SCIENCE EXPERIMENTS THROUGH "LOW COST NO COST" TOOLS IN A SIMPLE WAY

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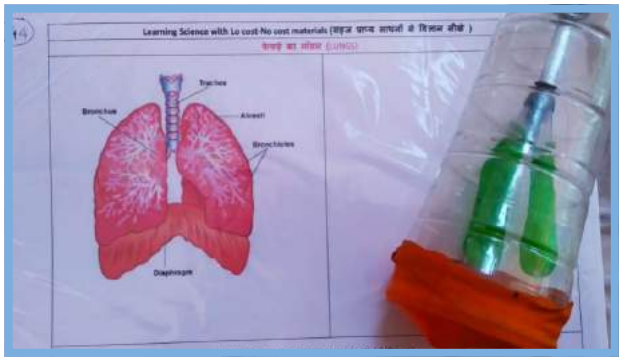
Shri Prakashchandra Suthar joined Timbi Girls School located in Amreli taluka as a teacher in February 1992. After working there for 5 years, he was transferred to the government-run Pipalva School in Lathi taluka. Here, too he served for 5 years until 2001 when he went on to join Keshargunj Primary School in Vadali taluka in Sabarkantha district. Another five yeard later, Shri Suthar was transferred to the adjoining Chulla School. Between 2010 and 2012 he worked in the same taluka as the CRC Coordinator of Mendh cluster. In 2013–2014, he was selected as the State Pedagogy Co-ordinator under the "Sarva Shiksha Abhiyan" at the state capital, Gandhinagar. He played a major role in the Pragna Campaign as part of the Quality Enhancement Cell. Shri Suthar has also worked as writer and consultant for 27 different types of literature/books meant for classes 1 to 5. He has also worked as the editor of the newsletter "Gyan Shakti" published by "Sarva Shiksha Abhiyan". Shri Suthar was also selected to be a part of the State Resource Group for the Science subject in 2003–04 by GCERT Gandhinagar. He has also written and reviewed about 18 books, self-learning workbooks and experiment-based workbooks.

Students using scientific instruments

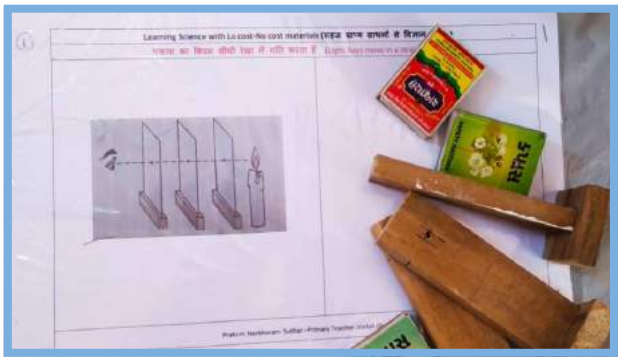
Shri Suthar was also the chief editor of the mouthpiece publication called "Sabar Shikshak Sangh" published by Sabarkantha district's Primary Teachers Union's from 2007 to 2010. He has been part of many workshops and research activities. Shri Suthar also runs his own Youtube channel called "Prakash Narbheram Suthar". Besides, he also shares his experience and thoughts in a blog sutharpn.blogspot.com. At present, he is working as the main teacher at Kanjali Primary School in Vadali taluka.

When Shri Suthar was transferred to Sabarkantha district in 2001, his duty was to teach math and science t students of classes 5 to 7. He found that the school did not have enough equipment, models or financial resources to teach science. As a result, students were largely disinterested in the subject. To rectify the situation, he collected some "Low cost No cost" tools from from his surroundings. He also asked the students to look for such tools to be used in performing experiments. Students' participation in the activity ignited their interest. Gradually, they were able to come up with an experiment kit that was suitable to supplement their science lessons.

In 2002, Shri Suthar trained teachers from other schools with the limited number of tools available at the Science Laboratory. During this session, the teachers informed him that while the training was good, they did not have these teaching aids in their respective schools. And the experiment kits were not sufficient for all students. Added to these was the fact that the equipment in the science lab was either lost,



Sheets and tools for experimenting with science



Low cost experimental equipment

broken or worse for wear. Further, the schools did not have enough funds to buy new equipment or invest in experiment kits. Hence, it was difficult to implement these concepts in the classrooms.

In his earlier stints as a teacher, Shri Suthar had prepared a list of all the science experiments and activities for the classes he had taught. He realized there was no point in just focussing on theory when teaching science and the students could only learn by doing. The schools where he had taught had faced issues of funds and he had invested in some equipment from his own pocket, for instance, convex and concave lens, magnets, chemicals, dry cells, and more. Besides, he had also prepared about 70 "Low cost, No cost" models or instruments on his own leveraging his carpentry and painting skills.

