Numbers and operations like addition, subtraction, multiplication, division can be studied with its help.

**Electric circuit.** It is made with wire, bulb and cells. Pairs of questions and answers are placed on this card. If a question in the pair matches with the answer, the bulb lights up. This aid is also very useful in self-evaluation. It has



Math Box

been used for teaching and practicing formulae and basic operations.

**Fractional Discs.** A circular shape is cut from a cardboard and stuck on a square piece. On another cardboard, another circle is cut and then divided into different parts. By fixing these parts on the circular board, a circle with two or more parts can be created. This is used to teach circle, radius, diameter, circumference, area, and fractions.

**Multipurpose Hexagon.** Six wooden strips of equal size are fixed together with the help of screws, to make a hexagon or other shapes. It is used to teach geometry.

**Volume Box.** A wooden box of  $5'' \times 4'' \times 3''$  with 36 small unit cubes is used to teach the concept of volume, and area, and also various related formulae.

Shri Nachane calls this box the Constructive Mathematical Box. Students' performance has been seen to increase by about 95% after learning through this box; many students have even passed the scholarship exams and pursued higher education in mathematics.

Building his experience, Shri Nachane constantly adds new creative teaching aids to the box. As cluster head, he trains other teachers in teaching math concepts using such aids. Recently, the Government of Maharashtra distributed a Math box to all schools, which was based on Shri Nachane's box.

The Constructive Mathematical Box i.e. TLM has won many Awards and Prizes at the district and state levels.



#### QUESTIONS FOR TEACHERS

1. How to increase the effectiveness of teaching-learning process by using educational tools?
2. What activities can be done to teach mathematics in an interesting way?
3. What games can be organized to explain the concept of mathematics in everyday life?

#### QUESTIONS FOR TRAINEES

1. What educational tools can be used to explain geometry?
2. How is empirical knowledge useful in study?
3. What games should be organized to bring creative development in children?