

PREPARING THE SOIL

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As a child I loved tinkering and was fascinated with production processes. I used to spend hours looking at the carpenter sharpening his tools or a roadside mechanic repairing bikes. The early 70's were politically very volatile years. Intellectuals the world over were searching a meaningful role for themselves. Some had sworn never to design bombs / missiles or be part of the industrial-military complex, but work for the betterment of ordinary people. The political slogan in those days was:

'Go to the people

Live with the, love them

Start from what they know

Build on what they have.'

During my IIT / Kanpur days (1970-75) I helped run *The Opportunity School* – meant for the children of mess servants and other menial employees. We also conducted evening classes for poor children. I starkly remember seeing a Young Oxfam poster which showed a supersonic aeroplane flying over a parched village with the caption:

'And somewhere there are engineers

Helping others to fly faster than sound.

But where are the engineers

Helping those who must live on the ground.'

In 1978, I took a year off from TELCO / Pune to work with the Hoshangabad Science Teaching Programme (HSTP). The HSTP was trying to revitalise the learning of science in village schools. It was a big challenge then, and it still remains so. I spent 6 months with the HSTP and the remaining time with Laurie Baker. Laurie was my college day idol. I thought he was the only architect who had touched the lives of the poor.

During my stay with the HSTP I designed several simple science experiments, which have been used by children all over the country for 27 years. The *Matchstick Mecanno* - is a good example. Here, children use bits of cycle valve tube (available in most villages) and matchsticks to make lots of two and three-

dimensional models. In the process they learn the importance of triangles in real life. Why do houses have triangular roofs? Why are bridges made of triangles? While making tetrahedrons, octahedrons and prisms children get a good 'feel' for structures.

In 1984, Prof. Yashpal – then Secretary of the Department of Science & Technology gave me a fellowship to pen down my 'tinkerings'. The outcome was *Matchstick Models & Other Science Experiments* – a slim 50-page booklet on science activities. It was low priced and printed on newsprint. It showed possibilities of doing science creatively with simple, local materials available in Indian villages. This book caught the imagination of several popular science movements / groups and within a few years got translated and printed in a dozen Indian languages. Now it is in the 9th edition in Hindi and 11th edition in Malayalam. This book is so low-priced that bookshops don't make much money selling it. Still it has sold over 7 lakh copies. You can now download it from my site <http://arvindguptatoys.com>

Since then I have written over a dozen books on science activities. Some of the books - *Little Science, Toy Bag, Toy Treasures, Little Toys, Pumps from the Dump, Leaf Zoo, Toy-Joy, Ten Little Fingers, The String Book, Hands-On* have appeared in several Indian languages. All my books and toys are in the free public domain. Any individual / group anywhere in the world can use, adapt, translate and print them without any permission or fee for educational purposes. For five years I wrote a monthly column 'Little Science' for *Science Age, Science Reporter* and *Vigyan Pragati*. Several newspapers - *Rajasthan Patrika, Loksatta, Nai Dunia* have serialised science experiments for my books.

I have conducted workshops in over 1,500 schools in India. During this long journey I have seen run down schools, met uninspiring principals and bored teachers. But not once have the children failed me. There is always a 'gleam in their eyes' especially after seeing an 'action' toy that spins, flies, whistles, jumps, and hops. For 6 years I ran the science club in *Mirambika* – an experimental school in Delhi. I just made toys and let children play with them. I never imposed the scientific explanation behind the toy, but helped the children discover it intuitively.

For children the whole world is a laboratory. Children are more likely to appreciate a science principle if they can experience it in a toy. Burettes, pipettes, test tubes – and other fancy laboratory apparatus often threaten children. With the most expensive apparatus we could be doing bad science, and with simple, humble trinkets we could do exciting science. In the ultimate analysis, science is a worldview – of looking at the world minutely and critically.

Most children learn science by rote. They mug up scores of definitions and formulae and spit them out in the exams. City schools keep children out of bounds from the lab lest they break fancy glassware! Village schools have no science labs.

Before children can understand a thing, they need experience: seeing, touching, hearing, tasting, smelling, choosing, arranging, putting things together, taking them apart. Experimenting with real things. Learning by experience is profound knowledge. It is more deeply imprinted in memory than words or formulae.

The ability to improvise experiments with almost zero-cost, holds great promise in this resource-starved country. The message is loud and clear - school kids can do great science with little money. After all, the student's mind is the most expensive piece of equipment involved!

For instance 2-film cans, a piece of cycle tube, a ball pen refill and sticky tape can be easily put together to make a simple pump. With this pump children can easily inflate a balloon and pop it! With another, 15-minute, zero-cost pump, they can throw water 15-feet away! Fifteen years ago I made a simple electric motor which could be put together in less than 10 minutes. The most expensive thing in this motor was an ordinary 1.5 – volt torch battery! Over the years we have made over 7,000 simple motors with teachers and children!

My books document over 300 simple science experiments and toys. Old newspapers can be folded into a dozen caps. The most popular remains the *Cricket Cap* – folded from half a newspaper. In this process children learn a lot of geometry in a very concrete way. The *Pentagonal Knot* is another astounding activity. It is as easy as tying a knot. Take a 2-cm wide parallel, long strip from an old Xerox sheet and just tie a knot. The tight knot results in a symmetric pentagon!

In our country there is a great dearth of good books on education, popular science and maths activities. For years I have struggled to promote some of the world's most inspiring books on education *Divasvapna, Tottochan, Teacher, Summerhill, Duishen, The Man Who Planted Trees, How Children Fail, Danger School, Letter to a Teacher, Bahuroope Gandhi, VSO Science & Maths Teachers Handbooks, The Story of Physics, Making Things* into various Indian languages. With *Vigyan Prasar's* help we have reprinted over twenty popular science classics like *Soap Bubbles* – C.V. Boys, *The Chemical History of a Candle* – Michael Faraday, *Science in Everyday Life* and *Everything has a History* – J.B.S. Haldane, *The Insect World of J. Henri Fabre, Environment & Self-Reliance* – Yona Friedman, *Why the Sky is Blue?* – C.V. Raman. Since these books became available in English, they have been translated in many Indian languages.

The situation in Hindi is very grim. Despite 400 million Hindi speaking people there is a tremendous paucity of good reading material. It reflects the BIMARU culture of the Hindi speaking states. I have translated 85 books in Hindi. I was deeply involved with the 75 books in Hindi under the *Balvachan* series of the Bharat Gyan Vigyan Samiti. These books on science experiments, peace, anti-nuke, environment, education, creative activities and good children's literature from across the world are modestly priced between Rs 10 – Rs 12 have sold a million copies. They have also been translated in Gujarati, Marathi and Telegu by various NGO's.

By digitizing / uploading books on the web we can fulfill our dream of A MILLION BOOKS FOR A BILLION PEOPLE. I hope someday all the good books in the world will be available to every child – rich or poor, at the click of the mouse.

In the last 20 years I have presented over a 90 short films on science activities on the National Television. These films have been repeatedly shown and reached a very wide audience.

Our educational terrain is dreary and barren. There is no soil to nurture. Even a good seed will wilt away in such harsh conditions. We need to prepare the soil. Our children have tremendous potential. Each one of them is a good seed. And if we prepare the soil someday we will see a spring harvest.