To conduct an activity, Shri Suthar would prepare in advance. He would ask the students to be observant and collect resources from their surroundings. Once the activity was conducted all the resources were carefully labelled and stored in their classroom for further use. Over the period, each student had their own experiment kit comprising of resources they have collected from their immediate surroundings. They would then take these kits with themselves when they were promoted to the next class.

Coming back to the training which Shri Suthar had conducted for the teachers in the year 2002, he informed them of this innovation, that is, "Low cost No cost" instruments, he had implemented during his earlier stints as a teacher in order to overcome the issues of funds.

To further motivate the teachers, and also the students, he declared that he was willing to teach them to make and use these kits on all off days and further also share his "Low Cost No Cost" for their use without charging anything.

Shri Suthar received invitations from several schools to demonstrate his capabilities. In all such cases, he would communicate with the inviting school beforehand with a request for participants to collect these "Low Cost No Cost" instruments. These resources usually included inexpensive or freely available things such as glass bottles, rubber corks, pieces of a mirror, thermocol sheets, card paper, wooden strips, old knives, thread, waste ball pens and refills, plastic pipe, sand, waste sarees, marbles, old bearings and nails. He would then visit the school during his off day and demonstrate the activity. He would also involve the students in conducting experiments using these resources.

With these simple solutions, he motivated both teachers and students to think out of the box and use commonly available resources to conduct the activities. The students and teachers too developed their own experiment kits, and thus, to a large extent they were able to overcome the obstacles of lack of funds.

In 2017, Ahmedabad-based "Sky Foundation", provided Shri Suthar the opportunity to conduct a Science workshop at Fikuri in Nuvakoot district in Nepal. In the year 2019, the innovator also shared his knowledge in Kashmir working with the Mehsana-based "Vishwagram" organisation. Under the auspices of Doda district's DIET, he also showcased his work and shared his knowledge with the schools in the district.

His innovative teaching method has been adopted by many B.Ed. and PTC trainees belonging to around 130 schools through the DIET, Idar. Besides, he has also conducted training for teachers of KGBV under the aegis of Sarva Shiksha Abhiyaan. Shri Suthar has also trained a number of teachers and presentedhis work through the BISAG Studio.

Shri Suthar has received many awards, such as the "Innovative Teachers Award" from IIMA in 2006; the "Chitrakoot Award" by spiritual guru Morari Bapu in 2010; the "Best Practices Teacher" in 2017 by DIET IDAR; Best Work by Sabarkantha District Teacher's Committee in 2017-18; "Prof. P.A Pandya Best Teacher Award" in 2018 by Gujarat Science; the Governor's award in 2018; "Guru Gaurav Award" in 2019; and the Zero-Investment for Education Initiatives award in 2019.

Some of these tools are listed in the table below.

NO	NAME OF EXPERIMENT/ACTIVITY	TOOLS LISTED IN THE TEXTBOOK	MARKET COST, RS	TOOLS USED IN THE LOW-COST MODEL	LOW COST, RS
1	Light ray moves in a straight line	3 cardboards, matchbox, rod, stand, candle	50	3 empty matchboxes and incense sticks	1
2	Pin hole camera	Pin hole camera model	75	Empty plastic bottle	0
3	Possibilities of reflection of light	Transparent-Translucent-Opaque glass strips	30	A simple glass	5
4	Transparent-Translucent-Opaque	Transparent-Translucent-Opaque	–	A simple glass	5
5	Reflection of Light	Flat mirror, stand, pins, protractor, scale, laser torch	200	strip of flat mirror, thermocol sheet, simple strip stand	10
6	Smoke box to show reflection of light	Smoke box to show reflection of light	200	Flat mirror, empty ice-cream box, laser torch, incense stick	125
7	Regular and irregular reflection	Flat mirror, rough surfaced mirror	30	Packing paper	5
8	Reflection is reversed from left to right in a flat mirror.	Flat mirror, stand	30	Flat mirror, card paper	5
9	Distance between reflection and object	Flat mirror, stand, scale, candle	200	Flat mirror, scale	10
10	Periscope	Model of Periscope	200	An empty cover of toothpaste, two flat mirrors	2
11	Multiplier reflection	Multiplier reflection	150	Two flat mirrors of same size, glue stick	10
12	Kaleidoscope	Kaleidoscope	100	3 flat mirrors, adhesive tape, pieces of glass bangles	15
13	Technical terms related to concave mirror	–	–	Plastic ball, two rods of a cycle	12
14	Study of reflection obtained in concave mirror	Concave mirror, stand, curtain	50	Concave mirror, a simple stand made of strips, curtain	20
15	Lens of a bulb	–	–	Bulb, candle, wire rod	10
16	Base point of Elevation	Base point of Elevation	250	Simple piece of wooden strip, a small piece of wood, iron nails, waste bearing	5
17	Principles of lever	Principles of lever models, two weights each of 200 gms, 100 gms, 50 gms	250	Simple wooden strip, 8 coins of 50 paise, a plastic bag, two "S" shaped hooks	58
18	Measuring size of irregular shape	Marked cylinder, thread, an object of irregular shape	75	Empty water bottle, thread, an object of irregular shape	5
19	Measuring size of irregular shape	Container, marked cylinder, thread, an object of irregular shape	50	Empty water bottle, thread, an object of irregular shape, box of waste ball pen	5
20	Model of density	–	–	Piece of wood	0
21	Lines of magnetic forces	Magnet, iron powder	50	Magnet made from wire, iron powder	5
22	Compass	Compass model	40	needle, plastic strip	2
23	Sand-timer	Sand-timer model	50	Two small glass bottles, sand, piece of plastic tube	5
24	Sun dial	Sun dial model	50	Wooden piece, iron	0
25	Analysis of filter	Analysis of filter	250	Injection syringe	5
26	Distillation	Filtration container, condenser tube, beaker, cork with two holes	450	Aluminium bottle, plastic tube, brass valve of cycle tube, U-form pieces	10
27	Volta Meter	Volta Meter model	300	Plastic box, wooden strips, two plastic bottles, wires, dry cell	25
28	Conduction of heat	Stand, iron rods, pins, candles	100	Iron strip, pins, candles	5
29	Thermodynamics	Circular jug, tripod, spirit lamp, filter,	175	bulb, wire rod, candles	105
30	Release of heat	4 Glass bottles	100	4 Glass bottles	10

Table continuation

NO	NAME OF EXPERIMENT/ACTIVITY	TOOLS LISTED IN THE TEXTBOOK	MARKET COST, RS	TOOLS USED IN THE LOW-COST MODEL	LOW COST, RS
31	The volume of liquid increases due to heat	Circular jug, tripod, spirit lamp, filter, thin flowing tube	100	Small glass bottle, rubber cork, refill	5
32	The size of solid increases due to heat	Link ball, spirit lamp, tongs	60	marbles, wire rod, candles	2
33	The quantity of gas increases due to heat	Circular jug, tripod, spirit lamp, filter, balloon	100	Glass bottle, balloon, candle	5
34	Air has a mass	Two balloons, thin wire, thread	10	Two balloons, thin wire, thread	10
35	Planets revolve around the Sun	Model showing that planets revolve around the Sun	200	Two stones, thread, empty thread reel	0
36	Light and heavy pressure of air	–	–	Small plastic bell, thread	2
37	Tornado	–	100	Two plastic bottles, adhesive	10
38	Smooth and rough surface	Smooth and rough surface model	100	Model prepared from wooden piece, two marbles	20
39	Potential energy and kinetic energy	Potential energy and kinetic energy Model	200	Wooden wheel, pencil and thread	5
40	Simple Stethoscope	Stethoscope	900	Plastic sieve, rubber pipe	20
41	Newton cycle	Newton cycle model	100	Waste CD, white card paper, adhesive, sketch pens	5
42	Action and reaction model	–	200	Waste ball pen, rubber bands	5
43	Pythagoras theorem	Pythagoras theorem	200	Piece of plastic tube, cardboard, thread, stone, protractor	15
44	Simple Telephone	–	–	Lids of two plastic bottles, thread	0
45	Couture	–	–	Plastic bottle, waste ball pen, adhesive, plastic bag, thread	10
46	Model of the lungs	Model of lungs	500	Plastic bottles, waste ball pens, adhesive, two small balloons, one big balloon, thread	20
47	Electrical Circuit	Electrical Circuit model	300	Piece of wood, push pin, piece of wire, battery bulb, dry cell	20
48	Atomic numbers	–	–	Piece of wood	20
49	Hovercraft	Hovercraft model	50	Plastic bottle, waste ball pen, adhesive, one big balloon, thread	0
50	Burnoli's experiments	Beaker, L shaped tube	75	Refill, seed of jujube fruit	0

QUESTIONS FOR TEACHERS

1. What should be done as a precaution to explain the experiments in science to the children?
2. What activities can be done to develop the skill of doing various experiments in science and technology in children?
3. How can children be taught the importance of reading a book?

QUESTIONS FOR TRAINEES

1. What games can be played to increase the interest of children towards science subject?
2. What activities can be organized to strengthen the content of science subject?
3. What kind of planning should be done before doing the activity in the classroom?